ATTACHMENT "A"
(Marked-Up Proposed Specifications)
Unit 2

CORE ALTERATION (continued)	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 for the current reload cycle. These cycle specific parameter limits shall be determined for each reload cycle in accordance with Specification 5.7.1.5. Plant operation within these limits is addressed in individual Specifications.
DOSE EQUIVALENT I-131	DOSE EQUIVALENT I-131 shall be that concentration of I-131 (microcuries/gram) that alone would produce the same thyroid dose as the quantity and isotopic mixture of I-131, I-132, I-133, I-134, and I-135 actually present. The thyroid dose conversion factors used for this calculation shall be those listed in Table ~~III of TID-14844, AEC, 1962, "Calculation of Distance Factors for Power and Test Reactor Sites."~~ E-7 of Regulatory Guide 1.109.
$\bar{E}$ – AVERAGE DISINTEGRATION ENERGY	$\bar{E}$ shall be the average (weighted in proportion to the concentration of each radionuclide in the reactor coolant at the time of sampling) of the sum of the average beta and gamma energies per disintegration (in MeV) for isotopes, other than iodines, with half lives > 15 minutes, making up at least 95% of the total noniodine activity in the coolant.
ENGINEERED SAFETY FEATURE (ESF) RESPONSE TIME	The ESF RESPONSE TIME shall be that time interval from when the monitored parameter exceeds its ESF 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 diesel generator 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.

(continued)

1.1 Definitions (continued)

LEAKAGE

LEAKAGE shall be:

a. Identified LEAKAGE

1. LEAKAGE, such as that from pump seals or valve packing (except reactor coolant pump (RCP) 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 (SG) to the Secondary System.

b. Unidentified LEAKAGE

All LEAKAGE that is not identified LEAKAGE.

c. Pressure Boundary LEAKAGE

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

~~d. Controlled LEAKAGE~~

~~The seal water flow supplied to or from the RCP seals.~~

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.

(continued)

EXAMPLES
(continued)

EXAMPLE 1.3-3

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One Function X train inoperable.	A.1 Restore Function X train to OPERABLE status.	7 days AND 10 days from discovery of failure to meet the LCO
B. One Function Y train inoperable.	B.1 Restore Function Y train to OPERABLE status.	72 hours AND 10 days from discovery of failure to meet the LCO
C. One Function X train inoperable. AND One Function Y train inoperable.	C.1 Restore Function X train to OPERABLE status. OR C.2 Restore Function Y train to OPERABLE status.	72 hours 72 hours

(continued)

EXAMPLES

EXAMPLE 1.3-3 (continued)

When one Function X train and one Function Y train are inoperable, Condition A and Condition B are concurrently applicable. The Completion Times for Condition A and Condition B are tracked separately for each train starting from the time each train was declared inoperable and the Condition was entered. A separate Completion Time is established for Condition C and tracked from the time the second train was declared inoperable (i.e., the time the situation described in Condition C was discovered).

If Required Action C.2 is completed within the specified Completion Time, Conditions B and C are exited. If the Completion Time for Required Action A.1 has not expired, operation may continue in accordance with Condition A. The remaining Completion Time in Condition A is measured from the time the affected train was declared inoperable (i.e., initial entry into Condition A).

The Completion Times of Conditions A and B are modified by a logical connector, with a separate 10 day Completion Time measured from the time it was discovered the LCO was not met. In this example, without the separate Completion Time, it would be possible to alternate between Conditions A, B, and C in such a manner that operation could continue indefinitely without ever restoring systems to meet the LCO. The separate Completion Time modified by the phrase "from discovery of failure to meet the LCO" is designed to prevent indefinite continued operation while not meeting the LCO. This Completion Time allows for an exception to the normal "time zero" for beginning the Completion Time "clock." In this instance, the Completion Time "time zero" is specified as commencing at the time the LCO was initially not met, instead of at the time the associated Condition was entered.

(continued)

1.3 Completion Times

EXAMPLES
(continued)

EXAMPLE 1.3-~~4~~3

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more valves inoperable.	A.1 Restore valve(s) to OPERABLE status.	4 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	AND	
	B.2 Be in MODE 4.	12 hours

A single Completion Time is used for any number of valves inoperable at the same time. The Completion Time associated with Condition A is based on the initial entry into Condition A and is not tracked on a per valve basis. Declaring subsequent valves inoperable, while Condition A is still in effect, does not trigger the tracking of separate Completion Times.

Once one of the valves has been restored to OPERABLE status, the Condition A Completion Time is not reset, but continues from the time the first valve was declared inoperable. The Completion Time may be extended if the valve restored to OPERABLE status was the first inoperable valve. The Condition A Completion Time may be extended for up to 4 hours provided this does not result in any subsequent valve being inoperable for > 4 hours.

If the Completion Time of 4 hours (including any extensions) expires while one or more valves are still inoperable, Condition B is entered.

(continued)

1.3 Completion Times

EXAMPLES
(continued)

EXAMPLE 1.3-~~5~~4

ACTIONS

---------------------------NOTE---------------------------
Separate Condition entry is allowed for each inoperable valve.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more valves inoperable.	A.1 Restore valve to OPERABLE status.	4 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3. AND B.2 Be in MODE 4.	6 hours 12 hours

The Note above the ACTIONS table is a method of modifying how the Completion Time is tracked. If this method of modifying how the Completion Time is tracked was applicable only to a specific Condition, the Note would appear in that Condition rather than at the top of the ACTIONS Table.

The Note allows Condition A to be entered separately for each inoperable valve, and Completion Times tracked on a per valve basis. When a valve is declared inoperable, Condition A is entered and its Completion Time starts. If subsequent valves are declared inoperable, Condition A is entered for each valve and separate Completion Times start and are tracked for each valve.

(continued)

1.3 Completion Times

EXAMPLES

EXAMPLE 1.3-~~6~~4 (continued)

If the Completion Time associated with a valve in Condition A expires, Condition B is entered for that valve. If the Completion Times associated with subsequent valves in Condition A expire, Condition B is entered separately for each valve and separate Completion Times start and are tracked for each valve. If a valve that caused entry into Condition B is restored to OPERABLE status, Condition B is exited for that valve.

Since the Note in this example allows multiple Condition entry and tracking of separate Completion Times, Completion Time extensions do not apply.

EXAMPLE 1.3-~~6~~5

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One channel inoperable.	A.1 Perform SR 3.x.x.x. OR A.2 Reduce THERMAL POWER to ≤ 50% RTP.	Once per 8 hours 8 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours

(continued)

EXAMPLES

EXAMPLE 1.3-~~6~~5 (continued)

Entry into Condition A offers a choice between Required Action A.1 or A.2. Required Action A.1 has a "Once per" Completion Time, which qualifies for the 25% extension, per SR 3.0.2, to each performance after the initial performance. If Required Action A.1 is followed and the Required Action is not met within the Completion Time (including the 25% extension allowed by SR 3.0.2), Condition B is entered. If Required Action A.2 is followed and the Completion Time of 8 hours is not met, Condition B is entered.

If after entry into Condition B, Required Action A.1 or A.2 is met, Condition B is exited and operation may then continue in Condition A.

(continued)

EXAMPLES
(continued)

EXAMPLE 1.3-~~7~~6

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One subsystem inoperable.	A.1 Verify affected subsystem isolated.	1 hour AND Once per 8 hours thereafter
	AND	
	A.2 Restore subsystem to OPERABLE status.	72 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	AND	
	B.2 Be in MODE 5.	36 hours

Required Action A.1 has two Completion Times. The 1 hour Completion Time begins at the time the Condition is entered and each "Once per 8 hours thereafter" interval begins upon performance of Required Action A.1.

If after Condition A is entered, Required Action A.1 is not met within either the initial 1 hour or any subsequent 8 hour interval from the previous performance (including the 25% extension allowed by SR 3.0.2), Condition B is entered.

(continued)

1.3 Completion Times

EXAMPLES

EXAMPLE 1.3-~~7~~6 (continued)

The Completion Time clock for Condition A does not stop after Condition B is entered, but continues from the time Condition A was initially entered. If Required Action A.1 is met after Condition B is entered, Condition B is exited and operation may continue in accordance with Condition A, provided the Completion Time for Required Action A.2 has not expired.

IMMEDIATE COMPLETION TIME

When "Immediately" is used as a Completion Time, the Required Action should be pursued without delay and in a controlled manner.

EXAMPLES
(continued)

EXAMPLE 1.4-3

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
------------------NOTE------------------ Not required to be performed until 12 hours after ≥ 25% RTP. -- Perform channel adjustment.	7 days

The interval continues, whether or not the unit operation is < 25% RTP between performances.

As the Note modifies the required <u>performance</u> of the Surveillance, it is construed to be part of the "specified Frequency." Should the 7 day interval be exceeded while operation is < 25% RTP, this Note allows 12 hours after power reaches ≥ 25% RTP to perform the Surveillance. The Surveillance is still considered to be performed within the "specified Frequency." Therefore, if the Surveillance were not performed within the 7 day (plus 25% per SR 3.0.2) interval, but operation was < 25% RTP, it would not constitute a failure of the SR or failure to meet the LCO. Also, no violation of SR 3.0.4 occurs when changing MODES, even with the 7 day Frequency not met, provided operation does not exceed 12 hours with power ≥ 25% RTP.

Once the unit reaches 25% RTP, 12 hours would be allowed for completing the Surveillance. If the Surveillance were not performed within this 12 hour interval, there would then be a failure to perform a Surveillance within the specified Frequency; MODE changes then would be restricted in accordance with SR 3.0.4 and the provisions of SR 3.0.3 would apply.

2.2 SL Violations (continued)

①

2.2.6 ~~Critical~~ ~~o~~Operation (Modes 1 and 2) of the unit shall not be resumed until authorized by the NRC.

3.0 LCO APPLICABILITY

LCO 3.0.4 (continued)

Specification shall not prevent changes in MODES or other specified conditions in the Applicability that are required to comply with ACTIONS.

Exceptions to this Specification are stated in the individual Specifications. These exceptions allow entry into MODES or other specified conditions in the Applicability when the associated ACTIONS to be entered allow unit operation in the MODE or other specified condition in the Applicability only for a limited period of time.

LCO 3.0.5

Equipment removed from service or declared inoperable to comply with ACTIONS may be returned to service under administrative control solely to perform testing required to demonstrate its OPERABILITY or the OPERABILITY of other equipment. This is an exception to LCO 3.0.2 for the system returned to service under administrative control to perform the testing required to demonstrate OPERABILITY.

LCO 3.0.6

When a supported system LCO is not met solely due to a support system LCO not being met, the Conditions and Required Actions associated with this supported system are not required to be entered. Only the support system LCO ACTIONS are required to be entered. This is an exception to LCO 3.0.2 for the supported system. In this event, (6) additional evaluations and limitations may be required in accordance with Specification 5.~~8~~, "Safety Function Determination Program (SFDP)." If a loss of safety function is determined to exist by this program, the appropriate Conditions and Required Actions of the LCO in which the loss of safety function exists are required to be entered.

When a support system's Required Action directs a supported system to be declared inoperable or directs entry into Conditions and Required Actions for a supported system, the applicable Conditions and Required Actions shall be entered in accordance with LCO 3.0.2.

(continued)

LCO 3.0.6
(continued)

However, there are instances where a support system's Required Action may either direct a supported system to be declared inoperable or direct entry into Conditions and Required Actions for the supported system. This may occur immediately or after some specified delay to perform some other Required Action. Regardless of whether it is immediate or after some delay, when a support system's Required Action directs a supported system to be declared inoperable or directs entry into Conditions and Required Actions for a supported system, the applicable Conditions and Required Actions shall be entered in accordance with LCO 3.0.2.

Specification 5.~~8~~6, "Safety Function Determination Program (SFDP)," ensures loss of safety function is detected and appropriate actions are taken. Upon failure to meet two or more LCOs concurrently, an evaluation shall be made to determine if loss of safety function exists. Additionally, other limitations, remedial actions, or compensatory actions may be identified as a result of the support system inoperability and corresponding exception to entering supported system Conditions and Required Actions. The SFDP implements the requirements of LCO 3.0.6.

Cross train checks to identify a loss of safety function for those support systems that support multiple and redundant safety systems are required. The cross train check verifies that the supported systems of the redundant OPERABLE support system are OPERABLE, thereby ensuring safety function is retained. If this evaluation determines that a loss of safety function exists, the appropriate Conditions and Required Actions of the LCO in which the loss of safety function exists are required to be entered.

LCO 3.0.7

Special tests and operations are required at various times over the unit's life to demonstrate performance characteristics, to perform maintenance activities, and to perform special evaluations. Because TS normally preclude these tests and operations, special test exceptions (STEs) allow specified requirements to be changed or suspended under controlled conditions. STEs are included in applicable sections of the Specifications. Unless otherwise specified, all other TS requirements remain unchanged and in

3.1 REACTIVITY CONTROL SYSTEMS

3.1.1 SHUTDOWN MARGIN (SDM) – T_{avg} > 200°F

LCO 3.1.1 SDM shall be ≥ 5.15% Δk/k.

APPLICABILITY: MODES 3 and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. SDM not within limit.	A.1 Initiate boration to restore SDM to within limit.	15 minutes

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.1.1.~~1~~2 Verify SDM is ≥ 5.15% Δk/k.	24 hours ①
SR 3.1.1.1 Verify SDM is acceptable with increased allowance for the withdrawn worth of inoperable CEAs,	1 hour after detection of inoperable CEA(s) and every 12 hours thereafter

3.1 REACTIVITY CONTROL SYSTEMS

3.1.4 Moderator Temperature Coefficient (MTC)

LCO 3.1.4 The MTC shall be maintained within the limits specified in the COLR, and a maximum positive limit as specified below:

a. 0.5 E-4 ΔK/K/°F ~~Δk F~~ when THERMAL POWER is ≤ 70% RTP; and ②

b. 0.0 ΔK/K/°F ~~Δk F~~ when THERMAL POWER is > 70% RTP.

APPLICABILITY: MODES 1 and 2 with $K_{eff} \geq 1.0$

ACTION

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. MTC not within limits.	A.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
	-------------------NOTE-------------------- SR 3.1.4.1 is not required to be performed prior to entry into MODE 2. ---	
SR 3.1.4.1	Verify MTC within the upper limit.	Prior to entering MODE 1 after each fuel loading

(continued)

3.1 REACTIVITY CONTROL SYSTEMS

3.1.5 Control Element Assembly (CEA) Alignment

LCO 3.1.5 All full length CEAs shall be OPERABLE and all full and part length CEAs shall be aligned to within 7 inches (~~indicated position,~~ with 2 of 3 position indicators available) of all other CEAs in its group. ③

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One regulating CEA trippable and misaligned from its group by > 7 inches.	A.1 Reduce THERMAL POWER in accordance with LCS requirements.	15 minutes
	<u>AND</u>	
	A.2.1 Verify SDM is ≥ 5.15% Δk/k.	1 hour
	<u>OR</u>	
	A.2.2 Initiate boration to restore SDM to within limit.	1 hour
	<u>AND</u>	
	A.3.1 Restore the misaligned CEA(s) to within 7 inches ~~(indicated position)~~ of its group.	2 hours ③
	<u>OR</u>	

(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.3.2 Align the remainder of the CEAs in the group to within 7 inches ~~(indicated position)~~ of the misaligned CEA(s) while maintaining the insertion limit of LCO 3.1.7, "Regulating Control Element Assembly (CEA) Insertion Limits."	2 hours ③
B. One shutdown CEA trippable and misaligned from its group by > 7 inches.	B.1 Reduce THERMAL POWER in accordance with LCS requirements.	~~1 hours~~ 15 minutes ④
	AND	
	B.2.1 Verify SDM is ≥ 5.15% Δk/k.	1 hour
	OR	
	B.2.2 Initiate boration to restore SDM to within limit.	1 hour
	AND	
	B.3 Restore the misaligned CEA(s) to within 7 inches ~~(indicated position)s~~ of its group.	2 hours ③

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME	
C. One part length CEA misaligned from its group by > 7 inches.	C.1 Reduce THERMAL POWER in accordance with LCS requirements.	~~1 hours~~ 15 minutes	④
	<u>AND</u>		
	C.2.1 Restore the misaligned CEA(s) to within 7 inches ~~(indicated position)~~ of its group.	2 hours	③
	<u>OR</u>		
	C.2.2 Align the remainder of the CEAs in the group to within 7 inches ~~(indicated position)~~ of the misaligned CEA(s), while maintaining the insertion limit of LCO 3.1.~~7~~8, Part Length "~~Regulating~~ Control Element Assembly (CEA) Insertion Limits."	2 hours	③ ⑤
D. Required position indication inoperable.	D.1 Restore inoperable position indicator channel to OPERABLE status.	6 hours	6 ⑥
	<u>OR</u>		
	D.~~2~~1 Align the CEA group(s) with the inoperable position indicator(s) at the fully withdrawn position.	6 hours	

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. Required Action and associated Completion Time of Condition A, B, C or D not met OR One full length CEA untrippable. OR More than one full length CEA trippable, but misaligned from any other CEA in its group by > 7 inches. OR More than one part length CEA misaligned from any other CEA in its group by > 7 inches.	E.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.5.1	Verify the ~~indicated~~ position of each full and part length CEA is within 7 inches of all other CEAs in its group.	12 hours

③

(continued)

3.1 REACTIVITY CONTROL SYSTEMS

3.1.8 Part Length Control Element Assembly (CEA) Insertion Limits

LCO 3.1.8 The part length CEA groups shall be limited to the insertion limits specified in of the COLR.

APPLICABILITY: MODE 1 > 20% RTP.

---------------------------NOTE---------------------------
This LCO not applicable while exercising part length CEAs.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Part length CEA groups inserted beyond the transient insertion limit.	A.1 Restore part length CEA groups to within the limit.	2 hours
	<u>OR</u>	
	A.2 Reduce THERMAL POWER to less than or equal to the fraction of RTP allowed by the CEA group position and insertion limits specified in the COLR.	2 hours
B. Part length CEA groups inserted between the long term steady state insertion limit and the transient insertion limit for intervals > 7 effective full power days (EFPD) per 30 EFPD or > 14 EFPD per 365 EFPD interval.	B.1 Restore part length CEA groups to within the long term steady state insertion limit.	2 hours

(continued)

⑦

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
			~~(continued)~~ ⑦
C. Required Action and associated Completion Time of Condition B not met.	C.1	Reduce THERMAL POWER to ≤ 20% RTP.	4 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.8.1	Verify part length CEA group position.	12 hours
SR 3.1.8.2	Verify the accumulated time during which the part length CEA groups are inserted beyond the long term steady state insertion limit but within the transient insertion limit.	24 hours

MINIMUM STORED BORIC ACID VOLUME AS A FUNCTION OF CONCENTRATION
(Gallons)

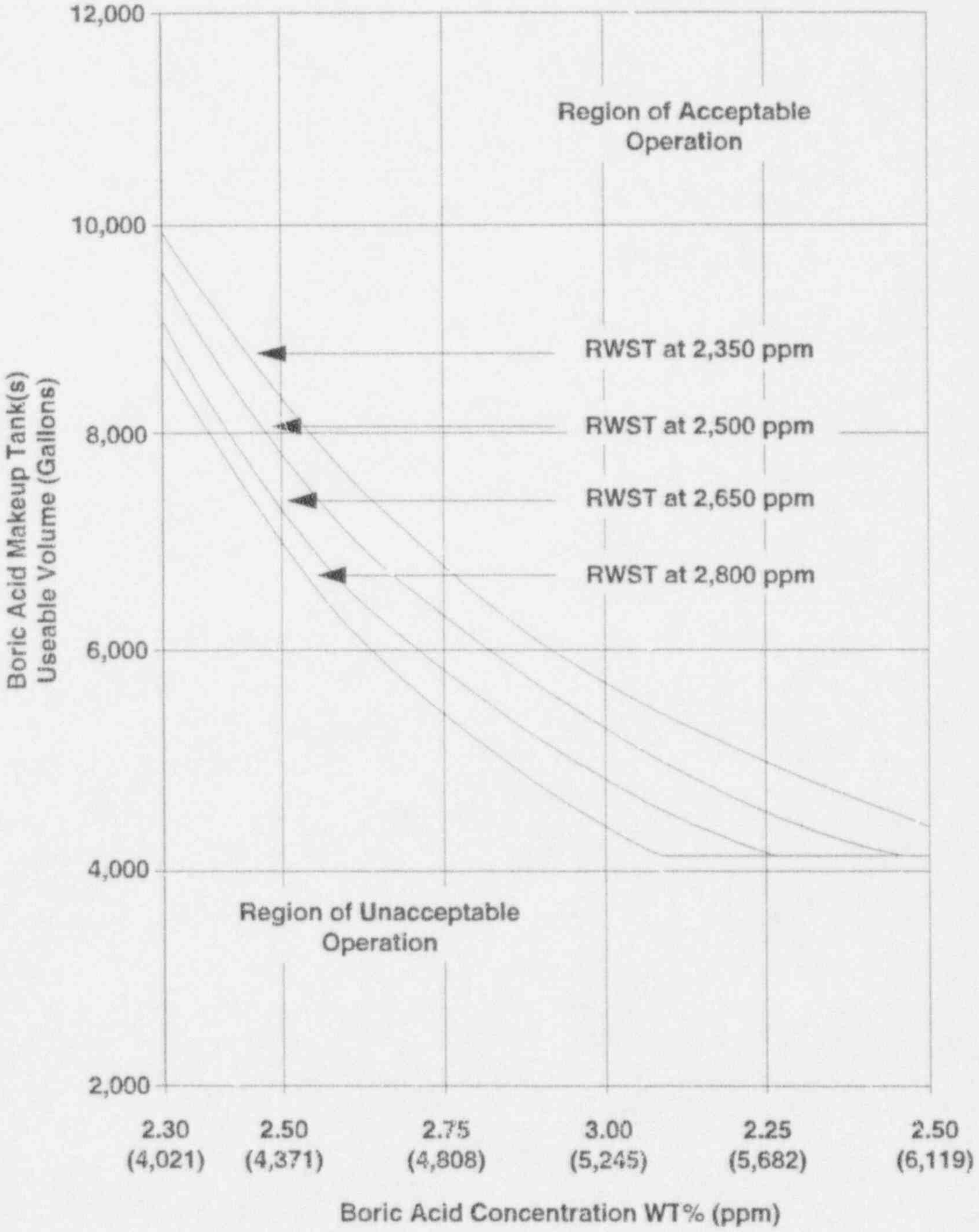

Figure 3.1.9-1

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.1.10.1	Verify that at least one of the above required flow paths is OPERABLE and ~~each valve (manual, power operated or automatic)~~ is in its correct position.	31 days

that each valve (manual, power operated or automatic, that is not locked, sealed, or otherwise secured) in the above required flow path

⑨

3.1 REACTIVITY CONTROL SYSTEMS

3.1.12 Special Test Exception (STE) - MODES 2 and 3

LCO 3.1.12 During performance of PHYSICS TESTS the following LCOs may be suspended:

⑩

LCO 3.1.1, "SHUTDOWN MARGIN (SDM) – T_{avg} > 200°F:" (Provided the shutdown reactivity available for trip insertion is ~~maintained to at least the equivalent amount of those CEAs actually withdrawn.~~ equivalent to at least the highest estimated CEA worth)
LCO 3.1.4, "Moderator Temperature Coefficient (MTC);"
LCO 3.1.5, "Control Element Assembly (CEA) Alignment;"
LCO 3.1.6, "Shutdown Control Element Assembly (CEA) Insertion Limits;"
LCO 3.1.7, "Regulating Control Element Assembly (CEA) Insertion Limits;"
LCO 3.1.8, "Part Length CEA Insertion Limits;"
LCO 3.3.1, "RPS Instrumentation - Operating," Table 3.3.1-1, ALLOWABLE VALUE for FUNCTION 2 and footnote (d) for FUNCTIONS ~~14~~ 11 and ~~15.~~ 12 ⑪

APPLICABILITY: MODES 2 and 3 during PHYSICS TESTS.

-----------------------------NOTE-----------------------------
Operation in MODE 3 shall be limited to 6 consecutive hours.

3.1 REACTIVITY CONTROL SYSTEMS

3.1.14 Special Test Exceptions (STE) - Center CEA Misalignment and Regulating CEA Insertion Limits

LCO 3.1.14 During performance of PHYSICS TESTS the following LCOs may be suspended:

LCO 3.1.5, "Control Element Assembly (CEA) Alignment;" and
LCO 3.1.7, "Regulating CEA Insertion Limits;"

provided that:

a. Only the center CEA (CEA #1) is misaligned, or only regulating CEA Group 6 is inserted beyond the transient insertion Limit of LCO 3.1.7; and

b. The LHR and DNBR do not exceed the limits specified in the COLR.

APPLICABILITY: MODE 1.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. LHR or DNBR outside the limits specified in the COLR.	A.1~~.1~~	Reduce THERMAL POWER to restore LHR and DNBR to within limits.	15 minutes
		~~OR~~	
B. Required Action and associated Completion Time NOT MET	B.1 ~~A.1.2~~	Be in MODE 3.	6 hours

~~(continued)~~

⑫

3.3 INSTRUMENTATION

3.3.1 Reactor Protective System (RPS) Instrumentation — Operating

LCO 3.3.1 Four RPS trip and operating bypass removal channels for each Function in Table 3.3.1-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.1-1.

ACTIONS

------------------------------------NOTES------------------------------------

1. Separate Condition entry is allowed for each RPS Function.
2. If a channel is placed in bypass, continued operation with the channel in the bypassed condition for the Completion Time specified by Required Action A.2 or C.2.2 shall be reviewed by the Onsite Review Committee.

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One or more Functions with one automatic RPS trip channel inoperable.	A.1	Place channel ~~Functional Unit of Table 3.3.1-2~~ in bypass or trip.	1 hour
	<u>AND</u>		
	A.2	Restore channel to OPERABLE status.	Prior to entering MODE 2 following next MODE 5 entry

(continued)

Table 3.3.1-1 (page 1 of 2)
Reactor Protective System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. Linear Power Level - High	1,2	SR 3.3.1.1 SR 3.3.1.4 SR 3.3.1.6 SR 3.3.1.7 SR 3.3.1.8 SR 3.3.1.9 SR 3.3.1.13	≤ 111.0% RTP
2. Logarithmic Power Level - High[a]	$2^{(b)}$	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.12 SR 3.3.1.13	.93% ≤ .93% RTP
3. Pressurizer Pressure - High	1,2	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.13	≤ 2385 psia
4. Pressurizer Pressure - Low[c]	1,2	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.12 SR 3.3.1.13	≥ 1700 psia
5. Containment Pressure - High	1,2	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.13	≤ 3.4 psig
6. Steam Generator 1 Pressure-Low	1,2	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.13	≥ 729 psia
7. Steam Generator 2 Pressure-Low	1,2	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.13	≥ 729 psia

(continued)

(a) Trip may be bypassed when THERMAL POWER is > 1E-4% RTP. Bypass shall be automatically removed when THERMAL POWER is < 1E-4% RTP. Trip may be manually bypassed during physics testing pursuant to LCO ~~3.1.10.~~ 3.1.12

(b) When any RTCB is closed.

(c) The setpoint may be decreased to a minimum value of 300 psia, as pressurizer pressure is reduced, provided the margin between pressurizer pressure and the setpoint is maintained ≤ 400 psia. Trips may be bypassed when pressurizer pressure is < 472 psia. Bypass shall be automatically removed when pressurizer pressure is ≥ 472 psia. The setpoint shall be automatically increased to the normal setpoint as pressurizer pressure is increased.

Table 3.3.1-1 (page 2 of 2)
Reactor Protective System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
8. Steam Generator 1 Level – Low	1,2	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.13	≥ 20%
9. Steam Generator 2 Level – Low	1,2	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.13	≥ 20%
10. Reactor Coolant Flow – Low(d)	1,2	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.12 SR 3.3.1.13	Ramp: ≤ 0.231 psid/sec. Floor: ≥ 12.1 psid Step: 7.25 psid
11. Local Power Density – High(d)	1,2	SR 3.3.1.1 SR 3.3.1.3 SR 3.3.1.4 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.10 SR 3.3.1.11 SR 3.3.1.12 SR 3.3.1.13	≤ 21.0 kW/ft
12. Departure From Nucleate Boiling Ratio (DNBR) – Low(d)	1,2	SR 3.3.1.1 SR 3.3.1.2 SR 3.3.1.3 SR 3.3.1.4 SR 3.3.1.5 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.10 SR 3.3.1.11 SR 3.3.1.12 SR 3.3.1.13	≥ 1.31

(d) Trip may be bypassed when THERMAL POWER is < 1E-4% RTP. Bypass shall be automatically removed when THERMAL POWER is ≥ 1E-4% RTP. During testing pursuant to LCO ~~3.4.13~~ 3.1.12, trip may be bypassed below 5% RTP. Bypass shall be automatically removed when THERMAL POWER is ≥ 5% RTP.

Table 3.3.1-2 (page 1 of 1)
Functional Units

Required Action A.1

	Process Measurement Circuit	Functional Unit Bypassed
1.	Linear Power (Subchannel or Linear)	Linear Power Level - High Local Power Density - High DNBR - Low
2.	Pressurizer Pressure - High	Pressurizer Pressure - High Local Fower Density - High DNBR - Low
3.	Containment Pressure - High	Containment Pressure - High (RPS) Containment Pressure High (ESF)
4.	Steam Generator Pressure - Low	Steam Generator Pressure - Low Steam Generator ΔP 1 AND 2 (EFAS 1 and 2)
5.	Steam Generator Level	Steam Generator Level - Low Steam Generator Level - High Steam Generator ΔP (EFAS)
6.	Core Protection Calculator	Local Power Density - High DNBR - Low

Required Action A.2

	Process Measurement Circuit	Functional Unit Bypassed
1.	Linear Power (Subchannel or Linear)	Linear Power Level - High Local Power Density - High DNBR - Low
2.	Pressurizer Pressure - High	Pressurizer Pressure - High Local Power Density - High DNBR - Low
3.	Containment Pressure - High	Containment Pressure - High (RPS) Containment Pressure - High (ESF)
4.	Steam Generator Pressure - Low	Steam Generator Pressure - Low Steam Generator ΔP 1 and 2 (EFAS 1 and 2)
5.	Steam Generator Level	Steam Generator - Low Steam Generator - High Steam Generator ΔP (ESFAS)
6.	Core Protection Calculator	Local Power Density - High DNBR - Low

3.3 INSTRUMENTATION

3.3.2 Reactor Protective System (RPS) Instrumentation – Shutdown

LCO 3.3.2 Four RPS Logarithmic Power Level – High trip channels and associated instrument and operating bypass removal channels shall be OPERABLE. Trip channels shall have an Allowable Value of ≤ .93% RTP.

APPLICABILITY: MODES 3, 4, and 5, with any reactor trip circuit breakers (RTCBs) closed and any control element assembly capable of being withdrawn.

-----------------------------NOTE-----------------------------
Trip may be bypassed when THERMAL POWER is > 1E-4% RTP. Bypass shall be automatically removed when THERMAL POWER is ≤ 1E-4% RTP.

ACTIONS

-----------------------------NOTE-----------------------------
If a channel is placed in bypass, continued operation with the channel in the bypassed condition for the Completion Time specified by Required Action A.2 or C.2.2 shall be reviewed by the Onsite Review Committee.

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One RPS logarithmic power level trip channel inoperable.	A.1	Place channel in bypass or trip.	1 hour
	AND		
	A.2	Restore channel to OPERABLE status.	Prior to entering MODE 2 following next MODE 5 entry

(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. (continued)	B.2 Verify all full length and part length control element assembly (CEA) groups are fully withdrawn and maintained fully withdrawn, except during Surveillance testing pursuant to SR 3.1.5.3 and SR 3.1.5.4 or for control, when CEA group #6 may be inserted to a maximum of 127.5 inches.	4 hours
	AND	
	B.3 Verify the "RSPT/CEAC Inoperable" addressable constant in each core protection calculator (CPC) is set to indicate that ~~both~~ the applicable CEA(s) ~~are~~ is (are) inoperable.	4 hours
	AND	
	B.4 Verify the Control Element Drive Mechanism Control System is placed in "OFF" and maintained in "OFF," except during CEA motion permitted by Required Action B.2.	4 hours
	AND	
	B.5 Perform SR 3.1.5.1.	Once per 4 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. Required Action and associated Completion Time of Condition A, B, or D not met. OR One or more Functions with more than one Manual Trip, Matrix Logic, Initiation Logic, or RTCB channel inoperable for reasons other than Condition A or D.	E.1 Be in MODE 3. AND E.2 Open all RTCBs.	6 hours 6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.4.1	Perform a CHANNEL FUNCTIONAL TEST on each ~~RPS Logic channel and~~ RTCB channel.	31 days
SR 3.3.4.~~2~~3	Perform a CHANNEL FUNCTIONAL TEST, including separate verification of the undervoltage and shunt trips, on each RTCB.	18 months
SR 3.3.4.~~3~~4	Perform a CHANNEL FUNCTIONAL TEST on each RPS Manual Trip channel.	Once within 7 days prior to each reactor startup

SR 3.3.4.2	Perform a CHANNEL FUNCTIONAL TEST on each RPS Logic channel.	92 days

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. (continued)	D.2 Place one affected automatic trip channel in bypass and place the other in trip.	1 hour
E. Required Action and associated Completion Time not met. for Safety Injection Actuation Signal, Containment Spray Actuation Signal, Containment Isolation Actuation Signal, Main Steam Isolation Signal, or Emergency Feedwater Actuation Signal	E.1 Be in MODE 3. AND E.2 Be in MODE 4.	6 hours 12 hours
F. Required Action and associated Completion Time for Recirculation Actuation Signal not met.	F.1 Be in MODE 3. AND F.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.5.1	Perform a CHANNEL CHECK of each ESFAS channel.	12 hours
SR 3.3.5.2	Perform a CHANNEL FUNCTIONAL TEST of each ESFAS channel, including bypass removal functions.	92 days
SR 3.3.5.3	Perform a CHANNEL CALIBRATION of Function 5, Recirculation Actuation Signal, including bypass removal functions.	18 months

(continued)

Table 3.3.5-1 (page 1 of 1)
Engineered Safety Features Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	ALLOWABLE VALUE
1. Safety Injection Actuation Signal(a)		
a. Containment Pressure - High	1,2,3	≤ 3.7 psig
b. Pressurizer Pressure - Low(b)		≥ 1700 psia
2. Containment Spray Actuation Signal (e)		
a. Containment Pressure - High-High	1,2,3	≤ 15.0 psig
3. Containment Isolation Actuation Signal		
a. Containment Pressure - High	1,2,3	≤ 3.7 psig
4. Main Steam Isolation Signal		
a. Steam Generator Pressure - Low(c)	1,2(d),3(d)	≥ 729 psia
5. Recirculation Actuation Signal		
a. Refueling Water Storage Tank Level - Low	1,2,3,4	19.27% ≥ tap span ≥ 17.73%
6. Emergency Feedwater Actuation Signal SG #1~~(c)~~ (EFAS-1)		
a. Steam Generator Level - Low	1,2,3	≥ 20%
b. SG Pressure Difference - High		≤ 140 psid
c. Steam Generator Pressure - Low (c)		≥ 729 psia
7. Emergency Feedwater Actuation Signal SG #2~~(c)~~ (EFAS-2)		
a. Steam Generator Level - Low	1,2,3	≥ 20%
b. SG Pressure Difference - High		≤ 140 psid
c. Steam Generator Pressure - Low (c)		≥ 729 psia

(a) Automatic SIAS also initiates a Containment Cooling Actuation Signal (CCAS).

(b) The setpoint may be decreased to a minimum value of 300 psia, as pressurizer pressure is reduced, provided the margin between pressurizer pressure and the setpoint is maintained ≤ 400 psia. Trips may be bypassed when pressurizer pressure is < 472 psia decreasing. Bypass shall be automatically removed when pressurizer pressure is ≥ 472 psia increasing. The setpoint shall be automatically increased to the normal setpoint as pressurizer pressure is increased.

(c) The setpoint may be decreased as steam pressure is reduced, provided the margin between steam pressure and the setpoint is maintained ≤ 200 psi. The setpoint shall be automatically increased to the normal setpoint as steam pressure is increased.

(d) The Main Steam Isolation Signal Function (Steam Generator Pressure - Low) is not required to be OPERABLE when all associated valves isolated by the MSIS Function are closed and de-activated.

(e) Automatic SIAS is required for Containment Spray Actuation Signal (CSAS).

Table 3.3.5-2 (page 1 of 1)
Functional Units

Action A.1

	Process Measurement Circuit	Functional Unit Bypassed
1.	Containment Pressure - High	Containment Pressure - High (ESF) Containment Pressure - High (RPS)
2.	Steam Generator Pressure - Low	Steam Generator Pressure Low Steam Generator ΔP 1 and 2 (EFAS)
3.	Steam Generator Level	Steam Generator Level - Low Steam Generator Level - High Steam Generator ΔP (EFAS)

Action B.1

	Process Measurement Circuit	Functional Unit Bypassed/Tripped
1.	Containment Pressure ~~Circuit~~	Containment Pressure - High (ESF) Containment Pressure - High (RPS)
2.	Steam Generator Pressure - Low	Steam Generator Pressure - Low Steam Generator Pressure ΔP (EFAS)
3.	Steam Generator Level - Low	Steam Generator Level - Low Steam Generator Level - High Steam Generator ΔP (EFAS)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. One or more Functions with two Initiation Logic channels affecting the same trip leg inoperable.	C.1	Initiate action to Open at least one contact in the affected trip leg of both ESFAS Actuation Logics.	Immediately
	AND		
	C.2	Restore channels to OPERABLE status.	48 hours
D. One or more Functions with one Actuation Logic channel inoperable.	D.1	--------NOTE--------- One channel of Actuation Logic may be bypassed for up to 1 hour for Surveillances, provided the other channel is OPERABLE. --------------------- Restore inoperable channel to OPERABLE status.	48 hours
E. Required Action and associated Completion Time of Conditions for Main Steam Isolation Signal, Containment Spray Actuation Signal, or Emergency Feedwater Actuation Signal not met.	E.1	Be in MODE 3.	6 hours
	AND		
	E.2	Be in MODE 4.	12 hours

(continued)

Table 3.3.6-1 (page 1 of 1)
Engineered Safety Features Actuation System Logic and Manual Trip Applicability

FUNCTION	APPLICABLE MODES
1. Safety Injection Actuation Signal	
a. Matrix Logic	1,2,3
b. Initiation Logic	1,2,3,4(c)
c. Actuation Logic	1,2,3,4
d. Manual Trip	1,2,3,4
2. Containment Isolation Actuation Signal	
a. Matrix Logic	1,2,3
b. Initiation Logic	1,2,3,4(c)
c. Actuation Logic	1,2,3,4
d. Manual Trip	1,2,3,4
3. Containment Cooling Actuation Signal(a)	
a. Initiation Logic	1,2,3,4(c)
b. Actuation Logic	1,2,3,4
c. Manual Trip	1,2,3,4
4. Recirculation Actuation Signal	
a. Matrix Logic	1,2,3,4
b. Initiation Logic	1,2,3,4
c. Actuation Logic	1,2,3,4
5. Containment Spray Actuation Signal(b)	
a. Matrix Logic	1,2,3
b. Initiation Logic	1,2,3
c. Actuation Logic	1,2,3
d. Manual Trip	1,2,3
6. Main Steam Isolation Signal	
a. Matrix Logic	1,2,3
b. Initiation Logic	1,2,3
c. Actuation Logic	1,2,3
d. Manual Trip	1,2,3
7. Emergency Feedwater Actuation Signal SG #1 (EFAS-1)	
a. Matrix Logic	1,2,3
b. Initiation Logic	1,2,3
c. Actuation Logic	1,2,3
d. Manual Trip	1,2,3
8. Emergency Feedwater Actuation Signal SG #2 (EFAS-2)	
a. Matrix Logic	1,2,3
b. Initiation Logic	1,2,3
c. Actuation Logic	1,2,3
d. Manual Trip	1,2,3

(a) Automatic SIAS also initiates CCAS.

(b) Automatic SIAS also required for automatic CSAS initiation.

(c) Only the portions of Initiation Logic necessary for manual trip are required in MODE 4.

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.7.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.7.2	Perform CHANNEL FUNCTIONAL TEST.	24 months
SR 3.3.7.3	Perform CHANNEL CALIBRATION with setpoint Allowable Values as follows: a. Degraded Voltage Function ≥ 4181 V and ≤ 4275 V ~~Time delay: ≥ 105 seconds and ≤ 135 seconds at 9228 V; and~~ b. Loss of Voltage Function ≥ 3554 V and ≤ 3796 V Time delay: ≥ 0.95 seconds and ≤ 1.05 seconds at 0 V.	24 months
SR 3.3.7.4	Verify Response Time of required DG-LOV channel is within 1.05 seconds.	24 months on a STAGGERED TEST BASIS

SDVSS (Sustained Degraded Grid Voltage):
Time delay: ≤ 135 seconds
(response time is measured from initiation of degraded voltage)

DGVSS (Degraded Grid Voltage with SIAS Signal):
Time delay: ≤ 6.14 seconds
(response time is measured from initiation of SIAS)

3.3 INSTRUMENTATION

3.3.10 Fuel Handling Isolation Signal (FHIS)

LCO 3.3.10 One FHIS channel shall be OPERABLE.

APPLICABILITY: During movement of irradiated fuel in the fuel handling building.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Actuation Logic, Manual Trip, or required channel of gaseous radiation monitor inoperable during movement of irradiated fuel assemblies.	A.1 Place one OPERABLE Fuel Handling Building Post Accident Cleanup System (PACU) train in operation. OR A.2 Suspend movement of irradiated fuel assemblies in the fuel handling building.	Immediately Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.10.1	Perform a CHANNEL CHECK on required FHIS radiation monitor channel.	12 hours
SR 3.3.10.2	Perform a CHANNEL FUNCTIONAL TEST on required FHIS radiation monitor channel. Verify radiation monitor setpoint Allowable Values: Airborne Gaseous: ≤ 6E4 cpm above background	92 days
SR 3.3.10.3	-------------------NOTE-------------------- Testing of Actuation Logic shall include the actuation of each initiation relay and verification of the proper operation of each ignition relay. --- Perform a CHANNEL FUNCTIONAL TEST on required FHIS Actuation Logic channel.	18 months
SR 3.3.10.4	Perform a CHANNEL FUNCTIONAL TEST on required FHIS Manual Trip logic.	18 months
SR 3.3.10.5	Perform a CHANNEL CALIBRATION on required FHIS radiation monitor channel.	18 months

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. ---------NOTE--------- Not applicable to hydrogen monitor channels. ---------------------- One or more Functions with two required channels inoperable.	C.1	Restore one channel to OPERABLE status.	7 days
D. Two hydrogen monitor channels inoperable.	D.1	Restore one hydrogen monitor channel to OPERABLE status.	72 hours
E. Required channel of Functions 18, 21, 24, or 25 inoperable.	E.1	Restore required channel to OPERABLE status.	7 days
F. Required Action and associated Completion Time of Condition C, D or E not met.	F.1	Enter the Condition referenced in Table 3.3.11-1 for the channel.	Immediately
G. As required by Required Action F.1 and referenced in Table 3.3.11-1.	G.1	Be in MODE 3.	6 hours
	<u>AND</u>		
	G.2	Be in MODE 4.	12 hours
H. As required by Required Action F.1 and referenced in Table 3.3.11-1.	H.1	Initiate action in accordance with Specification 5.7.2.	Immediately

~~SURVEILLANCE REQUIREMENTS~~

3.3 INSTRUMENTATION

3.3.13 Source Range Monitoring Channels

LCO 3.3.13 Two channels of source range monitoring instrumentation shall be OPERABLE.

APPLICABILITY: MODES 3, 4, and 5, with the reactor trip circuit breakers open or Control Element Assembly (CEA) Drive System not capable of CEA withdrawal.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more required channels inoperable.	A.1 Suspend all operations involving positive reactivity additions.	Immediately
	AND	
	A.2 Perform SDM verification in accordance with SR 3.1.1.1, if T_{avg} > 200°F, or SR 3.1.2.~~1~~ 2, if T_{avg} ≤ 200°F.	4 hours AND Once per 12 hours thereafter

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.1 RCS Pressure, Temperature, and Flow Limits

LCO 3.4.1 RCS parameters for pressurizer pressure, cold leg temperature, and RCS total flow rate shall be within the limits specified below:

a. Pressurizer pressure ≥ 2025 psia and ≤ 2275 psia;

④ b. RCS cold leg temperature (T_c):
1. For RTP ≤ 30%, ~~T_c limit not applicable~~, 520°F ≤ T_c ≤ 557°F
2. For 30% < RTP < 70%, 535°F ≤ T_c ≤ 557°F,
3. For RTP ≥ 70%, 544°F ≤ T_c ≤ 557°F; and

c. RCS total flow rate is specified by the COLR.

APPLICABILITY: MODE 1.

---------------------------NOTE------------------------
Pressurizer pressure limit does not apply during:

a. THERMAL POWER ramp > 5% RTP per minute; or

b. THERMAL POWER step > 10% RTP.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. Pressurizer pressure or RCS flow rate not within limits.	A.1	Restore parameter(s) to within limit.	2 hours
B. Required Action and associated Completion Time of Condition A not met.	B.1	Be in MODE 2.	6 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. RCS cold leg temperature not within limits.	C.1 Restore cold leg temperature to within limits.	2 hours
D. Required Action and associated Completion Time of Condition C not met.	D.1 Reduce THERMAL POWER to ≤ 30% RTP.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.1.1 Verify pressurizer pressure ≥ 2025 psia and ≤ 2275 psia.	12 hours
⑤ SR 3.4.1.2 Verify RCS cold leg temperature: 2. ~~1.~~ For 30% < RTP < 70%, 535°F ≤ T_c ≤ 557°F, 3. ~~2.~~ For RTP ≥ 70%, 544°F ≤ T_c ≤ 557°F 1. For RTP≤30% 520°F ≤ T_C ≤ 557°F	12 hours
----------NOTE---------- Required to be met in MODE 1 with all RCPs running. -------------------- SR 3.4.1.3 Verify RCS total flow rate is within limit specified in the COLR.	12 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. No RCS loop OPERABLE. OR No RCS loop in operation.	C.1	Suspend all operations involving a reduction of RCS boron concentration.	Immediately
	AND		
	C.2	Initiate action to restore one RCS loop to OPERABLE status and operation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.5.1	Verify required RCS loop is in operation.	12 hours
SR 3.4.5.2	Verify secondary side water level in each steam generator ≥ 10% (wide range). ① 9 50	12 hours
SR 3.4.5.3	Verify correct breaker alignment and indicated power available to the required pump that is not in operation.	7 days

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.6.1	Verify at least one RCS loop or SDC train is in operation.	12 hours
SR 3.4.6.2	Verify secondary side water level in required SG(s) is ≥ 10% (wide range). ② 9 50	12 hours
SR 3.4.6.3	Verify correct breaker alignment and indicated power available to the required pump that is not in operation.	7 days

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.7 RCS Loops – MODE 5, Loops Filled

LCO 3.4.7 At least one of the following loop(s)/trains listed below shall be OPERABLE and in operation:

a. Reactor Coolant Loop 1 and its associated steam generator and at least one associated Reactor Coolant Pump

b. Reactor Coolant Loop 2 and its associated steam generator and at least one associated Reactor Coolant Pump

c. Shutdown Cooling Train A

d. Shutdown Cooling Train B

One additional Reactor Coolant Loop/shutdown cooling train shall be OPERABLE, or

⑬ The secondary side water level of each steam generator shall be greater than 10% (wide range).

50

-----------------------------NOTES-----------------------------

1. All reactor coolant pumps (RCPs) and pumps providing shutdown cooling may be de-energized for ≤ 1 hour per 8 hour period, provided:

   a. No operations are permitted that would cause reduction of the RCS boron concentration; and

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

2. One required SDC train may be inoperable for up to 2 hours for surveillance testing provided that the other SDC train or RCS loop is OPERABLE and in operation.

3. One required RCS loop may be inoperable for up to 2 hours for surveillance testing provided that the other RCS loop or SDC train is OPERABLE and in operation.

-- (continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. No SDC train/RCS loop in operation	B.1	Suspend all operations involving reduction in RCS boron concentration	Immediately
	<u>AND</u>		
	B.2	Initiate action to restore required SDC train/RCS loop to operation	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.7.1	Verify at least one RCS loop or SDC train is in operation.	12 hours
SR 3.4.7.2 ③	Verify required SG secondary side water level is ≥ 10% (wide range). 50	12 hours
SR 3.4.7.3	Verify correct breaker alignment and indicated power available to the required pump that is not in operation.	7 days

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.12.1 Low Temperature Overpressure Protection (LTOP) System

RCS Temperature ≤ LTOP Enable Temperature ⑦ or depressurized to less than the PTLR Limit

LCO 3.4.12.1 No more than two high pressure safety injection pumps shall be OPERABLE, the safety injection tanks shall be isolated, and at least one of the following overpressure protection systems shall be OPERABLE:

a. The Shutdown Cooling System Relief Valve (PSV9349) with:

   1) A lift setting of 406 ± 10 psig

   2) Relief Valve isolation valves 2HV9337, 2HV9339, 2HV9377, and 2HV9378 open,

or,

b. The Reactor Coolant System depressurized with an RCS vent of greater than or equal to 5.6 square inches.

APPLICABILITY: MODE 4 when the temperature of any one RCS cold leg is less than or equal to the enable temperatures specified in the PTLR,

MODE 5, and

MODE 6 when the head is on the reactor vessel.

(14)

---------------------------NOTES---------------------------

1. The SDCS Relief Valve lift setting assumes valve temperatures less than or equal to 130°F.

2. SIT isolation or depressurization to less than the PTLR Limit is only required when SIT pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed by the P/T limit curves provided in the PTLR.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. With more than two HPSI pumps capable of injecting into the RCS.	A.1 Initiate action to verify a maximum of two HPSI pumps capable of injecting into the RCS	Immediately
B. SIT pressure is greater than or equal to the maximum RCS pressure for existing cold leg temperature allowed in the PTLR.	B.1 Isolate affected SIT. OR ⑧	1 hour
⑧ C. Required Action & associated Completion Time of Condition B not met	~~B.2~~ C.1 Depressurize affected SIT to less than the maximum RCS pressure for existing cold leg temperature allowed in the PTLR.	12 hours
⑧ D. With one or both SDCS Relief Valve isolation valves in a single SDCS Relief Valve isolation valve pair (valve pair 2HV9337 and 2HV9339 or valve pair 2HV9377 and 2HV9378) closed.	D.1 ⑧ Open the closed valve(s). OR D.2 ⑧ Power-lock open the OPERABLE SDCS Relief Valve isolation valve pair.	24 hours 24 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
E ~~F~~. SDCS Relief Valve inoperable. ⑧ OR Required Action and associated Completion Time of Condition A, C ~~D~~, or ~~E~~ D not met. ⑧ OR LTOP System inoperable for any reason other than Condition A, ~~C~~, ~~D or E~~ C or D ⑧	E ~~F~~.1 ⑧	Reduce T_{avg} to less than 200°F, depressurize RCS and establish RCS vent of ≥ 5.6 square inches.	8 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.12.1.1	-------------------NOTE------------------- A HPSI pump is secured by verifying that its motor circuit breaker is not racked-in, or its discharge valve is locked closed. The requirement to rack out the HPSI pump breaker is satisfied with the pump breaker racked out to its disconnected or test position. -- Verify a maximum of two HPSI pumps are capable of injecting into the RCS.	12 hours
SR 3.4.12.1.2	-------------------NOTE------------------- Required to be performed when complying with LCO 3.4.12.1 Note 2. -- ⑨ Verify each SIT is isolated, or depressurized less than the PTLR Limit	12 hours
SR 3.4.12.1.3	Verify RCS vent ≥ 5.6 square inches is open when in use for overpressure protection.	12 hours for unlocked open vent valve(s) AND 31 days for locked, sealed, or otherwise secured open vent valve(s), or open flanged RCS penetrations

(continued)

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. No pressurizer code safety valves OPERABLE. AND The SDCS Relief Valve INOPERABLE.	A.1	Be in MODE 5 and vent the RCS through a greater than or equal to 5.6 square inch vent.	8 hours
B. With one or both SDCS Relief Valve isolation valves in a single SDCS Relief Valve isolation valve pair (valve pair 2HV9337 and 2HV9339 or valve pair 2HV9377 and 2HV9378) closed	B.1	~~Open all closed the~~ Open the closed valve(s)	24 hours
	or B.2	Power-lock open the OPERABLE SDCS Relief Valve isolation valve pair	24 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
	---------------------Note--------------------- Only required when the SDCS Relief Valve is being used for overpressure protection. ---	
SR 3.4.12.2.1	Verify that the SDCS Relief Valve isolation valves 2HV9337, 2HV9339, 2HV9377, and 2HV9378 are open.	72 hours
SR 3.4.12.2.2	Verify relief valve setpoint.	In accordance with the Inservice Testing Program

⑩ ⑩

Table 3.4.14-1
REACTOR COOLANT SYSTEM PRESSURE ISOLATION VALVES

SECTION A

VALVE NUMBER	VALVE DESCRIPTION
S21204MU018	HPSI Check to Loop #1A
S21204MU019	HPSI Check to Loop #1B
S21204MU020	HPSI Check to Loop #2A
S21204MU021	HPSI Check to Loop #2B
S21204MU152	Hot leg injection to loop #1
S21204MU156	Hot leg injection to loop #2
S21204MU157	Hot leg injection check
S21204MU158	Hot leg injection check
2HV-9337	SDC Suction Isolation
2HV-9339	SDC Suction Isolation
2HV-9377	SDC Suction Isolation
2HV-9378	SDC Suction Isolation

⑪

SECTION B

VALVE NUMBER	VALVE DESCRIPTION
S21204MU072	LPSI Check to Loop #1A
S21204MU073	LPSI Check to Loop #1B
S21204MU074	LPSI Check to Loop #2A
S21204MU075	LPSI Check to Loop #2B
S21204MU027*	Cold leg injection to loop #1A
S21204MU029*	Cold leg injection to loop #1B
S21204MU031*	Cold leg injection to loop #2A
S21204MU033*	Cold leg injection to loop #2B
S21204MU040	SIT T008 Check
S21204MU041	SIT T007 Check
S21204MU042	SIT T009 Check
S21204MU043	SIT T010 Check

*Redundant to LPSI and SIT checks

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.16 RCS Specific Activity

6

LCO 3.4.16 The specific iodine activity of the reactor coolant shall be limited to:

a. DOSE EQUIVALENT I-131 specific activity ≤ 1.0 μCi/gm; and

b. Gross specific activity ≤ 100/E μCi/gm.

APPLICABILITY: MODES 1 and 2,
MODE 3 with RCS average temperature (T_{avg}) ≥ 500°F

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. DOSE EQUIVALENT I-131 > 1.0 μCi/gm.	- - - - - - NOTE - - - - - The provisions of Specification 3.0.4 are not applicable. - - - - - - NOTE - - - - 6	
	A.1 Verify DOSE EQUIVALENT I-131 within the acceptable region of Figure 3.4.16-1.	Once per 4 hours
	AND	
	A.2 Restore DOSE EQUIVALENT I-131 to within limit.	48 hours

(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.1 Verify the OPERABLE door is closed in the affected air lock.	1 hour
	<u>AND</u>	
	A.2 Lock the OPERABLE door closed in the affected air lock.	24 hours
	<u>AND</u>	
	A.3 --------NOTE--------- Air lock doors in high radiation areas may be verified locked closed by administrative means. --------------------- Verify the OPERABLE door is locked closed in the affected air lock.	Once per 31 days
B. One or more containment air locks with containment air lock interlock mechanism inoperable.	------------NOTES------------ 1. Required Actions B.1, B.2, and B.3 are not applicable if both doors in the same air lock are inoperable and Condition C is entered. 2. Entry and exit of containment is permissible under the control of a dedicated individual. ----------------------------	
		(continued)

add

3. The provisions of LCO 3.0.4 are not applicable.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. (continued)	D.2 --------NOTE--------- Valves and blind flanges in high radiation areas may be verified by use of administrative means. --------------------- Verify the affected penetration flow path is isolated.	Once per 31 days for isolation devices outside containment <u>AND</u> Prior to entering MODE 4 from MODE 5 if not performed within the previous 92 days for isolation devices inside containment
	<u>AND</u>	
	D.3 Perform SR 3.6.3.6 for the resilient seal purge valves closed to comply with Required Action D.1.	Once per 184 days
E. One or more Section D.1 containment isolation valve(s) inoperable.	E.1 Secure the inoperable valve(s) in its ESFAS actuated position.	4 hours
	<u>AND</u>	
	E.2 Restore the inoperable valve(s) to OPERABLE status.	Prior to ~~entry~~ completing next cold shutdown ~~into MODE 5, or~~ if cold shutdown entered within 30 days, otherwise within 30 days. ~~whichever is~~ ~~shorte~~r.

SURVEILLANCE REQUIREMENTS

-------------------------------------NOTE-------------------------------------
1. Section A, B, C, D, and E isolation valves are located in the LCS.

SURVEILLANCE	FREQUENCY
SR 3.6.3.1 Verify each 42 inch purge valve is sealed closed except for one purge valve in a penetration flow path while in Condition D of this LCO.	31 days
SR 3.6.3.2 Verify each 8 inch purge valve is closed except when the 8 inch purge valves are open for pressure control, ALARA or air quality considerations for personnel entry, or for Surveillances that require the valves to be open.	31 days
SR 3.6.3.3 -------------------NOTE-------------------- Valves and blind flanges in high radiation areas may be verified by use of administrative means. --- Verify each containment isolation manual valve and blind flange that is located outside containment and is required to be closed during accident conditions is closed, except for containment isolation valves that are open under administrative controls.	31 days

(continued)

SURVEILLANCE	FREQUENCY
SR 3.6.3.4 -------------------NOTE------------------- Valves and blind flanges in high radiation areas may be verified by use of administrative means. -- Verify each containment isolation manual valve and blind flange that is located inside containment and required to be closed during accident conditions is closed, except for containment isolation valves that are open under administrative controls.	Prior to entering MODE 4 from MODE 5 if not performed within the previous 92 days
SR 3.6.3.5 Verify the isolation time of each Section A and B power operated and each automatic containment isolation valve is within limits.	In accordance with the Inservice Testing Program
SR 3.6.3.6 -------------------NOTE------------------- Results shall be evaluated against acceptance criteria of SR 3.6.1.1 in accordance with 10 CFR 50, Appendix J, as modified by approved exemptions. -- Perform leakage rate testing for containment purge valves with resilient seals.	184 days AND Within 92 days after opening the valve

(continued)

SURVEILLANCE	FREQUENCY
SR 3.6.3.7 -------------------NOTE-------------------- The provisions of the Inservice Testing Program are not applicable when the valves are secured open. --- Verify each Section D1 and D2 containment isolation valve is OPERABLE.	In accordance with the Inservice Testing Program and those SRS associated with those Specifications pertaining to each valve or system in which it is installed.
SR 3.6.3.8 Verify each Section A, B, C, and E automatic containment isolation valve actuates to the isolation position on an actual or simulated actuation signal.	24 months

3.7 PLANT SYSTEMS

3.7.4 Atmospheric Dump Valves (ADVs)

LCO 3.7.4 One ADV per required Steam Generator (SG) shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3,
MODE 4 when steam generator is being relied upon for heat removal.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One required ADV inoperable.	A.1	--------NOTE--------- LCO 3.0.4 is not applicable. --------------------- Restore ADV to OPERABLE status.	72 hours
B. Two ADVs inoperable.	B.1	Restore one ADV to OPERABLE status.	24 hours
C. Backup nitrogen gas supply system capacity ≤ 8 hours for each ADV	C.1	Restore backup nitrogen gas supply system capacity for each ADV	72 hours

(continued)

①

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Actions and associated Completion Times of Conditions A or B not met.	C.1 Be in MODE 3. AND C.2 Be in MODE 5.	6 hours ~~30~~ hours ② 36

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.7.1.1	Verify the contained water volume in the Primary Plant Makeup Storage Tank is within its limits.	7 days
SR 3.7.7.1.2	Verify each CCW Safety Related Makeup pump develops the required differential pressure on recirculation flow.	In accordance with inservice testing program
SR 3.7.7.1.3	Measure CCW Leakage.	24 months

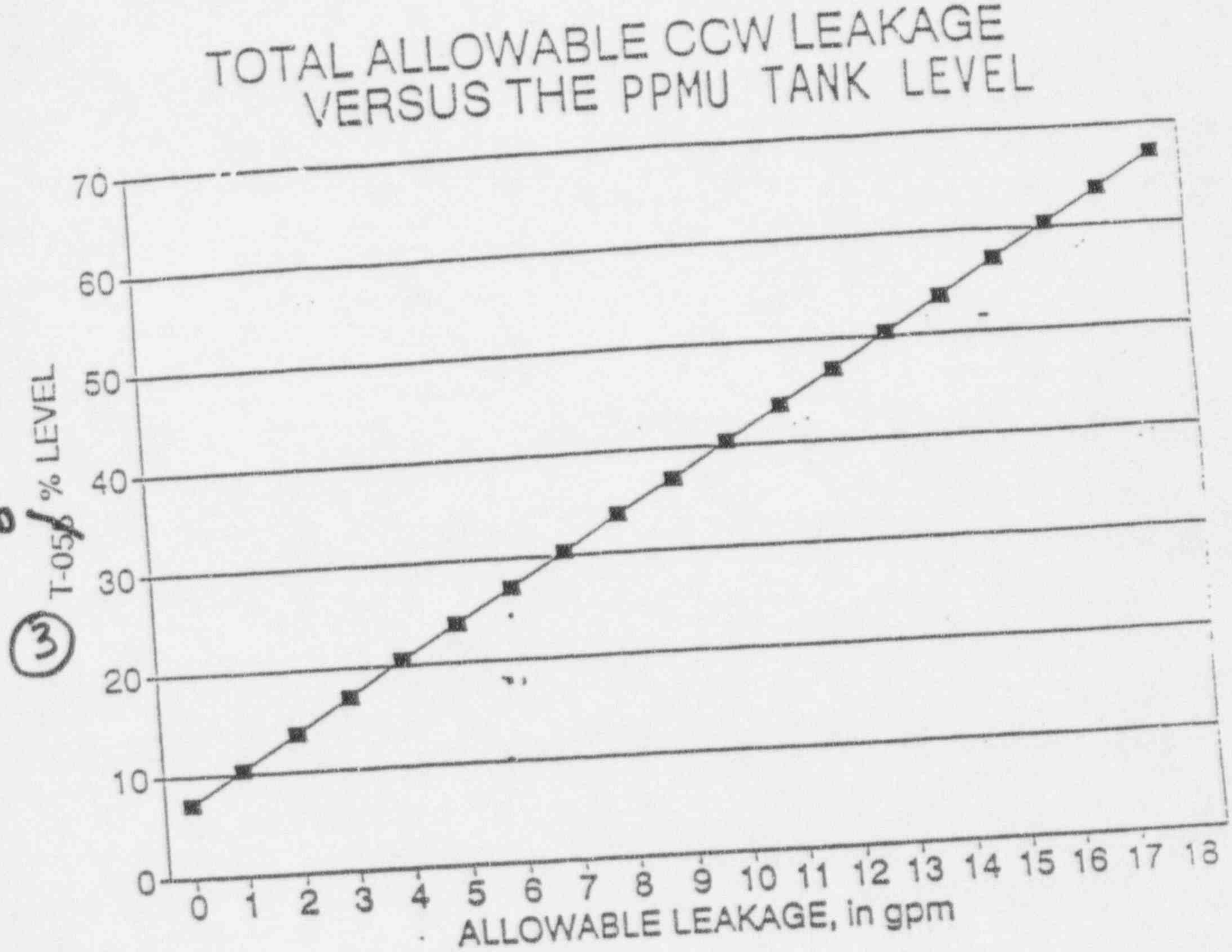

Figure 3.7.7.1-1

~~3.7 PLANT SYSTEMS~~

~~3.7.14 Fuel Handling Building Post-Accident Cleanup Filter System~~

~~LCO 3.7.14 Two Fuel Handling Building Post-Accident Cleanup Filter System trains shall be OPERABLE.~~

~~APPLICABILITY: During movement of irradiated fuel assemblies in the fuel building.~~

~~ACTIONS~~

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~A. One Fuel Handling Building Post-Accident Cleanup Filter System train inoperable.~~	~~A.1 Restore Fuel Handling Building Post-Accident Cleanup Filter System train to OPERABLE status.~~	~~7 days~~
~~B. Required Action and Associated Completion Time of Condition A not met during movement of irradiated fuel assemblies in the fuel building.~~	~~B.1 Place OPERABLE Fuel Handling Building Post-Accident Cleanup Filter System train in operation.~~ ~~OR~~ ~~B.2 Suspend movement of irradiated fuel assemblies in the fuel building.~~	~~Immediately~~ ~~Immediately~~

④

PP 3.7-28 to 30

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ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. Two Fuel Handling Building Post-Accident Cleanup Filter System trains inoperable during movement of irradiated fuel assemblies in the fuel building.	C.1	Suspend movement of irradiated fuel assemblies in the fuel building.	Immediately

④

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.14.1	Operate each Fuel Handling Building Post-Accident Cleanup Filter System train for ≥ 10 continuous hours with the heaters operating.	31 days on a STAGGERED TEST BASIS
SR 3.7.14.2	Perform required Fuel Handling Building Post-Accident Cleanup Filter System filter testing in accordance with the Ventilation Filter Testing Program (VFTP).	In accordance with the VFTP
SR 3.7.14.3	Verify each Fuel Handling Building Post-Accident Cleanup Filter System train actuates on an actual or simulated actuation signal.	24 months

④

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
F. Required Action and Associated Completion Time of Condition A, B, C, D, or E not met.	F.1 Be in MODE 3. AND F.2 Be in MODE 5.	6 hours 36 hours
G. Three or more required AC sources inoperable.	G.1 Enter LCO 3.0.3.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.1.1	-------------------NOTES------------------- 1. Buses 3A04 and 3D1 are required when unit crosstie breaker 3A0416 is used to provide a source of AC power. 2. Buses 3A06 and 3D2 are required when unit crosstie breaker 3A0603 is used to provide a source of AC power. --- Verify correct breaker alignment and indicated power availability for each required offsite circuit.	7 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.3	-------------------NOTES------------------- 1. DG loadings may include gradual loading as recommended by the manufacturer. 2. Momentary transients outside the load range do not invalidate this test. 3. This Surveillance shall be conducted on only one DG at a time. 4. This SR shall be preceded by, and immediately follow without shutdown, a successful performance of SR 3.8.1.2 or SR 3.8.1.7. -- Verify each DG is synchronized and loaded, and operates for ≥ 60 minutes at a load ≥ 4230 kW and ≤ 4700 kW. 4450	As specified in Table 3.8.1-1 on a staggered test basis
SR 3.8.1.4	Verify each day tank contains ≥ 825 gal of fuel oil. 30 inches	31 days
SR 3.8.1.5	Check for and remove accumulated water from each day tank.	31 days
SR 3.8.1.6	Verify the fuel oil transfer system operates to automatically transfer fuel oil from storage tank to the day tank.	31 days

(continue

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.8.1.9	-------------------NOTE------------------- Credit may be taken for unplanned events that satisfy this SR. -- Verify each DG, when operating with design basis kW loading and maximum kVAR loading permitted during testing, rejects a load ≥ 682 kW, and: a. Following load rejection, the frequency is ≥ 54 Hz and ≤ 66 Hz; 66.75 b. Within 4 seconds following load rejection, the voltage is ≥ 3924 V and ≤ 4796 V; and c. Within 4 seconds following load rejection, the frequency is ≥ 58.8 Hz and ≤ 61.2 Hz.	24 months
SR 3.8.1.10	-------------------NOTE------------------- Credit may be taken for unplanned events that satisfy this SR. -- Verify each DG, when operating with design basis kW loading and maximum kVAR loading permitted during testing, does not trip and voltage is maintained ≤ 5450 V during and following a load rejection of ≥ 4230 kW and ≤ 4700 kW. 4450	24 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.14	-------------------NOTES------------------- 1. Momentary transients outside the load and power factor ranges do not invalidate this test. 2. Credit may be taken for unplanned events that satisfy this SR. --- Verify each DG, when operating with the maximum kVAR loading permitted during testing, operates for ≥ 24 hours: a. For ≥ 2 hours loaded ≥ 4935 kW and ≤ 5170 kW; and b. For the remaining hours of the test loaded ≥ 4230 kW and ≤ 4700 kW. 4450	24 months
SR 3.8.1.15	-------------------NOTES------------------- 1. This Surveillance shall be performed within 5 minutes of shutting down the DG after the DG has operated ≥ 2 hours loaded ≥ 4230 kW and ≤ 4700 kW. 4450 Momentary transients outside of load range do not invalidate this test. 2. All DG starts may be preceded by an engine prelube period. --- Verify each DG starts and achieves, in ≤ 10 seconds, voltage ≥ 3924 V and ≤ 4796 V, and frequency ≥ 58.8 Hz and ≤ 61.2 Hz; and operates ≥ 5 minutes	24 months

(continue

3.8 ELECTRICAL POWER SYSTEMS

3.8.3 Diesel Fuel Oil, Lube Oil, and Starting Air

LCO 3.8.3 The stored diesel fuel oil, lube oil, and starting air subsystem shall be within limits for each required diesel generator (DG).

APPLICABILITY: When associated DG is required to be OPERABLE.

ACTIONS

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

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more DGs with fuel level < ~~49,724 gal~~ 89 % and ≥ ~~42,960 gal~~ 76 % in storage tank during Mode 1, 2, 3, or 4.	A.1 Restore fuel oil level to within limits.	48 hours
B. One or more DGs with lube oil inventory < ~~412 gal~~ TS min and ~~≥ 387 gal for the 20 cylinder engine, < 370 gal and ≥ 348 gal for the 16 cylinder engine~~ TS inop	B.1 Restore lube oil inventory to within limits.	48 hours
INSERT "A"		
~~C~~ D. One or more DGs with stored fuel oil total particulates not within limits.	~~C~~ D.1 Restore fuel oil total particulates to within limits.	7 days

(continued)

INSERT "A"

C.	One required DG with fuel level in the storage tank <72% and >63% during Mode 5 or 6.	C.1	Restore fuel oil level to within limits.	48 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E ~~D~~. One or more DGs with new fuel oil properties not within limits.	E ~~D~~.1 Restore stored fuel oil properties to within limits.	30 days
F ~~E~~. One or more DGs with starting air receiver pressure < 175 psig and ≥ 136 psig.	F ~~E~~.1 Restore starting air receiver pressure to ≥ 175 psig.	48 hours
G ~~F~~. Required Action and associated Completion Time of Condition A, B, C, D, E, or ~~E~~ F not met. OR One or more DGs with diesel fuel oil, lube oil, or starting air subsystem not within limits for reasons other than Condition A, B, C, D, E, or ~~E~~ F.	G ~~F~~.1 Declare associated DG inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.3.1	Verify each fuel oil storage tank contains ≥ ~~40,734 gal of fuel.~~ 89% level in Mode 1,2,3, or 4 and ≥ 72% level in Mode 5 or 6.	31 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.8.3.2	Verify lubricating oil inventory is ≥ [illegible]13 gal for the 20 cylinder engine and ≥ 370 gal for the 16 cylinder engine. TS$_{min}$ limit.	31 days
SR 3.8.3.3	Verify fuel oil properties of new and stored fuel oil are tested in accordance with, and maintained within the limits of, the Diesel Fuel Oil Testing Program.	In accordance with the Diesel Fuel Oil Testing Program
SR 3.8.3.4	Verify each DG air start receiver pressure is ≥ 175 psig.	31 days
SR 3.8.3.5	Check for and remove accumulated water from each fuel oil storage tank.	31 days
SR 3.8.3.6	For each fuel oil storage tank: a. Drain the fuel oil; b. Remove the sediment; and c. Clean the tank.	10 years

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources – Operating

LCO 3.8.4 The Train A, Train B, Train C, and Train D DC electrical power subsystems shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. ~~One~~ Train A or Train B battery or associated control equipment or cabling inoperable.	A.1 Restore DC electrical power subsystem to OPERABLE status.	2 hours
INSERT "C"		
C ~~B~~. Required Action and Associated Completion Time of Condition A or B not met.	C ~~B~~.1 Be in MODE 3. AND C ~~B~~.2 Be in MODE 5.	6 hours 36 hours
D ~~C~~. One required battery charger or associated control equipment or cabling inoperable.	------------NOTE------------ Entry into MODE 1, 2 or 3 per LCO 3.0.4 is not allowed, except during power reductions. ---------------------------- D ~~C~~.1 Verify battery cell parameters meet Table 3.8.6-1 Category A limits.	 1 hour AND Once per 8 hours thereafter

(continued)

INSERT "C"

B. Train C or Train D battery or associated control equipment or cabling inoperable.	B.1 Restore DC electrical power subsystems to OPERABLE status.	72 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E ~~D~~. Required Action and associated Completion Time of Condition ~~C~~ D not met.	E ~~D~~.1 Declare associated battery inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.1	Verify battery terminal voltage is ≥ 129 V on float charge.	7 days
SR 3.8.4.2	Verify no visible corrosion at terminals and connectors. <u>OR</u> Verify connection resistance is ≤ 150×10^{-6} ohm for inter-cell connections, ≤ 150×10^{-6} ohm for inter-rack connections, ≤ 150×10^{-6} ohm for inter-tier connections, and ≤ 150×10^{-6} ohm for terminal connections.	92 days
SR 3.8.4.3	Verify cells, cell plates, and battery racks show no visual indication of physical damage or abnormal deterioration.	24 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.4	Remove visible terminal corrosion, verify cell to cell and terminal connections are clean and tight, and are coated with anti-corrosion material.	24 months
SR 3.8.4.5	Verify connection resistance is $\leq 150x10^{-6}$ ohm for inter-cell connections, $\leq 150x10^{-6}$ ohm for inter-rack connections, $\leq 150x10^{-6}$ ohm for inter-tier connections, and $\leq 150x10^{-6}$ ohm for terminal connections.	24 months
SR 3.8.4.6	--------------------NOTE-------------------- Credit may be taken for unplanned events that satisfy this SR. -- Verify each battery charger supplies $\geq$ 300 amps at $\geq$ 125 V for $\geq$ 12 hours.	24 months
SR 3.8.4.7	-------------------NOTES------------------- 1. SR 3.8.4.8 may be performed in lieu of SR 3.8.4.7 once per 72 months. 60 2. Credit may be taken for unplanned events that satisfy this SR. -- Verify battery capacity is adequate to supply, and maintain in OPERABLE status, the required emergency loads for the design duty cycle when subjected to a battery service test.	24 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.8	--------------------NOTE------------------- Credit may be taken for unplanned events that satisfy this SR. -- Verify battery capacity is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test.	~~72~~ 60 months **AND** -----NOTE------ Only applicable when battery shows degradation or has reached 85% of the expected life --------------- 12 months

3.8 ELECTRICAL POWER SYSTEMS

3.8.7 Inverters – Operating

(either Train A or Train B)

R

LCO 3.8.7 The required Train A, Train B, Train C, and Train D inverters shall be OPERABLE.

One inverter (either Train C or Train D) may be disconnected from its associated vital bus for ≤72 hours to perform an equalizing charge on its associated battery provided all other AC vital buses for the remaining trains are energized from their associated OPERABLE inverters.

-----------------------------NOTE-----------------------------

One inverter may be disconnected from its associated DC bus for ≤ 24 hours to perform an equalizing charge on its associated battery, provided:

a. The associated AC vital bus is energized from the Class 1E constant voltage source transformer; and

b. All other AC vital buses for the remaining trains are energized from their associated OPERABLE inverters.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
	------------NOTE------------ Enter applicable Conditions and Required Actions of LCO 3.8.9 with one AC vital bus de-energized. ---------------------------	
A. One required Train A or Train B inverter inoperable.	A.1 Power AC vital bus from its Class 1E constant voltage source transformer.	2 hours
	<u>AND</u>	
	A.2 Restore inverter to OPERABLE status.	24 hours

(continued)

ACTIONS (continued)

INSERT

CONDITION	REQUIRED ACTION		COMPLETION TIME
~~B~~ C. Required Action and associated Completion Time of Condition A or B not met.	~~B~~C.1	Be in MODE 3.	6 hours
	AND		
	~~B~~C.2	Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.7.1	Verify correct inverter voltage and alignment to required AC vital buses.	7 days

	---------NOTE--------- Enter applicable Conditions and Required Actions of LCO 3.8.9 with one AC vital bus de-energized. ----------------------	
B. One required Train C or Train D inverter inoperable.	B.1 Restore inverter to OPERABLE status.	72 hours

3.8 ELECTRICAL POWER SYSTEMS

3.8.9 Distribution Systems – Operating

LCO 3.8.9 Train A and Train B AC; Trains A, B, C, and D DC; and Trains A, B, C, and D AC vital bus electrical power distribution subsystems shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One AC electrical power distribution subsystem inoperable.	A.1 Restore AC electrical power distribution subsystem to OPERABLE status.	8 hours
B. Train A or Train B ~~One~~ AC vital bus inoperable.	B.1 Restore AC vital bus subsystem to OPERABLE status.	2 hours
INSERT "E"		
D ~~C~~. Train A or Train B ~~One~~ DC electrical power distribution subsystem inoperable.	D ~~C~~.1 Restore DC electrical power distribution subsystem to OPERABLE status.	2 hours
INSERT "F"		
F ~~D~~. Required Action and associated Completion Time of Condition A, B, ~~or~~ C, D, or E not met.	F ~~D~~.1 Be in MODE 3. AND F ~~D~~.2 Be in MODE 5.	6 hours 36 hours

INSERT "E"

C. Train C or Train D AC vital bus inoperable.	C.1 Restore AC vital bus subsystem to OPERABLE status.	72 hours

INSERT "F"

E. Train C or Train D DC electrical power distribution subsystem inoperable.	E.1 Restore DC electrical power distribution subsystem to OPERABLE status.	72 hours

4.0 DESIGN FEATURES

4.1 Site

4.1.1 Exclusion Area Boundary

The exclusion area boundary shall be as shown in Figure 4.1-1.

4.1.2 Low Population Zone (LPZ)

The LPZ shall be as shown in Figure 4.1-2.

4.2 Reactor Core

4.2.1 Fuel Assemblies

The reactor shall contain 217 fuel assemblies. Each assembly shall consist of a matrix of Zircaloy clad fuel rods with an initial composition of natural or slightly enriched uranium dioxide (UO_2) as fuel material. Integral or Discrete Burnable Absorber Rods may be used. Limited substitutions of zirconium alloy or stainless steel filler rods for fuel rods, in accordance with approved applications of fuel rod configurations, may be used. Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases. A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions.

INSERT

4.2.2 Control Element Assemblies

and eight part length

The reactor core shall contain 83 full length control element assemblies (CEAs). The control material shall be silver indium cadmium, boron carbide, and inconel as approved by the NRC.

They may include: borosilicate glass—($Na_2O-B_2O_3-SiO_2$ components), boron carbide—B_4C, zirconium boride—ZrB_2, gadolinium oxide—Gd_2O_3, erbium oxide—Er_2O_3.

(continued)

5.2 Organization

5.2.2 UNIT STAFF

The unit staff organization shall include the following:

INSERT "A" → a. Each on duty shift shall be composed of at least the minimum shift crew composition shown in the LCS. e

b. At least one licensed Reactor Operator (RO) shall be in the Control Room when fuel is in the reactor. In addition, while the unit is in MODE 1, 2, 3 or 4, at least one licensed Senior Reactor Operator (SRO) shall be in the Control Room Area.

INSERT "B" → c.

d. ~~c.~~ A health physics 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.

e. ~~d.~~ Administrative procedures shall be developed and implemented to limit the working hours of unit staff who perform safety-related functions (e.g., licensed SROs, licensed ROs, health physicists, nuclear plant equipment operators, and key maintenance personnel).

Adequate shift coverage shall be maintained without routine heavy use of overtime. The objective shall be to have operating personnel work an 8 or 12-hour day, nominal 40-hour week, while the unit is operating. However, in the event that unforeseen problems require substantial amounts of overtime to be used, or during extended periods of shutdown for refueling, major maintenance, or major plant modification, on a temporary basis, the following guidelines shall be followed:

1) An individual should not be permitted to work more than 16 hours straight, excluding shift turnover time.

2) An individual should not be permitted to work more than 16 hours in any 24-hour period, nor more than 24 hours in any 48-hour period, nor more than 72 hours in any 7-day period, all excluding shift turnover time. Personnel regularly assigned to 12-hour shifts may work up to 26 hours in a 48-hour period.

3) A break of at least 8 hours should be allowed between work periods, including shift turnover time.

(continued)

INSERT "A"

A non-licensed Operator shall be assigned to each reactor containing fuel and an additional non-licensed Operator shall be assigned for each Unit when a reactor is operating in MODES 1, 2, 3, or 4.

~~Two Units~~ With both Units shutdown or defueled ~~require~~ a total of three non-licensed operators are required for the two Units

INSERT "B"

Shift crew composition may be less than the minimum requirement of 10CFR 50.54(m)(2)(i) and 5.2.2.a for a period of time not to exceed 2 hours in order to accomodate unexpected absence of on-duty shift crew members provided immediate action is taken to restore the shift crew composition to within the minimum requirements.

5.2 Organization

5.2.2 UNIT STAFF (continued)

4) Except during extended shutdown periods, the use of overtime should be considered on an individual basis and not for the entire staff on a shift.

Any deviation from the above guidelines shall be authorized by the Vice President-Nuclear Generation or designee, in accordance with approved administrative procedures, or by higher levels of management, in accordance with established procedures and with documentation of the basis for granting the deviation.

Controls shall be included in the procedures such that individual overtime shall be reviewed monthly by the Vice President-Nuclear Generation or designee to ensure that excessive hours have not been assigned. Routine deviation from the above guidelines is not authorized.

f. 8. The Plant Superintendent (at time of appointment), the Assistant Plant Superintendent-Operations, Shift Superintendents, and Control Room Supervisors shall hold a Senior Reactor Operator's license. The Control Operators and Assistant Control Operators shall hold a Reactor Operator's license or Senior Reactor Operator's license.

g. 8. The Shift Technical Advisor (STA) shall provide advisory technical support to the Shift Superintendent in the areas of thermal hydraulics, reactor engineering, and plant analysis with regard to the safe operation of the unit. The STA shall have a Bachelor's Degree or equivalent in a scientific or engineering discipline with specific training in plant design and in the response and analysis of the plant for transients and accidents.

5.5 Procedures, Programs, and Manuals

5.5.2.7 Explosive Gas and Storage Tank Radioactivity Monitoring Program (continued)

The program shall include:

a. The limits for the concentrations of hydrogen and oxygen in the Gaseous Radwaste System and a surveillance program to ensure the limits are maintained. Such limits shall be appropriate to the system's design criteria (i.e., whether or not the system is designed to withstand a hydrogen explosion); and

b. A surveillance program to ensure that the quantity of radioactivity contained in each waste gas decay tank and fed into the gaseous radwaste vent system is less than the amount that would result in a whole body exposure of greater than or equal to 0.5 rem to any individual in the unrestricted area, in the event of an uncontrolled release of the tanks contents; and

c. A surveillance program to ensure that the quantity of radioactivity contained in all outdoor liquid radwaste tanks that are not surrounded by liners, dikes, or walls, capable of holding the tanks' contents and that do not have tank overflows and surrounding area drains connected to the Liquid Waste Management System is less than the amount that would result in concentrations less than the limits of 10 CFR Part 20, Appendix B, Table II, Column 2, at the nearest potable water supply and the nearest surface water supply in an unrestricted area, in the event of an uncontrolled release of the tanks' contents.

The provisions of SR 3.0.2 and SR 3.0.3 are applicable to the Explosive Gas and Storage Tank Radioactivity Monitoring Program surveillance frequencies.

INSERT "C"

INSERT "C"

5.5.2.8. Primary Coolant Sources Outside Containment.

This program provides controls to minimize leakage from those portions of systems outside containment that could contain highly radioactive fluids during a serious transient or accident to levels as low as practicable. Program itself is relocated to the LCS.

5.5.2.9. Pre-Stressed Concrete Containment Tendon Surveillance Program.

This program provides controls for monitoring any tendon degradation in pre-stressed concrete containment, including effectiveness of its corrosion protection medium, to ensure containment Structural integrity. Program itself is relocated to LCS.

5.5.2.10 Inservice Testing Program

This program provides controls for inservice testing of ASME Code Class 1, 2, and 3 components including applicable supports. Program itself is relocated to the LCS.

San Onofre - Unit 2

5.5.2.11 Steam Generator (SG) Tube Surveillance Program

This program provides acceptance criteria, methodologies, and surveillance requirements and recommendations to verify SG OPERABILITY. Program itself is relocated to the LCS

5.5.2.12. Ventilation Filter Testing Program

This program provides acceptance criteria, methodologies, surveillance requirements and recommendations concerning testing of Engineered Safety Feature (ESF) filter ventilation systems. Program itself is relocated to the LCS.

5.5.2.13 Diesel Fuel Oil Testing Program

This program implements required testing of both new fuel oil and stored fuel oil. Program itself is relocated to the LCS.

5.7.2 Special Reports (continued)

b. Following each inservice inspection of steam generator (SG) tubes, in accordance with the SG Tube Surveillance Program, the number of tubes plugged and tubes sleeved in each SG shall be reported to the NRC within 15 days. The complete results of the SG tube inservice inspection shall be submitted to the NRC within 12 months following the completion of the inspection. The report shall include:

1. Number and extent of tubes inspected, and

2. Location and percent of wall-thickness penetration for each indication of an imperfection, and

3. Identification of tubes plugged and tubes sleeved.

Results of SG tube inspections which fall into Category C-3 shall be reported to the NRC prior to resumption of plant operation. This report shall provide a description of investigations conducted to determine cause of the tube degradation and corrective measures taken to prevent recurrence.

INSERT 'D"

INSERT "D"

(High Radiation Area) e
5.11 e
5.8

~~5.11~~ 5.8 High Radiation Area e

e

5.11.1 e
5.8.1 Pursuant to 10 CFR 20, paragraph 20.203(c)(5), in lieu of the requirements of 10 CFR 20.203(c), each high radiation area, as defined in 10 CFR 20, in which the intensity of radiation is > 100 mrem/hr but < 1000 mrem/hr, shall be barricaded and conspicuously posted as a high radiation area and entrance thereto shall be controlled by requiring issuance of a Radiation Work Exposure Permit (RWP) (REP). Individuals qualified in radiation protection procedures (e.g., (Health Physics Technicians)) or personnel continuously escorted by such individuals may be exempt from the RWP REP issuance requirement during the performance of their assigned duties in high radiation areas with exposure rates ≤ 1000 mrem/hr, provided they are otherwise following plant radiation protection procedures for entry into such high radiation areas.

Any individual or group of individuals permitted to enter such areas shall be provided with or accompanied by one or more of the following:

a. A radiation monitoring device that continuously indicates the radiation dose rate in the area.

b. A radiation monitoring device that continuously integrates the radiation dose rate in the area and alarms when a preset integrated dose is received. Entry into such areas with this monitoring device may be made after the dose rate levels in the area have been established and personnel are aware of them.

c. An individual qualified in radiation protection procedures with a radiation dose rate monitoring device, who is responsible for providing positive control over the activities within the area and shall perform periodic radiation surveillance at the frequency specified by the (Radiation Protection Manager) in the RWP REP.

e

5.11.2
5.8.2 In addition to the requirements of Specification 5.11.1 8 e, areas with radiation levels ≥ 1000 mrem/hr shall be provided with locked or continuously guarded doors to prevent unauthorized entry and the keys shall be maintained under the administrative control of the Shift Foreman on duty or health physics supervision. Doors shall remain locked except during periods of access by personnel

(continued)

5.8

5.11 High Radiation Area

5.11.2 (continued)

5.8.2

REP

under an approved RWP that shall specify the dose rate levels in the immediate work areas and the maximum allowable stay times for individuals in those areas. In lieu of the stay time specification of the RWP, direct or remote (such as closed circuit TV cameras) continuous surveillance may be made by personnel qualified in radiation protection procedures to provide positive exposure control over the activities being performed within the area.

REP

5.11.3

5.8.3

For individual high radiation areas with radiation levels of > 1000 mrem/hr, accessible to personnel, that are located within large areas such as reactor containment, where no enclosure exists for purposes of locking, or that cannot be continuously guarded, and where no enclosure can be reasonably constructed around the individual area, that individual area shall be barricaded and conspicuously posted, and a flashing light shall be activated as a warning device.

SONGS-Unit 2

5.0 ADMINISTRATIVE CONTROLS

5.6 Safety Function Determination Program (SFDP)

5.6.1 This program ensures loss of safety function is detected and appropriate actions taken. Upon failure to meet two or more LCOs at the same time, an evaluation shall be made to determine if loss of safety function exists. Additionally, other appropriate limitations and remedial or compensatory actions may be identified to 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.

5.6.2 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.

c. Provisions to ensure that an inoperable supported system's Completion Time is not inappropriately extended as a result of multiple support system inoperabilities.

d. Other appropriate limitations and remedial or compensatory actions.

5.6.3 A loss of safety function exists when, assuming no concurrent single failure, a safety function assumed in the accident analysis cannot be performed. For the purpose of this program, a loss of safety function may exist when a support system is inoperable, and:

a. A required system redundant to system(s) supported by the inoperable support system is also inoperable; or (Case A)

b. A required system redundant to system(s) in turn supported by the inoperable supported system is also inoperable; or (Case B)

c. A required system redundant to support system(s) for the supported systems (a) and (b) above is also inoperable. (Case C)

INSERT "E"

5.6.4 The Safety Function Determination Program identifies where a loss of safety function exists. If a loss of safety function is determined to exist by this program, the appropriate Conditions and Required Actions of the LCO in which the loss of safety function exists are required to be entered.

INSERT "E"

Generic Example:

Train A

System i
↓
System ii ← (Support System Inoperable)
↓
System iii
↓
System iv

Train B

System i ← Case C
↓
System ii
↓
System iii ← Case A
↓
System iv ← Case B

ATTACHMENT "B"
(Marked-Up Proposed Specifications)
Unit 3

1.1 Definitions

CORE ALTERATION (continued)	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 for the current reload cycle. These cycle specific parameter limits shall be determined for each reload cycle in accordance with Specification 5.7.1.5. Plant operation within these limits is addressed in individual Specifications.
DOSE EQUIVALENT I-131	DOSE EQUIVALENT I-131 shall be that concentration of I-131 (microcuries/gram) that alone would produce the same thyroid dose as the quantity and isotopic mixture of I-131, I-132, I-133, I-134, and I-135 actually present. The thyroid dose conversion factors used for this calculation shall be those listed in Table ~~III of TID-14844, AEC, 1962, "Calculation of Distance Factors for Power and Test Reactor Sites."~~ E-7 of Regulatory Guide 1.109.
E – AVERAGE DISINTEGRATION ENERGY	E shall be the average (weighted in proportion to the concentration of each radionuclide in the reactor coolant at the time of sampling) of the sum of the average beta and gamma energies per disintegration (in MeV) for isotopes, other than iodines, with half lives > 15 minutes, making up at least 95% of the total noniodine activity in the coolant.
ENGINEERED SAFETY FEATURE (ESF) RESPONSE TIME	The ESF RESPONSE TIME shall be that time interval from when the monitored parameter exceeds its ESF 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 diesel generator 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.

(continued)

1.1 Definitions (continued)

LEAKAGE	LEAKAGE shall be:

a. Identified LEAKAGE

1. LEAKAGE, such as that from pump seals or valve packing (except reactor coolant pump (RCP) 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 (SG) to the Secondary System.

b. Unidentified LEAKAGE

All LEAKAGE that is not identified LEAKAGE.

c. Pressure Boundary LEAKAGE

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

~~d. Controlled LEAKAGE~~

~~The seal water flow supplied to or from the RCP seals.~~

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.

(continued)

EXAMPLES (continued)

EXAMPLE 1.3-3

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One Function X train inoperable.	A.1 Restore Function X train to OPERABLE status.	7 days AND 10 days from discovery of failure to meet the LCO
B. ~~One~~ Function Y train inoperable.	B.1 Restore Function Y train to OPERABLE status.	72 hours AND 10 days from discovery of failure to meet the LCO
C. One Function X train inoperable. AND One Function Y train inoperable.	C.1 Restore Function X train to OPERABLE status. OR C.2 Restore Function Y train to OPERABLE status.	72 hours 72 hours

(continued)

EXAMPLES

EXAMPLE 1.3-3 (continued)

When one Function X train and one Function Y train are inoperable, Condition A and Condition B are concurrently applicable. The Completion Times for Condition A and Condition B are tracked separately for each train starting from the time each train was declared inoperable and the Condition was entered. A separate Completion Time is established for Condition C and tracked from the time the second train was declared inoperable (i.e., the time the situation described in Condition C was discovered).

If Required Action C.2 is completed within the specified Completion Time, Conditions B and C are exited. If the Completion Time for Required Action A.1 has not expired, operation may continue in accordance with Condition A. The remaining Completion Time in Condition A is measured from the time the affected train was declared inoperable (i.e., initial entry into Condition A).

The Completion Times of Conditions A and B are modified by a logical connector, with a separate 10 day Completion Time measured from the time it was discovered the LCO was not met. In this example, without the separate Completion Time, it would be possible to alternate between Conditions A, B, and C in such a manner that operation could continue indefinitely without ever restoring systems to meet the LCO. The separate Completion Time modified by the phrase "from discovery of failure to meet the LCO" is designed to prevent indefinite continued operation while not meeting the LCO. This Completion Time allows for an exception to the normal "time zero" for beginning the Completion Time "clock." In this instance, the Completion Time "time zero" is specified as commencing at the time the LCO was initially not met, instead of at the time the associated Condition was entered.

(continued)

1.3 Completion Times

EXAMPLES
(continued)

EXAMPLE 1.3-~~4~~3

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more valves inoperable.	A.1 Restore valve(s) to OPERABLE status.	4 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3. AND B.2 Be in MODE 4.	6 hours 12 hours

A single Completion Time is used for any number of valves inoperable at the same time. The Completion Time associated with Condition A is based on the initial entry into Condition A and is not tracked on a per valve basis. Declaring subsequent valves inoperable, while Condition A is still in effect, does not trigger the tracking of separate Completion Times.

Once one of the valves has been restored to OPERABLE status, the Condition A Completion Time is not reset, but continues from the time the first valve was declared inoperable. The Completion Time may be extended if the valve restored to OPERABLE status was the first inoperable valve. The Condition A Completion Time may be extended for up to 4 hours provided this does not result in any subsequent valve being inoperable for > 4 hours.

If the Completion Time of 4 hours (including any extensions) expires while one or more valves are still inoperable, Condition B is entered.

(continued)

1.3 Completion Times

EXAMPLES
(continued)

EXAMPLE 1.3-~~5~~4

ACTIONS

----------------------------NOTE----------------------------
Separate Condition entry is allowed for each inoperable valve.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more valves inoperable.	A.1 Restore valve to OPERABLE status.	4 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3. AND B.2 Be in MODE 4.	6 hours 12 hours

The Note above the ACTIONS table is a method of modifying how the Completion Time is tracked. If this method of modifying how the Completion Time is tracked was applicable only to a specific Condition, the Note would appear in that Condition rather than at the top of the ACTIONS Table.

The Note allows Condition A to be entered separately for each inoperable valve, and Completion Times tracked on a per valve basis. When a valve is declared inoperable, Condition A is entered and its Completion Time starts. If subsequent valves are declared inoperable, Condition A is entered for each valve and separate Completion Times start and are tracked for each valve.

(continued)

EXAMPLES

EXAMPLE 1.3-~~5~~4 (continued)

If the Completion Time associated with a valve in Condition A expires, Condition B is entered for that valve. If the Completion Times associated with subsequent valves in Condition A expire, Condition B is entered separately for each valve and separate Completion Times start and are tracked for each valve. If a valve that caused entry into Condition B is restored to OPERABLE status, Condition B is exited for that valve.

Since the Note in this example allows multiple Condition entry and tracking of separate Completion Times, Completion Time extensions do not apply.

EXAMPLE 1.3-~~6~~5

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One channel inoperable.	A.1 Perform SR 3.x.x.x. OR A.2 Reduce THERMAL POWER to ≤ 50% RTP.	Once per 8 hours 8 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours

(continued)

1.3 Completion Times

EXAMPLES

EXAMPLE 1.3.~~6~~5 (continued)

Entry into Condition A offers a choice between Required Action A.1 or A.2. Required Action A.1 has a "Once per" Completion Time, which qualifies for the 25% extension, per SR 3.0.2, to each performance after the initial performance. If Required Action A.1 is followed and the Required Action is not met within the Completion Time (including the 25% extension allowed by SR 3.0.2), Condition B is entered. If Required Action A.2 is followed and the Completion Time of 8 hours is not met, Condition B is entered.

If after entry into Condition B, Required Action A.1 or A.2 is met, Condition B is exited and operation may then continue in Condition A.

(continued)

1.3 Completion Times

EXAMPLES
(continued)

EXAMPLE 1.3-6

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One subsystem inoperable.	A.1 Verify affected subsystem isolated.	1 hour AND Once per 8 hours thereafter
	AND	
	A.2 Restore subsystem to OPERABLE status.	72 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	AND	
	B.2 Be in MODE 5.	36 hours

Required Action A.1 has two Completion Times. The 1 hour Completion Time begins at the time the Condition is entered and each "Once per 8 hours thereafter" interval begins upon performance of Required Action A.1.

If after Condition A is entered, Required Action A.1 is not met within either the initial 1 hour or any subsequent 8 hour interval from the previous performance (including the 25% extension allowed by SR 3.0.2), Condition B is entered.

(continued)

1.3 Completion Times

EXAMPLES

EXAMPLE 1.3-~~1~~6 (continued)

The Completion Time clock for Condition A does not stop after Condition B is entered, but continues from the time Condition A was initially entered. If Required Action A.1 is met after Condition B is entered, Condition B is exited and operation may continue in accordance with Condition A, provided the Completion Time for Required Action A.2 has not expired.

IMMEDIATE COMPLETION TIME

When "Immediately" is used as a Completion Time, the Required Action should be pursued without delay and in a controlled manner.

1.4 Frequency

EXAMPLES (continued)

EXAMPLE 1.4-3

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
------------------NOTE------------------ Not required to be performed until 12 hours after ≥ 25% RTP. -- Perform channel adjustment.	7 days

The interval continues, whether or not the unit operation is < 25% RTP between performances.

As the Note modifies the required performance of the Surveillance, it is construed to be part of the "specified Frequency." Should the 7 day interval be exceeded while operation is < 25% RTP, this Note allows 12 hours after power reaches ≥ 25% RTP to perform the Surveillance. The Surveillance is still considered to be performed within the "specified Frequency." Therefore, if the Surveillance were not performed within the 7 day (plus 25% per SR 3.0.2) interval, but operation was < 25% RTP, it would not constitute a failure of the SR or failure to meet the LCO. Also, no violation of SR 3.0.4 occurs when changing MODES, even with the 7 day Frequency not met, provided operation does not exceed 12 hours with power ≥ 25% RTP.

Once the unit reaches 25% RTP, 12 hours would be allowed for completing the Surveillance. If the Surveillance were not performed within this 12 hour interval, there would then be a failure to perform a Surveillance within the specified Frequency; MODE changes then would be restricted in accordance with SR 3.0.4 and the provisions of SR 3.0.3 would apply.

2.2 SL Violations (continued)

2.2.6 ~~Critical~~ O~~o~~peration (Modes 1 and 2) of the unit shall not be resumed until authorized by the NRC. ①

3.0 LCO APPLICABILITY

LCO 3.0.4 (continued)

Specification shall not prevent changes in MODES or other specified conditions in the Applicability that are required to comply with ACTIONS.

Exceptions to this Specification are stated in the individual Specifications. These exceptions allow entry into MODES or other specified conditions in the Applicability when the associated ACTIONS to be entered allow unit operation in the MODE or other specified condition in the Applicability only for a limited period of time.

LCO 3.0.5

Equipment removed from service or declared inoperable to comply with ACTIONS may be returned to service under administrative control solely to perform testing required to demonstrate its OPERABILITY or the OPERABILITY of other equipment. This is an exception to LCO 3.0.2 for the system returned to service under administrative control to perform the testing required to demonstrate OPERABILITY.

LCO 3.0.6

When a supported system LCO is not met solely due to a support system LCO not being met, the Conditions and Required Actions associated with this supported system are not required to be entered. Only the support system LCO ACTIONS are required to be entered. This is an exception to LCO 3.0.2 for the supported system. In this event, additional evaluations and limitations may be required in ⑥ accordance with Specification 5~~.8~~, "Safety Function Determination Program (SFDP)." If a loss of safety function is determined to exist by this program, the appropriate Conditions and Required Actions of the LCO in which the loss of safety function exists are required to be entered.

When a support system's Required Action directs a supported system to be declared inoperable or directs entry into Conditions and Required Actions for a supported system, the applicable Conditions and Required Actions shall be entered in accordance with LCO 3.0.2.

(continued)

LCO 3.0.6
(continued)

However, there are instances where a support system's Required Action may either direct a supported system to be declared inoperable or direct entry into Conditions and Required Actions for the supported system. This may occur immediately or after some specified delay to perform some other Required Action. Regardless of whether it is immediate or after some delay, when a support system's Required Action directs a supported system to be declared inoperable or directs entry into Conditions and Required Actions for a supported system, the applicable Conditions and Required Actions shall be entered in accordance with LCO 3.0.2.

Specification 5.~~8~~6, "Safety Function Determination Program (SFDP)," ensures loss of safety function is detected and appropriate actions are taken. Upon failure to meet two or more LCOs concurrently, an evaluation shall be made to determine if loss of safety function exists. Additionally, other limitations, remedial actions, or compensatory actions may be identified as a result of the support system inoperability and corresponding exception to entering supported system Conditions and Required Actions. The SFDP implements the requirements of LCO 3.0.6.

Cross train checks to identify a loss of safety function for those support systems that support multiple and redundant safety systems are required. The cross train check verifies that the supported systems of the redundant OPERABLE support system are OPERABLE, thereby ensuring safety function is retained. If this evaluation determines that a loss of safety function exists, the appropriate Conditions and Required Actions of the LCO in which the loss of safety function exists are required to be entered.

LCO 3.0.7

Special tests and operations are required at various times over the unit's life to demonstrate performance characteristics, to perform maintenance activities, and to perform special evaluations. Because TS normally preclude these tests and operations, special test exceptions (STEs) allow specified requirements to be changed or suspended under controlled conditions. STEs are included in applicable sections of the Specifications. Unless otherwise specified, all other TS requirements remain unchanged and in

3.1 REACTIVITY CONTROL SYSTEMS

3.1.1 SHUTDOWN MARGIN (SDM) – T_{avg} > 200°F

LCO 3.1.1 SDM shall be ≥ 5.15% Δk/k.

APPLICABILITY: MODES 3 and 4.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. SDM not within limit.	A.1	Initiate boration to restore SDM to within limit.	15 minutes

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.1.~~1~~2	Verify SDM is ≥ 5.15% Δk/k.	24 hours ①
SR 3.1.1.1	Verify SDM is acceptable with increased allowance for the withdrawn worth of inoperable CEAs.	1 hour after detection of inoperable CEA(s) and every 12 hours thereafter

3.1 REACTIVITY CONTROL SYSTEMS

3.1.4 Moderator Temperature Coefficient (MTC)

LCO 3.1.4 The MTC shall be maintained within the limits specified in the COLR, and a maximum positive limit as specified below:

a. 0.5 E-4 ~~Δk °F~~ ΔK/K/°F when THERMAL POWER is ≤ 70% RTP; and

b. 0.0 ~~Δk °F~~ ΔK/K/°F when THERMAL POWER is > 70% RTP.

②

APPLICABILITY: MODES 1 and 2 with $K_{eff} \geq 1.0$

ACTION

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. MTC not within limits.	A.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
	-------------------NOTE-------------------- SR 3.1.4.1 is not required to be performed prior to entry into MODE 2. ---	
SR 3.1.4.1	Verify MTC within the upper limit.	Prior to entering MODE 1 after each fuel loading

(continued)

3.1 REACTIVITY CONTROL SYSTEMS

3.1.5 Control Element Assembly (CEA) Alignment

LCO 3.1.5 All full length CEAs shall be OPERABLE and all full and part length CEAs shall be aligned to within 7 inches (~~indicated position,~~ with 2 of 3 position indicators available) of all other CEAs in its group. ③

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One regulating CEA trippable and misaligned from its group by > 7 inches.	A.1	Reduce THERMAL POWER in accordance with LCS requirements.	15 minutes
	AND		
	A.2.1	Verify SDM is ≥ 5.15% Δk/k.	1 hour
	OR		
	A.2.2	Initiate boration to restore SDM to within limit.	1 hour
	AND		
	A.3.1	Restore the misaligned CEA(s) to within 7 inches ~~(indicated position)~~ of its group. ③	2 hours
	OR		

(continued)

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME	
A. (continued)	A.3.2	Align the remainder of the CEAs in the group to within 7 inches ~~(indicated position)~~ of the misaligned CEA(s) while maintaining the insertion limit of LCO 3.1.7, "Regulating Control Element Assembly (CEA) Insertion Limits."	2 hours	③
B. One shutdown CEA trippable and misaligned from its group by > 7 inches.	B.1	Reduce THERMAL POWER in accordance with LCS requirements.	~~1 hour~~ 15 minutes	④
	AND			
	B.2.1	Verify SDM is ≥ 5.15% Δk/k.	1 hour	
	OR			
	B.2.2	Initiate boration to restore SDM to within limit.	1 hour	
	AND			
	B.3	Restore the misaligned CEA(s) to within 7 inches ~~(indicated position)~~ of its group.	2 hours	③

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME	
C. One part length CEA misaligned from its group by > 7 inches.	C.1	Reduce THERMAL POWER in accordance with LCS requirements.	~~1 hour~~ 15 minutes	④
	AND			
	C.2.1	Restore the misaligned CEA(s) to within 7 inches ~~(indicated position)~~ of its group.	2 hours	③
	OR			
	C.2.2	Align the remainder of the CEAs in the group to within 7 inches ~~(indicated position)~~ of the misaligned CEA(s), while maintaining the insertion limit of LCO 3.1.~~7~~8 Part Length "~~Regulating~~ Control Element Assembly (CEA) Insertion Limits."	2 hours	③ ⑤
D. Required position indication inoperable.	D.1	Restore inoperable position indicator channel to OPERABLE status.	6 hours	⑥
	OR			
	D.~~2~~ 1	Align the CEA group(s) with the inoperable position indicator(s) at the fully withdrawn position.	6 hours	

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. Required Action and associated Completion Time of Condition A, B, C or D not met. OR One full length CEA untrippable. OR More than one full length CEA trippable, but misaligned from any other CEA in its group by > 7 inches. OR More than one part length CEA misaligned from any other CEA in its group by > 7 inches.	E.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.5.1	Verify the ~~indicated~~ position of each full and part length CEA is within 7 inches of all other CEAs in its group.	12 hours

③

(continued)

3.1 REACTIVITY CONTROL SYSTEMS

3.1.8 Part Length Control Element Assembly (CEA) Insertion Limits

LCO 3.1.8 The part length CEA groups shall be limited to the insertion limits specified in of the COLR.

APPLICABILITY: MODE 1 > 20% RTP.

---------------------------NOTE---------------------------
This LCO not applicable while exercising part length CEAs.

ACTIONS

CONDITION		REQUIRED ACTION	COMPLETION TIME
A. Part length CEA groups inserted beyond the transient insertion limit.	A.1	Restore part length CEA groups to within the limit.	2 hours
	<u>OR</u>		
	A.2	Reduce THERMAL POWER to less than or equal to the fraction of RTP allowed by the CEA group position and insertion limits specified in the COLR.	2 hours
B. Part length CEA groups inserted between the long term steady state insertion limit and the transient insertion limit for intervals > 7 effective full power days (EFPD) per 30 EFPD or > 14 EFPD per 365 EFPD interval.	B.1	Restore part length CEA groups to within the long term steady state insertion limit.	2 hours

(continued)

⑦

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
			~~(continued)~~ ⑦
C. Required Action and associated Completion Time of Condition B not met.	C.1	Reduce THERMAL POWER to ≤ 20% RTP.	4 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.8.1	Verify part length CEA group position.	12 hours
SR 3.1.8.2	Verify the accumulated time during which the part length CEA groups are inserted beyond the long term steady state insertion limit but within the transient insertion limit.	24 hours

MINIMUM STORED BORIC ACID VOLUME AS A FUNCTION OF CONCENTRATION
(Gallons)

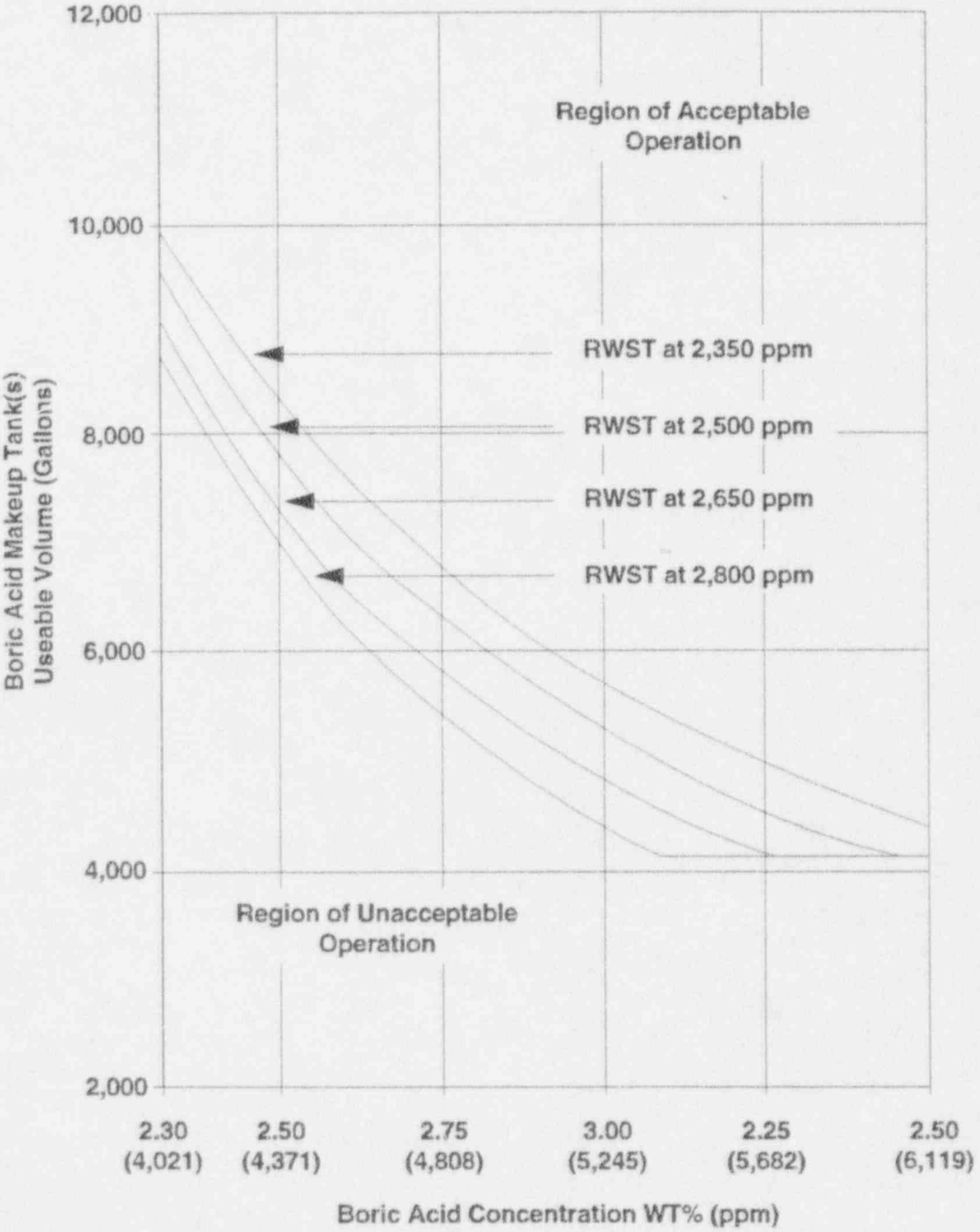

Figure 3.1.9-1

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.10.1	Verify that at least one of the above required flow paths is OPERABLE and ~~each valve (manual, power operated or automatic)~~ is in its correct position.	31 days

that each valve (manual, power operated or automatic, that is not locked, sealed, or otherwise secured) in the above required flow path

⑨

3.1 REACTIVITY CONTROL SYSTEMS

3.1.12 Special Test Exception (STE) – MODES 2 and 3

LCO 3.1.12 During performance of PHYSICS TESTS the following LCOs may be suspended:

⑩

LCO 3.1.1, "SHUTDOWN MARGIN (SDM) – T_{avg} > 200°F:" (Provided the shutdown reactivity available for trip insertion is ~~maintained to at least the equivalent amount of those CEAs actually withdrawn.~~ equivalent to at least the highest estimated CEA worth)
LCO 3.1.4, "Moderator Temperature Coefficient (MTC);"
LCO 3.1.5, "Control Element Assembly (CEA) Alignment;"
LCO 3.1.6, "Shutdown Control Element Assembly (CEA) Insertion Limits;"
LCO 3.1.7, "Regulating Control Element Assembly (CEA) Insertion Limits;"
LCO 3.1.8, "Part Length CEA Insertion Limits;"
LCO 3.3.1, "RPS Instrumentation - Operating," Table 3.3.1-1, ALLOWABLE VALUE for FUNCTION 2 and footnote (d) for FUNCTIONS ~~14~~ 11 and ~~15.~~ 12.

⑪

APPLICABILITY: MODES 2 and 3 during PHYSICS TESTS.

---------------------------NOTE---------------------------
Operation in MODE 3 shall be limited to 6 consecutive hours.

3.1 REACTIVITY CONTROL SYSTEMS

3.1.14 Special Test Exceptions (STE) - Center CEA Misalignment and Regulating CEA Insertion Limits

LCO 3.1.14 During performance of PHYSICS TESTS the following LCOs may be suspended:

LCO 3.1.5, "Control Element Assembly (CEA) Alignment;" and
LCO 3.1.7, "Regulating CEA Insertion Limits;"

provided that:

a. Only the center CEA (CEA #1) is misaligned, or only regulating CEA Group 6 is inserted beyond the transient insertion Limit of LCO 3.1.7; and

b. The LHR and DNBR do not exceed the limits specified in the COLR.

APPLICABILITY: MODE 1.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. LHR or DNBR outside the limits specified in the COLR.	A.1~~.1~~ Reduce THERMAL POWER to restore LHR and DNBR to within limits. ~~OR~~	15 minutes
B. Required Action and associated Completion Time not met	B.1 ~~A.1.2~~ Be in MODE 3.	6 hours

⑫

~~(continued)~~

3.3 INSTRUMENTATION

3.3.1 Reactor Protective System (RPS) Instrumentation – Operating

LCO 3.3.1 Four RPS trip and operating bypass removal channels for each Function in Table 3.3.1-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.1-1.

ACTIONS

-----NOTES-----

1. Separate Condition entry is allowed for each RPS Function.
2. If a channel is placed in bypass, continued operation with the channel in the bypassed condition for the Completion Time specified by Required Action A.2 or C.2.2 shall be reviewed by the Onsite Review Committee.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one automatic RPS trip channel inoperable.	A.1 Place channel ~~Functional Unit of Table 3.3.1-2~~ in bypass or trip.	1 hour
	<u>AND</u>	
	A.2 Restore channel to OPERABLE status.	Prior to entering MODE 2 following next MODE 5 entry

(continued)

Table 3.3.1-1 (page 1 of 2)
Reactor Protective System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. Linear Power Level – High	1,2	SR 3.3.1.1 SR 3.3.1.4 SR 3.3.1.6 SR 3.3.1.7 SR 3.3.1.8 SR 3.3.1.9 SR 3.3.1.13	≤ 111.0% RTP
2. Logarithmic Power Level – High(a)	2(b)	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.12 SR 3.3.1.13	.93% ≤ [illegible] RTP
3. Pressurizer Pressure – High	1,2	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.13	≤ 2385 psia
4. Pressurizer Pressure – Low(c)	1,2	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.12 SR 3.3.1.13	≥ 1700 psia
5. Containment Pressure – High	1,2	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.13	≤ 3.4 psig
6. Steam Generator 1 Pressure-Low	1,2	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.13	≥ 729 psia
7. Steam Generator 2 Pressure-Low	1,2	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.13	≥ 729 psia

(continued)

(a) Trip may be bypassed when THERMAL POWER is > 1E-4% RTP. Bypass shall be automatically removed when THERMAL POWER is < 1E-4% RTP. Trip may be manually bypassed during physics testing pursuant to LCO ~~3.1.10.~~ 3.1.12

(b) When any RTCB is closed.

(c) The setpoint may be decreased to a minimum value of 300 psia, as pressurizer pressure is reduced, provided the margin between pressurizer pressure and the setpoint is maintained ≤ 400 psia. Trips may be bypassed when pressurizer pressure is < 400 psia. Bypass shall be automatically removed when pressurizer pressure is ≥ 472 psia. The setpoint shall be automatically increased to the normal setpoint as pressurizer pressure is increased.

Table 3.3.1-1 (page 2 of 2)
Reactor Protective System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
8. Steam Generator 1 Level – Low	1,2	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.13	≥ 20%
9. Steam Generator 2 Level – Low	1,2	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.13	≥ 20%
10. Reactor Coolant Flow – Low[d]	1,2	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.12 SR 3.3.1.13	Ramp: ≤ 0.231 psid/sec. Floor: ≥ 12.1 psid Step: 7.25 psid
11. Local Power Density – High[d]	1,2	SR 3.3.1.1 SR 3.3.1.3 SR 3.3.1.4 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.10 SR 3.3.1.11 SR 3.3.1.12 SR 3.3.1.13	≤ 21.0 kW/ft
12. Departure From Nucleate Boiling Ratio (DNBR) – Low[d]	1,2	SR 3.3.1.1 SR 3.3.1.2 SR 3.3.1.3 SR 3.3.1.4 SR 3.3.1.5 SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.10 SR 3.3.1.11 SR 3.3.1.12 SR 3.3.1.13	≥ 1.31

(d) Trip may be bypassed when THERMAL POWER is < 1E-4% RTP. Bypass shall be automatically removed when THERMAL POWER is ≥ 1E-4% RTP. During testing pursuant to LCO ~~3.4.17~~, trip may be bypassed below 5% RTP. Bypass shall be automatically removed when THERMAL POWER is ≥ 5% RTP.

3.1.12

Table 3.3.1-2 (page 1 of 1)
Functional Units

Required Action A.1

	Process Measurement Circuit	Functional Unit Bypassed
1.	Linear Power (Subchannel or Linear)	Linear Power Level - High Local Power Density - High DNBR - Low
2.	Pressurizer Pressure - High	Pressurizer Pressure - High Local Power Density - High DNBR - Low
3.	Containment Pressure - High	Containment Pressure - High (RPS) Containment Pressure High (ESF)
4.	Steam Generator Pressure - Low	Steam Generator Pressure - Low Steam Generator ΔP 1 AND 2 (EFAS 1 and 2)
5.	Steam Generator Level	Steam Generator Level - Low Steam Generator Level - High Steam Generator ΔP (EFAS)
6.	Core Protection Calculator	Local Power Density - High DNBR - Low

Required Action A.2

	Process Measurement Circuit	Functional Unit Bypassed
1.	Linear Power (Subchannel or Linear)	Linear Power Level - High Local Power Density - High DNBR - Low
2.	Pressurizer Pressure - High	Pressurizer Pressure - High Local Power Density - High DNBR - Low
3.	Containment Pressure - High	Containment Pressure - High (RPS) Containment Pressure - High (ESF)
4.	Steam Generator Pressure - Low	Steam Generator Pressure - Low Steam Generator ΔP 1 and 2 (EFAS 1 and 2)
5.	Steam Generator Level	Steam Generator - Low Steam Generator - High Steam Generator ΔP (ESFAS)
6.	Core Protection Calculator	Local Power Density - High DNBR - Low

3.3 INSTRUMENTATION

3.3.2 Reactor Protective System (RPS) Instrumentation – Shutdown

LCO 3.3.2 Four RPS Logarithmic Power Level – High trip channels and associated instrument and operating bypass removal channels shall be OPERABLE. Trip channels shall have an Allowable Value of ≤ .93% RTP.

APPLICABILITY: MODES 3, 4, and 5, with any reactor trip circuit breakers (RTCBs) closed and any control element assembly capable of being withdrawn.

-----------------------------NOTE-----------------------------
Trip may be bypassed when THERMAL POWER is > 1E-4% RTP. Bypass shall be automatically removed when THERMAL POWER is ≤ 1E-4% RTP.

ACTIONS

-----------------------------NOTE-----------------------------
If a channel is placed in bypass, continued operation with the channel in the bypassed condition for the Completion Time specified by Required Action A.2 or C.2.2 shall be reviewed by the Onsite Review Committee.

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One RPS logarithmic power level trip channel inoperable.	A.1	Place channel in bypass or trip.	1 hour
	<u>AND</u>		
	A.2	Restore channel to OPERABLE status.	Prior to entering MODE 2 following next MODE 5 entry

(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. (continued)	B.2 Verify all full length and part length control element assembly (CEA) groups are fully withdrawn and maintained fully withdrawn, except during Surveillance testing pursuant to SR 3.1.5.3 and SR 3.1.5.4 or for control, when CEA group #6 may be inserted to a maximum of 127.5 inches.	4 hours
	AND	
	B.3 Verify the "RSPT/CEAC Inoperable" addressable constant in each core protection calculator (CPC) is set to indicate that ~~both~~ the CEAC(s) ~~are~~ is(are) inoperable.	4 hours applicable
	AND	
	B.4 Verify the Control Element Drive Mechanism Control System is placed in "OFF" and maintained in "OFF," except during CEA motion permitted by Required Action B.2.	4 hours
	AND	
	B.5 Perform SR 3.1.5.1.	Once per 4 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. Required Action and associated Completion Time of Condition A, B, or D not met. OR One or more Functions with more than one Manual Trip, Matrix Logic, Initiation Logic, or RTCB channel inoperable for reasons other than Condition A or D.	E.1 Be in MODE 3. AND E.2 Open all RTCBs.	6 hours 6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.4.1	Perform a CHANNEL FUNCTIONAL TEST on each ~~RPS Logic channel and~~ RTCB channel.	31 days
SR 3.3.4.~~2~~3	Perform a CHANNEL FUNCTIONAL TEST, including separate verification of the undervoltage and shunt trips, on each RTCB.	18 months
SR 3.3.4.~~3~~4	Perform a CHANNEL FUNCTIONAL TEST on each RPS Manual Trip channel.	Once within 7 days prior to each reactor startup
SR 3.3.4.2	Perform a CHANNEL FUNCTIONAL TEST on each RPS Logic channel.	92 days

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
D. (continued)	D.2	Place one affected automatic trip channel in bypass and place the other in trip.	1 hour
E. Required Action and associated Completion Time not met for Safety injection Actuation Signal, Containment spray Actuation Signal, Containment Isolation Actuation Signal, Main Steam isolation Signal, or Emergency Feedwater Actuation Signal	E.1	Be in MODE 3.	6 hours
	AND		
	E.2	Be in MODE 4.	12 hours
F. Required Action and associated Completion Time for Recirculation Actuation Signal not met	F.1	Be in MODE 3	6 hours
	AND		
	F.2	Be in MODE 5	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.5.1	Perform a CHANNEL CHECK of each ESFAS channel.	12 hours
SR 3.3.5.2	Perform a CHANNEL FUNCTIONAL TEST of each ESFAS channel, including bypass removal functions.	92 days
SR 3.3.5.3	Perform a CHANNEL CALIBRATION of Function 5, Recirculation Actuation Signal, including bypass removal functions.	18 months

(continued)

Table 3.3.5-1 (page 1 of 1)
Engineered Safety Features Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	ALLOWABLE VALUE
1. Safety Injection Actuation Signal(a)		
a. Containment Pressure - High	1,2,3	≤ 3.7 psig
b. Pressurizer Pressure - Low(b)		≥ 1700 psia
2. Containment Spray Actuation Signal (e)		
a. Containment Pressure - High-High	1,2,3	≤ 15.0 psig
3. Containment Isolation Actuation Signal		
a. Containment Pressure - High	1,2,3	≤ 3.7 psig
4. Main Steam Isolation Signal		
a. Steam Generator Pressure - Low(c)	1,2(d),3(d)	≥ 729 psia
5. Recirculation Actuation Signal		
a. Refueling Water Storage Tank Level - Low	1,2,3,4	19.27% ≥ tap span ≥ 17.73%
6. Emergency Feedwater Actuation Signal SG #1 (EFAS-1)		
a. Steam Generator Level - Low	1,2,3	≥ 20%
b. SG Pressure Difference - High		≤ 140 psid
c. Steam Generator Pressure - Low (c)		≥ 729 psia
7. Emergency Feedwater Actuation Signal SG #2 (EFAS-2)		
a. Steam Generator Level - Low	1,2,3	≥ 20%
b. SG Pressure Difference - High		≤ 140 psid
c. Steam Generator Pressure - Low (c)		≥ 729 psia

(a) Automatic SIAS also initiates a Containment Cooling Actuation Signal (CCAS).

(b) The setpoint may be decreased to a minimum value of 300 psia, as pressurizer pressure is reduced, provided the margin between pressurizer pressure and the setpoint is maintained ≤ 400 psia. Trips may be bypassed when pressurizer pressure is < 472 psia decreasing. Bypass shall be automatically removed when pressurizer pressure is ≥ 472 psia increasing. The setpoint shall be automatically increased to the normal setpoint as pressurizer pressure is increased.

(c) The setpoint may be decreased as steam pressure is reduced, provided the margin between steam pressure and the setpoint is maintained ≤ 200 psi. The setpoint shall be automatically increased to the normal setpoint as steam pressure is increased.

(d) The Main Steam Isolation Signal Function (Steam Generator Pressure - Low) is not required to be OPERABLE when all associated valves isolated by the MSIS Function are closed and de-activated.

(e) Automatic SIAS is required for Containment Spray Actuation Signal (CSAS).

Table 3.3.5-2 (page 1 of 1)
Functional Units

Action A.1

	Process Measurement Circuit	Functional Unit Bypassed
1.	Containment Pressure - High	Containment Pressure - High (ESF) Containment Pressure - High (RPS)
2.	Steam Generator Pressure - Low	Steam Generator Pressure Low Steam Generator ΔP 1 and 2 (EFAS)
3.	Steam Generator Level	Steam Generator Level - Low Steam Generator Level - High Steam Generator ΔP (EFAS)

Action B.1

	Process Measurement Circuit	Functional Unit Bypassed/Tripped
1.	Containment Pressure Circuit	Containment Pressure - High (ESF) Containment Pressure - High (RPS)
2.	Steam Generator Pressure - Low	Steam Generator Pressure - Low Steam Generator Pressure ΔP (EFAS)
3.	Steam Generator Level - Low	Steam Generator Level - Low Steam Generator Level - High Steam Generator ΔP (EFAS)

9

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. One or more Functions with two Initiation Logic channels affecting the same trip leg inoperable.	C.1 Initiate action to Open at least one contact in the affected trip leg of both ESFAS Actuation Logics.	Immediately
	AND	
	C.2 Restore channels to OPERABLE status.	48 hours
D. One or more Functions with one Actuation Logic channel inoperable.	D.1 --------NOTE--------- One channel of Actuation Logic may be bypassed for up to 1 hour for Surveillances, provided the other channel is OPERABLE. --------------------- Restore inoperable channel to OPERABLE status.	48 hours
E. Required Action and associated Completion Time of Conditions for Main Steam Isolation Signal, Containment Spray Actuation Signal, or Emergency Feedwater Actuation Signal not met.	E.1 Be in MODE 3.	6 hours
	AND	
	E.2 Be in MODE 4.	12 hours

(continued)

Table 3.3.6-1 (page 1 of 1)
Engineered Safety Features Actuation System Logic and Manual Trip Applicability

FUNCTION	APPLICABLE MODES
1. Safety Injection Actuation Signal	
a. Matrix Logic	1,2,3
b. Initiation Logic	1,2,3,4 (c)
c. Actuation Logic	1,2,3,4
d. Manual Trip	1,2,3,4
2. Containment Isolation Actuation Signal	
a. Matrix Logic	1,2,3
b. Initiation Logic	1,2,3,4 (c)
c. Actuation Logic	1,2,3,4
d. Manual Trip	1,2,3,4
3. Containment Cooling Actuation Signal(a)	
a. Initiation Logic	1,2,3,4 (c)
b. Actuation Logic	1,2,3,4
c. Manual Trip	1,2,3,4
4. Recirculation Actuation Signal	
a. Matrix Logic	1,2,3,4
b. Initiation Logic	1,2,3,4
c. Actuation Logic	1,2,3,4
5. Containment Spray Actuation Signal(b)	
a. Matrix Logic	1,2,3
b. Initiation Logic	1,2,3
c. Actuation Logic	1,2,3
d. Manual Trip	1,2,3
6. Main Steam Isolation Signal	
a. Matrix Logic	1,2,3
b. Initiation Logic	1,2,3
c. Actuation Logic	1,2,3
d. Manual Trip	1,2,3
7. Emergency Feedwater Actuation Signal SG #1 (EFAS-1)	
a. Matrix Logic	1,2,3
b. Initiation Logic	1,2,3
c. Actuation Logic	1,2,3
d. Manual Trip	1,2,3
8. Emergency Feedwater Actuation Signal SG #2 (EFAS-2)	
a. Matrix Logic	1,2,3
b. Initiation Logic	1,2,3
c. Actuation Logic	1,2,3
d. Manual Trip	1,2,3

(a) Automatic SIAS also initiates CCAS.

(b) Automatic SIAS also required for automatic CSAS initiation.

(c) Only the portions of initiation Logic necessary for manual trip required in MODE 4.

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.3.7.1 Perform CHANNEL CHECK.	12 hours
SR 3.3.7.2 Perform CHANNEL FUNCTIONAL TEST.	24 months
SR 3.3.7.3 Perform CHANNEL CALIBRATION with setpoint Allowable Values as follows: a. Degraded Voltage Function ≥ 4181 V and ≤ 4275 V ~~Time delay: ≥ 105 seconds and ≤ 135 seconds at 9228 V; and~~ b. Loss of Voltage Function ≥ 3554 V and ≤ 3796 V Time delay: ≥ 0.95 seconds and ≤ 1.05 seconds at 0 V.	24 months
SR 3.3.7.4 Verify Response Time of required DG-LOV channel is within 1.05 seconds.	24 months on a STAGGERED TEST BASIS

SDVSS (Sustained Degraded Grid Voltage):
Time delay: ≤ 135 seconds
(response time is measured from initiation of degraded voltage)
DGVSS (Degraded Grid Voltage with SIAS signal):
Time delay: ≤ 6.14 seconds
(response time is measured from initiation of SIAS)

3.3 INSTRUMENTATION

3.3.10 Fuel Handling Isolation Signal (FHIS)

LCO 3.3.10 One FHIS channel shall be OPERABLE.

APPLICABILITY: During movement of irradiated fuel in the fuel handling building.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. Actuation Logic, Manual Trip, or required channel of gaseous radiation monitor inoperable during movement of irradiated fuel assemblies.	A.1	Place one OPERABLE Fuel Handling Building Post Accident Cleanup System (PACU) train in operation.	Immediately
	<u>OR</u>		
	A.2	Suspend movement of irradiated fuel assemblies in the fuel handling building.	Immediately

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.3.10.1	Perform a CHANNEL CHECK on required FHIS radiation monitor channel.	12 hours
SR 3.3.10.2	Perform a CHANNEL FUNCTIONAL TEST on required FHIS radiation monitor channel. Verify radiation monitor setpoint Allowable Values: Airborne Gaseous: ≤ 6E4 cpm above background	92 days
SR 3.3.10.3	-------------------NOTE-------------------- Testing of Actuation Logic shall include the actuation of each initiation relay and verification of the proper operation of each ignition relay. --- Perform a CHANNEL FUNCTIONAL TEST on required FHIS Actuation Logic channel.	18 months
SR 3.3.10.4	Perform a CHANNEL FUNCTIONAL TEST on required FHIS Manual Trip logic.	18 months
SR 3.3.10.5	Perform a CHANNEL CALIBRATION on required FHIS radiation monitor channel.	18 months

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. ---------NOTE--------- Not applicable to hydrogen monitor channels. --------------------- One or more Functions with two required channels inoperable.	C.1 Restore one channel to OPERABLE status.	7 days
D. Two hydrogen monitor channels inoperable.	D.1 Restore one hydrogen monitor channel to OPERABLE status.	72 hours
E. Required channel of Functions 18, 21, 24, or 25 inoperable.	E.1 Restore required channel to OPERABLE status.	7 days
F. Required Action and associated Completion Time of Condition C, D or E not met.	F.1 Enter the Condition referenced in Table 3.3.11-1 for the channel.	Immediately
G. As required by Required Action F.1 and referenced in Table 3.3.11-1.	G.1 Be in MODE 3.	6 hours
	<u>AND</u>	
	G.2 Be in MODE 4.	12 hours
H. As required by Required Action F.1 and referenced in Table 3.3.11-1.	H.1 Initiate action in accordance with Specification 5.7.2.	Immediately

SURVEILLANCE REQUIREMENTS

3.3 INSTRUMENTATION

3.3.13 Source Range Monitoring Channels

LCO 3.3.13 Two channels of source range monitoring instrumentation shall be OPERABLE.

APPLICABILITY: MODES 3, 4, and 5, with the reactor trip circuit breakers open or Control Element Assembly (CEA) Drive System not capable of CEA withdrawal.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One or more required channels inoperable.	A.1	Suspend all operations involving positive reactivity additions.	Immediately
	<u>AND</u>		
	A.2	Perform SDM verification in accordance with SR 3.1.1.1, if $T_{avg} > 200°F$, or SR 3.1.2.~~1~~ ②, if $T_{avg} \le 200°F$.	4 hours <u>AND</u> Once per 12 hours thereafter

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.1 RCS Pressure, Temperature, and Flow Limits

LCO 3.4.1 RCS parameters for pressurizer pressure, cold leg temperature, and RCS total flow rate shall be within the limits specified below:

a. Pressurizer pressure ≥ 2025 psia and ≤ 2275 psia;

④

b. RCS cold leg temperature (T_c):
1. For RTP ≤ 30%, T_c limit not applicable. $520°F \le T_c \le 557°F$
2. For 30% < RTP < 70%, $535°F \le T_c \le 557°F$,
3. For RTP ≥ 70%, $544°F \le T_c \le 557°F$; and

c. RCS total flow rate is specified by the COLR.

APPLICABILITY: MODE 1.

-----------------------------NOTE-----------------------------
Pressurizer pressure limit does not apply during:

a. THERMAL POWER ramp > 5% RTP per minute; or

b. THERMAL POWER step > 10% RTP.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. Pressurizer pressure or RCS flow rate not within limits.	A.1	Restore parameter(s) to within limit.	2 hours
B. Required Action and associated Completion Time of Condition A not met.	B.1	Be in MODE 2.	6 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. RCS cold leg temperature not within limits.	C.1	Restore cold leg temperature to within limits.	2 hours
D. Required Action and associated Completion Time of Condition C not met.	D.1	Reduce THERMAL POWER to ≤ 30% RTP.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.1.1	Verify pressurizer pressure ≥ 2025 psia and ≤ 2275 psia.	12 hours
SR 3.4.1.2 ⑤	Verify RCS cold leg temperature: 2. For 30% < RTP < 70%, 535°F ≤ T_c ≤ 557°F, 3. For RTP ≥ 70%, 544°F ≤ T_c ≤ 557°F 1. For RTP ≤ 30%, 520°F ≤ T_c ≤ 557°F	12 hours
--------------------------NOTE-------------------------- Required to be met in MODE 1 with all RCPs running. -- SR 3.4.1.3	Verify RCS total flow rate is within limit specified in the COLR.	12 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. No RCS loop OPERABLE. OR No RCS loop in operation.	C.1	Suspend all operations involving a reduction of RCS boron concentration.	Immediately
	AND		
	C.2	Initiate action to restore one RCS loop to OPERABLE status and operation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.5.1	Verify required RCS loop is in operation.	12 hours
SR 3.4.5.2 ①	Verify secondary side water level in each steam generator ≥ 10% (wide range). 9 50	12 hours
SR 3.4.5.3	Verify correct breaker alignment and indicated power available to the required pump that is not in operation.	7 days

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.6.1	Verify at least one RCS loop or SDC train is in operation.	12 hours
SR 3.4.6.2	Verify secondary side water level in required SG(s) is ≥ 10% (wide range). ② 9 50	12 hours
SR 3.4.6.3	Verify correct breaker alignment and indicated power available to the required pump that is not in operation.	7 days

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.7 RCS Loops — MODE 5, Loops Filled

LCO 3.4.7 At least one of the following loop(s)/trains listed below shall be OPERABLE and in operation:

a. Reactor Coolant Loop 1 and its associated steam generator and at least one associated Reactor Coolant Pump

b. Reactor Coolant Loop 2 and its associated steam generator and at least one associated Reactor Coolant Pump

c. Shutdown Cooling Train A

d. Shutdown Cooling Train B

One additional Reactor Coolant Loop/shutdown cooling train shall be OPERABLE, or

The secondary side water level of each steam generator shall be greater than 10% (wide range).

⑬ 9 50

-----------------------------NOTES-----------------------------

1. All reactor coolant pumps (RCPs) and pumps providing shutdown cooling may be de-energized for ≤ 1 hour per 8 hour period, provided:

   a. No operations are permitted that would cause reduction of the RCS boron concentration; and

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

2. One required SDC train may be inoperable for up to 2 hours for surveillance testing provided that the other SDC train or RCS loop is OPERABLE and in operation.

3. One required RCS loop may be inoperable for up to 2 hours for surveillance testing provided that the other RCS loop or SDC train is OPERABLE and in operation.

--- (continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. No SDC train/RCS loop in operation	B.1	Suspend all operations involving reduction in RCS boron concentration	Immediately
	AND		
	B.2	Initiate action to restore required SDC train/RCS loop to operation	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.7.1	Verify at least one RCS loop or SDC train is in operation.	12 hours
SR 3.4.7.2	Verify required SG secondary side water level is ≥ 10% (wide range). (.3) 9 50	12 hours
SR 3.4.7.3	Verify correct breaker alignment and indicated power available to the required pump that is not in operation.	7 days

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.12.1 Low Temperature Overpressure Protection (LTOP) System

RCS Temperature ≤ LTOP Enable Temperature

⑦ or depressurized to less than the PTLR lim

LCO 3.4.12.1 No more than two high pressure safety injection pumps shall be OPERABLE, the safety injection tanks shall be isolated, and at least one of the following overpressure protection systems shall be OPERABLE:

a. The Shutdown Cooling System Relief Valve (PSV9349) with:

  1) A lift setting of 406 ± 10 psig

  2) Relief Valve isolation valves ~~2~~3HV9337, ~~2~~3HV9339, ~~2~~3HV9377, and ~~2~~3HV9378 open,

or,

b. The Reactor Coolant System depressurized with an RCS vent of greater than or equal to 5.6 square inches.

APPLICABILITY: MODE 4 when the temperature of any one RCS cold leg is less than or equal to the enable temperatures specified in the PTLR,

MODE 5, and

MODE 6 when the head is on the reactor vessel.

------------------------------NOTES------------------------------

1. The SDCS Relief Valve lift setting assumes valve temperatures less than or equal to 130°F.

⑭ or depressurization to less than the PTLR limit

2. SIT isolation is only required when SIT pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed by the P/T limit curves provided in the PTLR.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. With more than two HPSI pumps capable of injecting into the RCS.	A.1 Initiate action to verify a maximum of two HPSI pumps capable of injecting into the RCS	Immediately
B. SIT pressure is greater than or equal to the maximum RCS pressure for existing cold leg temperature allowed in the PTLR.	B.1 Isolate affected SIT. ~~OR~~ ⑧	1 hour
⑧ C. Required Action & associated Completion Time of Condition B not met	~~B.2~~ C.1 Depressurize affected SIT to less than the maximum RCS pressure for existing cold leg temperature allowed in the PTLR.	12 hours
⑧ D ~~C~~. With one or both SDCS Relief Valve isolation valves in a single SDCS Relief Valve isolation valve pair (valve pair 3~~2~~HV9337 and 3~~2~~HV9339 or valve pair 3~~2~~HV9377 and 3 ~~2~~HV9378) closed.	D ~~C~~.1 ⑧ Open the closed valve(s). OR ~~C~~.2 D ⑧ Power-lock open the OPERABLE SDCS Relief Valve isolation valve pair.	24 hours 24 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E ~~B~~. SDCS Relief Valve inoperable. ⑧ OR Required Action and associated Completion Time of Condition A, ~~B~~, or ~~C~~, not met. ⑧ C D OR LTOP System inoperable for any reason other than Condition A, B, a ~~C~~, or D. ⑧ C	~~B~~.1 E ⑧ Reduce T_{avg} to less than 200°F, depressurize RCS and establish RCS vent of ≥ 5.6 square inches.	8 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.12.1.1	------------------NOTE------------------ A HPSI pump is secured by verifying that its motor circuit breaker is not racked-in, or its discharge valve is locked closed. The requirement to rack out the HPSI pump breaker is satisfied with the pump breaker racked out to its disconnected or test position. --- Verify a maximum of two HPSI pumps are capable of injecting into the RCS.	12 hours
SR 3.4.12.1.2 ⑨	------------------NOTE------------------ Required to be performed when complying with LCO 3.4.12.1 Note 2. --- Verify each SIT is isolated, or depressurized less than the PTLR limit	12 hours
SR 3.4.12.1.3	Verify RCS vent ≥ 5.6 square inches is open when in use for overpressure protection.	12 hours for unlocked open vent valve(s) **AND** 31 days for locked, sealed, or otherwise secured open vent valve(s), or open flanged RCS penetrations

(continued)

SURVEILLANCE REQUIREMENTS (continued) SURVEILLANCE	FREQUENCY
SR 3.4.12.1.4 -------------------NOTE------------------- The power-lock open requirement is satisfied either with the AC breakers open for valve pair 3~~2~~HV9337 and 3~~2~~HV9339 or the inverter input and output breakers open for valve pair 3~~2~~HV9377 and 3~~2~~HV9378, whichever valve pair is OPERABLE. --- ⑮ The OPERABLE SDCS Relief Valve isolation valve pair (valve pair 3~~2~~HV9337 and 3 ~~2~~HV9339, or valve pair 3~~2~~HV9377 and 3 ~~2~~HV9378) that is used for overpressure protection due to the other SDCS Relief Valve isolation valve pair being INOPERABLE shall be verified to be in the power-lock open condition until the INOPERABLE SDCS Relief Valve isolation valve pair is returned to OPERABLE status or the RCS is depressurized and vented.	12 hours
SR 3.4.12.1.5 ⑯ Verify that SDCS Relief Valve isolation valves 3~~2~~HV9337, 3~~2~~HV9339, 3~~2~~HV9377, and 3~~2~~HV9378 are open when the SDCS Relief Valve is used for overpressure protection.	72 hours
SR 3.4.12.1.6 Verify SDCS Relief Valve Setpoint	In accordance with the Inservice Testing Program

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. No pressurizer code safety valves OPERABLE. AND The SDCS Relief Valve INOPERABLE.	A.1 Be in MODE 5 and vent the RCS through a greater than or equal to 5.6 square inch vent.	8 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
	--------------------Note-------------------- Only required when the SDCS Relief Valve is being used for overpressure protection. --	
SR 3.4.12.2.1	Verify that the SDCS Relief Valve isolation valves 3HV9337, 3HV9339, 3HV9377, and 3HV9378 are open.	72 hours
SR 3.4.12.2.2	Verify relief valve setpoint.	In accordance with the Inservice Testing Program

INSERT

⑩

B. With one or both SDCS Relief Valve Isolation valves in a single SDCS Relief Valve isolation valve pair / valve pair 3HV9337 and 3HV9339 or valve pair 3HV9377 and 3HV9378) closed	B.1 Open the closed valve(s) OR B.2 Power-lock open the OPERABLE SDCS Relief Valve isolation valve pair.	24 hours 24 hours

Table 3.4.14-1
REACTOR COOLANT SYSTEM PRESSURE ISOLATION VALVES

SECTION A

⑰

VALVE NUMBER	VALVE DESCRIPTION
S~~2~~31204MU018	HPSI Check to Loop #1A
S~~2~~1204MU019	HPSI Check to Loop #1B
S~~2~~1204MU020	HPSI Check to Loop #2A
S~~2~~1204MU021	HPSI Check to Loop #2B
S~~2~~1204MU152	Hot leg injection to loop #1
S~~2~~1204MU156	Hot leg injection to loop #2
S~~2~~1204MU157	Hot leg injection check
S~~2~~1204MU158	Hot leg injection check
~~2~~3HV-9337	SDC Suction Isolation
~~2~~3HV-9339	SDC Suction Isolation
~~2~~3HV-9377	SDC Suction Isolation
~~2~~3HV-9378	SDC Suction Isolation

SECTION B

⑰

VALVE NUMBER	VALVE DESCRIPTION
S~~2~~31204MU072	LPSI Check to Loop #1A
S~~2~~1204MU073	LPSI Check to Loop #1B
S~~2~~1204MU074	LPSI Check to Loop #2A
S~~2~~1204MU075	LPSI Check to Loop #2B
S~~2~~1204MU027*	Cold leg injection to loop #1A
S~~2~~1204MU029*	Cold leg injection to loop #1B
S~~2~~1204MU031*	Cold leg injection to loop #2A
S~~2~~1204MU033*	Cold leg injection to loop #2B
S~~2~~1204MU040	SIT T008 Check
S~~2~~1204MU041	SIT T007 Check
S~~2~~1204MU042	SIT T009 Check
S~~2~~1204MU043	SIT T010 Check

*Redundant to LPSI and SIT checks

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.16 RCS Specific Activity ⑥

LCO 3.4.16 The specific iodine activity of the reactor coolant shall be limited to:

a. DOSE EQUIVALENT I-131 specific activity ≤ 1.0 μCi/gm; and

b. Gross specific activity ≤ 100/E μCi/gm.

APPLICABILITY: MODES 1 and 2,
MODE 3 with RCS average temperature (T_{avg}) ≥ 500°F

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. DOSE EQUIVALENT I-131 > 1.0 μCi/gm.	- - - - - - - NOTE - - - - - The provisions of Specification 3.0.4 are not applicable. - - - - - - NOTE - - - - -	⑥
	A.1 Verify DOSE EQUIVALENT I-131 within the acceptable region of Figure 3.4.16-1.	Once per 4 hours
	AND	
	A.2 Restore DOSE EQUIVALENT I-131 to within limit.	48 hours

(continued)

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. (continued)	A.1	Verify the OPERABLE door is closed in the affected air lock.	1 hour
	<u>AND</u>		
	A.2	Lock the OPERABLE door closed in the affected air lock.	24 hours
	<u>AND</u>		
	A.3	--------NOTE--------- Air lock doors in high radiation areas may be verified locked closed by administrative means. --------------------- Verify the OPERABLE door is locked closed in the affected air lock.	Once per 31 days
B. One or more containment air locks with containment air lock interlock mechanism inoperable.	------------NOTES------------ 1. Required Actions B.1, B.2, and B.3 are not applicable if both doors in the same air lock are inoperable and Condition C is entered. 2. Entry and exit of containment is permissible under the control of a dedicated individual. add 2 3. The provisions of LCO 3.0.4 are not applicable. -------------------------		(continued)

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
D. (continued)	D.2	--------NOTE-------- Valves and blind flanges in high radiation areas may be verified by use of administrative means. --------------------- Verify the affected penetration flow path is isolated.	Once per 31 days for isolation devices outside containment AND Prior to entering MODE 4 from MODE 5 if not performed within the previous 92 days for isolation devices inside containment
	AND		
	D.3	Perform SR 3.6.3.6 for the resilient seal purge valves closed to comply with Required Action D.1.	Once per 184 days
E. One or more Section D.1 containment isolation valve(s) inoperable.	E.1	Secure the inoperable valve(s) in its ESFAS actuated position.	4 hours
	AND		
	E.2	Restore the inoperable valve(s) to OPERABLE status.	completing next cold shutdown if cold shutdown entered within 30 days, otherwise within Prior to ~~entry into MODE 3, or~~ 30 days, ~~whichever i~~s ~~shorter.~~

SURVEILLANCE REQUIREMENTS

-----NOTE-----
1. Section A, B, C, D, and E isolation valves are located in the LCS.

SURVEILLANCE	FREQUENCY
SR 3.6.3.1 Verify each 42 inch purge valve is sealed closed except for one purge valve in a penetration flow path while in Condition D of this LCO.	31 days
SR 3.6.3.2 Verify each 8 inch purge valve is closed except when the 8 inch purge valves are open for pressure control, ALARA or air quality considerations for personnel entry, or for Surveillances that require the valves to be open.	31 days
SR 3.6.3.3 -----NOTE----- Valves and blind flanges in high radiation areas may be verified by use of administrative means. ---------- Verify each containment isolation manual valve and blind flange that is located outside containment and is required to be closed during accident conditions is closed, except for containment isolation valves that are open under administrative controls.	31 days

(continued)

SURVEILLANCE	FREQUENCY
SR 3.6.3.4 -----------------------------NOTE-------------------- Valves and blind flanges in high radiation areas may be verified by use of administrative means. -- Verify each containment isolation manual valve and blind flange that is located inside containment and required to be closed during accident conditions is closed, except for containment isolation valves that are open under administrative controls.	Prior to entering MODE 4 from MODE 5 if not performed within the previous 92 days
SR 3.6.3.5 Verify the isolation time of each Section A and B power operated and each automatic containment isolation valve is within limits.	In accordance with the Inservice Testing Program
SR 3.6.3.6 -----------------------------NOTE-------------------- Results shall be evaluated against acceptance criteria of SR 3.6.1.1 in accordance with 10 CFR 50, Appendix J, as modified by approved exemptions. -- Perform leakage rate testing for containment purge valves with resilient seals.	184 days AND Within 92 days after opening the valve

(continued)

SURVEILLANCE	FREQUENCY
SR 3.6.3.7 △ -------------------NOTE------------------- The provisions of the Inservice Testing Program are not applicable when the valves are secured open. --- Verify each Section D1 and D2 containment isolation valve is OPERABLE.	In accordance with the Inservice Testing Program and those SRS associated with those Specifications pertaining to each valve or system in which it is installed.
SR 3.6.3.8 △ Verify each Section A, B, C, and E automatic containment isolation valve actuates to the isolation position on an actual or simulated actuation signal.	24 months

3.7 PLANT SYSTEMS

3.7.4 Atmospheric Dump Valves (ADVs)

LCO 3.7.4 One ADV per required Steam Generator (SG) shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3,
MODE 4 when steam generator is being relied upon for heat removal.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One required ADV inoperable.	A.1	---------NOTE--------- LCO 3.0.4 is not applicable. --------------------- Restore ADV to OPERABLE status.	72 hours
B. Two ADVs inoperable.	B.1	Restore one ADV to OPERABLE status.	24 hours
C. Backup nitrogen gas supply system capacity ≤ 8 hours for each ADV	C.1	Restore backup nitrogen gas supply system capacity for each ADV	72 hours

(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Actions and associated Completion Times of Conditions A or B not met.	C.1 Be in MODE 3. AND C.2 Be in MODE 5.	6 hours Q- 30 hours 36

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.7.1.1	Verify the contained water volume in the Primary Plant Makeup Storage Tank is within its limits.	7 days
SR 3.7.7.1.2	Verify each CCW Safety Related Makeup pump develops the required differential pressure on recirculation flow.	In accordance with inservice testing program
SR 3.7.7.1.3	Measure CCW Leakage.	24 months

3.7 PLANT SYSTEMS

3.7.14 Fuel Handling Building Post-Accident Cleanup Filter System

LCO 3.7.14 Two Fuel Handling Building Post-Accident Cleanup Filter System trains shall be OPERABLE.

APPLICABILITY: During movement of irradiated fuel assemblies in the fuel building.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One Fuel Handling Building Post-Accident Cleanup Filter System train inoperable.	A.1	Restore Fuel Handling Building Post-Accident Cleanup Filter System train to OPERABLE status.	7 days
B. Required Action and Associated Completion Time of Condition A not met during movement of irradiated fuel assemblies in the fuel building.	B.1	Place OPERABLE Fuel Handling Building Post-Accident Cleanup Filter System train in operation.	Immediately
	<u>OR</u>		
	B.2	Suspend movement of irradiated fuel assemblies in the fuel building.	Immediately

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ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. Two Fuel Handling Building Post-Accident Cleanup Filter System trains inoperable during movement of irradiated fuel assemblies in the fuel building.	C.1	Suspend movement of irradiated fuel assemblies in the fuel building.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.14.1	Operate each Fuel Handling Building Post-Accident Cleanup Filter System train for ≥ 10 continuous hours with the heaters operating.	31 days on a STAGGERED TEST BASIS
SR 3.7.14.2	Perform required Fuel Handling Building Post-Accident Cleanup Filter System filter testing in accordance with the Ventilation Filter Testing Program (VFTP).	In accordance with the VFTP
SR 3.7.14.3	Verify each Fuel Handling Building Post-Accident Cleanup Filter System train actuates on an actual or simulated actuation signal.	24 months

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
F. Required Action and Associated Completion Time of Condition A, B, C, D, or E not met.	F.1 Be in MODE 3. AND F.2 Be in MODE 5.	6 hours 36 hours
G. Three or more required AC sources inoperable.	G.1 Enter LCO 3.0.3.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.1.1	-------------------NOTES------------------- 1. Buses 2A04 and 2D1 are required when unit crosstie breaker 2A0416 is used to provide a source of AC power. 2. Buses 2A06 and 2D2 are required when unit crosstie breaker 2A0603 is used to provide a source of AC power. --- Verify correct breaker alignment and ~~indicated~~ power availability for each required offsite circuit.	 7 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.3	-------------------NOTES------------------- 1. DG loadings may include gradual loading as recommended by the manufacturer. 2. Momentary transients outside the load range do not invalidate this test. 3. This Surveillance shall be conducted on only one DG at a time. 4. This SR shall be preceded by, and immediately follow without shutdown, a successful performance of SR 3.8.1.2 or SR 3.8.1.7. --- Verify each DG is synchronized and loaded, and operates for ≥ 60 minutes at a load ≥ 4230 kW and ≤ 4700 kW. 4450	As specified in Table 3.8.1-1 on a staggered test basis
SR 3.8.1.4	Verify each day tank contains ≥ 325 gal of fuel oil. 30 inches	31 days
SR 3.8.1.5	Check for and remove accumulated water from each day tank.	31 days
SR 3.8.1.6	Verify the fuel oil transfer system operates to automatically transfer fuel oil from storage tank to the day tank.	31 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.9	-------------------NOTE------------------- Credit may be taken for unplanned events that satisfy this SR. -- Verify each DG, when operating with design basis kW loading and maximum kVAR loading permitted during testing, rejects a load ≥ 682 kW, and: a. Following load rejection, the frequency is ≥ 54 Hz and ≤ 66 Hz; b. Within 4 seconds following load rejection, the voltage is ≥ 3924 V and ≤ 4796 V; and c. Within 4 seconds following load rejection, the frequency is ≥ 58.8 Hz and ≤ 61.2 Hz.	24 months 66.75
SR 3.8.1.10	-------------------NOTE------------------- Credit may be taken for unplanned events that satisfy this SR. -- Verify each DG, when operating with design basis kW loading and maximum kVAR loading permitted during testing, does not trip and voltage is maintained ≤ 5450 V during and following a load rejection of ≥ 4230 kW and ≤ 4700 kW. 4450	24 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.14	--------------------NOTES-------------------- 1. Momentary transients outside the load and power factor ranges do not invalidate this test. 2. Credit may be taken for unplanned events that satisfy this SR. --- Verify each DG, when operating with the maximum kVAR loading permitted during testing, operates for ≥ 24 hours: a. For ≥ 2 hours loaded ≥ 4935 kW and ≤ 5170 kW; and b. For the remaining hours of the test loaded ≥ 4230 kW and ≤ 4700 kW. 4450	24 months
SR 3.8.1.15	--------------------NOTES-------------------- 1. This Surveillance shall be performed within 5 minutes of shutting down the DG after the DG has operated ≥ 2 hours loaded ≥ 4230 kW and ≤ 4700 kW. 4450 Momentary transients outside of load range do not invalidate this test. 2. All DG starts may be preceded by an engine prelube period. --- Verify each DG starts and achieves, in ≤ 10 seconds, voltage ≥ 3924 V and ≤ 4796 V, and frequency ≥ 58.8 Hz and ≤ 61.2 Hz; and operates ≥ 5 minutes.	24 months

(continue

3.8 ELECTRICAL POWER SYSTEMS

3.8.3 Diesel Fuel Oil, Lube Oil, and Starting Air

LCO 3.8.3 The stored diesel fuel oil, lube oil, and starting air subsystem shall be within limits for each required diesel generator (DG).

APPLICABILITY: When associated DG is required to be OPERABLE.

ACTIONS

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

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One or more DGs with fuel level < ~~40,724 gal~~ 89% and ≥ ~~42,960 gal~~ 76% in storage tank during Mode 1, 2, 3, or 4.	A.1	Restore fuel oil level to within limits.	48 hours
B. One or more DGs with lube oil inventory < ~~412 gal~~ TSmin and ≥ ~~387 gal for the 20 cylinder engine, < 370 gal and ≥ 340 gal for the 16 cylinder engine.~~ TSinop	B.1	Restore lube oil inventory to within limits.	48 hours
INSERT "A"			
~~C.~~ D One or more DGs with stored fuel oil total particulates not within limits.	~~C~~D.1	Restore fuel oil total particulates to within limits.	7 days

(continued)

INSERT "A"

C.	One required DG with fuel level in the storage tank <72% and >63% during Mode 5 or 6.	C.1	Restore fuel oil level to within limits.	48 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
E ~~D~~. One or more DGs with new fuel oil properties not within limits.	E ~~D~~.1	Restore stored fuel oil properties to within limits.	30 days
F ~~E~~. One or more DGs with starting air receiver pressure < 175 psig and ≥ 136 psig.	F ~~E~~.1	Restore starting air receiver pressure to ≥ 175 psig.	48 hours
G ~~F~~. Required Action and associated Completion Time of Condition A, B, C, D, E, or ~~E~~ F not met. OR One or more DGs with diesel fuel oil, lube oil, or starting air subsystem not within limits for reasons other than Condition A, B, C, D, E, or ~~E~~ F.	G ~~F~~.1	Declare associated DG inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.3.1	Verify each fuel oil storage tank contains ≥ ~~48,724 gal of fuel.~~ 89% level in Mode 1, 2, 3, or 4 and ≥ 72% level in Mode 5 or 6.	31 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.3.2	Verify lubricating oil inventory is ≥ [illegible]13 gal for the 20 cylinder engine and ≥ 370 gal for the 16 cylinder engine. TS min limit.	31 days
SR 3.8.3.3	Verify fuel oil properties of new and stored fuel oil are tested in accordance with, and maintained within the limits of, the Diesel Fuel Oil Testing Program.	In accordance with the Diesel Fuel Oil Testing Program
SR 3.8.3.4	Verify each DG air start receiver pressure is ≥ 175 psig.	31 days
SR 3.8.3.5	Check for and remove accumulated water from each fuel oil storage tank.	31 days
SR 3.8.3.6	For each fuel oil storage tank: a. Drain the fuel oil; b. Remove the sediment; and c. Clean the tank.	10 years

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources – Operating

LCO 3.8.4 The Train A, Train B, Train C, and Train D DC electrical power subsystems shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. ~~One~~ Train A or Train B battery or associated control equipment or cabling inoperable.	A.1 Restore DC electrical power subsystem to OPERABLE status.	2 hours
INSERT "C"		
C ~~B~~. Required Action and Associated Completion Time of Condition A or B not met.	C ~~B~~.1 Be in MODE 3. AND C ~~B~~.2 Be in MODE 5.	6 hours 36 hours
D ~~C~~. One required battery charger or associated control equipment or cabling inoperable.	------------NOTE------------ Entry into MODE 1, 2 or 3 per LCO 3.0.4 is not allowed, except during power reductions. ---------------------------- D ~~C~~.1 Verify battery cell parameters meet Table 3.8.6-1 Category A limits.	1 hour AND Once per 8 hours thereafter

(continued)

INSERT "C"

B.	Train C or Train D battery or associated control equipment or cabling inoperable.	B.1	Restore DC electrical power subsystems to OPERABLE status.	72 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E ~~D~~. Required Action and associated Completion Time of Condition ~~C~~ D not met.	E ~~D~~.1 Declare associated battery inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.1	Verify battery terminal voltage is ≥ 129 V on float charge.	7 days
SR 3.8.4.2	Verify no visible corrosion at terminals and connectors. OR Verify connection resistance is ≤ 150x10^{-6} ohm for inter-cell connections, ≤ 150x10^{-6} ohm for inter-rack connections, ≤ 150x10^{-6} ohm for inter-tier connections, and ≤ 150x10^{-6} ohm for terminal connections.	92 days
SR 3.8.4.3	Verify cells, cell plates, and battery racks show no visual indication of physical damage or abnormal deterioration.	24 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.4	Remove visible terminal corrosion, verify cell to cell and terminal connections are clean and tight, and are coated with anti-corrosion material.	24 months
SR 3.8.4.5	Verify connection resistance is $\leq 150x10^{-6}$ ohm for inter-cell connections, $\leq 150x10^{-6}$ ohm for inter-rack connections, $\leq 150x10^{-6}$ ohm for inter-tier connections, and $\leq 150x10^{-6}$ ohm for terminal connections.	24 months
SR 3.8.4.6	--------------------NOTE-------------------- Credit may be taken for unplanned events that satisfy this SR. -- Verify each battery charger supplies ≥ 300 amps at ≥ 125 V for ≥ 12 hours.	24 months
SR 3.8.4.7	-------------------NOTES------------------- 1. SR 3.8.4.8 may be performed in lieu of SR 3.8.4.7 once per 72 months. 60 2. Credit may be taken for unplanned events that satisfy this SR. -- Verify battery capacity is adequate to supply, and maintain in OPERABLE status, the required emergency loads for the design duty cycle when subjected to a battery service test.	24 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.8	--------------------NOTE------------------ Credit may be taken for unplanned events that satisfy this SR. -- Verify battery capacity is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test.	60 72 months **AND** -----NOTE------ Only applicable when battery shows degradation or has reached 85% of the expected life --------------- 12 months

3.8 ELECTRICAL POWER SYSTEMS

3.8.7 Inverters - Operating

LCO 3.8.7 The required Train A, Train B, Train C, and Train D inverters shall be OPERABLE.

-----------------------------NOTE-----------------------------

One inverter (either Train A or Train B) may be disconnected from its associated DC bus for ≤ 24 hours to perform an equalizing charge on its associated battery, provided:

a. The associated AC vital bus is energized from the Class 1E constant voltage source transformer; and

b. All other AC vital buses for the remaining trains are energized from their associated OPERABLE inverters.

R

One inverter (either Train C or Train D) may be disconnected from its associated vital bus for ≤72 hours to perform an equalizing charge on its associated battery provided all other AC vital buses for the remaining trains are energized from their associated OPERABLE inverters.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
	------------NOTE------------ Enter applicable Conditions and Required Actions of LCO 3.8.9 with one AC vital bus de-energized. ----------------------------	
A. One required Train A or Train B inverter inoperable.	A.1 Power AC vital bus from its Class 1E constant voltage source transformer.	2 hours
	AND	
	A.2 Restore inverter to OPERABLE status.	24 hours

(continued)

ACTIONS (continued)

INSERT

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~B~~ C. Required Action and associated Completion Time of Condition A or B not met.	~~B~~ C.1 Be in MODE 3.	6 hours
	AND	
	~~B~~ C.2 Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.8.7.1 Verify correct inverter voltage and alignment to required AC vital buses.	7 days

	---------NOTE--------- Enter applicable Conditions and Required Actions of LCO 3.8.9 with one AC vital bus de-energized. ----------------------	
B. One required Train C or Train D inverter inoperable.	B.1 Restore inverter to OPERABLE status.	72 hours

3.8 ELECTRICAL POWER SYSTEMS

3.8.9 Distribution Systems – Operating

LCO 3.8.9 Train A and Train B AC; Trains A, B, C, and D DC; and Trains A, B, C, and D AC vital bus electrical power distribution subsystems shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One AC electrical power distribution subsystem inoperable.	A.1	Restore AC electrical power distribution subsystem to OPERABLE status.	8 hours
B. ~~One~~ Train A or Train B AC vital bus inoperable.	B.1	Restore AC vital bus subsystem to OPERABLE status.	2 hours
INSERT "E"			
D ~~C~~. ~~One~~ Train A or Train B DC electrical power distribution subsystem inoperable.	D ~~C~~.1	Restore DC electrical power distribution subsystem to OPERABLE status.	2 hours
INSERT "F"			
F ~~D~~. Required Action and associated Completion Time of Condition A, B, ~~or~~ C, D, or E not met.	F ~~D~~.1	Be in MODE 3.	6 hours
	AND		
	F ~~D~~.2	Be in MODE 5.	36 hours

INSERT "E"

C. Train C or Train D AC vital bus inoperable.	C.1 Restore AC vital bus subsystem to OPERABLE status.	72 hours

INSERT "F"

E. Train C or Train D DC electrical power distribution subsystem inoperable.	E.1 Restore DC electrical power distribution subsystem to OPERABLE status.	72 hours

4.0 DESIGN FEATURES

4.1 Site

4.1.1 Exclusion Area Boundary

The exclusion area boundary shall be as shown in Figure 4.1-1.

4.1.2 Low Population Zone (LPZ)

The LPZ shall be as shown in Figure 4.1-2.

4.2 Reactor Core

4.2.1 Fuel Assemblies

The reactor shall contain 217 fuel assemblies. Each assembly shall consist of a matrix of Zircaloy clad fuel rods with an initial composition of natural or slightly enriched uranium dioxide (UO_2) as fuel material. Integral or Discrete Burnable Absorber Rods may be used. Limited substitutions of zirconium alloy or stainless steel filler rods for fuel rods, in accordance with approved applications of fuel rod configurations, may be used. Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases. A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions.

4.2.2 Control Element Assemblies

The reactor core shall contain 83 full length and eight part length control element assemblies (CEAs). The control material shall be silver indium cadmium, boron carbide, and inconel as approved by the NRC.

INSERT

They may include: borosilicate glass—(Na_2O-B_2O_3-SiO_2 components), boron carbide—B_4C, zirconium boride—ZrB_2, gadolinium oxide—Gd_2O_3, erbium oxide—Er_2O_3.

(continued)

5.2 Organization

5.2.2 UNIT STAFF

The unit staff organization shall include the following:

INSERT "A" →

a. Each on duty shift shall be composed of at least the minimum shift crew composition shown in the LCS.

b. At least one licensed Reactor Operator (RO) shall be in the Control Room when fuel is in the reactor. In addition, while the unit is in MODE 1, 2, 3 or 4, at least one licensed Senior Reactor Operator (SRO) shall be in the Control Room Area.

INSERT "B" → c.

d. ~~c.~~ A health physics 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.

e. ~~d.~~ Administrative procedures shall be developed and implemented to limit the working hours of unit staff who perform safety-related functions (e.g., licensed SROs, licensed ROs, health physicists, nuclear plant equipment operators, and key maintenance personnel).

Adequate shift coverage shall be maintained without routine heavy use of overtime. The objective shall be to have operating personnel work an 8 or 12-hour day, nominal 40-hour week, while the unit is operating. However, in the event that unforeseen problems require substantial amounts of overtime to be used, or during extended periods of shutdown for refueling, major maintenance, or major plant modification, on a temporary basis, the following guidelines shall be followed:

1) An individual should not be permitted to work more than 16 hours straight, excluding shift turnover time.

2) An individual should not be permitted to work more than 16 hours in any 24-hour period, nor more than 24 hours in any 48-hour period, nor more than 72 hours in any 7-day period, all excluding shift turnover time. Personnel regularly assigned to 12-hour shifts may work up to 26 hours in a 48-hour period.

3) A break of at least 8 hours should be allowed between work periods, including shift turnover time.

(continued)

INSERT "A"

A non-licensed Operator shall be assigned to each reactor containing fuel and an additional non-licensed Operator shall be assigned for each Unit when a reactor is operating in MODES 1, 2, 3, or 4.

~~Two Units~~ With both Units shutdown or defueled ~~require~~ a total of three non-licensed operators are required for the two Units

INSERT "B"

Shift crew composition may be less than the minimum requirement of 10CFR 50.54(m)(2)(i) and 5.2.2.a for a period of time not to exceed 2 hours in order to accomodate unexpected absence of on-duty shift crew members provided immediate action is taken do restore the shift crew composition to within the minimum requirements.

San Onofre Unit 3

5.2 Organization

5.2.2 UNIT STAFF (continued)

4) Except during extended shutdown periods, the use of overtime should be considered on an individual basis and not for the entire staff on a shift.

Any deviation from the above guidelines shall be authorized by the Vice President-Nuclear Generation or designee, in accordance with approved administrative procedures, or by higher levels of management, in accordance with established procedures and with documentation of the basis for granting the deviation.

Controls shall be included in the procedures such that individual overtime shall be reviewed monthly by the Vice President-Nuclear Generation or designee to ensure that excessive hours have not been assigned. Routine deviation from the above guidelines is not authorized.

f. 5. The Plant Superintendent (at time of appointment), the Assistant Plant Superintendent-Operations, Shift Superintendents, and Control Room Supervisors shall hold a Senior Reactor Operator's license. The Control Operators and Assistant Control Operators shall hold a Reactor Operator's license or Senior Reactor Operator's license.

g. 6. The Shift Technical Advisor (STA) shall provide advisory technical support to the Shift Superintendent in the areas of thermal hydraulics, reactor engineering, and plant analysis with regard to the safe operation of the unit. The STA shall have a Bachelor's Degree or equivalent in a scientific or engineering discipline with specific training in plant design and in the response and analysis of the plant for transients and accidents.

5.5 Procedures, Programs, and Manuals

5.5.2.7 Explosive Gas and Storage Tank Radioactivity Monitoring Program (continued)

The program shall include:

a. The limits for the concentrations of hydrogen and oxygen in the Gaseous Radwaste System and a surveillance program to ensure the limits are maintained. Such limits shall be appropriate to the system's design criteria (i.e., whether or not the system is designed to withstand a hydrogen explosion); and

b. A surveillance program to ensure that the quantity of radioactivity contained in each waste gas decay tank and fed into the gaseous radwaste vent system is less than the amount that would result in a whole body exposure of greater than or equal to 0.5 rem to any individual in the unrestricted area, in the event of an uncontrolled release of the tanks contents; and

c. A surveillance program to ensure that the quantity of radioactivity contained in all outdoor liquid radwaste tanks that are not surrounded by liners, dikes, or walls, capable of holding the tanks' contents and that do not have tank overflows and surrounding area drains connected to the Liquid Waste Management System is less than the amount that would result in concentrations less than the limits of 10 CFR Part 20, Appendix B, Table II, Column 2, at the nearest potable water supply and the nearest surface water supply in an unrestricted area, in the event of an uncontrolled release of the tanks' contents.

The provisions of SR 3.0.2 and SR 3.0.3 are applicable to the Explosive Gas and Storage Tank Radioactivity Monitoring Program surveillance frequencies.

INSERT "C"

INSERT "C"

5.5.2.8. Primary Coolant Sources Outside Containment.

This program provides controls to minimize leakage from those portions of systems outside containment that could contain highly radioactive fluids during a serious transient or accident to levels as low as practicable. Program itself is relocated to the LCS.

5.5.2.9. Pre-Stressed Concrete Containment Tendon Surveillance Program.

This program provides controls for monitoring any tendon degradation in pre-stressed concrete containment, including effectiveness of its corrosion protection medium, to ensure containment Structural integrity. Program itself is relocated to LCS.

5.5.2.10 Inservice Testing Program

This program provides controls for inservice testing of ASME Code Class 1, 2, and 3 components including applicable supports. Program itself is relocated to the LCS.

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5.5.2.11 Steam Generator (SG) Tube Surveillance Program

This program provides acceptance criteria, methodologies, ~~and~~ surveillance requirements and recommendations to verify SG OPERABILITY. Program itself is relocated to the LCS

5.5.2.12. Ventilation Filter Testing Program

This program provides acceptance criteria, methodologies, surveillance requirements and recommendations concerning testing of Engineered Safety Feature (ESF) filter ventilation systems. Program itself is relocated to the LCS.

5.5.2.13 Diesel Fuel Oil Testing Program

This program implements required testing of both new fuel oil and stored fuel oil. Program itself is relocated to the LCS.

5.7 Reporting Requirements

5.7.2 Special Reports (continued)

b. Following each inservice inspection of steam generator (SG) tubes, in accordance with the SG Tube Surveillance Program, the number of tubes plugged and tubes sleeved in each SG shall be reported to the NRC within 15 days. The complete results of the SG tube inservice inspection shall be submitted to the NRC within 12 months following the completion of the inspection. The report shall include:

1. Number and extent of tubes inspected, and
2. Location and percent of wall-thickness penetration for each indication of an imperfection, and
3. Identification of tubes plugged and tubes sleeved.

Results of SG tube inspections which fall into Category C-3 shall be reported to the NRC prior to resumption of plant operation. This report shall provide a description of investigations conducted to determine cause of the tube degradation and corrective measures taken to prevent recurrence.

INSERT "D"

INSERT "D"

5.8 ~~5.11~~ High Radiation Area

~~5.11.1~~ 5.8.1 Pursuant to 10 CFR 20, paragraph 20.203(c)(5), in lieu of the requirements of 10 CFR 20.203(c), each high radiation area, as defined in 10 CFR 20, in which the intensity of radiation is > 100 mrem/hr but < 1000 mrem/hr, shall be barricaded and conspicuously posted as a high radiation area and entrance thereto shall be controlled by requiring issuance of a Radiation ~~Work~~ Exposure Permit ~~(RWP)~~ (REP). Individuals qualified in radiation protection procedures (e.g., Health Physics Technicians) or personnel continuously escorted by such individuals may be exempt from the ~~RWP~~ REP issuance requirement during the performance of their assigned duties in high radiation areas with exposure rates ≤ 1000 mrem/hr, provided they are otherwise following plant radiation protection procedures for entry into such high radiation areas.

Any individual or group of individuals permitted to enter such areas shall be provided with or accompanied by one or more of the following:

a. A radiation monitoring device that continuously indicates the radiation dose rate in the area.

b. A radiation monitoring device that continuously integrates the radiation dose rate in the area and alarms when a preset integrated dose is received. Entry into such areas with this monitoring device may be made after the dose rate levels in the area have been established and personnel are aware of them.

c. An individual qualified in radiation protection procedures with a radiation dose rate monitoring device, who is responsible for providing positive control over the activities within the area and shall perform periodic radiation surveillance at the frequency specified by the Radiation Protection Manager in the ~~RWP~~ REP.

~~5.11.2~~ 5.8.2 In addition to the requirements of Specification 5.~~11~~8.1, areas with radiation levels ≥ 1000 mrem/hr shall be provided with locked or continuously guarded doors to prevent unauthorized entry and the keys shall be maintained under the administrative control of the Shift Foreman on duty or health physics supervision. Doors shall remain locked except during periods of access by personnel

(continued)

5.8

5.11 High Radiation Area

5.11.2 (continued)
5.8.2

REP

under an approved RWP that shall specify the dose rate levels in the immediate work areas and the maximum allowable stay times for individuals in those areas. In lieu of the stay time specification of the RWP, direct or remote (such as closed circuit TV cameras) continuous surveillance may be made by personnel qualified in radiation protection procedures to provide positive exposure control over the activities being performed within the area.

REP

5.11.3
5.8.3

For individual high radiation areas with radiation levels of > 1000 mrem/hr, accessible to personnel, that are located within large areas such as reactor containment, where no enclosure exists for purposes of locking, or that cannot be continuously guarded, and where no enclosure can be reasonably constructed around the individual area, that individual area shall be barricaded and conspicuously posted, and a flashing light shall be activated as a warning device.

5.0 ADMINISTRATIVE CONTROLS

5.6 Safety Function Determination Program (SFDP)

5.6.1 This program ensures loss of safety function is detected and appropriate actions taken. Upon failure to meet two or more LCOs at the same time, an evaluation shall be made to determine if loss of safety function exists. Additionally, other appropriate limitations and remedial or compensatory actions may be identified to 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.

5.6.2 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.

c. Provisions to ensure that an inoperable supported system's Completion Time is not inappropriately extended as a result of multiple support system inoperabilities.

d. Other appropriate limitations and remedial or compensatory actions.

5.6.3 A loss of safety function exists when, assuming no concurrent single failure, a safety function assumed in the accident analysis cannot be performed. For the purpose of this program, a loss of safety function may exist when a support system is inoperable, and:

a. A required system redundant to system(s) supported by the inoperable support system is also inoperable; or (Case A)

b. A required system redundant to system(s) in turn supported by the inoperable supported system is also inoperable; or (Case B)

c. A required system redundant to support system(s) for the supported systems (a) and (b) above is also inoperable. (Case C)

INSERT "E"

5.6.4 The Safety Function Determination Program identifies where a loss of safety function exists. If a loss of safety function is determined to exist by this program, the appropriate Conditions and Required Actions of the LCO in which the loss of safety function exists are required to be entered.

INSERT "E"

Generic Example:

Train A		Train B	
System i		System i	←Case C
↓		↓	
System ii	←(Support System Inoperable)	System ii	
↓		↓	
System iii		System iii	←Case A
↓		↓	
System iv		System iv	←Case B

San Onofre - Unit 3

ATTACHMENT "C"
(Marked-Up Proposed Table of Contents and Bases)
Unit 2

(continued)

(continued)

(continued)

APPLICABLE SAFETY ANALYSIS (continued)

pressure, linear heat rate, and the DNBR do not exceed allowable limits.

The startup of an inactive RCP will not result in a "cold water" criticality, even if the maximum difference in temperature exists between the SG and the core. The maximum positive reactivity addition that can occur due to an inadvertent RCP start is less than half the minimum required SDM. An idle RCP cannot, therefore, produce a return to power from the hot standby condition.

The ~~withdrawal~~ ejection of a CEA~~s~~ from subcritical or low power Conditions adds reactivity to the reactor core, causing both the core power level and heat flux to increase with corresponding increases in reactor coolant temperatures and pressure. The ~~withdrawal~~ ejection of a CEA~~s~~ also produces a time dependent redistribution of core power.

The SDM satisfies Criterion 2 of the NRC Policy Statement.

LCO

The MSLB (Ref. 2) and the boron dilution (Ref. 3) accidents are the most limiting analyses that establish the SDM value of the LCO. For MSLB accidents, if the LCO is violated, there is a potential to exceed the DNBR limit and to exceed 10 CFR 100, "Reactor Site Criterion," limits (Ref. 4). For the boron dilution accident, if the LCO is violated, then the minimum required time assumed for operator action to terminate dilution may no longer be applicable.

SDM is a core physics design condition that can be ensured through CEA positioning (regulating and shutdown CEAs) and through the soluble boron concentration.

APPLICABILIT

In MODES 3 and 4, the SDM requirements are applicable to provide sufficient negative reactivity to meet the assumptions of the safety analyses discussed above. In MODES 1 and 2, SDM is ensured by complying with LCO 3.1.6, "Shutdown Control Element Assembly (CEA) Insertion Limits," and LCO 3.1.7. If the insertion limits of LCO 3.1.6 or LCO 3.1.7 are not being complied with, SDM is not automatically violated. The SDM must be calculated by performing a reactivity balance calculation (considering the

(continued)

BASES

BACKGROUND (continued)

Element Assembly (CEA) Insertion Limits." When the unit is in the shutdown and refueling modes, the SDM requirements are met by means of adjustments to the RCS boron concentration.

APPLICABLE SAFETY ANALYSES

The minimum required SDM is assumed as an initial condition in safety analysis. The safety analysis (Ref. 2) establishes an SDM that ensures specified acceptable fuel design limits are not exceeded for normal operation and AOOs with the assumption of the highest worth CEA stuck out following a reactor trip. When the CEAs are all verified to be inserted, by both open reactor trip breakers and the CEA position indications, it is not required to assume that the highest reactivity worth CEA is stuck out. Specifically, for MODE 5, the primary safety analysis that relies on the SDM limits is the boron dilution analysis.

The acceptance criteria for the SDM requirements are that the specified acceptable fuel design limits are maintained. This is done by ensuring that:

a. The reactor can be made subcritical from all operating conditions, transients, and Design Basis Events;

b. The reactivity transients associated with postulated accident conditions are controllable within acceptable limits (departure from nucleate boiling ratio, fuel centerline temperature limits for AOOs, and ≤ 280 cal/gm energy deposition for the CEA ejection accident); and

c. The reactor will be maintained sufficiently subcritical to preclude inadvertent criticality in the shutdown condition.

An inadvertent boron dilution is a moderate frequency incident as defined in Reference 2. The core is initially subcritical with all CEAs inserted. A Chemical and Volume Control System malfunction occurs, which causes unborated water to be pumped to the RCS ~~via three charging pumps.~~

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.1.2.1 (continued)

d. Fuel burnup based on gross thermal energy generation;

e. Xenon concentration;

f. Samarium concentration; and

g. Isothermal temperature coefficient (ITC).

Using the ITC accounts for Doppler reactivity in this calculation because the reactor is subcritical, and the fuel temperature will be changing at the same rate as that of the RCS.

INSERT

The Frequency of 24 hours is based on the generally slow change in required boron concentration, and it allows sufficient time for the operator to collect the required data, which includes performing a boron concentration analysis, and complete the calculation.

REFERENCES

1. 10 CFR 50, Appendix A, GDC 26.
2. FSAR, Section 15.4.1.4.

(continued)

INSERT

The reactivity effects of items c, d, e, and f above, are nominally constant, and are bound while the RCS boron concentration is maintained greater than the refueling boron concentration specified for MODE 6 and all CEAs inserted.

Therefore, a SDM ≥ 3.0% is assured by determining at least once per 24 hours that:

a. The core has not been critical since the refueling (e.g. factors c through f are unchanged).

b. The reactor coolant system boron concentration is greater than or equal to the refueling boron concentration required by TS 3.9.1.

c. All CEAs are inserted.

d. No more than one charging pump is functional, by verifying that power is removed from the remaining charging pumps, when the reactor coolant level is below the hot leg centerline.

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.3 Reactivity Balance

BASES

BACKGROUND

According to GDC 26, GDC 28, and GDC 29 (Ref. 1), reactivity shall be controllable, such that, subcriticality is maintained under cold conditions, and acceptable fuel design limits are not exceeded during normal operation and anticipated operational occurrences. Therefore, a reactivity balance is used to compare the predicted versus measured core reactivity during power operation. The periodic confirmation of core reactivity is necessary to ensure that Design Basis Accident (DBA) and transient safety analyses remain valid. A large reactivity difference could be the result of unanticipated changes in fuel, control element assembly (CEA) worth, or operation at Conditions not consistent with those assumed in the predictions of core reactivity, and could potentially result in a loss of SDM or violation of acceptable fuel design limits. Comparing predicted versus measured core reactivity validates the nuclear methods used in the safety analysis and supports the SDM demonstrations (LCO 3.1.1, "SHUTDOWN MARGIN (SDM) — T_{avg} > 200°F") in ensuring the reactor can be brought safely to cold, subcritical conditions.

When the reactor core is critical or in normal power operation, a reactivity balance exists and the net reactivity is zero. A comparison of predicted and measured reactivity is convenient under such a balance, since parameters are being maintained relatively stable under steady state power conditions. The positive reactivity inherent in the core design is balanced by the negative reactivity of the control components, thermal feedback, neutron leakage, and materials in the core that absorb neutrons, such as burnable absorbers producing zero net reactivity. Excess reactivity can be inferred from the critical boron curve, which provides a prediction of the soluble boron concentration in the Reactor Coolant System (RCS) versus cycle burnup. Periodic measurement of the RCS boron concentration for comparison with the predicted value with other variables fixed (such as CEA height, temperature, and power) provides a convenient method of ensuring that core reactivity is within design expectations, and that the calculational models used to generate the safety analysis are adequate.

(continued)

BASES

BACKGROUND (continued)

In order to achieve the required fuel cycle energy output, the uranium enrichment in the new fuel loading and in the fuel remaining from the previous cycle(s), provides excess positive reactivity beyond that required to sustain steady state operation throughout the cycle. When the reactor is critical at RTP ~~and moderator temperature~~, the excess positive reactivity is compensated by burnable absorbers, CEAs, whatever neutron poisons (mainly xenon and samarium) are present in the fuel, and the RCS boron concentration.

When the core is producing THERMAL POWER, the fuel is being depleted and excess reactivity is decreasing. As the fuel depletes, the RCS boron concentration is reduced to decrease negative reactivity and maintain constant THERMAL POWER. The critical boron curve is based on steady state operation at RTP. Therefore, deviations from the predicted boron letdown curve may indicate deficiencies in the design analysis, deficiencies in the calculational models, or abnormal core conditions, and must be evaluated.

APPLICABLE SAFETY ANALYSES

Accurate prediction of core reactivity is either an explicit or implicit assumption in the accident analysis evaluations. Every accident evaluation (Ref. 2) is, therefore, dependent upon accurate evaluation of core reactivity. In particular, SDM, and reactivity transients such as CEA withdrawal accidents or CEA ejection accidents, are very sensitive to accurate prediction of core reactivity. These accident analysis evaluations rely on computer codes that have been qualified against available test data, operating plant data, and analytical benchmarks. Monitoring reactivity balance additionally ensures that the nuclear methods provide an accurate representation of the core reactivity.

Design calculations and safety analyses are performed for each fuel cycle for the purpose of predetermining reactivity behavior and the RCS boron concentration requirements for reactivity control during fuel depletion.

The comparison between measured and predicted initial core reactivity provides a normalization for calculational models used to predict core reactivity. If the measured and predicted RCS boron concentrations for identical core conditions at beginning of cycle (BOC) do not agree, then

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

the assumptions used in the reload cycle design analysis or the calculational models used to predict soluble boron requirements may not be accurate. If reasonable agreement between measured and predicted core reactivity exists at BOC, then the prediction may be normalized to the measured boron concentration. Thereafter, any significant deviations in the measured boron concentration from the predicted critical boron curve that develop during fuel depletion may be an indication that the calculational model is not adequate for core burnups beyond BOC, or that an unexpected change in core conditions has occurred.

The normalization of predicted RCS boron concentration to the measured value is to be performed prior to reaching 60 EFPD following startup from a refueling outage, with the CEAs in their normal positions for power operation. The normalization is performed near BOC, so that core reactivity relative to predicted values can be continually monitored and evaluated as core conditions change during the cycle.

The reactivity balance satisfies Criterion 2 of the NRC Policy Statement.

LCO

Large differences between actual and predicted core reactivity may indicate that the assumptions of the DBA and transient analyses are no longer valid, or that the uncertainties in the nuclear design methodology are larger than expected. A limit on the reactivity balance of ± 1% Δk/k has been established, based on engineering judgment. A ±1% Δk/k deviation in reactivity from that predicted is larger than expected for normal operation, and should therefore be evaluated.

When measured core reactivity is within ±1% Δk/k of the predicted value at steady state thermal conditions, the core is considered to be operating within acceptable design limits. Since deviations from the limit are normally detected by comparing predicted and measured steady state RCS critical boron concentrations, the difference between measured and predicted values would be approximately 100 ppm (depending on the boron worth) before the limit is reached.

(continued)

BASES

LCO (continued)

These values are well within the uncertainty limits for analysis of boron concentration samples, so that spurious violations of the limit due to uncertainty in measuring the RCS boron concentration are unlikely.

APPLICABILITY

The limits on core reactivity must be maintained during MODES 1 and 2 because a reactivity balance must exist when the reactor is critical or producing THERMAL POWER. As the fuel depletes, core conditions are changing, and - confirmation of the reactivity balance ensures the core is operating as designed. This Specification does not apply in MODES 3, 4, and 5 because the reactor is shut down and the reactivity balance is not changing.

In MODE 6, fuel loading results in a continually changing core reactivity. Boron concentration requirements (LCO 3.9.1, "Boron Concentration") ensure that fuel movements are performed within the bounds of the safety analysis. A SDM demonstration is required by the LCS during the first startup following operations that could have altered core reactivity (e.g., fuel movement, or CEA replacement, or shuffling).

ACTIONS

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

Should an anomaly develop between measured and predicted core reactivity, an evaluation of the core design and safety analysis must be performed. Core conditions are evaluated to determine their consistency with input to design calculations. Measured core and process parameters are evaluated to determine that they are within the bounds of the safety analysis, and safety analysis calculational models are reviewed to verify that they are adequate for representation of the core conditions. The required Completion Time of 72 hours is based on the low probability of a DBA occurring during this period, and allows sufficient time to assess the physical condition of the reactor and complete the evaluation of the core design and safety analysis.

Following evaluations of the core design and safety analysis, the cause of the reactivity anomaly may be

(continued)

ACTIONS

A.1 and A.2 (continued)

resolved. If the cause of the reactivity anomaly is a mismatch in core conditions at the time of RCS boron concentration sampling, then a recalculation of the RCS boron concentration requirements may be performed to demonstrate that core reactivity is behaving as expected. If an unexpected physical change in the condition of the core has occurred, it must be evaluated and corrected, if possible. If the cause of the reactivity anomaly is in the calculation technique, then the calculational models must be revised to provide more accurate predictions. If any of these results are demonstrated and it is concluded that the reactor core is acceptable for continued operation, then the boron letdown curve may be renormalized, and power operation may continue. If operational restrictions or additional SRs are necessary to ensure the reactor core is acceptable for continued operation, then they must be defined.

The required Completion Time of 72 hours is adequate for preparing whatever operating restrictions or Surveillances that may be required to allow continued reactor operation.

B.1

If the core reactivity cannot be restored to within ±1% Δk/k, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours. If the SDM for MODE 3 is not met, then boration as required by TS 3.1.1.1 ACTION A.1 would occur. 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 3.1.3.1

Core reactivity is verified by periodic comparisons of measured and predicted RCS boron concentrations. The comparison is made considering that other core conditions are fixed or stable including CEA position, moderator temperature, fuel temperature, fuel depletion, xenon concentration, and samarium concentration.

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.1.3.1 (continued)

The SR is modified by three Notes. The first Note indicates that the normalization of predicted core reactivity to the measured value (if performed) may take place within the first 60 effective full power days (EFPD) after each fuel loading. This allows sufficient time for core conditions to reach steady state, but prevents operation for a large fraction of the fuel cycle without establishing a benchmark for the design calculations. The required subsequent Frequency of every 31 EFPD following the initial 60 EFPD after entering MODE 1, is acceptable, based on the slow rate of core changes due to fuel depletion and the presence of other indicators for prompt indication of an anomaly. A Note, "Only required after 60 EFPD," is added to the Frequency column to allow this. The Second Note indicates that the performance of SR 3.1.3.1 is not required prior to entering MODES 1 or 2. This Note is required to allow entry into MODES 1 or 2 to verify core reactivity because Applicability is for MODES 1 and 2.

REFERENCES

1. 10 CFR 50, Appendix A, GDC 26, GDC 28, and GDC 29.
2. SONGS Units 2 and 3 UFSAR, Section 15.

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.5 Control Element Assembly (CEA) Alignment

BASES

BACKGROUND

The OPERABILITY (e.g., trippability) of the shutdown and regulating CEAs is an initial assumption in all safety analyses that assume CEA insertion upon reactor trip. Maximum CEA misalignment is an initial assumption in the safety analyses that directly affects core power distributions and assumptions of available SDM.

The applicable criteria for these reactivity and power distribution design requirements are 10 CFR 50, Appendix A, GDC 10 and GDC 26 (Ref. 1) and 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Cooled Nuclear Power Plants" (Ref. 2).

Mechanical or electrical failures may cause a CEA to become inoperable or to become misaligned from its group. CEA inoperability or misalignment may cause increased power peaking, due to the asymmetric reactivity distribution and a reduction in the total available CEA worth for reactor shutdown. Therefore, CEA alignment and operability are related to core operation in design power peaking limits and the core design requirement of a minimum SDM.

Limits on CEA alignment and operability have been established, and all CEA positions are monitored and controlled during power operation to ensure that the power distribution and reactivity limits defined by the design power peaking and SDM limits are preserved.

CEAs are moved by their control element drive mechanisms (CEDMs). Each CEDM moves its CEA one step (approximately ¾ inch) at a time, but at varying rates (~~steps per minute~~) depending on the signal output from the Control Element Drive Mechanism Control System (CEDMCS).

30 inches/min full length CEAs and 20 inches/min for part length CEAs

The CEAs are arranged into groups that are radially symmetric. Therefore, movement of the CEAs does not introduce radial asymmetries in the core power distribution. The shutdown and regulating CEAs provide the required reactivity worth for immediate reactor shutdown upon a reactor trip. The regulating CEAs also provide reactivity (power level) control during normal operation and

(continued)

BASES

BACKGROUND (continued)

transients. ~~Their movement may be automatically controlled by the Reactor Regulating System.~~ Part length CEAs are not credited in the safety analyses for shutting down the reactor, as are the regulating and shutdown groups. The part length CEAs are used ~~solely~~ for ASI control and reactivity (power level) control during normal operation and transients. The axial position of shutdown and regulating CEAs is indicated by two separate and independent systems, which are the Plant Computer CEA Position Indication System and the Reed Switch Position Indication System.

The Plant Computer CEA Position Indication System counts the commands sent to the CEA gripper coils from the CEDMCS that moves the CEAs. There is one step counter for each group of CEAs. Individual CEAs in a group all receive the same signal to move and should, therefore, all be at the same position indicated by the group step counter for that group. The Plant Computer CEA Position Indication Syster is considered highly precise (± one step or ± ¾ inch). If a CEA does not move one step for each command signal, the step counter will still count the command and incorrectly reflect the position of the CEA.

The Reed Switch Position Indication System provides a highly accurate indication of actual CEA position, but at a lower precision than the step counters. This system is ~~based on inductive analog signals from~~ a series of reed switches spaced along a tube with a center to center distance of 1.5 inches, which is two steps. To increase the reliability of the system, there are redundant reed switches at each position.

APPLICABLE SAFETY ANALYSES

CEA misalignment accidents are analyzed in the safety analysis (Ref. 3). The accident analysis defines CEA misoperation as any event, with the exception of sequential group withdrawals, which could result from a single malfunction in the reactivity control systems. For example, CEA misalignment may be caused by a malfunction of the CEDM, CEDMCS, or by operator error. A stuck CEA may be caused by mechanical jamming of the CEA fingers or of the gripper. Inadvertent withdrawal of a single CEA may be caused by ~~opening of the electrical circuit of the CEDM holding coil for a full length or part length CEA.~~ a single malfunction of the CEDMCS or by operator error A dropped CEA

(continued)

APPLICABLE SAFETY ANALYSES (continued)

subgroup could be caused by an electrical failure in the CEA coil power programmers.

The acceptance criteria for addressing CEA inoperability or misalignment are that:

a. There shall be no violations of:

  1. specified acceptable fuel design limits, or
  2. Reactor Coolant System (RCS) pressure boundary integrity; and

b. The core must remain subcritical after accident transients.

Three types of misalignment are distinguished. During movement of a group, one CEA may stop moving while the other CEAs in the group continue. This condition may cause excessive power peaking. The second type of misalignment occurs if one CEA fails to insert upon a reactor trip and remains stuck fully withdrawn. This condition requires an evaluation to determine that sufficient reactivity worth is held in the remaining CEAs to meet the SDM requirement with the maximum worth CEA stuck fully withdrawn (Ref. 5). If a CEA is stuck in the fully withdrawn position, its worth is added to the SDM requirement, since the safety analysis does not take two stuck CEAs into account. The third type of misalignment occurs when one CEA drops partially or fully into the reactor core. This event causes an initial power reduction followed by a return towards the original power due to positive reactivity feedback from the negative moderator temperature coefficient. Increased peaking during the power increase may result in excessive local linear heat rates (LHRs).

Another type of misalignment occurs if one CEA fails to insert upon a reactor trip and remains stuck fully withdrawn. This condition is assumed in the evaluation to determine that the required SDM is met with the maximum worth CEA also fully withdrawn (Ref. 5). 6

(continued)

APPLICABLE ANALYSES (continued)

The effect of any misoperated CEA on the core power SAFETY distribution will be assessed by the CEA calculators, and an appropriately augmented power distribution penalty factor will be supplied as input to the core protection calculators (CPCs). As the reactor core responds to the reactivity changes caused by the misoperated CEA and the ensuing reactor coolant and Doppler feedback effects, the CPCs will initiate a low DNBR or high local power density trip signal if specified acceptable fuel design limits (SAFDLs) are approached.

Since the CEA drop incidents result in the most rapid approach to SAFDLs caused by a CEA misoperation, the accident analysis analyzed a single full length CEA drop, a single part length CEA drop, and a part length CEA subgroup drop. The most rapid approach to the DNBR SAFDL may be caused by either a single full length drop or a part length CEA subgroup drop depending upon initial conditions. The most rapid approach to the fuel centerline melt SAFDL is caused by a single part length CEA drop.

In the case of the full length CEA drop, a prompt decrease in core average power and a distortion in radial power are initially produced, which when conservatively coupled result in local power and heat flux increases, and a decrease in DNBR. For plant operation within the DNBR and local power density (LPD) LCOs, DNBR and LPD trips can normally be avoided on a dropped CEA.

For a part length CEA subgroup drop, a distortion in power distribution, and a decrease in core power are produced. As the dropped part length CEA subgroup is detected, an appropriate power distribution penalty factor is ~~supplied to~~ determined by the CPCs, and a reactor trip signal on low DNBR ~~is~~ may be generated. For the part length CEA drop, both core average power and three dimensional peak to average power density increase promptly. As the dropped part length CEA is detected, core power and an appropriately augmented power distribution penalty factor are supplied to the CPCs.

(continued)

BASES (continued)

ACTIONS

A.1, A.2.1, A.2.2, A.3.1, ~~and~~ A.3.2, B.1, B.2.1, B.2.2, and B.3

A CEA may become misaligned, yet remain trippable. In this condition, the CEA can still perform its required function of adding negative reactivity should a reactor trip be necessary.

If one or more regulating CEAs are misaligned by 7 inches but trippable, continued operation in MODES 1 and 2 may continue, provided, within 1 hour, the power is reduced in accordance with Figure 3.1.5-1, and SDM is ≥ 5.15% Δk/k, and within 2 hours the misaligned CEA(s) is aligned within 7 inches of its group or the misaligned CEA's group is aligned within 7 inches of the misaligned CEA(s). 6

Xenon redistribution in the core starts to occur as soon as a CEA becomes misaligned. Reducing THERMAL POWER in accordance with ~~Figure 3.1.5-1 (in the accompanying LCO)~~ the COLR ensures acceptable power distributions are maintained (Ref. 6). For small misalignments (< 7 inches) of ~~the~~ a CEA~~s~~, there is:

a. A small effect on the time dependent long term power distributions relative to those used in generating LCOs and limiting safety system settings (LSSS) setpoints;

b. A small effect on the available SDM; and

c. A small effect on the ejected CEA worth used in the accident analysis.

With a large CEA misalignment (≥ 7 inches), however, this misalignment would cause distortion of the core power distribution. This distortion may, in turn, have a significant effect on:

a. The available SDM;

b. The time dependent, long term power distributions relative to those used in generating LCOs and LSSS setpoints; and

c. The ejected CEA worth used in the accident analysis.

(continued)

BASES

ACTIONS

A.1, A.2.1, A.2.2, A.3.1, ~~and~~ A.3.2, B.1, B.2.1, B.2.2, and B.3 (continued)

Therefore, this condition is limited to the single CEA misalignment, while still allowing 2 hours for recovery.

In both cases, a 2 hour time period is sufficient to:

a. Identify cause of a misaligned CEA;

b. Take appropriate corrective action to realign the CEAs; and

c. Minimize the effects of xenon redistribution.

In this condition, an additional allowance must be made for the worth of the affected CEA when calculating the available SDM. With one or more misaligned CEAs, SDM must be verified for CEAs at the existing nonaligned positions. SDM is calculated by performing a reactivity balance calculation according to procedure, considering the listed effects in SR 3.1.1.1. This is necessary since the OPERABLE CEAs must still meet the single failure criterion. If additional negative reactivity is required to provide the necessary SDM, it must be provided by increasing the RCS boron concentration. One hour allows sufficient time to perform the SDM calculation and make any required boron adjustment to the RCS.

6

B.1, B.2.1, B.2.2, and B.3

If one or more shutdown CEAs are misaligned by > 7 inches but trippable, continued operation in MODES 1 and 2 may continue, provided, within 1 hour, the power is reduced in accordance with Figure 3.1.5-1, and SDM is ≥ 5.15% Δk/k, and within 2 hours the misaligned CEA(s) is aligned within 7 inches of its group.

6

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

If one or more part length CEAs are misaligned by > 7 inches continued operation in MODES 1 and 2 may continue, provided power is reduced in accordance with the appropriate figure within 1 hour, and within 2 hours the misaligned CEA(s) is

(continued)

ACTIONS

C.1, C.2.1, and C.2.2 (continued)

6

restored to within 7 inches of its group, or the misaligned CEA's group is aligned within 7 inches of the misaligned CEA.

Although a part length CEA has less of an effect on core flux than a full length CEA, a misaligned part length CEA will still result in xenon redistribution and affect core power distribution. Requiring realignment within 2 hours minimizes these effects and ensures acceptable power distribution is maintained.

D.1

The ACTION statements applicable to inoperable CEA position indicators permit continued operations when the positions of CEAs with inoperable position indicators can be verified by the "Full In" or "Full Out" limits. Setting the "RSPT/CEAC Inoperable" addressable constant in the CPCs to indicate to the CPCs that one or both of the CEACs is inoperable does not necessarily constitute the inoperability of the RSPT rod indications from the respective CEAC. Operability of the CEAC rod indications is determined from the normal surveillance.

E.1

If a Required Action or associated Completion Time of Condition A, Condition B, Condition C or Condition D is not met, one regulating or shutdown CEA is untrippable, or more than one full length or part length CEA misaligned, the unit is required to be brought to MODE 3. By being brought to MODE 3, the unit is brought outside its MODE of applicability.

When a Required Action cannot be completed within the required Completion Time, a controlled shutdown should be commenced. The allowed Completion Time of 6 hours is reasonable, based on operating experience, for reaching MODE 3 from full power conditions in an orderly manner and without challenging plant systems.

If a CEA is untrippable, it is not available for reactivity insertion during a reactor trip. With an untrippable CEA,

(continued)

ACTIONS

E.1 (continued)

meeting the insertion limits of LCO 3.1.6, "Shutdown Control Element Assembly (CEA) Insertion Limits," and LCO 3.1.7, "Regulating Control Element Assembly (CEA) Insertion Limits," does not ensure that adequate SDM exists. Therefore, the plant must be shut down in order to evaluate the SDM required boron concentration and power level for critical operation.

Continued operation is not allowed in the case of more than one CEA(s) misaligned from any other CEA~~,~~ in its group by > 7 inches, or with one full length CEA~~s~~ untrippable. This is because these cases are indicative of a ~~loss of SDM and~~ core power distribution~~, and a loss of safety functions, respectively,~~ outside the initial conditions assumed in the safety analysis.

SURVEILLANCE REQUIREMENTS

SR 3.1.5.1

Verification that individual CEA positions are within 7 inches (indicated reed switch positions) of all other CEAs in the group at a 12 hour Frequency allows the operator to detect a CEA that is beginning to deviate from its expected position. The specified Frequency takes into account other CEA position information that is continuously available to the operator in the control room, so that during actual CEA motion, deviations can immediately be detected.

SR 3.1.5.2

OPERABILITY of at least two CEA position indicator channels is required to determine CEA positions, and thereby ensure compliance with the CEA alignment and insertion limits. The CEA full in and full out limits provide an additional independent means for determining the CEA positions when the CEAs are at either their fully inserted or fully withdrawn positions.

SR 3.1.5.3

Verifying each full length CEA is trippable would require that each CEA be tripped. In MODES 1 and 2 tripping each

(continued)

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.6 Shutdown Control Element Assembly (CEA) Insertion Limits

BASES

BACKGROUND

The insertion limits of the shutdown CEAs are initial assumptions in all safety analyses that assume CEA insertion upon reactor trip. The insertion limits directly affect core power distributions and assumptions of available SDM, ejected CEA worth, and initial reactivity insertion rate.

The applicable criteria for these reactivity and power distribution design requirements are 10 CFR 50, Appendix A, GDC 10, "Reactor Design," and GDC 26, "Reactivity Limits" (Ref. 1), and 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors" (Ref. 2). Limits on shutdown CEA insertion have been established, and all CEA positions are monitored and controlled during power operation to ensure that the reactivity limits, ejected CEA worth, and SDM limits are preserved.

The shutdown CEAs are arranged into groups that are radially symmetric. Therefore, movement of the shutdown CEAs does not introduce radial asymmetries in the core power distribution. The shutdown and regulating CEAs provide the required reactivity worth for immediate reactor shutdown upon a reactor trip.

The design calculations are performed with the assumption that the shutdown CEAs are withdrawn prior to the regulating CEAS. The shutdown CEAs can be fully withdrawn without the core going critical. This provides available negative reactivity for SDM in the event of boration errors. The shutdown CEAs are controlled manually ~~or automatically,~~ by the control room operator. During normal unit operation, the shutdown CEAs are fully withdrawn. The shutdown CEAs must be completely withdrawn from the core prior to withdrawing regulating CEAs during an approach to criticality. The shutdown CEAs are then left in this position until receipt of a reactor trip signal and they are inserted into the reactor core to add negative reactivity and shutdown the reactor.

(continued)

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.7 Regulating Control Element Assembly (CEA) Insertion Limits

BASES

BACKGROUND

The insertion limits of the regulating CEAs are initial assumptions in all safety analyses that assume CEA insertion upon reactor trip. The insertion limits directly affect core power distributions, assumptions of available SDM, and initial reactivity insertion rate. The applicable criteria for these reactivity and power distribution design requirements are 10 CFR 50, Appendix A, GDC 10, "Reactor Design," and GDC 26, "Reactivity Limits" (Ref. 1), and 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors" (Ref. 2).

Limits on regulating CEA insertion have been established, and all CEA positions are monitored and controlled during power operation to ensure that the power distribution and reactivity limits defined by the design power peaking, ejected CEA worth, reactivity insertion rate, and SDM limits are preserved.

The regulating CEA groups operate with a predetermined amount of position overlap, in order to approximate a linear relation between CEA worth and position ~~(integral CEA worth)~~. The regulating CEA groups are withdrawn and operate in a predetermined sequence. Specification 3.1.7 and the core protection calculators will not permit a lower number group (e.g.: Group 5) to be inserted more than a higher numbered group (e.g.: Group 6). The group sequence and overlap limits are specified in the COLR.

The regulating CEAs are used for precise reactivity control of the reactor. The positions of the regulating CEAs are manually controlled. They are capable of adding reactivity very quickly (compared to borating or diluting).

The power density at any point in the core must be limited to maintain specified acceptable fuel design limits, including limits that preserve the criteria specified in 10 CFR 50.46 (Ref. 2). Together, LCO 3.1.7; LCO 3.2.4, "Departure from Nucleate Boiling Ratio (DNBR)"; and LCO 3.2.5, "AXIAL SHAPE INDEX (ASI)," provide limits on control component operation and on monitored process variables to ensure the core operates within LCO 3.2.1,

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

increased power peaking and corresponding increased local LHRs.

The SDM requirement is ensured by limiting the regulating and shutdown CEA insertion limits, so that the allowable inserted worth of the CEAs is such that sufficient reactivity is available in the CEAs to shut down the reactor to hot zero power with a reactivity margin that assumes the maximum worth CEA remains fully withdrawn upon trip (Ref. 4).

Operation at the insertion limits or ASI may approach the maximum allowable linear heat generation rate or peaking factor, with the allowed T_q present. Operation at the insertion limit may also indicate the maximum ejected CEA worth could be equal to the limiting value in fuel cycles that have sufficiently high ejected CEA worths. 6

The regulating and shutdown CEA insertion limits ensure that safety analyses assumptions for reactivity insertion rate, SDM, ejected CEA worth, and power distribution peaking factors are preserved (Ref. 5).

The regulating CEA insertion limits satisfy Criterion 2 of the NRC Policy Statement.

LCO

The limits on regulating CEA sequence, ~~overlap,~~ 6 and physical insertion, as defined in the COLR, must be maintained because they serve the function of preserving power distribution, ensuring that the SDM is maintained, ensuring that ejected CEA worth is maintained, and ensuring adequate negative reactivity insertion on trip. The overlap between regulating banks provides more uniform rates of reactivity insertion and withdrawal. ~~and is imposed to maintain acceptable power peaking during regulating CEA motion.~~

The power dependent insertion limit (PDIL) alarm circuit is required to be OPERABLE for notification that the CEAs are outside the required insertion limits. When the PDIL alarm circuit is inoperable, the verification of CEA positions is increased to ensure improper CEA alignment is identified before unacceptable flux distribution occurs.

The overlap of the Regulating groups may be increased, provided that the sequence of regulating group movement and the insertion limits are satisfied.

(continued)

BASES (continued)

APPLICABILITY

The regulating CEA sequence, overlap, and physical insertion limits shall be maintained with the reactor in MODES 1 and 2. These limits must be maintained, since they preserve the assumed power distribution, ejected CEA worth~~,~~ and SDM~~, and reactivity rate insertion~~ assumptions. Applicability in MODES 3, 4, and 5 is not required, since neither the power distribution nor ejected CEA worth assumptions would be exceeded in these MODES. SDM is preserved in MODES 3, 4, and 5 by adjustments to the soluble boron concentration.

This LCO is modified by a Note indicating the LCO requirement is suspended during SR 3.1.5.3. This SR verifies the freedom of the CEAs to move, and requires the regulating CEAs to move below the LCO limits, which would normally violate the LCO.

ACTIONS

A.1.1, A.1.2, A.2.1, and A.2.2

Operation beyond the transient insertion limit may result in a loss of SDM and excessive peaking factors. If the regulating CEA insertion limits are not met, then SDM must be verified by performing a reactivity balance calculation, considering the listed reactivity effects in Bases Section SR 3.1.1.1. One hour is sufficient time for conducting the calculation and commencing boration if the SDM is not within limits. The transient insertion limit should not be violated during ~~normal~~ operation. ~~this violation,~~ However, violations may occur during transients when the operator is manually controlling the CEAs in response to changing plant conditions. When the regulating groups are inserted beyond the transient insertion limits, actions must be taken to either withdraw the regulating groups above ~~beyond~~ the limits or to reduce THERMAL POWER to less than or equal to that allowed for the actual CEA insertion limit. Two hours provides a reasonable time to accomplish this, allowing the operator to deal with current plant conditions while limiting peaking factors to acceptable levels.

B.1 and B.2

If the CEAs are inserted between the long term steady state insertion limits and the transient insertion limits for

(continued)

ACTIONS

B.1 and B.2 (continued)

intervals > 4 hours per 24 hour period, ~~and the short term steady state insertion limits are exceeded,~~ peaking factors can develop that are of immediate concern (Ref. 6).

Additionally, since the CEAs can be in this condition without misalignment, penalty factors are not ~~inserted in~~ generated by the core protection calculators to compensate for the developing peaking factors. Verifying the short term steady state insertion limits are not exceeded ensures that the peaking factors that do develop are within those allowed for continued operation. Fifteen minutes provides adequate time for the operator to verify if the short term steady state insertion limits are exceeded.

Experience has shown that rapid power increases in areas of the core, in which the flux has been depressed, can result in fuel damage as the LHR in those areas rapidly increases. Restricting the rate of THERMAL POWER increases to ≤ 5% RTP per hour, following CEA insertion beyond the long term steady state insertion limits, ensures the power transients experienced by the fuel will not result in fuel failure (Ref. 7).

C.1

With the regulating CEAs inserted between the long term steady state insertion limit and the transient insertion limit for greater than ~~and with the core approaching the~~ 5 effective full power days (EFPD) per 30 EFPD, or 14 EFPD per 365 EFPD limits, the core ~~approaches the acceptable limits placed on operation with~~ may develop flux patterns outside those assumed in the long term burnup assumptions. In this case, the CEAs must be returned to within the long term steady state insertion limits, or the core must be placed in a condition in which the abnormal fuel burnup cannot continue. A Completion Time of 2 hours is a reasonable time to return the CEAs to within the long term steady state insertion limits.

The required Completion Time of 2 hours from initial discovery of a regulating CEA group outside the limits until its restoration to within the long term steady state limits, shown on the figures in the COLR, allows sufficient time for

(continued)

ACTIONS

C.1 (continued)

borated water to enter the Reactor Coolant System from the chemical addition and makeup systems, and to cause the regulating CEAs to withdraw to the acceptable region. It is reasonable to continue operation for 2 hours after it is discovered that the 5 ~~days~~ EFPD or 14 ~~days~~ EFPD limit has been exceeded. This Completion Time is based on limiting the potential xenon redistribution, the low probability of an accident, and the steps required to complete the action.

D.1.1, D.1.2, D.2.1, and D.2.2

If the regulating CEA insertion limits are not met, then SDM must be verified by performing a reactivity balance calculation, considering the effects in SR 3.1.1.1 bases. One hour is sufficient time for conducting the calculation and commencing boration if the SDM is not within limits.

With the Core Operating Limit Supervisory System out of service, operation beyond the short term steady state insertion limits can result in peaking factors that could approach the DNB or local power density trip setpoints. Eliminating this condition within 2 hours limits the magnitude of the peaking factors to acceptable levels (Ref. 8). Restoring the CEAs to within the limit or reducing THERMAL POWER to that fraction of RTP that is allowed by CEA group position, using the limits specified in the COLR, ensures acceptable peaking factors are maintained.

E.1

With the PDIL circuit inoperable, performing SR 3.1.7.1 within 1 hour and every 4 hours thereafter ensures improper CEA alignments are identified before unacceptable flux distributions occur.

F.1

When a Required Action cannot be completed within the required Completion Time, a controlled shutdown should be commenced. The allowed Completion Time of 6 hours is

(continued)

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.8 Part Length Control Element Assembly (CEA) Insertion Limits

BASES

BACKGROUND

The insertion limits of the part length CEAs are initial assumptions in all safety analyses. The insertion limits directly affect core power distributions. The applicable criteria for these power distribution design requirements are 10 CFR 50, Appendix A, GDC 10, "Reactor Design" (Ref. 1), and 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Plants" (Ref. 2). Limits on part length CEA insertion have been established, and all CEA positions are monitored and controlled during power operation to ensure that the power distribution defined by the design power peaking limits is preserved.

The ~~regulating~~ part length CEAs are used for precise part length reactivity control of the reactor. The positions of the ~~regulating~~ CEAs are manually controlled. They are capable of adding reactivity very quickly (compared to borating or diluting).

The power density at any point in the core must be limited to maintain specified acceptable fuel design limits, including limits that preserve the criteria specified in 10 CFR 50.46 (Ref. 2). Together, LCO 3.1.8, "~~Regulating~~ Part length Control Element Assembly (CEA) Insertion Limits"; ~~LCO 3.1.8,~~ LCO 3.2.4, "Departure From Nucleate Boiling Ratio (DNBR)"; and LCO 3.2.5, "AXIAL SHAPE INDEX (ASI)," provide limits on control component operation and on monitored process variables to ensure the core operates within the linear heat rate (LHR) (LCO 3.2.1, "Linear Heat Rate (LHR)"); planar peaking factor (F_{xy}) (LCO 3.2.2, "Planar Radial Peaking Factors (F_{xy})"); and LCO 3.2.4 limits in the COLR.

Operation within the limits given in ~~Figure 3.1-3~~ of the COLR prevents power peaks that would exceed the loss of coolant accident (LOCA) limits derived by the Emergency Core Cooling Systems analysis. Operation within the F_{xy} and departure from nucleate boiling (DNB) limits given in the COLR prevents DNB during a loss of forced reactor coolant flow accident.

The establishment of limiting safety system settings and LCOs requires that the expected long and short term behavior

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

d. The CEAs must be capable of shutting down the reactor with a minimum required SDM, with the highest worth CEA stuck fully withdrawn, GDC 26 (Ref. 1).

Regulating CEA position, part length CEA position, ASI, and T_q are process variables that together characterize and control the three dimensional power distribution of the reactor core.

Fuel cladding damage does not occur when the core is operated outside these LCOs during normal operation. However, fuel cladding damage could result, should an accident occur with simultaneous violation of one or more of these LCOs. Changes in the power distribution can cause increased power peaking and corresponding increased local LHRs.

The part length CEA insertion limits ensure that safety analyses assumptions for ejected CEA worth and power distribution peaking factors are preserved.

The part length ~~regulating~~ CEA insertion limits satisfy Criterion 2 of the NRC Policy Statement. The part length CEAs are required due to the potential peaking factor violations that could occur if part length CEAs exceed insertion limits.

6

LCO

The limits on part length CEA insertion, as defined in the COLR, must be maintained because they serve the function of preserving power distribution and ensuring that ejected CEA worth is maintained within limits.

APPLICABILITY

The part length insertion limits shall be maintained with the reactor in MODE 1 > 20% RTP. These limits must be maintained, since they preserve the assumed power distribution

an ejected CEA worth are within limits.

. Applicability in lower MODES is not required, since the power distribution assumptions would not be exceeded in these MODES.

below 20% RTP and

This LCO has been modified by a Note suspending the LCO requirement while exercising part length CEAs. Exercising part length CEAs may require moving them outside their insertion limits.

(continued)

B 3.1 REACTIVITY CONTROL SYSTEM

B 3.1.9 Boration Systems - Operating

BASES

The boron injection system ensures that negative reactivity control is available during each mode of facility operation. The components required to perform this function include 1) borated water sources, 2) charging pumps, 3) separate flow paths, 4) boric acid makeup pumps, and 5) an emergency power supply from OPERABLE diesel generators.

With the RCS average temperature above 200°F, a minimum of two separate and redundant boron injection systems are provided to ensure single functional capability the event an assumed failure renders one of the systems inoperable Allowable out-of-service periods ensure that minor component repair or corrective action may be completed without undue risk to overall facility safety from injection system failures during the repair period.

The boration capability of either system is sufficient to provide a SHUTDOWN MARGIN from expected operating conditions of 3.0% delta k/k after xenon decay and cooldown to 200°F. The maximum expected boration capability requirements occurs at EOL from full power equilibrium xenon conditions and requires boric acid solution from the boric acid makeup tanks in the allowable concentration and volumes of Specification 3.1.9 plus approximately 13,000 gallons of 2350 ppm borated water from the refueling water tank or approximately 26,000 gallons of 2350 ppm borated water from the refueling water tank alone.

6

With the RCS temperature below 200°F one injection system is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the additional restrictions prohibiting CORE ALTERATIONS and positive reactivity changes in the event the single injection system becomes inoperable.

6

The boron capability required below 200°F is based upon providing a 3% delta K/k SHUTDOWN MARGIN after xenon decay and cooldown from 200°F to 140°F. This condition requires 4150 gallons of 2350 ppm borated water from either the refueling water tank or boric acid solution from a boric acid makeup tank.

The water volume limits are specified relative to the top of the highest suction connection to the tank. (Water volume below this datum is not considered recoverable for purposes of this specification.) Vortexing, internal structures and instrument error are considered in determining the tank level corresponding to the specified water volume limits.

(continued)

BASES (continued)

6

The OPERABILITY of one boron injection system during REFUELING ensures that this system is available for reactivity control while in MODE 6.

The limits on water volume and boron concentration of the RWST also ensure a pH value greater than 7.0 for the solution recirculated within containment after a LOCA. This pH minimizes the effect of chloride and caustic stress corrosion on mechanical systems and components. The maximum RWST volume is not specified since analysis of pH limits and containment flooding post-LOCA considered RWST overflow conditions.

B 3.1 REACTIVITY CONTROL SYSTEM

B 3.1.10 Boration Systems - Shutdown

BASES

The boron injection system ensures that negative reactivity control is available during each mode of facility operation. The components required to perform this function include 1) borated water sources, 2) charging pumps, 3) separate flow paths, 4) boric acid makeup pumps, and 5) an emergency power supply from OPERABLE diesel generators.

6

With the RCS average temperature above 200°F, a minimum of two separate and redundant boron injection systems are provided to ensure single functional capability the event an assumed failure renders one of the systems inoperable. Allowable out-of-service periods ensure that minor component repair or corrective action may be completed without undue risk to overall facility safety from injection system failures during the repair period.

6

The boration capability of either system is sufficient to provide a SHUTDOWN MARGIN from expected operating conditions of 3.0% delta k/k after xenon decay and cooldown to 200°F. The maximum expected boration capability requirements occurs at EOL from full power equilibrium xenon conditions and requires boric acid solution from the boric acid makeup tanks in the allowable concentration and volumes of Specification 3.1.9 plus approximately 13,000 gallons of 2350 ppm borated water from the refueling water tank or approximately 26,000 gallons of 2350 ppm borated water from the refueling water tank alone.

With the RCS temperature below 200°F one injection system is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the additional restrictions prohibiting CORE ALTERATIONS and positive reactivity changes in the event the single injection system becomes inoperable. When suspending positive reactivity changes temperature fluctuations do not need to be considered.

The boron capability required below 200°F is based upon providing a 3% delta K/k SHUTDOWN MARGIN after xenon decay and cooldown from 200°F to 140°F. This condition requires 4150 gallons of 2350 ppm borated water from either the refueling water tank or boric acid solution from a boric acid makeup tank.

6

The water volume limits are specified relative to the top of the highest suction connection to the tank. (Water volume below this datum is not considered recoverable for purposes of this specification.) Vortexing, internal structures and instrument error are considered in determining the tank level corresponding to the specified water volume limits.

(continued)

B 3.1 REACTIVITY CONTROL SYSTEM

B 3.1.11 Borated Water Sources - Shutdown

BASES

The boron injection system ensures that negative reactivity control is available during each mode of facility operation. The components required to perform this function include 1) borated water sources, 2) charging pumps, 3) separate flow paths, 4) boric acid makeup pumps, and %0 an emergency power supply from OPERABLE diesel generators.

With the RCS average temperature above 200°F, a minimum of two separate and redundant boron injection systems are provided to ensure single functional capability the event an assumed failure renders one of the systems inoperable. Allowable out-of-service periods ensure that minor component repair or corrective action may be completed without undue risk to overall facility safety from injection system failures during the repair period. 6

The boration capability of either system is sufficient to provide a SHUTDOWN MARGIN from expected operating conditions of 3.0% delta k/k after xenon decay and cooldown to 200°F. The maximum expected boration capability requirements occurs at EOL from full power equilibrium xenon conditions and requires boric acid solution from the boric acid makeup tanks in the allowable concentration and volumes of Specification 3.1.11 plus approximately 13,000 gallons of 2350 ppm borated water from the refueling water tank or approximately 26,000 gallons of 2350 ppm borated water from the refueling water tank alone. 6

With the RCS temperature below 200°F one injection system is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the additional restrictions prohibiting CORE ALTERATIONS and positive reactivity changes in the event the single injection system becomes inoperable. 6

The boron capability required below 200°F is based upon providing a 3% delta K/k SHUTDOWN MARGIN after xenon decay and cooldown from 200°F to 140°F. This condition requires 4150 gallons of 2350 ppm borated water from either the refueling water tank or boric acid solution from a boric acid makeup tank.

The water volume limits are specified relative to the top of the highest suction connection to the tank. (Water volume below this datum is not considered recoverable for purposes of this specification.) Vortexing, internal structures and instrument error are considered in determining the tank level corresponding to the specified water volume limits.

Without the required source of borated water positive reactivity changes are suspended without consideration of temperature fluctuations.

(continued)

BASES (continued)

The OPERABILITY of one boron injection system during REFUELING ensures that this system is available for reactivity control while in MODE 6.

The limits on water volume and boron concentration of the RWST also ensure a pH value greater than 7.0 for the solution recirculated within containment after a LOCA. This pH minimizes the effect of chloride and caustic stress corrosion on mechanical systems and components. The maximum RWST volume is not specified since analysis of pH limits and containment flooding post-LOCA considered RWST overflow conditions. 6

BASES

core are consistent with the design predictions and that the core can be operated as designed (Ref. 4).

PHYSICS TESTS procedures are written and approved in accordance with established formats. The procedures include all information necessary to permit a detailed execution of testing required to ensure that the design intent is met. PHYSICS TESTS are performed in accordance with these procedures and test results are approved prior to continued power escalation and long term power operation. Examples of PHYSICS TESTS include determination of critical boron concentration, CEA group worths, reactivity coefficients, flux symmetry, and core power distribution.

APPLICABLE SAFETY ANALYSES

It is acceptable to suspend certain LCOs for PHYSICS TESTS because ~~fuel damage criteria are not exceeded. Even if an accident occurs during PHYSICS TESTS with one or more LCOs suspended, fuel damage criteria are preserved because~~ adequate limits on power ~~distribution~~ level and shutdown capability are maintained during PHYSICS TESTS.

add [illegible]

Reference 5 defines the requirements for initial testing of the facility, including PHYSICS TESTS. Requirements for reload fuel cycle PHYSICS TESTS are defined in ANSI/ANS-19.6.1-1985 (Ref. 4). PHYSICS TESTS for reload fuel cycles are given in Table 1 of ANSI/ANS-19.6.1-1985. Although these PHYSICS TESTS are generally accomplished within the limits of all LCOs, conditions may occur when one or more LCOs must be suspended to make completion of PHYSICS TESTS possible or practical. This is acceptable as long as the fuel design criteria are not violated. As long as the linear heat rate (LHR) remains within its limit, fuel design criteria are preserved.

In this test, the following LCOs are suspended:

a. LCO 3.1.1, "SHUTDOWN MARGIN (SDM) – T_{avg} > 200°F"; and

b. LCO 3.1.4, "Moderator Temperature Coefficient (MTC)";

c. LCO 3.1.5, "Control Element Assembly (CEA) Alignment";

d. LCO 3.1.6, "Shutdown Control Element Assembly (CEA) Insertion Limits";

e. LCO 3.1.7, "Regulating Control Element Assembly (CEA) Insertion Limits."

f. LCO 3.1.8, "Part Length CEA Insertion Limits";

g. LCO 3.3.1, "RPS Instrumentation - Operating," Table 3.3.1-1, ALLOWABLE VALUE for FUNCTION 2 and footnote (d) for FUNCTIONS 14 and 15.

Therefore, this LCO places limits on the minimum amount of CEA worth required to be available for reactivity control when CEA worth measurements are performed.

group height

The individual LCOs cited above govern SDM, CEA groupheight, insertion, and alignment and MTC. Additionally, theLCOs the LCO governing Reactor Coolant System (RCS) flow, reactor inlet temperature T_c, and pressurizer pressure contribute to maintaining departure from nucleate boiling (DNB) parameter limits. The initial condition criteria for accidents sensitive to core power distribution are preserved by the LHR and DNB parameter limits. The criteria for the loss of coolant accident (LOCA) are specified in 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors" (Ref. 6). The criteria for the loss of forced reactor coolant flow accidents are specified in Reference 7. Operation within the LHR limit preserves the LOCA criteria; operation within the DNB parameter limits preserves the loss of flow criteria.

SRs are conducted as necessary to ensure that LHR and DNB parameters remain within limits during PHYSICS TESTS. Performance of these SRs allows PHYSICS TESTS to be conducted without decreasing the margin of safety.

APPLICABLE
SAFETY ANALYSIS
(continued)

Add space

Requiring that shutdown reactivity equivalent to at least the highest estimated CEA worth (of those CEAs actually withdrawn) be available for trip insertion from the OPERABLE CEAs, provides a high degree of assurance that shutdown capability is maintained for the most challenging postulated accident, a stuck CEA. Since LCO 3.1.1 is suspended, however, there is not the same degree of assurance during this test that the reactor would always be shut down if the highest worth CEA was stuck out and calculational uncertainties or the estimated highest CEA worth was not as expected (the single failure criterion is not met). Thissituation is judged acceptable, however, because ~~specified acceptable fuel damage limits are still met.~~ The

it is unlikely that a design basis event will occur during the time that this STE is in effect.

risk of experiencing a stuck CEA and subsequent criticality is reduced during this PHYSICS TEST exception by the requirements to determine CEA positions every 2 hours; by the trip of each CEA to be withdrawn within 7 days prior to suspending the SDM; and by ensuring that shutdown reactivity equivalent to the reactivity worth of the estimated highest worth withdrawn CEA (Ref. 5) is available every 2 hours.

PHYSICS TESTS include measurement of core parameters or exercise of control components that affect process variables. Among the process variables involved are total planar radial peaking factor, total integrated radial peaking factor, T_q, and ASI, which represent initial condition input (power peaking) to the accident analysis. Also involved are the shutdown and regulating CEAs, which affect power peaking and are required for shutdown of the reactor. The limits for these variables are specified for each fuel cycle in the COLR.

PHYSICS TESTS meet the criteria for inclusion in the Technical Specifications since the components and process variable LCOs suspended during PHYSICS TESTS meet Criteria 1, 2, and 3 of the NRC Policy Statement.

LCO

This LCO provides that a minimum amount of CEA worth is immediately available for reactivity control when ~~CEA worths~~ PHYSICS TESTS ~~measurement tests~~ are performed. This STE is required to permit the periodic verification of the actual versus predicted core reactivity condition occurring as a result of fuel burnup or fuel cycling operations. The requirements of LCO 3.1.1, LCO 3.1.4, LCO 3.1.5, LCO 3.1.6, LCO 3.1.7, LCO 3.1.8, and LCO 3.3.1 (Adjustment of 10^{-4}% Bistable to ≤5% and Adjustment of Hi Log Power Trip to ≤5%) may be suspended.

APPLICABILITY

This LCO is applicable in MODES 2 and 3. Although PHYSICS TESTS are conducted in MODE 2, sufficient negative reactivity is inserted during the performance of surveillance 3.1.12.2 to result in temporary entry into MODE 3. Because the intent is to immediately return to

BASES

MODE 2 to continue ~~CEA worth measurements~~ PHYSICS TESTS, the STE allows limited operation to 6 consecutive hours in MODE 3 as indicated by the Note, without having to borate to meet the SDM requirements of LCO 3.1.1.

ACTIONS

A.1

With any CEA not fully inserted and less than the minimum required reactivity equivalent available for insertion, or with all CEAs inserted and the reactor subcritical by less than the reactivity equivalent of the highest worth withdrawn CEA, restoration of the minimum SDM requirements must be accomplished by increasing the RCS boron concentration. The required Completion Time of 15 minutes for initiating boration allows the operator sufficient time to align the valves and start the boric acid pumps and is consistent with the Completion Time of LCO 3.1.1.

SURVEILLANCE REQUIREMENTS

SR 3.1.12.1

Verification of the position of each partially or fully withdrawn full length or part length CEA provides assurance that the CEAs are in the expected positions through the PHYSICS TESTS. A 2 hour Frequency is sufficient to verify that each CEA position is acceptable.

SR 3.1.12.2

Prior demonstration that each CEA to be withdrawn from the core during PHYSICS TESTS is capable of full insertion, when tripped from at least a 50% withdrawn position, ensures that the CEA will insert on a trip signal. The 7 day Frequency ensures that the CEAs are OPERABLE prior to reducing SDM to less than the limits of LCO 3.1.1.

2

SURVEILLANCE REQUIREMENTS (continued)

SR 3.1.12.3

Verifying that the required shutdown reactivity equivalent of at least the highest estimated CEA worth (of those CEAs actually withdrawn) is available ensures that the shutdown capability is preserved. A 2 hour Frequency is sufficient to verify the appropriate acceptance criteria.

core are consistent with the design predictions and that the core can be operated as designed (Ref. 4).

BACKGROUND (continued)

PHYSICS TESTS procedures are written and approved in accordance with established formats. The procedures include all information necessary to permit a detailed execution of testing required to ensure that design intent is met. PHYSICS TESTS are performed in accordance with these procedures and test results are approved prior to continued power escalation and long term power operation.

Examples of PHYSICS TESTS include determination of critical boron concentration, CEA group worths, reactivity coefficients, flux symmetry, and core power distribution.

APPLICABLE SAFETY ANALYSES

It is acceptable to suspend certain LCOs for PHYSICS TESTS because ~~fuel damage criteria are not exceeded. Even if an accident occurs during PHYSICS TESTS with one or more LCOs suspended, fuel damage criteria are preserved because the~~ additional limits on ~~linear heat rate is~~ Power level and Power distribution are maintained during PHYSICS TESTS.

Reference 5 defines requirements for initial testing of the facility, including PHYSICS TESTS. Requirements for reload fuel cycle PHYSICS TESTS are defined in ANSI/ANS-19.6.1-1985 (Ref. 4). Although these PHYSICS TESTS are generally accomplished within the limits of all LCOs, conditions may occur when one or more LCOs must be suspended to make completion of PHYSICS TESTS possible or practical. This is acceptable as long as the fuel design criteria are not violated. As long as the linear heat rate (LHR) remains within its limit, fuel design criteria are preserved.

During PHYSICS TESTS, the following LCOs may be suspended:

LCO 3.1.7, "Regulating Control Element Assembly (CEA) Insertion Limits (F_{xy}^{T})";
LCO 3.1.8, "Part Length Control Element Assembly (CEA) Insertion Limits";
LCO 3.2.2, "Planar Radial Peaking Factors";
LCO 3.2.3, "AZIMUTHAL POWER TILT (T_q)"; and
LCO 3.2.5, "Axial Shape Index".

(continued)

APPLICABLE SAFETY ANALYSES (continued)

The safety analysis (Ref. 6) places limits on allowable THERMAL POWER during PHYSICS TESTS and requires that the LHR parameter be maintained within limits. The power plateau of ≤ 85% RTP ensures that LHR is maintained within acceptable limits.

The individual LCOs governing CEA group ~~height,~~ insertion ~~and alignment,~~ ASI, total planar radial peaking factor, ~~total integrated radial peaking factor,~~ and T_q, preserve the LHR limits. Additionally, the LCOs governing Reactor Coolant System (RCS) flow, reactor inlet temperature (T_c), and pressurizer pressure contribute to maintaining DNB parameter limits. The initial condition criteria for accidents sensitive to core power distribution are preserved by the LHR and DNB parameter limits. The criteria for the loss of coolant accident (LOCA) are specified in 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors" (Ref. 7). The criteria for the loss of forced reactor coolant flow accident are specified in Reference 7. Operation within the LHR limit preserves the LOCA criteria; operation within the DNB parameter limits preserves the loss of flow criteria.

During PHYSICS TESTS, one or more of the LCOs that normally preserve the LHR and DNB parameter limits may be suspended. The results of the accident analysis are not adversely impacted, however, if LHR is verified to be within its limit while the LCOs are suspended. Therefore, SRs are placed as necessary to ensure that LHR remains within its limit during PHYSICS TESTS. Performance of these Surveillances allows PHYSICS TESTS to be conducted without decreasing the margin of safety.

PHYSICS TESTS include measurement of core parameters or exercise of control components that affect process variables. Among the process variables involved are total planar radial peaking factor, ~~total integrated radial peaking factor,~~ T_q, and ASI, which represent initial condition input (power peaking) to the accident analysis. Also involved are the ~~shutdown~~ and regulating CEAs, which affect power peaking and are required for shutdown of the reactor. The limits for these variables are specified for each fuel cycle in the COLR.

part length

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

PHYSICS TESTS meet the criteria for inclusion in the Technical Specifications, since the component and process variable LCOs suspended during PHYSICS TESTS meet Criteria 1, 2, and 3 of the NRC Policy Statement.

LCO

This LCO permits individual CEA~~s~~ groups to be positioned outside of their normal group heights and insertion limits during the performance of PHYSICS TESTS, such as those required to:

a. Measure CEA worth;

b. Determine the reactor stability index and damping factor under xenon oscillation conditions;

c. Determine power distributions for rodded CEA configurations;

d. Measure rod shadowing factors; and

e. Measure temperature and power coefficients.

6

Additionally, it permits the center CEA to be misaligned during PHYSICS TESTS to determine the isothermal temperature coefficient (ITC), MTC, and power coefficient.

The requirements of LCO 3.1.7, LCO 3.1.8, LCO 3.2.2, LCO 3.2.3, and LCO 3.2.5 may be suspended during the performance of PHYSICS TESTS provided:

a. THERMAL POWER is restricted to test power plateau, which shall not exceed 85% RTP; and

b. LHR does not exceed the limit specified in the COLR.

APPLICABILITY

This LCO is applicable in MODE 1 because the reactor must be critical at various THERMAL POWER levels to perform the PHYSICS TESTS described in the LCO section. Limiting the test power plateau to ≤ 85% RTP ensures that LHR is maintained within acceptable limits.

(continued)

ACTIONS

A.1

If THERMAL POWER exceeds the test power plateau in MODE 1, THERMAL POWER must be reduced to restore the additional thermal margin provided by the reduction. The 15 minute Completion Time ensures that prompt action shall be taken to reduce THERMAL POWER to within acceptable limits.

B.1

If the LHR requirement is not met, THERMAL POWER must be reduced promptly. A Completion Time of 15 minutes is adequate for an operator to correctly align and start the required systems and components. Power reduction will continue until the LHR is within the limit.

C.1 and C.2

If Required Action A.1 or B.1 cannot be completed within the required Completion Time, PHYSICS TESTS must be suspended within 1 hour, and the reactor must be brought to MODE 3. Allowing 1 hour for suspending PHYSICS TESTS allows the operator sufficient time to change any abnormal CEA configuration back to within the limits of LCO 3.1.7 and LCO 3.1.8. Bringing the reactor to MODE 3 within 6 hours increases thermal margin and is consistent with the Required Actions of the power distribution LCOs. The required Completion Time of 6 hours is adequate for performing a controlled shutdown from full power conditions in an orderly manner and without challenging plant systems, and is consistent with the power distribution LCO Completion Times.

SURVEILLANCE REQUIREMENTS

SR 3.1.13.1

Verifying that THERMAL POWER is equal to or less than that allowed by the test power plateau, as specified in the PHYSICS TEST procedure ~~and required by the safety analysis,~~ ensures that adequate LHR margin is maintained while LCOs are suspended. The 1 hour Frequency is sufficient, based upon the slow rate of power change and increased operational controls in place during PHYSICS TESTS. Monitoring LHR ensures that the limits are not exceeded.

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.14 Special Test Exceptions (STE) – Center CEA Misalignment and Regulating CEA insertion Limits

BASES

BACKGROUND

The primary purpose of the Center CEA Misalignment and Regulating CEA insertion Limits STE is to permit relaxation of existing LCOs to allow the performance of PHYSICS TESTS. These tests are conducted to determine the isothermal temperature coefficient, moderator temperature coefficient and power coefficient.

Section XI of 10 CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Processing Plants" (Ref. 1), requires that a test program be established to ensure that structures, systems, and components will perform satisfactorily in service. All functions necessary to ensure that specified design conditions are not exceeded during normal operation and anticipated operational occurrences must be tested. Testing is required as an integral part of the design, fabrication, construction, and operation of the power plant. Requirements for notification of the NRC, for the purpose of conducting tests and experiments, are specified in 10 CFR 50.59, "Changes, Tests, and Experiments" (Ref. 2).

The key objectives of a test program are to (Ref. 3):

a. Ensure that the facility has been adequately designed;

b. Validate the analytical models used in design and analysis;

c. Verify assumptions used for predicting plant response;

d. Ensure that installation of equipment in the facility has been accomplished in accordance with the design; and

e. Verify that operating and emergency procedures are adequate.

(continued)

BASES

BACKGROUND (continued)

To accomplish these objectives, testing is required prior to initial criticality and after each refueling shutdown during startup, low power operation, power ascension, and at power operation. The PHYSICS TESTS requirements for reload fuel cycles ensure that the operating characteristics of the core are consistent with the design predictions and that the core can be operated as designed (Ref. 4).

PHYSICS TESTS procedures are written and approved in accordance with established formats. The procedures include all information necessary to permit a detailed execution of testing required to ensure that the design intent is met. PHYSICS TESTS are performed in accordance with these procedures and test results are approved prior to continued power escalation and long term power operation. Examples of PHYSICS TESTS include determination of critical boron concentration, CEA group worths, reactivity coefficients, flux symmetry, and core power distribution.

APPLICABLE SAFETY ANALYSES

It is acceptable to suspend certain LCOs for PHYSICS TESTS because fuel damage criteria are not exceeded. Even if an accident occurs during PHYSICS TESTS with one or more LCOs suspended, fuel damage criteria are preserved because adequate limits on power distribution and shutdown capability are maintained during PHYSICS TESTS.

Reference 5 defines the requirements for initial testing of the facility, including PHYSICS TESTS. Requirements for reload fuel cycle PHYSICS TESTS are defined in ANSI/ANS-19.6.1-1985 (Ref. 4). PHYSICS TESTS for reload fuel cycles are given in Table 1 of ANSI/ANS-19.6.1-1985. Although these PHYSICS TESTS are generally accomplished within the limits of all LCOs, conditions may occur when one or more LCOs must be suspended to make completion of PHYSICS TESTS possible or practical. This is acceptable as long as the fuel design criteria are not violated. As long as the linear heat rate (LHR) and departure from ~~nucleon~~ nucleate boiling ratio (DNBR) remains within their limits, fuel design criteria are preserved.

(continued)

BACKGROUND

Measurement Channels (continued)

bistables, and most provide indication in the control room. Measurement channels used as an input to the RPS are not used for control functions. There are some measurement channels that provide an input to a common RPS/ESFAS bistable within the same RPS channel. When a channel monitoring a parameter exceeds a predetermined setpoint, indicating an unsafe condition, the bistable monitoring the parameter in that channel will trip. Tripping bistables monitoring the same parameter in two or more channels will de-energize Matrix Logic, which in turn de-energizes the Initiation Logic. This causes all eight RTCBs to open, interrupting power to the CEAs, allowing them to fall into the core.

Three of the four measurement and bistable channels are necessary to meet the redundancy and testability of 10 CFR 50, Appendix A, GDC 21 (Ref. 1). The fourth channel provides additional flexibility by allowing one channel to be removed from service (trip channel bypass) for maintenance or testing while still maintaining a minimum two-out-of-three logic. Thus, even with a channel inoperable, no single additional failure in the RPS can either cause an inadvertent trip or prevent a required trip from occurring.

Adequate channel to channel independence includes physical and electrical independence of each channel from the others. This allows operation in two-out-of-three logic with one channel removed from service until following the next MODE 5 entry. Since no single failure will either cause or prevent a protective system actuation, and no protective channel feeds a control, this arrangement meets the requirements of IEEE Standard 279-1971 (Ref. 4).

The CPCs perform the calculations required to derive the DNBR and LPD parameters and their associated RPS trips. Four separate CPCs perform the calculations independently, one for each of the four RPS channels. The CPCs provide outputs to drive display indications (DNBR margin, LPD margin, and calibrated neutron flux power levels) and provide DNBR — Low and LPD — High pretrip and trip signals. The CPC channel outputs for the DNBR — Low and LPD — High trips operate contacts in the Matrix Logic in a manner identical to the other RPS trips.

(continued)

BACKGROUND

RPS Logic (continued)

When a coincidence occurs in two RPS channels, all four matrix relays in the affected matrix de-energize. This in turn de-energizes all four breaker control relays, which simultaneously de-energize the undervoltage and energize the shunt trip attachments in all eight RTCBs, tripping them open.

Matrix Logic refers to the matrix power supplies, trip channel bypass contacts, and interconnecting matrix wiring between bistable relay cards, up to but not including the matrix relays.

The Initiation Logic consists of the trip path power source, matrix relays and their associated contacts, all interconnecting wiring, and solid state ~~(auxiliary~~) relays through the K-relay contacts in the RTCB control circuitry.

It is possible to change the two-out-of-four RPS Logic to a two-out-of-three logic for a given input parameter in one channel at a time by trip channel bypassing select portions of the Matrix Logic. Trip channel bypassing a bistable effectively shorts the bistable relay contacts in the three matrices associated with that channel. Thus, the bistables will function normally, producing normal trip indication and annunciation, but a reactor trip will not occur unless two additional channels indicate a trip condition. Trip channel bypassing can be simultaneously performed on any number of parameters in any number of channels, providing each parameter is bypassed in only one channel at a time. An interlock prevents simultaneous trip channel bypassing of the same parameter in more than one channel. Trip channel bypassing is normally employed during maintenance or testing.

Two-out-of-three logic also prevents inadvertent trips caused by any single channel failure in a trip condition.

In addition to the trip channel bypasses, there are also operating bypasses on select RPS trips. These bypasses are enabled manually in all four RPS channels when plant conditions do not warrant the specific trip protection. All operating bypasses are automatically removed when enabling

(continued)

BACKGROUND

RPS Logic (continued)

bypass conditions are no longer satisfied. Operating bypasses are normally implemented in the bistable, so that normal trip indication is also disabled. Trips with operating bypasses include Pressurizer Pressure — Low, Logarithmic Power Level — High, Reactor Coolant Flow — Low, and CPC (DNBR — Low and LPD — High).

Reactor Trip Circuit Breakers (RTCBs)

The reactor trip switchgear, addressed in LCO 3.3.4, consists of eight RTCBs, which are operated in four sets of two breakers (four channels). Power input to the reactor trip switchgear comes from two full capacity MG sets operated in parallel, such that the loss of either MG set does not de-energize the CEDMs. There are two separate CEDM power supply buses, each bus powering half of the CEDMs. Power is supplied from the MG sets to each bus via two redundant paths (trip legs). Trip legs 1A and 1B supply power to CEDM bus 1. Trip legs 2A and 2B supply power to CEDM bus 2. This ensures that a fault or the opening of a breaker in one trip leg (i.e., for testing purposes) will not interrupt power to the CEDM buses.

Each of the four trip legs consists of two RTCBs in series. The two RTCBs within a trip leg are actuated by separate initiation circuits.

The eight RTCBs are operated as four sets of two breakers (four channels). For example, if a breaker receives an open signal in trip leg A (for CEDM bus 1), an identical breaker in trip leg B (for CEDM bus 2) will also receive an open signal. This arrangement ensures that power is interrupted to both CEDM buses, thus preventing trip of only half of the CEAs (a half trip). Any one inoperable breaker in a channel will make the entire channel inoperable.

Each set of RTCBs is operated by either a manual reactor trip push button or an RPS initiated ~~actuated~~ K-relay. There are four Manual Trip push buttons, arranged in two sets of two. Depressing both push buttons in either set will result in a reactor trip.

(continued)

BASES

BACKGROUND

Reactor Trip Circuit Breakers (RTCBs) (continued)

When a Manual Trip is ~~initiated~~ actuated using the control room push buttons, the RPS trip paths and K-relays are bypassed, and the RTCB undervoltage and shunt trip attachments are actuated independent of the RPS.

Manual Trip circuitry includes the push button and interconnecting wiring to both RTCBs necessary to actuate both the undervoltage and shunt trip attachments but excludes the K-relay contacts and their interconnecting wiring to the RTCBs, which are considered part of the Initiation Logic.

Functional testing of the entire RPS, from bistable input through the opening of individual sets of RTCBs, can be performed either at power or shutdown and is normally performed on a quarterly basis. UFSAR, Section 7.2 (Ref. 8), explains RPS testing in more detail.

APPLICABLE SAFETY ANALYSES

Design Basis Definition

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

- The associated actuation will occur when the parameter monitored by each channel reaches its setpoint and the specific coincidence logic is satisfied;
- Separation and redundancy are maintained to permit a channel to be out of service for testing or maintenance while still maintaining redundancy within the RPS instrumentation network.

Each of the analyzed accidents and transients can be detected by one or more RPS Functions. The accident analysis takes credit for most of the RPS trip Functions. Those functions for which no credit is taken, termed equipment protective functions, are not needed from a safety perspective.

(continued)

APPLICABLE SAFETY ANALYSES (continued)

2. Logarithmic Power Level – High

The Logarithmic Power Level – High trip protects the integrity of the fuel cladding and helps protect the RCPB in the event of an unplanned criticality from a shutdown condition.

In MODES 2, 3, 4, and 5, with the RTCBs closed and the CEA Drive System capable of CEA withdrawal, protection is required for CEA withdrawal events originating when THERMAL POWER is < 1E-4% RTP. For events originating above this power level, other trips provide adequate protection.

MODES 3, 4, and 5, with the RTCBs closed, are addressed in LCO 3.3.2, "Reactor Protective System (RPS) Instrumentation – Shutdown."

In MODES 3, 4, or 5, with the RTCBs open or the CEAs not capable of withdrawal, the Logarithmic Power Level – High trip does not have to be OPERABLE. However, the indication and alarm portion of two logarithmic channels must be OPERABLE to ensure proper indication of neutron population and to indicate a boron dilution event. The indication and alarm functions are addressed in LCO 3.3.13, "Logarithmic Power Monitoring Channels."

3. Pressurizer Pressure – High

The Pressurizer Pressure – High trip provides protection for the high RCS pressure SL. In conjunction with the pressurizer safety valves and the main steam safety valves (MSSVs), it provides protection against overpressurization of the RCPB during the following events:

- Loss of Electrical Load Without a Reactor Trip Being Generated by the Turbine Trip (AOO);
- Loss of Condenser Vacuum (AOO);
- CFA Withdrawal From Low Power Conditions (AOO);
- Chemical and Volume Control System Malfunction (AOO), and

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

4. Pressurizer Pressure – Low

The Pressurizer Pressure – Low trip is provided to trip the reactor to assist the ESF System in the event of loss of coolant accidents (LOCAs). During a LOCA, the SLs may be exceeded; however, the consequences of the accident will be acceptable. A Safety Injection Actuation Signal (SIAS) and CCAS are initiated simultaneously.

5. Containment Pressure – High

The Containment Pressure – High trip prevents exceeding the containment design pressure psig during a design basis LOCA or main steam line break (MSLB) accident. During a LOCA or MSLB the SLs may be exceeded; however, the consequences of the accident will be acceptable. An SIAS, CCAS, CIAS are initiated simultaneously.

6, 7. Steam Generator Pressure – Low

The Steam Generator #1 Pressure – Low and Steam Generator #2 Pressure – Low trips ~~provide protection against an excessive rate of heat extraction from the steam generators and resulting rapid, uncontrolled~~ co~~oldown of the RC~~S. This trip is needed to shut down the reactor and assist the ESF System in the event of an MSLB or main feedwater line break accident. A main steam isolation signal (MSIS) is initiated simultaneously.

prevents a reactor power excursion due to the positive reactivity insertion to the core due to the cooldown by shutting down the reactor.

8, 9. Steam Generator Level – Low

The Steam Generator #1 Level – Low and Steam Generator #2 Level – Low trips ensure that a reactor trip signal is generated for the following events to help prevent exceeding the design pressure of the RCS due to the loss of the heat sink:

- Inadvertent Opening of a Steam Generator Atmospheric Dump Valve (AOO);

(continued)

LCO

2. Logarithmic Power Level – High (continued)

MODE 3, 4, or 5 when the RTCBs are shut and the CEA Drive System is capable of CEA withdrawal.

The MODES 3, 4, and 5 Condition is addressed in LCO 3.3.2.

The Allowable Value is high enough to provide an operating envelope that prevents unnecessary Logarithmic Power Level – High reactor trips during normal plant operations. The Allowable Value is low enough for the system to maintain a margin to unacceptable fuel cladding damage should a CEA withdrawal event occur.

The Logarithmic Power Level – High trip may be bypassed when THERMAL POWER is above 1E-4% RTP to allow the reactor to be brought to power during a reactor startup. This bypass is automatically removed when THERMAL POWER decreases below 1E-4% RTP. Above 1E-4% RTP, the Linear Power Level – High and Pressurizer Pressure – High trips provide protection for reactivity transients.

3.1.12

The trip may be manually bypassed during physics testing pursuant to LCO ~~3.4.17~~, "~~RCS Loops – Test~~ "Special Test Exceptions - MODES 2 and 3." ~~Exceptions~~." During this testing, the Linear Power Level – High trip and administrative controls provide the required protection.

3. Pressurizer Pressure – High

This LCO requires four channels of Pressurizer Pressure – High to be OPERABLE in MODES 1 and 2.

The Allowable Value is set below the nominal lift setting of the pressurizer code safety valves, and its operation avoids the undesirable operation of these valves during normal plant operation. In the event of a complete loss of electrical load from 100% power, this setpoint ensures the reactor trip will take place, thereby limiting further heat input to the RCS and consequent pressure rise. The pressurizer safety valves may lift to prevent overpressurization of the RCS.

(continued)

BASES

LCO 8, 9. Steam Generator Level – Low (continued)

cause a reactor trip during normal plant operations. The same bistable providing the reactor trip also initiates emergency feedwater to the affected generator via the Emergency Feedwater Actuation Signals (EFAS). The minimum setpoint is governed by EFAS requirements. The reactor trip will remove the heat source (except decay heat), thereby conserving the reactor heat sink.

This trip and the Steam Generator (1 and 2) Level – High trip may be manually bypassed simultaneously when cold leg temperature is below the specified limit to allow for CEA withdrawal during testing. The bypass is automatically removed when cold leg temperature reaches 200°F.

10. Reactor Coolant Flow - Low

This LCO requires four channels of Reactor Coolant Flow – Low to be OPERABLE in MODES 1 and 2. The Allowable Value is set low enough to allow for slight variations in reactor coolant flow during normal plant operations while providing the required protection. Tripping the reactor ensures that the resultant power to flow ratio provides adequate core cooling to maintain DNBR under the expected pressure conditions for this event.

The Reactor Coolant Flow – Low trip may be manually bypassed when reactor power is less than 1E-4% RTP. This allows for de-energization of one or more RCPs (e.g., for plant cooldown), while maintaining the ability to keep the shutdown CEA banks withdrawn from the core if desired.

LCO 3.4.5, "RCS Loops – MODE 3," LCO 3.4.6, "RCS Loops – MODE 4," and LCO 3.4.7, "RCS Loops – MODE 5, Loops Filled," ensure adequate RCS flow rate is maintained. The bypass is automatically removed when THERMAL POWER increases above 1E-4% RTP, as sensed by the wide range (logarithmic) nuclear instrumentation. When below the power range, the Reactor Coolant Flow – Low is not required for plant protection.

(continued)

LCO
(continued)

11. Local Power Density – High

This LCO requires four channels of LPD – High to be OPERABLE.

The LCO on the CPCs ensures that the SLs are maintained during all AOOs and the consequences of accidents are acceptable.

A CPC is not considered inoperable if CEAC inputs to the CPC are inoperable. The Required Actions required in the event of CEAC channel failures ensure the CPCs are capable of performing their safety Function.

The CPC channels may be manually bypassed below 1E-4% RTP, as sensed by the logarithmic nuclear instrumentation. This bypass is enabled manually in all four CPC channels when plant conditions do not warrant the trip protection. The bypass effectively removes the DNBR – Low and LPD – High trips from the RPS Logic circuitry. The operating bypass is automatically removed when enabling bypass conditions are no longer satisfied.

This operating bypass is required to perform a plant startup, since both CPC generated trips will be in effect whenever shutdown CEAs are inserted. It also allows system tests at low power with Pressurizer Pressure – Low or RCPs off.

During special testing pursuant to LCO 3.1.12 ~~3.1.10~~, the CPC channels may be manually bypassed when THERMAL POWER is below 5% RTP to allow special testing without generating a reactor trip.

12. Departure from Nucleate Boiling Ratio (DNBR) – Low

This LCO requires four channels of DNBR – Low to be OPERABLE.

The LCO on the CPCs ensures that the SLs are maintained during all AOOs and the consequences of accidents are acceptable.

(continued)

LCO

12. Departure from Nucleate Boiling Ratio (DNBR) — Low (continued)

A CPC is not considered inoperable if CEAC inputs to the CPC are inoperable. The Required Actions required in the event of CEAC channel failures ensure the CPCs are capable of performing their safety Function.

The CPC channels may be manually bypassed below 1E-4% RTP, as sensed by the logarithmic nuclear instrumentation. This bypass is enabled manually in all four CPC channels when plant conditions do not warrant the trip protection. The bypass effectively removes the DNBR — Low and LPD — High trips from the RPS logic circuitry. The operating bypass is automatically removed when enabling bypass conditions are no longer satisfied.

This operating bypass is required to perform a plant startup, since both CPC generated trips will be in effect whenever shutdown CEAs are inserted. It also allows system tests at low power with Pressurizer Pressure — Low or RCPs off.

During special testing pursuant to LCO ~~3.1.10~~ 3.1.12, the CPC channels may be manually bypassed when THERMAL POWER is below 5% RTP to allow special testing without generating a reactor trip.

Bypasses

The LCO on bypass permissive removal channels requires that the automatic bypass removal feature of all four operating bypass channels be OPERABLE for each RPS Function with an operating bypass in the MODES addressed in the specific LCO for each Function. All four bypass removal channels must be OPERABLE to ensure that none of the four RPS channels are inadvertently bypassed.

This LCO applies to the bypass removal feature only. If the bypass enable Function is failed so as to prevent entering a bypass condition, operation may continue. In the case of the Logarithmic Power Level — High trip (Function 2), the absence of a bypass will limit maximum power to below the trip setpoint.

(continued)

APPLICABILITY

Most RPS trips are required to be OPERABLE in MODES 1 and 2 because the reactor is critical in these MODES. The reactor trips are designed to take the reactor subcritical, which maintains the SLs during AOOs and assists the ESFAS in providing acceptable consequences during accidents. Most trips are not required to be OPERABLE in MODES 3, 4, and 5. In MODES 3, 4, and 5, the emphasis is placed on return to power events. The reactor is protected in these MODES by ensuring adequate SDM. Exceptions to this are:

- The Logarithmic Power Level – High trip, RPS Logic RTCBs, and Manual Trip are required in MODES 3, 4, and 5, with the RTCBs closed, to provide protection for boron dilution and CEA withdrawal events.

The Logarithmic Power Level – High trip in these lower MODES is addressed in LCO 3.3.2. The Logarithmic Power Level – High trip is bypassed prior to MODE 1 entry and is not required in MODE 1. The RPS Logic in MODES 1, 2, 3, 4, and 5 is addressed in LCO 3.3.4.

ACTIONS

The most common causes of channel inoperability are outright failure or drift of the bistable or process module sufficient to exceed the allowable value determined ~~tolerance allowed~~ by the plant specific setpoint analysis. Typically, the drift is found to be small and results in a delay of actuation rather than a total loss of function. This determination is generally made during the performance of a CHANNEL FUNCTIONAL TEST when the process instrument is set up for adjustment to bring it to within setting tolerance ~~specification~~. If the trip setpoint is less conservative than the Allowable Value in Table 3.3.1-1, the channel is declared inoperable immediately, and the appropriate Condition(s) must be entered immediately.

In the event a channel's trip setpoint is found nonconservative with respect to the Allowable Value, or the transmitter, instrument loop, signal processing electronics, or RPS bistable trip unit is found inoperable, then all affected functions provided by that channel must be declared inoperable, and the unit must enter the Condition for the particular protection Function affected.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.4 (continued)

located in the control room to detect deviations in channel outputs. The Frequency is modified by a Note indicating this Surveillance need only be performed within 12 hours after reaching 20% RTP. The 12 hours after reaching 20% RTP is required for plant stabilization, data taking, and flow verification. The secondary calorimetric is inaccurate at lower power levels. A second Note in the SR indicates the SR may be suspended during PHYSICS TESTS. The conditional suspension of the daily calibrations under strict administrative control is necessary to allow special testing to occur.

SR 3.3.1.5

The RCS flow rate indicated by each CPC is verified to be less than or equal to the RCS total flow rate every ~~31~~ 92 days. The Note indicates the Surveillance is performed prior to exceeding 85% RTP, or within 12 hours after THERMAL POWER is ≥ 85% RTP. This check (and, if necessary, the adjustment of the CPC addressable flow constant coefficients) ensures that the DNBR setpoint is conservatively adjusted with respect to actual flow indications as determined by a calorimetric calculation. Operating experience has shown the specified Frequency is adequate, as instrument drift is minimal and changes in actual flow rate are minimal over core life.

SR 3.3.1.6

The three vertically mounted excore nuclear instrumentation detectors in each channel are used to determine APD for use in the DNBR and LPD calculations. Because the detectors are mounted outside the reactor vessel, a portion of the signal from each detector is from core sections not adjacent to the detector. SR 3.3.1.6 ensures that the preassigned gains are still proper.

The 92 day Frequency is adequate because the demonstrated long term drift of the instrument channels is minimal.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.7

A CHANNEL FUNCTIONAL TEST on each channel is performed every 92 days to ensure the entire channel will perform its intended function when needed. The SR is modified by two Notes. Note 1 is a requirement to verify the correct CPC addressable constant values are installed in the CPCs when the CPC CHANNEL FUNCTIONAL TEST is performed. Note 2 allows the CHANNEL FUNCTIONAL TEST for the Logarithmic Power Level – High channels to be performed 2 hours after power drops below 1E-4% RTP and is required to be performed only if the RTCBs are closed. Not required if performed within the surveillance interval.

~~In addition to power supply tests~~, the RPS CHANNEL FUNCTIONAL TEST consists of three overlapping tests as described in Reference 8. These tests verify that the RPS is capable of performing its intended function, from bistable input through the RTCBs. They include:

Bistable Tests

A test signal is superimposed on the input in one channel at a time to verify that the bistable trips within the specified tolerance around the setpoint. This is done with the affected RPS channel trip channel bypassed.

The requirements for this ~~review~~ verification are outlined in Reference 9.

Matrix Logic Tests

Matrix Logic tests are addressed in LCO 3.3.4. This test is performed one matrix at a time. It verifies that a coincidence in the two input channels for each Function removes power from the matrix relays. During testing, holding power is applied to the matrix relay test coils and prevents the matrix relay contacts from assuming their de-energized state. This test will detect any short circuits around the bistable contacts in the coincidence logic, such as may be caused by faulty bistable relay or trip channel bypass contacts.

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.1.8 (continued)

between successive tests. Measurement error determination, setpoint error determination, and calibration adjustment must be performed consistent with the plant specific setpoint analysis. The channel shall be left calibrated consistent with the assumptions of the current plant specific setpoint analysis.

Operating experience has shown this Frequency to be satisfactory. The detectors are excluded from CHANNEL CALIBRATION because they are passive devices with minimal drift and because of the difficulty of simulating a meaningful signal. Slow changes in ~~detector sensitivity~~ leakage of neutrons with core burnup are compensated for by performing the daily calorimetric calibration (SR 3.3.1.4) and the quarterly linear subchannel gain check (SR 3.3.1.6). In addition, the associated control room indications are monitored by the operators.

SR 3.3.1.9

SR 3.3.1.9 is the performance of a CHANNEL CALIBRATION every 24 months.

CHANNEL CALIBRATION is a complete check of the instrument channel including the sensor. The Surveillance verifies that the channel responds to a measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drift between successive calibrations to ensure that the channel remains operational between successive tests. Measurement error determination, setpoint error determination, and calibration adjustment must be performed consistent with the plant specific setpoint analysis. The channel shall be left calibrated consistent with the assumptions of the current plant specific setpoint analysis.

The Frequency is based upon the assumption of a 24 month calibration interval for the determination of the magnitude of equipment drift in the setpoint analysis as well as operating experience and consistency with the typical 24 month fuel cycle.

The Surveillance is modified by a Note to indicate that the neutron detectors are excluded from CHANNEL CALIBRATION

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.1.9 (continued)

because they are passive devices with minimal drift and because of the difficulty of simulating a meaningful signal. Slow changes in ~~detector sensitivity~~ leakage of neutrons with core burnup are compensated for by performing the daily calorimetric calibration (SR 3.3.1.4) and the quarterly linear subchannel gain check (SR 3.3.1.6).

SR 3.3.1.10

Every 24 months, a CHANNEL FUNCTIONAL TEST is performed on the CPCs. The CHANNEL FUNCTIONAL TEST shall include the injection of a signal as close to the sensors as practicable to verify OPERABILITY including alarm and trip Functions.

The basis for the 24 month Frequency is that the CPCs perform a continuous self monitoring function that eliminates the need for frequent CHANNEL FUNCTIONAL TESTS. This CHANNEL FUNCTIONAL TEST essentially validates the self monitoring function and checks for a small set of failure modes that are undetectable by the self monitoring function. Operating experience has shown that undetected CPC or CEAC failures do not occur in any given 24 month interval.

SR 3.3.1.11

The three excore detectors used by each CPC channel for axial flux distribution information are far enough from the core to be exposed to flux from all heights in the core, although it is desired that they only read their particular level. The CPCs adjust for this flux overlap by using shape annealing matrix elements in the CPC software.

After refueling, it is necessary to re-establish the shape annealing matrix elements for the excore detectors based on more accurate incore detector readings. This is necessary because refueling could possibly produce a significant change in the shape annealing matrix coefficients.

Incore detectors are inaccurate at low power levels < 15%. THERMAL POWER should be significant but < 85% to perform an accurate axial shape calculation used to derive the shape annealing matrix elements.

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.1.11 (continued)

By restricting power to ≤ 85% until shape annealing matrix elements are verified, excessive local power peaks within the fuel are avoided. Operating experience has shown this Frequency to be acceptable.

SR 3.3.1.12

SR 3.3.1.12 is a CHANNEL FUNCTIONAL TEST similar to SR 3.3.1.7, except SR 3.3.1.12 is applicable only to bypass functions and is performed once within 92 days prior to each startup. Proper operation of bypass permissives is critical during plant startup because the bypasses must be in place to allow startup operation and must be removed at the appropriate points during power ascent to enable certain reactor trips. Consequently, the appropriate time to verify bypass removal function OPERABILITY is just prior to startup. The allowance to conduct this Surveillance within 92 days of startup is based on the reliability analysis presented in topical report CEN-327, "RPS/ESFAS Extended Test Interval Evaluation" (Ref. 9). Once the operating bypasses are removed, the bypasses must not fail in such a way that the associated trip Function gets inadvertently bypassed. This feature is verified by the trip Function CHANNEL FUNCTIONAL TEST, SR 3.3.1.7.

Therefore, further testing of the bypass function after startup is unnecessary.

SR 3.3.1.13

This SR ensures that the RPS RESPONSE TIMES are verified to be less than or equal to the maximum values assumed in the safety analysis. Individual component response times are not modeled in the analyses. The analyses model the overall or total elapsed time, from the point at which the parameter exceeds the trip setpoint value at the sensor to the point at which the RTCBs open. Response times are conducted on an 24 month STAGGERED TEST BASIS. This results in the interval between successive surveillances of a given channel of n x 24 months, where n is the number of channels in the function. The Frequency of 24 months is based upon operating experience, which has shown that random failures

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.1.13 (continued)

of instrumentation components causing serious response time degradation, but not channel failure, are infrequent occurrences. Also, response times cannot be determined at power, since equipment operation is required. Testing may be performed in one measurement or in overlapping segments, with verification that all components are tested.

A Note is added to indicate that the neutron detectors are excluded from RPS RESPONSE TIME testing because they are passive devices with minimal drift and because of the difficulty of simulating a meaningful signal. Slow changes in leakage of neutrons with core burnup ~~detector sensitivity~~ are compensated for by performing the daily calorimetric calibration (SR 3.3.1.4).

REFERENCES

1. 10 CFR 20.
2. 10 CFR 100.
3. NRC Safety Evaluation Report. Q 7
4. IEEE Standard 279-1971, April 5, 1972.
5. SONGS Units 2 and 3 UFSAR, Chapter 15.
6. 10 CFR 50.49.
7. PPS Setpoint Calculation CE-NPSD-570, Revision 3.
8. UFSAR, Section 7.2.
9. CEN-327, June 2, 1986, including Supplement 1, March 3, 1989.

(continued)

BASES

BACKGROUND (continued)

The acceptable limit during accidents is that the offsite dose shall be maintained within an acceptable fraction of 10 CFR 100 (Ref. 2) limits. Different accident categories allow 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 RPS is segmented into four interconnected modules. These modules are:

- Measurement channels;
- Bistable trip units;
- RPS Logic; and
- Reactor trip circuit breakers (RTCBs).

This LCO applies only to the Logarithmic Power Level – High trip in MODES 3, 4, and 5 with the RTCBs closed. In MODES 1 and 2, this trip Function is addressed in LCO 3.3.1, "Reactor Protective System (RPS) Instrumentation – Operating." LCO 3.3.13, "~~Logarithmic Power~~ Source Range Monitoring Channels," applies when the RTCBs are open. ~~In the case of LCO 3.3.13, the logarithmic channels are required for monitoring neutron flux, although the trip Function is not required.~~

Measurement Channels and Bistable Trip Units

The measurement channels providing input to the Logarithmic Power Level – High trip consist of the four logarithmic nuclear instrumentation channels detecting neutron flux leakage from the reactor vessel. Other aspects of the Logarithmic Power Level – High trip are similar to the other measurement channels and bistables. These are addressed in the Background section of LCO 3.3.1.

Functional testing of the entire RPS, from bistable input through the opening of individual sets of RTCBs, can be performed either at power or shutdown and is normally performed on a quarterly basis. Nuclear instrumentation can

(continued)

BASES (continued)

APPLICABLE SAFETY ANALYSES

be similarly tested. FSAR, Section 7.2 (Ref. 3), provides more detail on RPS testing. The RPS functions to maintain the SLs during AOOs and * mitigates the consequence of DBAs in all MODES in which the RTCBs are closed.

Each of the analyzed transients and accidents can be detected by one or more RPS Functions. Functions not specifically credited in the accident analysis were qualitatively credited in the safety analysis and the NRC staff approved licensing basis for the plant. Noncredited Functions include the Steam Generator Water Level – High ~~and the Loss of Load~~. The Steam Generator Water Level – High ~~and the Loss of Load~~ trip~~s~~ ~~are~~ is purely equipment protective, and ~~their~~ its use minimizes the potential for equipment damage.

The Logarithmic Power Level – High trip protects the integrity of the fuel cladding and helps protect the RCPB in the event of an unplanned criticality from a shutdown condition.

In MODES 2, 3, 4, and 5, with the RTCBs closed, and the Control Element Assembly (CEA) Drive System capable of CEA withdrawal, protection is required for CEA withdrawal events originating when THERMAL POWER is < 1E-4% RTP. For events originating above this power level, other trips provide adequate protection.

MODES 3, 4, and 5, with the RTCBs closed, are addressed in this LCO. MODE 2 is addressed in LCO 3.3.1.

In MODES 3, 4, or 5, with the RTCBs open or the CEAs not capable of withdrawal, the Logarithmic Power Level – High trip does not have to be OPERABLE. ~~However,~~ the indication and alarm portion ~~of two logarithmic channels~~ must be OPERABLE to ensure proper indication of neutron population and to indicate a boron dilution event. ~~The indication and alarm functions are addressed in LCO 3.3.13~~.

The RPS satisfies Criterion 3 of the NRC Policy Statement.

LCO

The LCO requires the Logarithmic Power Level – High RPS Function to be OPERABLE. Failure of any required portion of the instrument channel renders the affected channel(s) inoperable and reduces the reliability of the affected Function.

(continued)

BASES

LCO (continued)

and Pressurizer Pressure – High trips provide protection for reactivity transients.

The trip may be manually bypassed during physics testing pursuant to LCO 3.4.17, "RCS Loops – Test Exceptions." During this testing, the Linear Power Level – High trip and administrative controls provide the required protection.

APPLICABILITY

Most RPS trips are required to be OPERABLE in MODES 1 and 2 because the reactor is critical in these MODES. The trips are designed to take the reactor subcritical, which maintains the SLs during AOOs and assists the Engineered Safety Features Actuation System (ESFAS) in providing acceptable consequences during accidents. Most trips are not required to be OPERABLE in MODES 3, 4, and 5. In MODES 3, 4, and 5, the emphasis is placed on return to power events. The reactor is protected in these MODES by ensuring adequate SDM. Exceptions to this are:

- The Logarithmic Power Level – High trip, RPS Logic RTCBs, and Manual Trip are required in MODES 3, 4, and 5, with the RTCBs closed and any CEA capable of being withdrawn, to provide protection for boron dilution and CEA withdrawal events. The Logarithmic Power Level – High trip in these lower MODES is addressed in this LCO. The RPS Logic in MODES 1, 2, 3, 4, and 5 is addressed in LCO 3.3.4, "Reactor Protective System (RPS) Logic and Trip Initiation."

The Applicability is modified by a Note that allows the trip to be bypassed when THERMAL POWER is > 1E-4% RTP, and the bypass is automatically removed when THERMAL POWER is ≤ 1E-4% RTP.

ACTIONS

The most common causes of channel inoperability are outright failure or drift of the bistable or process module sufficient to exceed the tolerance allowed by the plant specific setpoint analysis. Typically, the drift is found to be small and results in a delay of actuation rather than a total loss of function. This determination is generally made during the performance of a CHANNEL FUNCTIONAL TEST

(continued)

BASES

ACTIONS (continued)

E.1

Condition E is entered when the Required Actions and associated Completion Times of Condition A, B, C, or D are not met.

If Required Actions associated with these Conditions cannot be completed within the required Completion Time, all RTCBs must be opened, placing the plant in a condition where the logarithmic power trip channels are not required to be OPERABLE. A Completion Time of 1 hour is a reasonable time to perform the Required Action, which maintains the risk at an acceptable level while having one or two channels inoperable.

SURVEILLANCE REQUIREMENTS

The SRs for the Logarithmic Power Level – High trip are an extension of those listed in LCO 3.3.1, listed here because of their Applicability in these MODES.

SR 3.3.2.1

SR 3.3.2.1 is the performance of a CHANNEL CHECK of each logarithmic power channel. This SR is identical to SR 3.3.1.1. Only the Applicability differs.

Performance of the CHANNEL CHECK once every 12 hours ensures that gross failure of instrumentation has not occurred. A CHANNEL CHECK is a comparison of the parameter indicated on one channel to a similar parameter on another channel. 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. 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 by the plant staff based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the match criteria, it may be an indication that the

(continued)

SURVEILLANCE REQUIREMENTS (continued)

Matrix Logic Tests

Matrix Logic Tests are addressed in LCO 3.3.4. This test is performed one matrix at a time. It verifies that a coincidence in the two input channels for each Function removes power from the matrix relays. During testing, holding power is applied to the matrix relay test coils and prevents the matrix relay contacts from assuming their de-energized state. This test will detect any short circuits around the bistable contacts in the coincidence logic, such as may be caused by faulty bistable relay or trip channel bypass contacts.

Trip Path Test

Trip path (Initiation Logic) tests are addressed in LCO 3.3.4. These tests are similar to the Matrix Logic tests except that test power is withheld from one matrix relay at a time, allowing the initiation circuit to de-energize, opening the affected set of RTCBs. The RTCBs must then be closed prior to testing the other three initiation circuits, or a reactor trip may result.

The Frequency of 92 days is based on the reliability analysis presented in topical report CEN-327, "RPS/ESFAS Extended Test Interval Evaluation" (Ref. 6). The excore channels use preassigned test signals to verify proper channel alignment. The excore logarithmic channel test signal is inserted into the preamplifier input, so as to test the first active element downstream of the detector.

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.2.4 (continued)

The Frequency is based upon the assumption of an 24 month calibration interval for the determination of the magnitude of equipment drift in the setpoint analysis and includes operating experience and consistency with the typical 24 month fuel cycle.

The Surveillance is modified by a Note to indicate that the neutron detectors are excluded from CHANNEL CALIBRATION because they are passive devices with minimal drift and because of the difficulty of simulating a meaningful signal. Slow changes in ~~detector sensitivity~~ are compensated for by performing the daily calorimetric calibration (SR 3.3.1.4).

leakage of neutrons with core burnup

SR 3.3.2.5

This SR ensures that the RPS RESPONSE TIMES are verified to be less than or equal to the maximum values assumed in the safety analysis. Individual component response times are not modeled in the analyses. The analyses model the overall or total elapsed time, from the point at which the parameter exceeds the trip setpoint value at the sensor to the point at which the RTCBs open. Response times are conducted on a 24 month STAGGERED TEST BASIS. This results in the interval between successive tests of a given channel of n x 24 months, where n is the number of channels in the Function. The 24 month Frequency is based upon operating experience, which has shown that random failures of instrumentation components causing serious response time degradation, but not channel failure, are infrequent occurrences. Also, response times cannot be determined at power, since equipment operation is required. Testing may be performed in one measurement or in overlapping segments, with verification that all components are tested.

(continued)

BACKGROUND
(continued)

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 RPS is segmented into four interconnected modules. These modules are:

- Measurement channels;
- Bistable trip units;
- RPS Logic; and
- Reactor trip circuit breakers (RTCBs).

This LCO addresses the CEACs. LCO 3.3.1, "Reactor Protective System (RPS) Instrumentation – Operating," provides a description of this equipment in the RPS.

The excore nuclear instrumentation, the core protection calculators (CPCs), and the CEACs are considered components in the measurement channels of the Linear Power Level – High, Logarithmic Power Level – High, DNBR – Low, and Local Power Density (LPD) – High trips. The CEACs are addressed by this Specification.

All four CPCs receive control element assembly (CEA) deviation penalty factors from each CEAC and use the larger of the penalty ~~power~~ factors from the two CEACs in the calculation of DNBR and LPD. CPCs are further described in the Background section of LCO 3.3.1.

The CEACs perform the calculations required to determine the position of CEAs within their subgroups for the CPCs. Two independent CEACs compare the position of each CEA to its subgroup position. If a deviation is detected by either CEAC, an annunciator sounds and appropriate "penalty factors" are transmitted to all CPCs. These penalty factors conservatively adjust the effective operating margins to the DNBR – Low and LPD – High trips. Each CEAC also drives a single cathode ray tube (CRT), which is switchable between CEACs. The CRT displays individual CEA positions and current values of the penalty factors from the selected CEAC.

(continued)

ACTIONS

A.1 and A.2 (continued)

position of all CEAs and provides verification of the proper operation of the remaining CEAC. An OPERABLE CEAC will not generate penalty factors until deviations of ≥ 9.7 inches within a subgroup are encountered.

The Completion Time of once per 4 hours is adequate based on operating experience, considering the low probability of an undetected CEA deviation coincident with an undetected failure in the remaining CEAC within this limited time frame.

As long as Required Action A.1 is accomplished as specified, the inoperable CEAC can be restored to OPERABLE status within 7 days. The Completion Time of 7 days is adequate for most repairs, while minimizing risk, considering that dropped CEAs are detectable by the redundant CEAC, and other LCOs specify Required Actions necessary to maintain DNBR and LPD margin.

B.1, B.2, B.3, B.4, and B.5

Condition B applies if the Required Action and associated Completion Time of Required Action A are not met, or if both CEACs are inoperable. Actions associated with this Condition involve disabling the Control Element Drive Mechanism Control System (CEDMCS), while providing increased assurance that CEA deviations are not occurring and informing all OPERABLE CPC channels, via a software flag, that the applicable ~~both~~ CEAC(s) is (are) ~~are~~ failed. This will ensure that the large penalty factor associated with two CEAC failures will be applied to CPC calculations. The penalty factor for two failed CEACs is sufficiently large that power must be maintained significantly < 100% RTP if CPC generated reactor trips are to be avoided. The Completion Time of 4 hours is adequate to accomplish these actions while minimizing risks.

The Required Actions are as follows:

B.1

Meeting the DNBR margin requirements of LCO 3.2.4, "DNBR," ensures that power level and ASI are within a conservative region of operation based on actual core conditions.

(continued)

ACTIONS
(continued)

B.2

The "full out" CEA reed switches provide acceptable indication of CEA position. Therefore, the CEAs will remain fully withdrawn, except as required for specified testing or flux control via group #6. This verification ensures that undesired perturbations in local fuel burnup are prevented.

B.3

The "RSPT/CEAC Inoperable" addressable constant in each of the CPCs is set to indicate that ~~both~~ the applicable CEAC(s) ~~are~~ is (are) inoperable. This provides a conservative penalty factor to ensure that a conservative effective margin is maintained by the CPCs in the computation of DNBR and LPD trips.

B.4

The CEDMCS is placed and maintained in "OFF," except during CEA motion permitted by Required Action B.2, to prevent inadvertent motion and possible misalignment of the CEAs.

B.5

A comprehensive set of comparison checks on individual CEAs within groups must be made within 4 hours. Verification that each CEA is within 7 inches of other CEAs in its group provides a check that no CEA has deviated from its proper position within the group.

C.1

Condition C applies if the CPC channel B or C cabinet receives a high temperature alarm. There is one temperature sensor in each of the four CPC bays. Since CPC bays B and C also house CEAC calculators 1 and 2, respectively, a high temperature in either of these bays may also indicate a problem with the associated CEAC.

If a CPC channel B or C cabinet high temperature alarm is received, it is possible for the CEAC to be affected and not be completely reliable. Therefore, a CHANNEL FUNCTIONAL TEST must be performed within 12 hours. The Completion Time of 12 hours is adequate, considering the low probability of

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.3.4 (continued)

The Frequency is based upon the assumption of an 24 month calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis and includes operating experience and consistency with the typical 24 month fuel cycle.

SR 3.3.3.5

Every 24 months, a CHANNEL FUNCTIONAL TEST is performed on the CEACs. The CHANNEL FUNCTIONAL TEST shall include the injection of a signal as close to the sensors as practicable to verify OPERABILITY, including alarm and trip Functions.

The basis for the 24 month Frequency is that the CEACs perform a continuous self monitoring function that eliminates the need for frequent CHANNEL FUNCTIONAL TESTS. This CHANNEL FUNCTIONAL TEST essentially validates the self ~~7778~~monitoring function and checks for a small set of failure modes that are undetectable by the self monitoring function. Operating experience has shown that undetected CPC or CEAC failures do not occur in any given 24 month interval.

SR 3.3.3.6

The isolation characteristics of each CEAC CEA position isolation amplifier and each optical isolator for CEAC to CPC data transfer are verified once per refueling to ensure that a fault in a CEAC or a CPC channel will not render another CEAC or CPC channel inoperable. The CEAC CEA position isolation amplifiers, mounted in CPC cabinets A and D, prevent a CEAC fault from propagating back to CPC A or D. The optical isolators for CPC to CEAC data transfer prevent a fault originating in any CPC channel from propagating back to any CEAC through this data link.

The Frequency is based on plant operating experience with regard to channel OPERABILITY, which demonstrates the failure of a channel in any 24 month interval is rare.

(continued)

BACKGROUND

RPS Logic (continued)

each have six contacts in series, one from each matrix, and perform a logical OR function, opening the RTCBs if any one or more of the six logic matrices indicate a coincidence condition.

Each trip path is responsible for opening one set of two of the eight RTCBs. The RTCB control relays (K-relays), when de-energized, interrupt power to the breaker undervoltage trip attachments and simultaneously apply power to the shunt trip attachments on each of the two breakers. Actuation of either the undervoltage or shunt trip attachment is sufficient to open the RTCB and interrupt power from the motor generator (MG) sets to the control element drive mechanisms (CEDMs).

When a coincidence occurs in two RPS channels, all four matrix relays in the affected matrix de-energize. This in turn de-energizes all four breaker control relays, which simultaneously de-energize the undervoltage and energize the shunt trip attachments in all eight RTCBs, tripping them open.

Matrix Logic refers to the matrix power supplies, trip channel bypass contacts, and interconnecting matrix wiring between bistable relay cards, up to but not including the matrix relays.

The Initiation Logic consists of the trip path power source, matrix relays and their associated contacts, all interconnecting wiring, and solid state ~~(auxiliary)~~ relays through the K-relay contacts in the RTCB control circuitry.

It is possible to change the two-out-of-four RPS Logic to a two-out-of-three logic for a given input parameter in one channel at a time by trip channel bypassing select portions of the Matrix Logic. Trip channel bypassing a bistable effectively shorts the bistable relay contacts in the three matrices associated with that channel. Thus, the bistables will function normally, producing normal trip indication and annunciation, but a reactor trip will not occur unless two additional channels indicate a trip condition. Trip channel bypassing can be simultaneously performed on any number of

(continued)

BACKGROUND

RPS Logic (continued)

parameters in any number of channels, providing each parameter is bypassed in only one channel at a time. An interlock prevents simultaneous trip channel bypassing of the same parameter in more than one channel. Trip channel bypassing is normally employed during maintenance or testing.

Reactor Trip Circuit Breakers (RTCBs)

The reactor trip switchgear consists of eight RTCBs, which are operated in four sets of two breakers (four channels). Power input to the reactor trip switchgear comes from two full capacity MG sets operated in parallel such that the loss of either MG set does not de-energize the CEDMs. There are two separate CEDM power supply buses, each bus powering half of the CEDMs. Power is supplied from the MG sets to each bus via two redundant paths (trip legs). This ensures that a fault or the opening of a breaker in one trip leg (i.e., for testing purposes) will not interrupt power to the CEDM buses.

Each of the four trip legs consists of two RTCBs in series. The two RTCBs within a trip leg are actuated by separate initiation circuits.

The eight RTCBs are operated as four sets of two breakers (four channels). For example, if a breaker receives an open signal in trip leg A (for CEDM bus 1), an identical breaker in trip leg B (for CEDM bus 2) will also receive an open signal. This arrangement ensures that power is interrupted to both CEDM buses, thus preventing trip of only half of the control element assemblies (CEAs) (a half trip). Any one inoperable breaker in a channel will make the entire channel inoperable.

Each set of RTCBs initiated is operated by either a Manual Trip push button or an RPS ~~actuated~~ K-relay. There are four Manual Trip push buttons, arranged in two sets of two. Depressing both push buttons in either set will result in a reactor trip.

(continued)

BASES

BACKGROUND

Reactor Trip Circuit Breakers (RTCBs) (continued)

When a Manual Trip is ~~initiated~~ actuated using the control room push buttons, the RPS trip paths and K-relays are bypassed, and the RTCB undervoltage and shunt trip attachments are actuated independent of the RPS.

Manual Trip circuitry includes the push button and interconnecting wiring to both RTCBs necessary to actuate both the undervoltage and shunt trip attachments, but excludes the K-relay contacts and their interconnecting wiring to the RTCBs, which are considered part of the Initiation Logic.

Functional testing of the entire RPS, from bistable input through the opening of the individual sets of RTCBs, can be performed either at power or shutdown and is normally performed on a quarterly basis. FSAR, Section 7.2 (Ref. 3), explains RPS testing in more detail.

APPLICABLE SAFETY ANALYSES

Reactor Protective System (RPS) Logic

The RPS Logic provides for automatic trip initiation to maintain the SLs during AOOs and assist the ESF systems in ensuring acceptable consequences during accidents. All transients and accidents that call for a reactor trip assume the RPS Logic is functioning as designed.

Reactor Trip Circuit Breakers (RTCBs)

All of the transient and accident analyses that call for a reactor trip assume that the RTCBs operate and interrupt power to the CEDMs.

Manual Trip

There are no accident analyses that take credit for the Manual Trip; however, the Manual Trip is part of the RPS circuitry. It is used by the operator to shut down the reactor whenever any parameter is rapidly trending toward its trip setpoint. A Manual Trip accomplishes the same results as any one of the automatic trip Functions.

(continued)

BASES

LCO

4. Manual Trip (continued)

Manual Trip push buttons are also provided at the reactor trip switchgear (locally) in case the control room push buttons become inoperable or the control room becomes uninhabitable. These are not part of the RPS and cannot be credited in fulfilling the LCO OPERABILITY requirements. Furthermore, LCO ACTIONS need not be entered due to failure of a local Manual Trip.

APPLICABILITY

The RPS Logic, RTCBs, and Manual Trip are required to be OPERABLE in any MODE when the CEAs are capable of being withdrawn off the bottom of the core (i.e., RTCBs closed and power available to the CEDMs). This ensures that the reactor can be tripped when necessary, but allows for maintenance and testing when the reactor trip is not needed.

In MODES 3, 4, and 5 with the RTCBs open, the CEAs are not capable of withdrawal and these Functions do not have to be OPERABLE. However, two Source Range Monitoring ~~logarithmic power level~~ channels must be OPERABLE to ensure proper indication of neutron population and to indicate a boron dilution event. This is addressed in LCO 3.3.13, "~~Logarithmic Power~~ Source Range Monitoring Channels."

ACTIONS

When the number of inoperable channels in a trip Function exceeds that specified in any related Condition associated with the same trip Function, then the plant is outside the safety analysis. Therefore, LCO 3.0.3 is immediately entered if applicable in the current MODE of operation.

A.1

Condition A applies if one Matrix Logic channel is inoperable in any applicable MODE. Loss of a single vital instrument bus will de-energize one of the two matrix power supplies in up to three matrices. This is considered a single matrix failure, providing the matrix relays associated with the failed power supplies de-energize as required. The above statement is supported by a Note.

(continued)

BASES

ACTIONS

D.1 (continued)

If the affected RTCB cannot be opened, Required Action E is entered. This would only occur if there is a failure in the Manual Trip circuitry or the RTCB(s).

E.1 and E.2

Condition E is entered if Required Actions associated with Condition A, B, or D are not met within the required Completion Time or, if for one or more Functions, more than one Manual Trip, Matrix Logic, Initiation Logic, or RTCB channel is inoperable for reasons other than Condition A or D.

If the RTCBs associated with the inoperable channel cannot be opened, the reactor must be shut down within 6 hours and all the RTCBs opened. A Completion Time of 6 hours is reasonable, based on operating experience, for reaching the required plant conditions from full power conditions in an orderly manner and without challenging plant systems and for opening RTCBs. All RTCBs should then be opened, placing the plant in a MODE where the LCO does not apply and ensuring no CEA withdrawal occurs.

SURVEILLANCE REQUIREMENTS

SR 3.3.4.1 and 3.3.4.2

A CHANNEL FUNCTIONAL TEST on each RPS Logic channel and RTCB channel is performed every 31 days and every 92 days respectively to ensure the entire channel will perform its intended function when needed.

The RPS CHANNEL FUNCTIONAL TEST consists of three overlapping tests as described in Reference 3. These tests verify that the RPS is capable of performing its intended function, from bistable input through the RTCBs. The first test, the bistable test, is addressed by SR 3.3.1.7 in LCO 3.3.1.

This SR addresses the two tests associated with the RPS Logic: Matrix Logic and Trip Path.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

Matrix Logic Tests

These tests are performed one matrix at a time. They verify that a coincidence in the two input channels for each Function removes power from the matrix relays. During testing, holding power is applied to the matrix relay test coils and prevents the matrix relay contacts from assuming their de-energized state. The Matrix Logic tests will detect any short circuits around the bistable contacts in the coincidence logic such as may be caused by faulty bistable relay or trip channel bypass contacts.

Trip Path Tests

These tests are similar to the Matrix Logic tests, except that test power is withheld from one matrix relay at a time, allowing the initiation circuit to de-energize, opening the affected set of RTCBs. The RTCBs must then be closed prior to testing the other three initiation circuits, or a reactor trip may result.

The Frequency of 92 days is based on the reliability analysis presented in topical report CEN-327, "RPS/ESFAS Extended Test Interval Evaluation" (Ref. 5).

SR 3.3.4.~~2~~ 3

Each RTCB is actuated by an undervoltage coil and a shunt trip coil. The system is designed so that either de-energizing the undervoltage coil or energizing the shunt trip coil will cause the circuit breaker to open. When an RTCB is opened, either during an automatic reactor trip or by using the manual push buttons in the control room, the undervoltage coil is de-energized and the shunt trip coil is energized. This makes it impossible to determine if one of the coils or associated circuitry is defective.

Therefore, once every 18 months, a CHANNEL FUNCTIONAL TEST is performed that individually tests all ~~four sets of~~ eight undervoltage coils and all eight ~~four sets of~~ shunt trip coils or for each RTC B. During undervoltage coil testing, the shunt trip coils must remain de-energized, preventing their operation. Conversely, during shunt trip coil testing, the undervoltage coils must remain energized, preventing their operation. This Surveillance ensures that every undervoltage coil and

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.4.~~1~~3 (continued)

every shunt trip coil is capable of performing its intended function and that no single active failure of any RTCB component will prevent a reactor trip. ~~The 18 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power~~. Operating experience has shown these components usually pass the Surveillance when performed at the Frequency of once every 18 months.

SR 3.3.4.~~2~~4

A CHANNEL FUNCTIONAL TEST on the Manual Trip channels is performed prior to a reactor startup to ensure the entire channel will perform its intended function if required. The Manual Trip Function can only be tested at shutdown. However, the simplicity of this circuitry and the absence of drift concern make this Frequency adequate.

Additionally, operating experience has shown that these components usually pass the Surveillance when performed at a Frequency of once every 7 days prior to each reactor startup.

REFERENCES

1. 10 CFR 50, Appendix A.
2. 10 CFR 100.
3. SONGS Units 2 and 3 UFSAR, Section 7.2.
4. NRC Safety Evaluation Report.
5. CEN-327, June 2, 1986, including Supplement 1, March 3, 1989.

BACKGROUND

Measurement Channels (continued)

Adequate channel to channel independence includes physical and electrical independence of each channel from the others. Furthermore, each channel must be energized from separate inverters and station batteries. SONGS Units 2 and 3 ~~Plants that have~~ has demonstrated adequate channel to channel independence and thus may operate in two-out-of-three logic configuration, with one channel removed from service, until following the next MODE 5 entry.

Since no single failure will either cause or prevent a protective system actuation, and no protective channel feeds a control channel, this arrangement meets the requirements of IEEE Standard 279-1971 (Ref. 4).

Bistable Trip Units

Bistable trip units, mounted in the Plant Protection System (PPS) cabinet, receive an analog input from the measurement channels, compare the analog input to trip setpoints, and provide contact output to the Matrix Logic for each ESFAS Function. They also provide local trip indication and remote annunciation.

There are four channels of bistables, designated A through D, for each ESFAS Function, one for each measurement channel. In cases where two ESF Functions share the same input and trip setpoint (e.g., containment pressure input to CIAS and SIAS), the same bistable may be used to satisfy both Functions. Similarly, bistables may be shared between the RPS and ESFAS (e.g., Pressurizer Pressure — Low input to the RPS and SIAS). Bistable output relays de-energize when a trip occurs, in turn de-energizing bistable relays mounted in the PPS relay card racks.

The contacts from these bistable relays are arranged into six coincidence matrices, comprising the Matrix Logic. If bistables monitoring the same parameter in at least two channels trip, the Matrix Logic will generate an ESF actuation (two-out-of-four logic).

(continued)

BACKGROUND

ESFAS Logic (continued)

four channels sense the same input parameter trip. This is called a two-out-of-four trip logic.

Bistable relay contact outputs from the four channels are configured into six logic matrices. Each logic matrix checks for a coincident trip in the same parameter in two bistable channels. The matrices are designated the AB, AC, AD, BC, BD, and CD matrices to reflect the bistable channels being monitored. Each logic matrix contains four normally energized matrix relays. When a coincidence is detected in the two channels being monitored by the logic matrix, all four matrix relays de-energize.

The matrix relay contacts are arranged into trip paths, with one relay contact from each matrix relay in each of the four trip paths. Each trip path controls two initiation relays. Each of the two initiation relays in each trip path controls a contact~~s~~ in the Actuation Logic for one train of ESF.

Each of the two channels of Actuation Logic, mounted in the Auxiliary Relay Cabinet (ARCs), is responsible for actuating one train of ESF equipment. Each ESF Function has separate Actuation Logic in each ARC.

The contacts from the Initiation Logic are configured in a selective two-out-of-four logic in the Actuation Logic, similar to the configuration employed by the RPS in the RTCBs. This logic controls ARC mounted subgroup relays, which are normally energized. Contacts from these relays, when de-energized, actuate specific ESF equipment.

When a coincidence occurs in two ESFAS channels, all four matrix relays in the affected matrix will de-energize. This in turn will de-energize all eight initiation relays, four used in each Actuation Logic.

Matrix Logic refers to the matrix power supplies, trip channel bypass contacts, and interconnecting matrix wiring between bistable relay cards, up to but not including the matrix relays. Matrix contacts on the bistable relay cards are excluded from the Matrix Logic definition, since they are addressed as part of the measurement channel.

(continued)

BACKGROUND

ESFAS Logic (continued)

shares an operating bypass with the Pressurizer Pressure – Low reactor trip.

Manual ESFAS initiation capability is provided for all functions except RAS to permit the operator to manually actuate an ESF System when necessary.

Two sets of two push buttons (located in the control room) for each ESF Function are provided, and each set actuates both trains. Each Manual Trip push button opens one trip path, de-energizing one set of two initiation relays, one affecting each train of ESF. Initiation relay contacts are arranged in a selective two-out-of-four configuration in the Actuation Logic. By arranging the push buttons in two sets of two, such that both push buttons in a set must be depressed, it is possible to ensure that Manual Trip will not be prevented in the event of a single random failure. Each set of two push buttons is designated a single channel in LCO 3.3.6.

APPLICABLE SAFETY ANALYSES

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 the secondary, or backup, actuation signal for one or more other accidents.

ESFAS protective Functions are as follows:

1. Safety Injection Actuation Signal

   SIAS ensures acceptable consequences during large break loss of coolant accidents (LOCAs), small break LOCAs, control element assembly ejection accidents, and main steam line breaks (MSLBs) inside containment. To provide the required protection, either a high containment pressure or a low pressurizer pressure signal will initiate SIAS. SIAS initiates the Emergency Core Cooling Systems (ECCS) and performs several other functions such as initiating a

(continued)

BASES

APPLICABLE SAFETY ANALYSES

1. Safety Injection Actuation Signal (continued)

   Containment Cooling Actuation Signal (CCAS), initiating control room isolation, and starting the diesel generators.

   CCAS mitigates containment overpressurization when required by either a manual CCAS actuation or an automatic SIAS Function.

2. Containment Spray Actuation Signal

   CSAS actuates containment spray, preventing containment overpressurization during large break LOCAs, small break LOCAs, and MSLBs or feedwater line breaks (FWLBs) inside containment. CSAS is initiated by high high containment pressure and an SIAS. This configuration reduces the likelihood of inadvertent containment spray.

3. Containment Isolation Actuation Signal

   CIAS ensures acceptable mitigating actions during large and small break LOCAs, and MSLBs or FWLBs inside containment. CIAS is initiated by high containment pressure.

4. Main Steam Isolation Signal

   MSIS ensures acceptable consequences during an MSLB or FWLB (between the steam generator and the main feedwater check valve), either inside or outside containment. MSIS isolates both steam generators if either generator indicates a low steam generator pressure condition. This prevents an excessive rate of heat extraction and subsequent cooldown of the RCS during these events.

5. Recirculation Actuation Signal

   At the end of the injection phase of a LOCA, the refueling water storage tank (RWST) will be nearly empty. Continued cooling must be provided by the ECCS to remove decay heat. The source of water for the ECCS pumps is automatically switched to the

(continued)

LCO

b. Pressurizer Pressure – Low (continued)

The Allowable Value for this trip is set low enough to prevent actuating the ESF Functions (SIAS) during normal plant operation and pressurizer pressure transients. The setting is high enough that, with the specified accidents, the ESF systems will actuate to perform as expected, mitigating the consequences of the accident.

The Pressurizer Pressure – Low trip setpoint, which provides SIAS, and RPS trip, may be manually decreased to a floor value of 300 psia to allow for a controlled cooldown and depressurization of the RCS without causing a reactor trip, or SIAS. The margin between actual pressurizer pressure and the trip setpoint must be maintained less than or equal to the specified value (400 psia) to ensure a reactor trip, and SIAS will occur if required during RCS cooldown and depressurization.

From this reduced setting, the trip setpoint will increase automatically as pressurizer pressure increases, tracking actual RCS pressure until the trip setpoint is reached.

When the trip setpoint has been lowered below the bypass permissive setpoint of ~~400~~ 472 psia, the Pressurizer Pressure – Low reactor trip, and SIAS actuation may be manually bypassed in preparation for shutdown cooling. When RCS pressure rises above the bypass removal setpoint, the bypass is automatically removed.

Bypass Removal

This LCO requires four channels of bypass removal for Pressurizer Pressure – Low to be OPERABLE in MODES 1, 2, and 3.

(continued)

BASES

LCO

Bypass Removal (continued)

Each of the four channels enables and disables the bypass capability for a single channel. Therefore, this LCO applies to the bypass removal feature only. If the bypass enable function is failed so as to prevent entering a bypass condition, operation may continue. Because the trip setpoint has a floor value of 300 psia, a channel trip will result if pressure is decreased below this setpoint without bypassing.

The bypass removal Allowable Value was chosen because MSLB events originating from below this setpoint add less positive reactivity than that which can be compensated for by required SDM.

2. Containment Spray Actuation Signal

~~CSAS is initiated either manually or automatically~~. For ~~an~~ automatic CSAS actuation, it is necessary to have a Containment Pressure — High High signal, coincident with an SIAS. The SIAS requirement should always be satisfied on a legitimate CSAS, since the Containment Pressure — High signal used in the SIAS will initiate before the Containment Pressure — High High. This ensures that a CSAS will not initiate unless required.

a. Containment Pressure — High High

This LCO requires four channels of Containment Pressure — High High to be OPERABLE in MODES 1, 2, and 3.

The Allowable Value for this trip is set high enough to allow for first response ESF systems (containment cooling systems) to attempt to mitigate the consequences of an accident before resorting to spraying borated water onto containment equipment. The setting is low enough to initiate CSAS in time to prevent containment pressure from exceeding design.

(continued)

LCO

a. Steam Generator Pressure – Low (continued)

The Allowable Value for this trip is set below the full load operating value for steam pressure so as not to interfere with normal plant operation. However, the setting is high enough to provide an MSIS (Function 4) during an excessive steam demand event. An excessive steam demand event causes the RCS to cool down, resulting in a positive reactivity addition to the core.

MSIS limits this cooldown by isolating both steam generators if the pressure in either drops below the trip setpoint. An RPS trip on Steam Generator Pressure – Low is initiated simultaneously, using the same bistable. The Steam Generator Pressure – Low bistable output is also used in the EFAS logic (Function 7) to aid in determining if a steam generator is intact.

The Steam Generator Pressure – Low trip setpoint may be manually decreased as steam generator pressure is reduced. This prevents an RPS trip or MSIS actuation during controlled plant cooldown. The margin between actual ~~pressurizer~~ steam generator pressure and the trip setpoint must be maintained less than or equal to the specified value of 200 psi to ensure a reactor trip and MSIS will occur when required. The setpoint will increase automatically to maintain the margin ≤ 200 psi as steam generator pressure is increased.

5. Recirculation Actuation Signal

a. Refueling Water Storage Tank Level – Low

This LCO requires four channels of RWST Level – Low to be OPERABLE in MODES 1, 2, 3, and 4.

The upper limit on the Allowable Value for this trip is set low enough to ensure RAS does not initiate before sufficient water is transferred to the containment sump. Premature recirculation could impair the reactivity control function of safety injection by limiting the amount of boron injection.

(continued)

BASES

LCO

c. Steam Generator Pressure – Low (continued)

The Steam Generator Pressure – Low input is derived from the Steam Generator Pressure – Low RPS bistable output. This output is also used as an MSIS input.

The Allowable Value for this trip is set below the full load operating value for steam pressure so as not to interfere with normal plant operation. However, the setting is high enough to provide an MSIS (Function 4) during an excessive steam demand event. An excessive steam demand is one indicator of a potentially ruptured steam generator; thus, this EFAS input, in conjunction with the SGPD Function, prevents the feeding of a potentially ruptured steam generator.

~~LCO~~

~~c. Steam Generator Pressure – Low (continued)~~

The Steam Generator Pressure – Low trip setpoint may be manually decreased as steam generator pressure is reduced. This prevents an RPS trip or MSIS actuation during controlled plant cooldown. The margin between actual ~~pressurizer~~ steam generator pressure and the trip setpoint must be maintained less than or equal to the specified value of 200 psi to ensure that a reactor trip and MSIS will occur when required. The setpoint will increase automatically to maintain the margin ≤ 200 psi as steam generator pressure is increased until the trip setpoint is reached.

APPLICABILITY

In MODES 1, 2 and 3 there is sufficient energy in the primary and secondary systems to warrant automatic ESF System responses to:

- Close the main steam isolation valves to preclude a positive reactivity addition;
- Actuate emergency feedwater to preclude the loss of the steam generators as a heat sink (in the event the normal feedwater system is not available);

(continued)

ACTIONS

D.1 and D.2 (continued)

per LCO 3.0.3, as explained in Condition B. Completion Times are consistent with Condition B.

for the Safety Injection Actuation Signal, Containment Spray Actuation Signal, Containment Isolation Actuation Signal, Main Steam Isolation Signal or Emergency Feedwater Actuation Signal

E.1 and E.2

If the Required Actions and associated Completion Times of Condition A, B, C, or D cannot be met, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 4 within 12 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

INSERT 1

SURVEILLANCE REQUIREMENTS

SR 3.3.5.1

Performance of the CHANNEL CHECK once every 12 hours ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is 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. 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 by the plant staff based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the match 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 match criteria, it is an indication that the channels are OPERABLE.

The Frequency, about once every shift, is based on operating experience that demonstrates channel failure is rare. Thus,

(continued)

INSERT 1

F.1 and F.2

If the Required Actions and associated Completion Times of Condition A, B, C, or D cannot be met for the Recirculation Actuation Signal, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions in an orderly manner and without challenging plant systems.

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.5.1 (continued)

performance of the CHANNEL CHECK guarantees that undetectedovert channel failure is limited to 12 hours. Since the probability of two random failures in redundant channels in any 12 hour period is low, the CHANNEL CHECK minimizes the chance of loss of protective function due to failure of redundant channels. The CHANNEL CHECK supplements less formal, but more frequent, checks of channel OPERABILITY during normal operational use of displays associated with the LCO required channels.

SR 3.3.5.2

A CHANNEL FUNCTIONAL TEST is performed every 92 days to ensure the entire channel will perform its intended function when needed.

The CHANNEL FUNCTIONAL TEST is part of an overlapping test sequence similar to that employed in the RPS. This sequence, consisting of SR 3.3.5.2, SR 3.3.6.1, and SR 3.3.6.2, tests the entire ESFAS from the bistable input through the actuation of the individual subgroup relays. These overlapping tests are described in Reference 1. SR 3.3.5.2 and SR 3.3.6.1 are normally performed together and in conjunction with ESFAS testing. SR 3.3.6.2 verifies that the subgroup relays are capable of actuating their respective ESF components when de-energized.

These tests verify that the ESFAS is capable of performing its intended function, from bistable input through the actuated components. SRs 3.3.6.1 and 3.3.6.2 are addressed in LCO 3.3.6. SR 3.3.5.2 includes bistable tests.

A test signal is superimposed on the input in one channel at a time to verify that the bistable trips within the specified tolerance around the setpoint. This is done with the affected PPS trip channel bypassed.

SR 3.3.5.3 and SR 3.3.5.4

CHANNEL CALIBRATION is a complete check of the instrument channel including the detector and the bypass removal functions. The Surveillance verifies that the channel

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.5.3 and SR 3.3.5.4 (continued)

responds to a measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drift between successive calibrations to ensure that the channel remains operational between successive surveillances. Measurement error determination, setpoint error determination, and calibration adjustment must be performed consistent with the plant specific setpoint analysis. The channel shall be left calibrated consistent with the assumptions of the current plant specific setpoint analysis.

The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power.

SR 3.3.5.5

This Surveillance ensures that the train actuation response times are within the maximum values assumed in the safety analyses.

Response time testing acceptance criteria are included in Reference 10.

ESF RESPONSE TIME tests are conducted on a STAGGERED TEST BASIS of once every 24 months. The 24 month Frequency is consistent with the typical industry refueling cycle and is based upon plant operating experience, which shows that random failures of instrumentation components causing serious response time degradation, but not channel failure, are infrequent occurrences.

SR 3.3.5.6

SR 3.3.5.6 is a CHANNEL FUNCTIONAL TEST similar to SR 3.3.5.2, except SR 3.3.5.6 is performed within 92 days prior to startup and is only applicable to bypass functions. Since the Pressurizer Pressure — Low bypass is identical for both the RPS and ESFAS, this is the same Surveillance performed for the RPS in SR 3.3.1.13.

(continued)

BACKGROUND (continued)

- Matrix Logic,
- Initiation Logic (trip paths), and
- Actuation Logic.

This LCO addresses ESFAS Logic. Bistables and measurement channels are addressed in LCO 3.3.5, "Engineered Safety Features Actuation System (ESFAS) Instrumentation."

The role of the measurement channels and bistables is described in LCO 3.3.5. The role of the ESFAS Logic is described below.

ESFAS Logic

The ESFAS Logic, consisting of Matrix, Initiation and Actuation Logic, employs a scheme that provides an ESF actuation of both trains when bistables in any two of the four channels sense the same input parameter trip. This is called a two-out-of-four trip logic.

Bistable relay contact outputs from the four channels are configured into six Matrix Logics. Each Matrix Logic checks for a coincident trip in the same parameter in two bistable channels. The matrices are designated the AB, AC, AD, BC, BD, and CD matrices, to reflect the bistable channels being monitored. Each Matrix Logic contains four normally energized matrix relays. When a coincidence is detected in the two channels being monitored by the Matrix Logic, all four matrix relays de-energize.

The matrix relay contacts are arranged into trip paths, with one relay contact from each matrix relay in each of the four trip paths. Each trip path controls two initiation relays. Each of the two initiation relays in each trip path controls a contact~~s~~ in the Actuation Logic for one train of ESF.

Each of the two channels of Actuation Logic, mounted in the Auxiliary Relay Cabinets (ARCs), is responsible for actuating one train of ESF equipment. Each ESF Function has separate Actuation Logic in each ARC.

The contacts from the Initiation Logic are configured in a selective two-out-of-four logic in the Actuation Logic, similar to the configuration employed by the RPS in the RTCBs. This logic controls ARC mounted subgroup relays

(continued)

BASES

BACKGROUND

ESFAS Logic (continued)

channel at a time. An interlock prevents simultaneous trip channel bypassing of the same parameter in more than one channel. Trip channel bypassing is normally employed during maintenance or testing. Trip channel bypassing is addressed in LCO 3.3.5.

Manual ESFAS initiation capability is provided to permit the operator to manually actuate an ESF System when necessary, with the exception of RAS which does not have manual initiation capability. Two sets of two push buttons (located in the control room) for each ESF Function are provided, and each set actuates both trains except for RAS. Each Manual Trip push button opens one trip path, de-energizing one set of two initiation relays, one affecting each train of ESF. Initiation relay contacts are arranged in a selective two-out-of-four configuration in the Actuation Logic. By arranging the push buttons in two sets of two, such that both push buttons in a set must be depressed, it is possible to ensure that Manual Trip will not be prevented in the event of a single random failure. Each set of two push buttons is designated a single channel in this LCO.

~~However,~~ RAS does not have manual pushbuttons on the Control Room panels. However, all ESFAS functions, including RAS, have ~~RAS~~ manual actuation ~~is~~ available from the Manual pushbuttons on the ESFAS panels. These pushbuttons operate contacts in the Actuation Logic, so Initiation Logic is not required for a manual actuation. These pushbuttons are not credited in the Technical Specifications.

APPLICABLE SAFETY ANALYSES

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.

ESFAS Functions are as follows:

1. Safety Injection Actuation Signal

SIAS ensures acceptable consequences during large break loss of coolant accidents (LOCAs), small break

(continued)

APPLICABLE SAFETY ANALYSES

1. Safety Injection Actuation Signal (continued)

and feedwater line breaks

LOCAs, control element assembly ejection accidents, and main steam line breaks (MSLBs) inside or outside containment. To provide the required protection, either a high containment pressure or a low pressurizer pressure signal will initiate SIAS. SIAS initiates the Emergency Core Cooling Systems (ECCS) and performs several other Functions, such as initiating a containment cooling actuation, initiating control room isolation, and starting the diesel generators.

2. Containment Isolation Actuation Signal

CIAS ensures acceptable mitigating actions during large and small break LOCAs and during MSLBs or feedwater line breaks (FWLBs) inside containment. CIAS is initiated by high containment pressure.

3. Containment Cooling Actuation Signal

CCAS mitigates containment overpressurization when required by either a manual CCAS actuation or an automatic SIAS Function.

4. Recirculation Actuation Signal

At the end of the injection phase of a LOCA, the refueling water storage tank (RWST) will be nearly empty. Continued cooling must be provided by the ECCS to remove decay heat. The source of water for the ECCS pumps is automatically switched to the containment recirculation sump. Switchover from RWST to containment sump must occur before the RWST empties to prevent damage to the ECCS pumps and a loss of core cooling capability. For similar reasons, switchover must not occur before there is sufficient water in the containment sump to support pump suction. Furthermore, early switchover must not occur to ensure sufficient borated water is injected from the RWST to ensure the reactor remains shut down in the recirculation mode. An RWST Level--Low signal initiates the RAS.

(continued)

APPLICABLE SAFETY ANALYSES (continued)

5. Containment Spray Actuation Signal

automatic SIAS

CSAS actuates containment spray, preventing containment overpressurization during large break LOCAs, small break LOCAs, and MSLBs or FWLBs inside containment. CSAS is initiated by high high containment pressure and a coincident. This configuration reduces the likelihood of inadvertent containment spray.

6. Main Steam Isolation Signal

MSIS ensures acceptable consequences during an MSLB either inside or outside containment or FWLB (between the steam generator and the main feedwater check valve). MSIS isolates both steam generators if either generator indicates a low pressure condition. This prevents an excessive rate of heat extraction and subsequent cooldown of the RCS during these events.

7, 8. Emergency Feedwater Actuation Signal

EFAS consists of two steam generator (SG) specific signals (EFAS-1 and EFAS-2). EFAS-1 initiates emergency feed to SG #1, and EFAS-2 initiates emergency feed to SG #2.

EFAS maintains a secondary heat sink during any event resulting in low steam generator water level.

EFAS logic maintains a ~~steam generator~~ secondary heat sink during ~~a steam generator tube rupture event and~~ an MSLB or FWLB event either inside or outside containment. by selectively feeding the unaffected or least affected steam generator. Low steam generator water level initiates emergency feed to the affected steam generator, providing the generator is not identified (by the circuitry) as faulted (an MSLB or FWLB).

EFAS logic includes steam generator specific inputs from the Steam Generator Pressure – Low bistable comparator (also used in MSIS) and the SG Pressure Difference – High (SG #1 > SG #2 or SG #2 > SG #1, bistable comparators) to determine if a rupture in either generator has occurred.

Rupture is assumed if the affected generator has a low pressure condition, unless that generator is

(continued)

BASES

APPLICABLE SAFETY ANALYSES

7, 8. Emergency Feedwater Actuation Signal (continued)

significantly higher in pressure than the other generator. This latter feature allows feeding the intact steam generator even if both are below the MSIS setpoint, while preventing the ruptured generator from being fed. Not feeding a ruptured generator prevents containment overpressurization during the analyzed events.

The ESFAS satisfies Criterion 3 of the NRC Policy Statement.

LCO

The LCO requires all channel components necessary to provide an ESFAS actuation to be OPERABLE.

The requirements for each Function are listed below. The reasons for the applicable MODES for each Function are addressed under APPLICABILITY.

1. Safety Injection Actuation Signal

Automatic SIAS is required ~~to initiate~~ for automatic initiation of CCAS and CSAS. Automatic SIAS occurs in Pressurizer Pressure — Low or Containment Pressure — High and is explained in Bases 3.3.5.

a. Manual Trip

This LCO requires two channels of SIAS Manual Trip to be OPERABLE in MODES 1, 2, 3, and 4.

b. Matrix Logic

This LCO requires six channels of SIAS Matrix Logic to be OPERABLE in MODES 1, 2, and 3.

c. Initiation Logic

This LCO requires four channels of SIAS Initiation Logic to be OPERABLE in MODES 1, 2, 3, and 4.

(continued)

LCO
(continued)

d. Actuation Logic

This LCO requires two channels of SIAS Actuation Logic to be OPERABLE in MODES 1, 2, 3, and 4.

2. Containment Isolation Actuation Signal

For Containment Pressure—High, the SIAS and CIAS share the same ~~input~~ measurement channels, bistables, and matrices and matrix relays. The remainder of the initiation channels, the manual channels, and the Actuation Logic are separate. Since their applicability is also the same, they have identical actions.

a. Manual Trip

This LCO requires two channels of CIAS Manual Trip ~~or two channels of SIAS Manual Trip~~ to be OPERABLE in MODES 1, 2, 3, and 4.

b. Matrix Logic

This LCO requires six channels of CIAS Matrix Logic to be OPERABLE in MODES 1, 2, and 3.

c. Initiation Logic

This LCO requires four channels of CIAS Initiation Logic to be OPERABLE in MODES 1, 2, 3, and 4.

d. Actuation Logic

This LCO requires two channels of CIAS Actuation Logic to be OPERABLE in MODES 1, 2, 3, and 4.

3. Containment Cooling Actuation Signal

The CCAS Function ~~can~~ will be ~~manually~~ automatically actuated on an automatic SIAS. It can also be manually actuated using two channels of CCAS push buttons, configured similarly to all other ESFAS Manual Trips except for RAS. CCAS therefore shares the SIAS

(continued)

BASES

LCO

3. Containment Cooling Actuation Signal (continued)

~~sensor~~ measurement channels, bistables, coincidence matrices, and matrix relays. It has separate manual channels and Actuation Logic.

a. Manual Trip

This LCO requires two channels of CCAS Manual Trip ~~or SIAS Manual Trip~~ to be OPERABLE in MODES 1, 2, 3, and 4.

b. Automatic SIAS

This LCO requires four channels of Automatic SIAS input to CCAS to be OPERABLE in MODES 1, 2, and 3, as described in the following Matrix Logic and Initiation Logic sections.

c. Matrix Logic

This LCO requires six channels of SIAS Matrix Logic to be OPERABLE in MODES 1, 2, and 3.

d ~~b~~. Initiation Logic

This LCO requires four channels of CCAS Initiation Logic to be OPERABLE in MODES 1, 2, 3, and 4.

Four channels of SIAS Initiation Logic are also required in MODES 1, 2, and 3. Failure of any channel of SIAS Initiation Logic may disable the corresponding channels of CCAS Initiation Logic.

e ~~c~~. Actuation Logic

This LCO requires two channels of CCAS Actuation Logic to be OPERABLE in MODES 1, 2, 3, and 4.

4. Recirculation Actuation Signal

a. Matrix Logic

This LCO requires six channels of RAS Matrix Logic to be OPERABLE in MODES 1, 2, ~~and~~ 3, and 4.

b. Initiation Logic

This LCO requires ~~two~~ four channels of RAS Initiation Logic to be OPERABLE in MODES 1, 2, 3, and 4.

c. Actuation Logic

This LCO requires two channels of RAS Actuation Logic to be OPERABLE in MODES 1, 2, 3, and 4.

5. Containment Spray Actuation Signal

CSAS is initiated either manually or automatically. For an automatic actuation it is necessary to have a

(continued)

LCO

5. Containment Spray Actuation Signal (continued)

Containment Pressure — High High signal, coincident with an automatic SIAS. The SIAS requirement should always be satisfied on a legitimate CSAS, since the Containment Pressure — High signal used in the SIAS will initiate before the Containment Pressure — High High input signal to CSAS. This ensures that a CSAS will not initiate unless required.

a. Manual Trip

This LCO requires two channels of CSAS Manual Trip to be OPERABLE in MODES 1, 2, and 3.

b. Automatic SIAS (Function 1)

This LCO requires four channels of Automatic SIAS input to CSAS to be OPERABLE in MODES 1, 2, and 3~~.~~ as described in the following Matrix Logic and Initiation Logic sections.
The Automatic SIAS occurs on Pressurizer Pressure — Low or Containment Pressure — High and is explained above.

c. Matrix Logic

This LCO requires six channels of CSAS Matrix Logic and Six channels of SIAS Matrix Logic to be OPERABLE in MODES 1, 2, and 3. Failure of one channel in one functions matrices will not be assumed to disable the corresponding channel in the other functions matrices.

d. Initiation Logic

This LCO requires four channels of CSAS Initiation Logic and four channels of SIAS Initiation Logic to be OPERABLE in MODES 1, 2, and 3. Failure of one channel of SIAS Initiation Logic may disable the corresponding channel of CSAS Initiation Logic.

e. Actuation Logic

This LCO requires two channels of CSAS Actuation Logic to be OPERABLE in MODES 1, 2, and 3.

(continued)

BASES

APPLICABILITY (continued)

- Actuate emergency feedwater to preclude the loss of the steam generators as a heat sink (in the event the normal feedwater system is not available);
- Actuate ESF systems to prevent or limit the release of fission product radioactivity to the environment by isolating containment and limiting the containment pressure from exceeding the containment design pressure during a design basis LOCA or MSLB; and
- Actuate ESF systems to ensure sufficient borated inventory to permit adequate core cooling and reactivity control during a design basis LOCA or MSLB accident.

In MODES 4, 5, and 6, automatic actuation of these Functions is not required because adequate time is available to evaluate plant conditions and respond by manually operating the ESF components if required.

ESFAS ~~Manual Trip~~ actuation capability is required in MODE 4 for SIAS, CIAS, CCAS, and RAS even though automatic actuation is not required for SIAS, CIAS, or CCAS. Because of the large number of components actuated by these Functions, ESFAS actuation is simplified by the use of the Manual Trip push buttons for SIAS, CIAS, and CCAS functions. The RAS function requires automatic actuation capability in MODE 4 and does not have manual trip pushbuttons.

CSAS, MSIS, and EFAS have relatively few components, which can be actuated individually if required in MODE 4, and the systems may be disabled or reconfigured, making system level Manual Trip impossible and unnecessary.

The ESFAS logic must be OPERABLE in the same MODES as the automatic and Manual Trip. In MODE 4, only the portion of the SIAS, CIAS, and CCAS functions ESFAS logic responsible for the required Manual Trip must be OPERABLE.

In MODES 5 and 6, the systems initiated by ESFAS are either reconfigured or disabled for shutdown cooling operation. Accidents in these MODES are slow to develop and would be mitigated by manual operation of individual components.

ACTIONS

When the number of inoperable channels in a trip Function exceeds those specified in any related Condition associated with the same trip Function, then the plant is outside the

(continued)

ACTIONS (continued)

safety analysis. Therefore, LCO 3.0.3 should be entered immediately, if applicable in the current MODE of operation.

A Note has been added to the ACTIONS to clarify the application of the Completion Time rules. The Conditions of this Specification may be entered independently for each Function. The Completion Time for the inoperable channel of a Function will be tracked separately for each Function, starting from the time the Condition was entered for that Function.

A.1

Condition A applies if one Matrix Logic channel is inoperable. Since matrix power supplies in a given matrix (e.g., AB, BC, etc.) are common to all ESFAS Functions, a single matrix power supply failure may affect more than one matrix, but not more than one matrix per function.
Failures of individual bistables and their relays are considered measurement channel failures. This section describes failures of the Matrix Logic not addressed in the above, such as the failure of matrix relay power supplies, or the failure of the trip channel bypass contact in the bypass condition. Loss of a single vital bus will de-energize one of the two power supplies in each of three matrices. This will result in two initiation circuits de-energizing, reducing the ESFAS Actuation Logic to a one-out-of-two logic in both trains.

This Condition has been modified by a Note stating that for the purposes of this LCO, de-energizing up to three matrix power supplies due to a single failure, such as loss of a vital instrument bus, is to be treated as a single matrix channel failure, providing the affected matrix relays de-energize as designed. Although each of the six matrices within an ESFAS Function uses separate power supplies, the matrices for the different ESFAS Functions share power supplies. Thus, failure of a matrix power supply may force entry into the Condition specified for each of the affected ESFAS Functions.

The channel must be restored to OPERABLE status within 48 hours. This provides the operator with time to take appropriate actions and still ensures that any risk involved in operating with a failed channel is acceptable. Operating

(continued)

ACTIONS

C.1 and C.2 (continued)

satisfying the Required Action to open at least one set of contacts in the affected trip leg. Indefinite operation in this condition is prohibited because of the difficulty of ensuring the contacts remain open under all conditions. Thus, the channel must be restored to OPERABLE status within 48 hours. This provides the operator with time to take appropriate actions and still ensures that any risk involved in operating with a failed channel is acceptable. Operating experience has demonstrated that the probability of a random failure of a second channel is low during any given 48 hour period. If the channel cannot be restored to OPERABLE status with 48 hours, Condition E or Condition F, as appropriate, is entered.

Of greater concern is the failure of the initiation circuit in a nontrip condition, e.g., due to two initiation relay failures. With one failed, there is still the redundant contact in the trip leg of each Actuation Logic. With both failed in a nontrip condition, the ESFAS Function is lost in the affected train. To prevent this, opening of at least one contact in the affected trip leg is required. If the required contact has not opened, as indicated by annunciation or trip leg current lamps, Manual Trip of the affected trip leg contacts may be attempted. Caution must be exercised, since depressing the wrong ESFAS push buttons may result in an ESFAS actuation.

INSERT #3

D.1

Condition D applies to Actuation Logic.

With one Actuation Logic channel inoperable, automatic actuation of one train of ESF may be inhibited. The remaining train provides adequate protection in the event of Design Basis Accidents, but the single failure criterion may be violated. For this reason operation in this condition is restricted.

The channel must be restored to OPERABLE status within 48 hours. Operating experience has demonstrated that the probability of a random failure in the Actuation Logic of the second train is low during a given 48 hour period.

(continued)

INSERT #3

For the EFAS function only, the contact opened must be in series with the Interposing relay. This will cause the cycling valve actuated by that relay to go to the open position and remain there, and will cause a contact to open in series with the subgroup relays. Opening only the contact in series with the subgroup relays would preserve the ability to deenergize the subgroup relays, but would leave the cycling valve unable to go to the EFAS actuated position.

With one EFAS cycling valve held open by a deenergized EFAS Interposing relay, an MSIS actuation will not be able to take that cycling valve to its MSIS actuated position (closed). Other MSIS actuated valves will prevent feeding the affected steam generator, but there will only be single valve isolation. This single valve isolation is acceptable for the short period of time allowed to restore the channel.

ACTIONS

D.1 (continued)

Failure of a single Initiation Logic channel, matrix channel power supply, or vital instrument bus may open one or both contacts in the same trip leg in both Actuation Logic channels. For the purposes of this Specification, the Actuation Logic is not inoperable. This obviates the need to enter LCO 3.0.3 in the event of a vital bus, matrix, or initiation channel failure.

Required Action D.1 is modified by a Note to indicate that one channel of Actuation Logic may be bypassed for up to 1 hour for Surveillance, provided the other channel is OPERABLE.

This allows performance of a PPS CHANNEL FUNCTIONAL TEST on an OPERABLE ESFAS train without generating an ESFAS actuation in the inoperable train.

E.1 and E.2

If the Required Actions and associated Completion Times of Conditions for MSIS, CSAS or EFAS cannot be met, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 4 within 12 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

F.1 and F.2

If the Required Actions and associated Completion Times for SIAS, CIAS, RAS, ~~CSAS,~~ or CCAS are not met, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.6.1

A CHANNEL FUNCTIONAL TEST is performed every 92 days to ensure the entire channel will perform its intended function when needed.

The CHANNEL FUNCTIONAL TEST is part of an overlapping test sequence similar to that employed in the RPS. This sequence, consisting of SR 3.3.5.2, SR 3.3.6.1, and SR 3.3.6.2, tests the entire ESFAS from the bistable input through the actuation of the individual subgroup relays. These overlapping tests are described in Reference 1. SR 3.3.5.2 and SR 3.3.6.1 are normally performed together and in conjunction with ESFAS testing. SR 3.3.6.2 verifies that the subgroup relays are capable of actuating their respective ESF components when de-energized.

These tests verify that the ESFAS is capable of performing its intended function, from bistable input through the actuated components. SR 3.3.5.2 is addressed in LCO 3.3.5. SR 3.3.6.1 includes Matrix Logic tests and trip path (Initiation Logic) tests.

Matrix Logic Tests

These tests are performed one matrix at a time. They verify that a coincidence in the two input channels for each function removes power to the matrix relays. During testing, holding power is applied to the matrix relay test coils, preventing the matrix relay contacts from assuming their de energized state. The Matrix Logic tests will detect any short circuits around the bistable contacts in the coincidence logic, such as may be caused by faulty bistable relay or trip channel bypass contacts.

Trip Path (Initiation Logic) Tests

These tests are similar to the Matrix Logic tests, except that test power is withheld from one matrix relay at a time, allowing the initiation circuit to de-energize, opening one contact in each Actuation Logic channel.

The initiation circuit lockout relay must be reset (except for EFAS, which lacks initiation circuit lockout relays) prior to testing the other three initiation circuits, or an ESFAS actuation may result.

(continued)

SURVEILLANCE REQUIREMENTS

Trip Path (Initiation Logic) Tests (continued)

Automatic Actuation Logic operation is verified during Initiation Logic testing by verifying that current is interrupted in each trip leg in the selective two-out-of-four actuation circuit logic whenever the initiation relay is de-energized. A Note is added to indicate that testing of Actuation Logic shall include verification of the proper operation of each initiation relay.

The Frequency of 92 days is based on the reliability analysis presented in topical report CEN-327, "RPS/ESFAS Extended Test Interval Evaluation" (Ref. 2).

SR 3.3.6.2

The Subgroup Relay Test of each Actuation Logic channel tests only the individual subgroup relays,

Individual ESFAS subgroup relays must ~~also~~ be tested, one at a time, to verify the individual ESFAS components will actuate when required. Proper operation of the individual subgroup relays is verified by de-energizing each relay in response to a test signal, ~~energizes in response to a reset signal, and at least~~ one connected component or pair of contacts is observed to actuate when the relay deenergizes.

energizing the relay by releasing the test signal and verifying at least

The 184 day Frequency is based on operating experience and ensures individual relay problems can be detected within this time frame. The actual justification is based on CEN-403, "Relaxation of Surveillance Test Interval for ESFAS Subgroup Relay Testing" (Ref. 3).

Some components cannot be tested at power since their actuation might lead to plant trip or equipment damage. Reference 1 lists those relays exempt from testing at power, with an explanation of the reason for each exception. Relays not tested at power must be tested in accordance with the Note to this SR.

SR 3.3.6.3

A CHANNEL FUNCTIONAL TEST is performed on the manual ESFAS actuation circuitry, de-energizing relays and providing manual actuation of the function.

(continued)

BASES

This test verifies that the manual trip push buttons are capable of opening contacts in the Actuation Logic as designed. The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown these components usually pass the Surveillance when performed at a Frequency of once every 24 months.

REFERENCES

1. SONGS Units 2 and 3 UFSAR, Section 7.3.
2. CEN-327, May 1986, including Supplement 1, March 1989.
3. CEN-403.

B 3.3 INSTRUMENTATION

B 3.3.7 Diesel Generator (DG) – Loss of Voltage Start (LOVS)

BASES

BACKGROUND

The DGs provide a source of emergency power when offsite power is either unavailable or insufficiently stable to allow safe unit operation. Undervoltage protection will generate a LOVS in the event a Loss of Voltage or Degraded Voltage condition occurs. There are two LOVS Functions for each 4.16 kV vital bus.

Four undervoltage relays with inverse time characteristics are provided on each 4.16 kV Class 1E instrument bus for the purpose of detecting a loss of bus voltage. Four undervoltage relays with definite time characteristics are provided for the purpose of detecting a sustained degraded voltage condition. The relays are combined in a two-out-of-four logic to generate a LOVS if the voltage is below 75% for a short time or below 90% for a long time. The LOVS initiated actions are described in "Onsite Power Systems" (Ref. 1).

Trip Setpoints and Allowable Values

The trip setpoints and Allowable Values are based on the analytical limits presented in "Accident Analysis," Reference 2. The selection of these 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, and instrument drift, Allowable Values ~~specified in Figure 3.3.7-1~~ are conservatively adjusted with respect to the analytical limits. The actual nominal trip setpoint is normally still more conservative than that required by the plant specific setpoint calculations. If the measured trip setpoint does not exceed the documented Surveillance acceptance criteria, the undervoltage relay is considered OPERABLE.

Setpoints in accordance with the Allowable Values will ensure that the consequences of accidents will be acceptable, providing the plant is operated from within the LCOs at the onset of the accident and the equipment functions as designed.

(continued)

ACTIONS
(continued)

Note 1 was added to ensure review by the Onsite Review Committee is performed to discuss the desirability of maintaining the channel in the bypassed condition.

A.1 and A.2

Condition A applies if one channel is inoperable for one Function per DG bus.

If the channel cannot be restored to OPERABLE status, the affected channel should either be bypassed or tripped within 1 hour (Required Action A.1).

Placing this channel in either Condition ensures that logic is in a known configuration. In trip, the LOVS Logic is one-out-of-three. In bypass, the LOVS Logic is two-out-of-three,3 ~~and interlocks prevent bypass of a second channel for the affected Function~~. The 1 hour Completion Time is sufficient to perform these Required Actions.

Once Required Action A.1 has been complied with, Required Action A.2 allows prior to entering MODE 2 following the next MODE 5 entry to repair the inoperable channel. If the channel cannot be restored to OPERABLE status, the plant cannot enter MODE 2 following the next MODE 5 entry. The time allowed to repair or trip the channel is reasonable to repair the affected channel while ensuring that the risk involved in operating with the inoperable channel is acceptable. The prior to entering MODE 2 following the next MODE 5 entry Completion Time is based on adequate channel independence, which allows a two-out-of-three channel operation since no single failure will cause or prevent a reactor trip.

B.1 and B.2

Condition B applies if two channels are inoperable for one Function.

The Required Action is modified by a Note stating that LCO 3.0.4 is not applicable. The Note was added to allow the changing of MODES even though two channels are inoperable, with one channel bypassed and one tripped. In this configuration, the protection system is in a

(continued)

ACTIONS

B.1 and B.2 (continued)

one-out-of-two logic, which is adequate to ensure that no random failure will prevent protection system operation.

If the channel cannot be placed in bypass or trip within 1 hour, the Conditions and Required Actions for the associated DG made inoperable by DG – LOVS instrumentation are required to be entered. Alternatively, one affected channel is required to be bypassed and the other is tripped, in accordance with Required Action B.2. This places the Function in one-out-of-two logic. The 1 hour Completion Time is sufficient to perform the Required Actions.

One of the two inoperable channels will need to be restored to OPERABLE status prior to the next required CHANNEL FUNCTIONAL TEST because channel surveillance testing on an OPERABLE channel requires that the OPERABLE channel be placed in bypass. However, it is not ~~possible~~ allowed to bypass more than one DG – LOVS channel, and placing a second channel in trip will result in a loss of voltage diesel start signal. Therefore, if one DG – LOVS channel is in trip and a second channel is in bypass, a third inoperable channel would place the unit in LCO 3.0.3.

After one channel is restored to OPERABLE status, the provisions of Condition A still apply to the remaining inoperable channel.

C.1

Condition C applies when more than two undervoltage or Degraded Voltage channels on a single bus are inoperable.

Required Action C.1 requires all but two channels to be restored to OPERABLE status within 1 hour. With more than two channels inoperable, the logic is not capable of providing the DG – LOVS signal for valid Loss of Voltage or Degraded Voltage conditions. The 1 hour Completion Time is reasonable to evaluate and take action to correct the degraded condition in an orderly manner and takes into account the low probability of an event requiring LOVS occurring during this interval.

(continued)

BASES

LCO (continued)

b. Airborne Radiation and Containment Area Radiation

The LCO on the radiation channels requires that each channel be OPERABLE for each Actuation Logic channel, since they are not totally redundant to each other.

The trip setpoint of twice background is selected to allow detection of small deviations from normal. The absolute value of the trip setpoint in MODES 5 and 6 differs from the setpoint in MODES 1, 2, 3, and 4 so that a fuel handling accident can be detected in the lower background radiation expected in ~~these~~ MODES. 6 ~~Only~~ The Containment Area Radiation channels are credited with being OPERABLE During MODE 6. The Airborne Radiation Channels are not required during mode 6.

c. Actuation Logic

One channel of Actuation Logic is required, since the valves can be shut independently of the CPIS signal either manually from the control room or using either the SIAS or CIAS push button.

APPLICABILITY

In MODES 1, 2, 3, and 4, the minipurge valves may be open. In these MODES, it is necessary to ensure the valves will shut in the event of a primary leak in containment whenever any of the containment purge valves are open.

With the purge valves open during CORE ALTERATIONS or movement of irradiated fuel assemblies within containment, a fuel handling accident would require CPIS on high radiation in containment.

The APPLICABILITY is modified by a Note, which states that the CPIS Specification is only required when the penetration is not isolated by at least one closed and de-activated automatic valve, closed manual valve, or blind flange.

(continued)

LCO (continued)

b. Airborne Radiation and Containment Area Radiation

one

The LCO on the radiation channels requires that ~~each~~ channel be OPERABLE for each Actuation Logic channel ~~since they are not totally redundant to each other~~.

The trip setpoint of twice background is selected to allow detection of small deviations from normal. The absolute value of the trip setpoint in MODES 5 and 6 differs from the setpoint in MODES 1, 2, 3, and 4 so that a fuel handling accident can be detected in the lower background radiation expected in these MODES.

c. Actuation Logic

One channel of Actuation Logic is required, since the valves can be shut independently of the CPIS signal either manually from the control room or using either the SIAS or CIAS push button.

APPLICABILITY

In MODES 1, 2, 3, and 4, the minipurge valves may be open. In these MODES, it is necessary to ensure the valves will shut in the event of a primary leak in containment whenever any of the containment purge valves are open.

With the purge valves open during CORE ALTERATIONS or movement of irradiated fuel assemblies within containment, a fuel handling accident would require CPIS on high radiation in containment.

The APPLICABILITY is modified by a Note, which states that the CPIS Specification is only required when the penetration is not isolated by at least one closed and de-activated automatic valve, closed manual valve, or blind flange.

(continued)

This test verifies that the trip push buttons are capable of opening contacts in the Actuation Logic as designed,

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.9.5 (continued)

de-energizing the initiation relays and providing Manual Trip of the function. The 18 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown these components usually pass the Surveillance when performed at a Frequency of once every 18 months.

REFERENCES

1. SONGS Units 2 and 3 UFSAR, Chapter 15.
2. PPS Selection of Trip Valves Document.
3. 10 CFR 50, Appendix A, GDC 19.

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add

B 3.3 INSTRUMENTATION

B 3.3.10 Fuel Handling Isolation Signal (FHIS)

BASES

BACKGROUND

This LCO encompasses FHIS actuation, which is a plant specific instrumentation channel that performs an actuation Function required for plant protection but is not otherwise included in LCO 3.3.6, "Engineered Safety Features Actuation System (ESFAS) Logic and Manual Trip," or LCO 3.3.7, "Diesel Generator (DG) – Loss of Voltage Start (LOVS)." This is a non-Nuclear Steam Supply System ESFAS Function that, because of differences in purpose, design, and operating requirements, is not included in LCO 3.3.6 and LCO 3.3.7.

The FHIS provides protection from radioactive contamination in the spent fuel pool area in the event that a spent fuel element ruptures during handling.

The FHIS will detect radioactivity from fission products in the fuel and will initiate appropriate actions so the release to the environment is limited. More detail is provided in Reference 1.

The FHIS includes two independent, redundant subsystems, including actuation trains. Each train employs a separate sensor to detect gaseous activity. Since the two sensors detect different types of activity, they are not considered redundant to each other. However, since there is a separate sensor in each train, the trains are redundant. If the bistable monitoring the sensor indicates an unsafe condition, that train will be actuated (one-out-of-two logic). The two trains actuate separate equipment.

<u>Trip Setpoints and Allowable Values</u>

Trip setpoints used in the bistables are based on the analytical limits (Ref. 2). The selection of these 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, and instrument drift, Allowable Values specified in LCO 3.3.10 are conservatively adjusted with respect to the analytical limits. A detailed description of the methodology used to calculate the trip

(continued)

BACKGROUND

Trip Setpoints and Allowable Values (continued)

setpoints, including their explicit uncertainties, is provided in "Plant Protection System Selection of Trip Setpoint Values" (Ref. 3). The actual nominal trip setpoint entered into the bistable is normally still more conservative than that specified by the Allowable Value to account for changes in random measurement errors detectable by a CHANNEL FUNCTIONAL TEST. One example of such a change in measurement error is drift during the surveillance interval. If the measured setpoint does not exceed the Allowable Value, the bistable is considered OPERABLE.

Setpoints in accordance with the Allowable Value will ensure the consequences of Design Basis Accidents will be acceptable, providing the plant is operated from within the LCOs at the onset of the accident and the equipment functions as designed.

APPLICABLE SAFETY ANALYSES

The FHIS is required to isolate the normal Fuel Handling Building Post Accident Cleanup (PACU) System and automatically initiate the recirculation and filtration systems in the event of the fuel handling accident in the fuel handling building, as described in Reference 2. The FHIS helps ensure acceptable consequences for the dropping of a spent fuel bundle breaching up to 60 fuel pins.

The FHIS satisfies the requirements of Criterion 3 of the NRC Policy Statement.

LCO

LCO 3.3.10 requires one channel of FHIS to be OPERABLE. The required channel consists of Actuation Logic, Manual Trip, and gaseous radiation monitor. The specific Allowable Values for the setpoints of the FHIS are listed in the SRs.

Only the Allowable Values are specified for each trip Function in the SRs. Operation with a trip setpoint less conservative than the nominal trip setpoint, but within its Allowable Value, is acceptable, provided that the difference between the nominal trip setpoint and the Allowable Value is

(continued)

BASES

LCO
(continued)

equal to or greater than the drift allowance assumed for each trip in the transient and accident analyses.

The Allowable Value specified is more conservative than the analytical limit assumed in the transient and accident analysis in order to account for instrument uncertainties appropriate to the trip Function. These uncertainties are defined in the "Plant Protection System Selection of Trip Setpoint Values" (Ref. 3).

The Bases for the LCO on the FHIS are discussed below for each Function:

a. <u>Manual Trip</u>

The LCO on Manual Trip ensures that the FHIS Function can easily be initiated if any parameter is trending rapidly toward its setpoint. Components can be actuated independently of the FHIS. Both available channels are required to ensure a single failure will not disable automatic initiation capability.

b. <u>Airborne Radiation</u>

The LCO on the two Airborne Radiation channels requires that each channel be OPERABLE for the required Actuation Logic channel, since they are not redundant to each other.

c. <u>Actuation Logic</u>

Two channels of Actuation Logic are required to be OPERABLE to ensure no single random failure can prevent automatic actuation.

APPLICABILITY

One FHIS channel is required to be OPERABLE during movement of irradiated fuel in the fuel building. The FHIS isolates the fuel building area in the event of a fuel handling accident.

ACTIONS

An FHIS channel is inoperable when it does not satisfy the OPERABILITY criteria for the channel's function. The most

(continued)

BASES

ACTIONS (continued)

common cause of channel inoperability is outright failure or drift of the bistable or process module sufficient to exceed the tolerance allowed by the plant specific setpoint analysis. Typically, the drift is not large and would result in a delay of actuation rather than a total loss of function. This determination is generally made during the performance of a CHANNEL FUNCTIONAL TEST when the process instrument is set up for adjustment to bring it within specification. If the trip setpoint is not consistent with the Allowable Value in LCO 3.3.10, the channel must be declared inoperable immediately and the appropriate Conditions must be entered.

In the event a channel's trip setpoint is found nonconservative with respect to the Allowable Value, or the sensor, instrument loop, signal processing electronics, or bistable is found inoperable, then all affected Functions provided by that channel are required to be declared inoperable and the LCO Condition entered for the particular protective function affected.

A.1 and A.2

Condition A applies to FHIS Manual Trip, Actuation Logic, and required gaseous radiation monitor inoperable during movement of irradiated fuel in the fuel handling building.

The Required Actions are to restore required channels to OPERABLE status, or place one OPERABLE PACU train in operation, or suspend movement of irradiated fuel in the fuel building. These Required Actions are required to be completed immediately. The Completion Time accounts for the higher likelihood of releases in the fuel building during fuel handling.

SURVEILLANCE REQUIREMENTS

SR 3.3.10.1

Performance of the CHANNEL CHECK once every 12 hours ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is 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.

(continued)

SURVEILLANCE REQUIRMENTS

SR 3.3.10.1 (continued)

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. 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 by the plant staff based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the match criteria, it may be an indication that the transmitter or the signal processing equipment has drifted outside its limit.

The Frequency, about once every shift, is based on operating experience that demonstrates the rarity of channel failure. Thus, performance of the CHANNEL CHECK guarantees that undetected overt channel failure is limited to 12 hours. Since the probability of two random failures in redundant channels in any 12 hour period is low, the CHANNEL CHECK minimizes the chance of loss of protective function due to failure of redundant channels. The CHANNEL CHECK supplements less formal, but more frequent, checks of channel OPERABILITY during normal operational use of the displays associated with the LCO required channels.

SR 3.3.10.2

A CHANNEL FUNCTIONAL TEST is performed on the required fuel building radiation monitoring channel to ensure the entire channel will perform its intended function.

The setpoint shall be left set consistent with the assumptions of the current plant specific setpoint analysis.

The Frequency of 92 days is based on plant operating experience with regard to channel OPERABILITY and drift, which demonstrates that failure of more than one channel of a given Function in any 92 day Frequency is a rare event.

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.10.3

Proper operation of the individual initiation relays is verified by actuating these relays during the CHANNEL FUNCTIONAL TEST of the Actuation Logic every 18 months. This will actuate the Function, operating all associated equipment. Proper operation of the equipment actuated by each train is thus verified. The Frequency of 18 months is based on plant operating experience with regard to channel OPERABILITY and drift, which demonstrates that failure of more than one channel of a given Function during any 18 month Frequency is a rare event.

A Note to the SR indicates that this Surveillance includes verification of operation for each initiation relay.

SR 3.3.10.4

Every 18 months, a CHANNEL FUNCTIONAL TEST is performed on the FHIS Manual Trip channel.

This Surveillance verifies that the trip push buttons are capable of opening contacts in the Actuation Logic as designed, de-energizing the initiation relays and providing Manual Trip of the Function. Operating experience has shown these components usually pass the Surveillance when performed at a Frequency of once every 18 months.

SR 3.3.10.5

CHANNEL CALIBRATION is a complete check of the instrument channel including the sensor. The Surveillance verifies that the channel responds to a measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drift between successive calibrations to ensure that the channel remains operational between successive tests. Measurement error determination, setpoint error determination, and calibration adjustment must be performed consistent with the plant specific setpoint analysis. The channel shall be left calibrated consistent with the assumptions of the current plant specific setpoint analysis.

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.10.5 (continued)

As found and as left channel calibration values are recorded. If the as found calibration is outside its Allowable Value, the plant specific setpoint analysis may be revised as appropriate, if the history of this setpoint and all other pertinent information indicate a need for setpoint revision. The setpoint analysis shall be revised before the next time this channel is calibrated.

The Frequency is based upon the assumption of an 24 month calibration interval for the determination of the magnitude of equipment drift in the setpoint analysis.

REFERENCES

1. SONGS Units 2 and 3 UFSAR, Chapter 9.
2. SONGS Units 2 and 3 UFSAR, Chapter 15.
3. "Plant Protection System Selection of Trip Setpoint Values."

LCO (continued)

2, 3. Reactor Coolant System (RCS) Hot and Cold Leg Temperature

RCS Hot and Cold Leg Temperatures are Category I variables provided for verification of core cooling and long term surveillance.

Reactor outlet temperature inputs to the PAMI are provided by two fast response resistance elements and associated transmitters in each loop. ~~The channels provide indication over a range of 32°F to 700°F.~~

4. Reactor Coolant System Pressure (wide range)

RCS Pressure (wide range) is a Category I variable, provided for verification of core cooling and RCS integrity long term surveillance.

~~Wide range RCS loop pressure is measured by pressure transmitters with a span of 0 psig to 3000 psig~~. The pressure transmitters are located inside the containment. Redundant monitoring capability is provided by two trains of instrumentation.

Operator actions to maintain a controlled cooldown, such as adjusting steam generator pressure or level, would use this indication. Furthermore, RCS pressure is one factor that may be used in decisions to terminate reactor coolant pump operation.

5. Reactor Vessel Water Level

Reactor Vessel Water Level is provided for verification and long term surveillance of core cooling.

The Reactor Vessel Water Level Monitoring System provides a direct measurement of the collapsed liquid level above the fuel alignment plate. The collapsed level represents the amount of liquid mass that is in the reactor vessel above the core.

(continued)

LCO

5. Reactor Vessel Water Level (continued)

Measurement of the collapsed water level is selected because it is a direct indication of the water inventory. The collapsed level is obtained over the same temperature and pressure range as the saturation measurements, thereby encompassing all operating and accident conditions where it must function. Also, it functions during the recovery interval. Therefore, it is designed to survive the high steam temperature that may occur during the preceding core recovery interval.

The level range extends from the top of the vessel down to the top of the fuel alignment plate. The response time is short enough to track the level during small break LOCA events. The resolution is sufficient to show the initial level drop, the key locations near the hot leg elevation, and the lowest levels just above the alignment plate. This provides the operator with adequate indication to track the progression of the accident and to detect the consequences of its mitigating actions or the functionality of automatic equipment.

A channel is eight sensors in a probe. A channel is OPERABLE if four or more sensors, one sensor in the upper head and three sensors in the lower ~~head~~ plenum are OPERABLE.

6. Containment Sump Water Level (wide range)

Containment Sump Water Level is provided for verification and long term surveillance of RCS integrity.

7. Containment Pressure (wide range)

Containment Pressure is provided for verification of RCS and containment OPERABILITY.

(continued)

LCO
(continued)

11. Pressurizer Level

Pressurizer Level is used to determine whether to terminate safety injection (SI), if still in progress, or to reinitiate SI if it has been stopped. Knowledge of pressurizer water level is also used to verify the plant conditions necessary to establish natural circulation in the RCS and to verify that the plant is maintained in a safe shutdown condition.

12. Steam Generator Water Level

Steam Generator Water Level is provided to monitor operation of decay heat removal via the steam generators. The Category I indication of steam generator level is the wide range level instrumentation. Temperature compensation of this indication is performed manually by the operator. Redundant monitoring capability is provided by two trains of instrumentation.

Operator action is based on the control room indication of Steam Generator Water Level. The RCS response during a design basis small break LOCA is dependent on the break size. For a certain range of break sizes. the boiler condenser mode of heat transfer is necessary to remove decay heat. Wide range level is a Type A variable because the operator must manually raise and control the steam generator 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.

13. Condensate Storage Tank (CST) Level

CST Level is provided to ensure water supply for AFW. The CST provides the ensured, safety grade water supply for the AFW System. ~~The CST consists of two~~

(continued)

LCO 13. Condensate Storage Tank (CST) Level (continued)

~~tanks connected by a common outlet header.~~ CST Level is displayed on a control room indicator, strip chart recorder, and plant computer. In addition, a control room annunciator alarms on low level.

CST Level is considered a Type A variable because the control room meter and annunciator are considered the primary indication used by the operator. The DBAs that require AFW are the loss of electric power, steam line break (SLB), and small break LOCA. The CST is the initial source of water for the AFW System.

14, 15, 16, 17. Core Exit Temperature

Core Exit Temperature is provided for verification and long term surveillance of core cooling.

An evaluation was made of the minimum number of valid core exit thermocouples necessary for inadequate core cooling detection. The evaluation determined the complement of core exit thermocouples necessary to detect initial core recovery and trend the ensuing core heatup. The evaluations account for core nonuniformities including incore effects of the radial decay power distribution and excore effects of condensate runback in the hot legs and nonuniform inlet temperatures. Based on these evaluations, adequate or inadequate core cooling detection is ensured with two valid core exit thermocouples per quadrant.

The design of the Incore Instrumentation System includes a Type K (chromel alumel) thermocouple within each of the 56 incore instrument detector assemblies. The junction of each thermocouple is located a few inches above the fuel assembly, inside a structure that supports and shields the incore instrument

(continued)

LCO

14, 15, 16, 17. Core Exit Temperature (continued)

detector assembly string from flow forces in the outlet plenum region. These core exit thermocouples monitor the temperature of the reactor coolant as it exits the fuel assemblies.

~~The core exit thermocouples have a usable temperature range from 32°F to 2300°F, although accuracy is reduced at temperatures above 1800°F.~~

18. Auxiliary Feedwater (AFW) Flow

AFW Flow is provided to monitor operation of decay heat removal via the steam generators.

~~AFW Flow to each steam generator is determined from a differential pressure measurement calibrated to a span of 0 gpm to 800 gpm.~~ Each differential pressure transmitter provides an input to a control room indicator and the plant computer. Since the primary indication used by the operator during an accident is the control room indicator, the PAMI Specification deals specifically with this portion of the instrument channel.

AFW Flow is also used by the operator to verify that the AFW System is delivering the correct flow to each steam generator. However, the primary indication used by the operator to ensure an adequate inventory is steam generator level.

19. Containment Pressure (Narrow Range)

Containment Pressure is provided for verification of containment OPERABILITY.

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.11.2 (continued)

Agreement criteria are determined by the plant staff based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the match 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 match criteria, it is an indication that the channels are OPERABLE. If the channels are normally off scale during times when surveillance is required, the CHANNEL CHECK will only verify that they are off scale in the same direction.

Off scale low current loop channels are verified to be reading at the bottom of the range and not failed downscale.

The Frequency of 31 days is based upon plant operating experience with regard to channel OPERABILITY and drift, which demonstrates that failure of more than one channel of a given Function in any 31 day interval is a rare event. The CHANNEL CHECK supplements less formal, but more frequent, checks of channel during normal operational use of the displays associated with this LCO's required channels.

SR 3.3.11.3

A 31 day CHANNEL FUNCTIONAL TEST is required for the Containment Area Radiation Monitor only.

SR 3.3.11.4

A CHANNEL CALIBRATION is performed every ~~24~~ 18 months or approximately every refueling. CHANNEL CALIBRATION is a complete check of the instrument channel including the sensor. The Surveillance verifies the channel responds to the measured parameter within the necessary range and accuracy.

The Frequency is based upon operating experience and consistency with the typical industry refueling cycle and is justified by the assumption of an ~~24~~ 18 month calibration interval for the determination of the magnitude of equipment drift.

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.11.5

A CHANNEL CALIBRATION is performed every 24 months for the Containment Area Radiation Monitor.

REFERENCES

1. SONGS Units 2 and 3 Regulatory Guide 1.97 Instrumentation Report #90065, Rev. 0, dated October 1, 1992.
2. Regulatory Guide 1.97, Revision 2.

~~REFERENCES (continued)~~

3. NUREG-0737, Supplement 1.
4. NRC Safety Evaluation Report (SER).

BASES

APPLICABLE SAFETY ANALYSES (continued)

10 CFR 20, Appendix A, GDC 19 (Ref. 1)

The Remote Shutdown System has been identified as an important contributor to the reduction of plant accident risk and, therefore, has been retained in the Technical Specifications, as indicated in the NRC Policy Statement.

LCO

The Remote Shutdown System LCO provides the requirements for the OPERABILITY of the instrumentation necessary to place and maintain the plant in MODE 3 from a location other than the control room. The instrumentation required are listed in Table 3.3.12-1 in the accompanying LCO.

Instrumentation is required for:

- Reactivity Control (initial and long term);
- Vital Auxiliaries
- RCS Inventory Control;
- RCS Pressure Control;
- Decay Heat Removal; and
- Safety support systems for the above Functions, as well as service water, component cooling water, and onsite power including the diesel generators.

A Function of a Remote Shutdown System is OPERABLE if all instrument channels needed to support the remote shutdown Functions are OPERABLE. In some cases, Table 3.3.12-1 may indicate that the required information ~~or control capability~~ is available from several alternative sources. In these cases, the Remote Shutdown System is OPERABLE as long as one channel of any of the alternative information ~~or control sources~~ for each Function is OPERABLE.

The Remote Shutdown System instrumentation ~~and control~~ circuits covered by this LCO do not need to be energized to be considered OPERABLE. This LCO is intended to ensure that

(continued)

LCO
(continued)

the instrument ~~and control~~ circuits will be OPERABLE if plant conditions require that the Remote Shutdown System be placed in operation.

APPLICABILITY

The Remote Shutdown System LCO is applicable in MODES 1, 2, and 3. This is required so that the unit can be placed and maintained in MODE 3 for an extended period of time from a location other than the control room.

This LCO is not applicable in MODE 4, 5, or 6. In these MODES, the unit is already subcritical and in the condition of reduced RCS energy. Under these conditions, considerable time is available to restore necessary instrument ~~control~~ Functions if control room instruments or control become unavailable.

ACTIONS

A Note has been included that excludes the MODE change restrictions 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 is acceptable due to the low probability of an event requiring this system.

Note 2 has been added in the ACTIONS to clarify the application of Completion Time rules. The Conditions of this Specification may be entered independently for each Function listed in Table 3.3.12-1. The Completion Time(s) of the inoperable channel(s)/train(s) of a Function will be tracked separately for each Function starting from the time the Condition was entered for that Function.

A.1

Condition A addresses the situation where one or more functions of the Remote Shutdown System are inoperable. This includes any Function listed in Table 3.3.12-1 ~~as well as the control and transfer switches.~~

The Required Action is to restore the Functions to OPERABLE status within 30 days. The Completion Time is based on

(continued)

B 3.3 INSTRUMENTATION

B 3.3.13 Source Range Monitoring Channels

BASES

BACKGROUND

Insert 1

The source range monitoring channels provide neutron flux power indication from < 1E-7% RTP to > 100% RTP. They also provide reactor protection when the reactor trip circuit breakers (RTCBs) are shut, in the form of a Logarithmic Power Level – High trip.

This LCO addresses MODES 3, 4, and 5 with the RTCBs open. When the RTCBs are shut, the source range monitoring channels are addressed by LCO 3.3.2, "Reactor Protective System (RPS) Instrumentation – Shutdown."

When the RTCBs are open, two of the four wide range power channels must be available to monitor neutron flux power. In this application, the RPS channels need not be OPERABLE since the reactor trip Function is not required. By monitoring neutron flux (wide range) power when the RTCBs are open, loss of SDM caused by boron dilution can be detected as an increase in flux. Alarms are also provided when power increases above the fixed bistable setpoints. For plants employing separate post accident, wide range nuclear instrumentation channels with adequate range, these can be substituted for the source range range channels. Two channels must be OPERABLE to provide single failure protection and to facilitate detection of channel failure by providing CHANNEL CHECK capability.

APPLICABLE SAFETY ANALYSES

The source range (startup) monitoring channels are necessary to monitor core reactivity changes. They are the primary means for detecting and triggering operator actions to respond to reactivity transients initiated from conditions in which the RPS is not required to be OPERABLE. They also trigger operator actions to anticipate RPS actuation in the event of reactivity transients starting from shutdown or low power conditions. The source range monitoring channel's LCO requirements support compliance with 10 CFR 50, Appendix A, GDC 13 (Ref. 1). Reference 2 describes the specific source range monitoring channel features that are critical to comply with the GDC.

(continued)

Insert 1

~~BACKGROUND~~

The source range (startup) monitoring channels provide neutron flux countrate level indication from 0.1 to 500,000 cps. They also provide a Boron Dilution Monitor and alarm in the Control Room to alert the operator of a boron dilution event.

This LCO addresses MODES 3, 4, and 5 with the RTCBs open. LCO 3.9.2 addresses the source range monitors during Mode 6 refueling operations.

Both source range monitoring channels must be available to monitor neutron flux level when the RTCBs are open. By monitoring source range countrate level, loss of SDM caused by a boron dilution event can be detected as an increase in neutron flux. The Boron Dilution Monitor provides an alarm when the countrate level exceeds the setpoint which is adjusted to 0.5 volt above background.

APPLICABLE SAFETY ANALYSES (continued)

The OPERABILITY of source range monitoring channels is necessary to meet the assumptions of the safety analyses and provide for the mitigation of accident and transient conditions.

The source range monitoring channels satisfy Criterion 3 of the NRC Policy Statement.

LCO

The LCO on the source range monitoring channels ensures that adequate information is available to verify core reactivity conditions while shut down.

A minimum of two source range monitoring channels are required to be OPERABLE. ~~At SONGS four channels are capable of performing this function. Therefore, multiple failures may be tolerated while the plants are still complying with LCO requirements~~.

APPLICABILITY

In MODES 3, 4, and 5, with RTCBs open or the Control Element Assembly (CEA) Drive System not capable of CEA withdrawal, source range monitoring channels must be OPERABLE to monitor core power for reactivity changes. In MODES 1 and 2, and in MODES 3, 4, and 5, with the RTCBs shut and the CEAs capable of withdrawal, the Logarithmic Power Monitoring ~~source range monitoring~~ channels are addressed as part of the RPS in LCO 3.3.1, "Reactor Protective System (RPS) Instrumentation – Operating," and LCO 3.3.2, "Reactor Protective System (RPS) Instrumentation – Shutdown."

The requirements for source range neutron flux monitoring in MODE 6 are addressed in LCO 3.9.2, "Nuclear Instrumentation." The source range nuclear instrumentation channels provide neutron flux coverage extending an additional one to two decades below the logarithmic channels for use during refueling, when neutron flux may be extremely low.

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.13.1 (continued)

verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined by the plant staff and should be based on a combination of the channel instrument uncertainties including control isolation, indication, and readability. If a channel is outside of the match criteria, it may be an indication that the transmitter or the signal processing equipment has drifted outside of its limits. If the channels are within the match criteria, it is an indication that the channels are OPERABLE.

The Frequency, about once every shift, is based on operating experience that demonstrates the rarity of channel failure. Thus, the performance of CHANNEL CHECK ensures that undetected overt channel failure is limited to 12 hours. Since the probability of two random failures in redundant channels in any 12 hour period is extremely low, CHANNEL CHECK minimizes the chance of loss of protective function due to failure of redundant channels. CHANNEL CHECK supplements less formal, but more frequent, checks of channel OPERABILITY during normal operational use of displays associated with the LCO required channels.

SR 3.3.13.2

A CHANNEL FUNCTIONAL TEST is performed every 92 days to ensure that the entire channel is capable of properly indicating neutron flux. Internal test circuitry is used to feed ~~preadjusted~~ test signals into the ~~preamplifier~~ signal processor to verify channel alignment. It is not necessary to test the detector, because generating a meaningful test signal is difficult; the detectors are of simple construction, and any failures in the detectors will be apparent as change in channel output. This Frequency is the same as that employed for the same channels in the other applicable MODES.

(continued)

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.1 RCS Pressure, Temperature, and Flow Limits

BASES

BACKGROUND

These Bases address requirements for maintaining RCS pressure, temperature, and flow rate within limits assumed in the safety analyses. The safety analyses (Ref. 1) of normal operating conditions and anticipated operational occurrences assume initial conditions within the normal steady state envelope. The limits placed on DNB related parameters ensure that these parameters will not be less conservative than were assumed in the analyses and thereby provide assurance that the minimum departure from nucleate boiling ratio (DNBR) will meet the required criteria for each of the transients analyzed.

The LCO limits for minimum and maximum RCS pressures as measured at the pressurizer are consistent with operation within the nominal operating envelope and are bounded by those used as the initial pressures in the analyses.

The LCO limits for minimum and maximum RCS cold leg temperatures are consistent with operation at the indicated power level and are bounded by those used as the initial temperatures in the analyses.

associated   a separate input to the safety analyses that is

Since RCS flow is ~~subject to variations during plant life~~ and due to ~~potential~~ instrument ~~errors of the flow meters~~ uncerta ~~which are used to measure RCS flow rate~~, monitoring of this parameter during plant operation will be specified by Core Operating Limits Report (COLR). The COLR limits for minimum and maximum RCS flow rates are bounded by those used as the initial flow rates in the analyses. and the associated RCS flow uncertainty

independent of all other inputs

that must be accounted for in the safety analyses,

APPLICABLE SAFETY ANALYSES

The requirements of LCO 3.4.1 represent the initial conditions for DNB limited transients analyzed in the safety analyses (Ref. 1). The safety analyses have shown that transients initiated from the limits of this LCO will meet the DNBR criterion of ≥ 1.31. This is the acceptance limit for the RCS DNB parameters. Changes to the facility that could impact these parameters must be assessed for their impact on the DNBR criterion. The transients analyzed for include loss of coolant flow events and dropped or struck

(continued)

APPLICABILITY (continued)

counterproductive. Also, since they represent transients initiated from power levels < 100% RTP, an increased DNBR margin exists to offset the temporary pressure variations. Also, a note which permits exception from RCS cold leg temperature limits when RTP ≤ 30% was included in the proposed APPLICABILITY.

Another set of limits on DNB related parameters is provided in Safety Limit (SL) 2.1.1, "Reactor Core Safety Limits." Those limits are less restrictive than the limits of this LCO, but violation of SLs merits a stricter, more severe Required Action. Should a violation of this LCO occur, the operator should check whether or not an SL may have been exceeded.

ACTIONS

A.1

Pressurizer pressure is a controllable and measurable parameter. With this parameter not within the LCO limits, action must be taken to restore the parameter.

The 2 hour Completion Time is based on plant operating experience that shows the parameter can be restored in this time period.

RCS flow rate is not a controllable parameter and is not expected to vary during steady state operation. If the flow rate is not within the limit specified in the COLR, then 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 provides sufficient time to adjust plant parameters, and to determine the cause of the off normal condition. The Completion Time 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

(continued)

BASES

50%

LCO (continued)

of requiring both SGs to be capable (> 10% wide range water level) of transferring heat from the reactor coolant at a controlled rate. Forced reactor coolant flow is the required way to transport heat, although natural circulation flow provides adequate removal. A minimum of one running RCP meets the LCO requirement for one loop in operation.

The Note permits a limited period of operation without RCPs. All RCPs may be de-energized for ≤ 1 hour per 8 hour period. This means that natural circulation has been established. When in natural circulation, a reduction in boron concentration is prohibited because an even concentration distribution throughout the RCS cannot be ensured. Core outlet temperature is to be maintained at least 10°F below the saturation temperature so that no vapor bubble may form and possibly cause a natural circulation flow obstruction.

In MODES 3, 4, and 5, it is sometimes necessary to stop all RCPs or shutdown cooling (SDC) pump forced circulation (e.g., to change operation from one SDC train to the other, to perform surveillance or startup testing, to perform the transition to and from SDC System cooling, or to avoid operation below the RCP minimum net positive suction head limit). The time period is acceptable because natural circulation is adequate for heat removal, or the reactor coolant temperature can be maintained subcooled and boron stratification affecting reactivity control is not expected.

An OPERABLE loop consists of at least one RCP providing forced flow for heat transport and an SG that is OPERABLE in accordance with the Steam Generator Tube Surveillance Program. An RCP is OPERABLE if it is capable of being powered and is able to provide forced flow if required.

APPLICABILITY

In MODE 3, the heat load is lower than at power; therefore, one RCS loop in operation is adequate for transport and heat removal. A second RCS loop is required to be OPERABLE but not in operation for redundant heat removal capability.

Operation in other MODES is covered by:

LCO 3.4.4, "RCS Loops — MODES 1 and 2";
LCO 3.4.6, "RCS Loops — MODE 4";
LCO 3.4.7, "RCS Loops — MODE 5, Loops Filled";

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.4.5.1

This SR requires verification every 12 hours that the required number of RCS loops are in operation. Verification includes flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal. The 12 hour interval has been shown by operating practice to be sufficient to regularly assess degradation and verify operation within safety analyses assumptions. In addition, control room indication and alarms will normally indicate loop status.

SR 3.4.5.2

50%

This SR requires verification every 12 hours that the secondary side water level in each SG is ≥ 10% wide range. An adequate SG water level is required in order to have a heat sink for removal of the core decay heat from the reactor coolant. The 12 hour interval has been shown by operating practice to be sufficient to regularly assess degradation and verify operation within the safety analyses assumptions.

SR 3.4.5.3

Verification that the required number of RCPs are OPERABLE ensures that the single failure criterion is met and that an additional RCS loop 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 availability to the required RCPs. The Frequency of 7 days is considered reasonable in view of other administrative controls available and has been shown to be acceptable by operating experience.

REFERENCES

1. UFSAR, Section 15.3.

BASES

ACTIONS

B.1 (continued)

reasonable, based on operating experience, to reach MODE 5 from MODE 4, with only one SDC train operating, in an orderly manner and without challenging plant systems.

C.1 and C.2

If no RCS loops or SDC trains are OPERABLE or in operation, except during conditions permitted by Note 1 in the LCO section, all operations involving reduction of RCS boron concentration must be suspended and action to restore one RCS loop or SDC train to OPERABLE status and operation must be initiated. Boron dilution requires forced circulation for proper mixing, and the margin to criticality must not be reduced in this type of operation. The immediate Completion Times reflect the importance of decay heat removal. The action to restore must continue until one loop or train is restored to operation.

SURVEILLANCE REQUIREMENTS

SR 3.4.6.1

This SR requires verification every 12 hours that one required loop or train is in operation. This ensures forced flow is providing heat removal. Verification includes flow rate, temperature, or pump status monitoring. The 12 hour Frequency has been shown by operating practice to be sufficient to regularly assess RCS loop status. In addition, control room indication and alarms will normally indicate loop status.

SR 3.4.6.2

50%

This SR requires verification every 12 hours of secondary side water level in the required SG(s) ≥ 10% (wide range). An adequate SG water level is required in order to have a heat sink for removal of the core decay heat from the reactor coolant. The 12 hour interval has been shown by operating practice to be sufficient to regularly assess degradation and verify operation within safety analyses assumptions.

(continued)

BASES (continued)

50%

LCO

The purpose of this LCO is to require at least one of the SDC trains or RCS loops be OPERABLE and in operation with an additional SDC train or RCS loop OPERABLE or secondary side water level of each SG shall be ≥ 10% wide range. One SDC train or RCS loop provides sufficient forced circulation to perform the safety functions of the reactor coolant under these conditions. The second SDC or RCS loop train is normally maintained OPERABLE as a backup to the operating train/loop to provide redundant paths for decay heat removal. However, if the standby SDC train/RCS loop is not OPERABLE, a sufficient alternate method to provide redundant paths for decay heat removal is two SGs with their secondary side water levels ≥ 10% wide range. Should the operating SDC train/RCS loop fail, the SGs could be used to remove the decay heat.

50%

Note 1 permits all RCPs and SDC pumps to be de-energized ≤ 1 hour per 8 hour period. The circumstances for stopping both SDC trains/RCS loops are to be limited to situations where pressure and temperature increases can be maintained well within the allowable pressure (pressure and temperature and low temperature overpressure protection) and 10°F subcooling limits, or an alternate heat removal path through the SG(s) is in operation.

This LCO is modified by a Note that prohibits boron dilution when forced flow is stopped because an even concentration distribution cannot be ensured. Core outlet temperature is to be maintained at least 10°F below saturation temperature, so that no vapor bubble would form and possibly cause a natural circulation flow obstruction. In this MODE, the SG(s) can be used as the backup for heat removal. To ensure their availability, the RCS loop flow path is to be maintained with subcooled liquid.

In MODE 5, it is sometimes necessary to stop all RCP or SDC forced circulation. This is permitted to change operation from one SDC train or RCS loop to the other, perform surveillance or startup testing, perform the transition to and from the SDC, or to avoid operation below the RCP minimum net positive suction head limit. The time period is acceptable because natural circulation is acceptable for decay heat removal, the reactor coolant temperature can be maintained subcooled, and boron stratification affecting reactivity control is not expected.

(continued)

BASES

LCO
(continued)

An OPERABLE RCS loop consists of at least one RCP providing forced flow for heat transport and an SG that is OPERABLE in accordance with the Steam Generator Tube Surveillance Program. An RCP is OPERABLE if it is capable of being powered and is able to provide forced flow if required.

APPLICABILITY

In MODE 5 with RCS loops filled, this LCO requires forced circulation to remove decay heat from the core and to provide proper boron mixing. One SDC train/RCS loop provides sufficient circulation for these purposes.

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 3.9.4, "Shutdown Cooling (SDC) and Coolant Circulation – High Water Level" (MODE 6); and
LCO 3.9.5, "Shutdown Cooling (SDC) and Coolant Circulation – Low Water Level" (MODE 6).

ACTIONS

A.1 and A.2

50%

If the required SDC train/RCS loop is inoperable and any SGs have secondary side water levels < 10% wide range, redundancy for heat removal is lost. Action must be initiated immediately to restore a second SDC train/RCS loop to OPERABLE status or to restore the water level in the required SGs. Either Required Action A.1 or Required Action A.2 will restore redundant decay heat removal paths. The immediate Completion Times reflect the importance of maintaining the availability of two paths for decay heat removal.

B.1 and B.2

If no SDC train/RCS loop is in operation, except as permitted in Note 1, all operations involving the reduction of RCS boron concentration must be suspended. Action to restore one SDC train/RCS loop to operation must be

(continued)

BASES

ACTIONS (continued)

initiated. Boron dilution requires forced circulation for proper mixing and the margin to criticality must not be reduced in this type of operation. The immediate Completion Times reflect the importance of maintaining operation for decay heat removal.

SURVEILLANCE REQUIREMENTS

SR 3.4.7.1

This SR requires verification every 12 hours that at least one SDC train/RCS loop is in operation. Verification includes flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing decay heat removal. The 12 hour Frequency has been shown by operating practice to be sufficient to regularly assess degradation and verify operation is within safety analyses assumptions. In addition, control room indication and alarms will normally indicate loop status.

The SDC/RCS flow is established to ensure that core outlet temperature is maintained sufficiently below saturation to allow time for swapover to the standby SDC train/RCS loop should the operating train be lost.

SR 3.4.7.2

50%

Verifying the SGs are OPERABLE by ensuring their secondary side water levels are ≥ 10% wide range ensures that redundant heat removal paths are available if the second SDC train/RCS loop is inoperable. The Surveillance is required to be performed when the LCO requirement is being met by use of the SGs. If both SDC trains are OPERABLE and one SDC train is in operation, this SR is not needed. The 12 hour Frequency has been shown by operating practice to be sufficient to regularly assess degradation and verify operation within safety analyses assumptions.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.7.3

Verification that the second SDC train/RCS loop is OPERABLE ensures that redundant paths for decay heat removal are available. The requirement also ensures that the additional train 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 the required pumps. The Surveillance is required to be performed when the LCO requirement is being met by one of two SDC trains or one of two RCS loops, e.g., both SGs have < 10% wide range water level. The Frequency of 7 days is considered reasonable in view of other administrative controls available and has been shown to be acceptable by operating experience.

< 50%

REFERENCES

1. UFSAR, Section 5.4.

APPLICABLE SAFETY ANALYSES

RCS Vent Performance (continued)

The RCS vent is passive and is not subject to active failure.

LCO

This LCO is required to ensure 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.

or depressurized to less than the PTLR limit

To limit the coolant input capability, the LCO requires at most two HPSI pumps capable of injecting into the RCS and the SITS isolated. LCO 3.5.3, "ECCS – Shutdown," defines the pump OPERABILITY requirements. LCO 3.3.2, "Engineered Safety Feature Activation System (ESFAS) Instrumentation," defines SI actuation OPERABILITY for the LTOP MODE 4 small break LOCA, as discussed in the previous section.

The elements of the LCO that provide overpressure mitigation through pressure relief are:

a. The Shutdown Cooling System Relief Valve; or

b. The depressurized RCS and an RCS vent.

The SDCS is OPERABLE for LTOP when both trains of isolation valves are open, its lift setpoint is set at 406 ± 10 psig or less and testing has proven its ability to open at that setpoint. An RCS vent is OPERABLE when open with an area ≥ 5.6 square inches.

Each of these methods of overpressure prevention is capable of mitigating the limiting LTOP transient.

APPLICABILITY

This LCO is applicable in MODE 4 when the temperature of any RCS cold leg is ≤ the enable temperatures specified in the PTLR, in MODE 5, and in MODE 6 when the reactor vessel head is on. The pressurizer safety valves provide overpressure protection that meets the Reference 1 P/T limits above the

(continued)

APPLICABILITY (continued)

enable temperatures specified in the PTLR. When the reactor vessel head is off, overpressurization cannot occur.

LCO 3.4.3 provides the operational P/T limits for all MODES. LCO 3.4.10, "Pressurizer Safety Valves," requires the OPERABILITY of the pressurizer safety valves that provide overpressure protection during MODES 1, 2, and 3, and MODE 4 above the enable temperatures specified in the PTLR.

Low temperature overpressure prevention is most critical during shutdown when the RCS is water solid, and a mass or heat input transient can cause a very rapid increase in RCS pressure when little or no time allows operator action to mitigate the event.

or depressurization to less than the PTLR limit

The Applicability is modified by a Note stating that SIT isolation is only required when the SIT pressure is greater than or equal to the RCS pressure for the existing temperature, as allowed by the P/T limit curves provided in the PTLR. This Note permits the SIT discharge valve surveillance performed only under these pressure and temperature conditions.

ACTIONS

A.1

With more than two HPSI pumps capable of injecting into the RCS, overpressurization is possible.

The immediate Completion Time to initiate actions to restore restricted coolant input capability to the RCS reflects the importance of maintaining overpressure protection of the RCS.

B.1 and B.2

When the SIT pressure is greater than or equal to the **maximum** RCS pressure for the existing cold leg temperature allowed in the PTLR, an unisolated SIT requires isolation within 1 hour or the affected SIT(s) must be depressurized to less than the maximum RCS pressure for the existing cold leg temperature allowed in the PTLR within 12 hours.

(continued)

BASES

ACTIONS

B.1 and B.2 (continued) 2

By isolating the SIT(s) or depressurizing the SIT(s) below the LTOP limit stated in the PTLR, the RCS is protected against the SIT tanks pressurizing the RCS in excess of the LTOP limits.

this activity →

The Completion Times ~~are~~ is based on operating experience that ~~these activities~~ can be accomplished in ~~these~~ this time periods and on engineering evaluations indicating that an event requiring LTOP is not likely in the allowed times.

INSERT "A" →

D.1 and D.2

The 24-hour Allowable Outage Time (AOT) for a single channel SDCS Relief Valve isolation valve(s) increases the availability of the LTOP system to mitigate low temperature overpressure transients especially during MODES 5 and 6 when the potential for these transients are highest (RCS temperatures between 80°F and 190°F and the RCS is water-solid). The 24-hour AOT implements the guidance provided in Generic Letter 90-06 (Ref. 6)

E.1

or D

If the SDCS Relief Valve is inoperable, or if a Required Action and the associated Completion Time of Condition A, ~~[illegible]~~ C, are not met, or if the LTOP System is inoperable for any reason other than Condition A, through C or condition D, the RCS must be depressurized and a vent established within 8 hours. The vent must be sized at least 5.6 square inches to ensure the flow capacity is greater than that required for the worst case mass input transient reasonable during the applicable MODES. This action protects the RCPB from a low temperature overpressure event and a possible brittle failure of the reactor vessel.

The Completion Time of 8 hours to depressurize and vent the RCS is based on the time required to place the plant in this condition and the relatively low probability of an overpressure event during this time period due to increased operator awareness of administrative control requirements.

(continued)

INSERT "A"

for the Bases 3.4.12.1, "LTOP System."

C.1

If the Required Action and associated Completion Time of Condition B is not met, the affected SIT(s) must be depressurized to less than the maximum RCS pressure for the existing cold leg temperature allowed in the PTLR within 12 hours.

By depressurizing the SIT(s) below the LTOP limit stated in the PTLR the RCS is protected against the SIT(s) pressurizing the RCS in excess of the LTOP limits.

The Completion Time is based on operating experience that this activity can be accomplished in this time period and on engineering evaluation indicating that an event requiring LTOP is not likely in the allowed time.

San Onofre - Unit 2

SURVEILLANCE REQUIREMENTS

SR 3.4.12.1.1 / and SR 3.4.12.1.2 and SR 3.4.12.1.3

To minimize the potential for a low temperature overpressure event by limiting the mass input capability, not more than two HPSI pumps are verified OPERABLE with the other pump locked out with power removed and the SIT discharge isolation valves are verified closed and deactivated or SIT(s) are depressurized to less than the [illegible] limit. The 12 hour interval considers operating practice to regularly assess potential degradation and to verify operation within the safety analysis.

SR 3.4.12.1.3

SR 3.4.12.1.3 requires verifying that the RCS vent is open ≥ 5.6 square inches is proven OPERABLE by verifying its open condition either:

a. Once every 12 hours for a vent valve that is unlocked open; and

b. Once every 31 days for a valve that is locked, sealed, or otherwise secured open and once every 31 days for open flanged RCS penetrations.

The passive vent arrangement must only be open to be OPERABLE. This Surveillance need only be performed if the vent is being used to satisfy the requirements of this LCO. The Frequencies consider operating experience with mispositioning of unlocked and locked vent valves, respectively.

SR 3.4.12.1.4 and SR 3.4.12.1.5

When one or both SDCS Relief Valve isolation valve(s) in one isolation valve pair becomes INOPERABLE, the other OPERABLE SDCS Relief Valve isolation valve pair is verified in a power-lock open condition every 12 hours to preclude a single failure which might cause undesired mechanical motion of one or both of the OPERABLE SDCS Relief Valve isolation valve(s) in a single isolation valve pair and result in loss of system function.

(continued)

BASES

LCO (continued)

Each of these methods of overpressure prevention is capable of mitigating the limiting LTOP transient.

APPLICABILITY

This LCO is applicable in MODE 4 when the temperature of all RCS cold legs are above the enable temperatures specified in the PTLR. When the temperature of any RCS cold leg is equal to or below the enable temperatures specified in the PTLR the Shutdown Cooling System Relief valve is used for overpressure protection or if the RCS is also depressurized, then an RCS vent to atmosphere sized 5.6 inches or greater can be used for overpressure protection. When the reactor vessel head is off, overpressurization cannot occur.

LCO 3.4.3 provides the operational P/T limits for all MODES. LCO 3.4.10, "Pressurizer Safety Valves," requires the OPERABILITY of the pressurizer safety valves that provide overpressure protection during MODES 1, 2, and 3.

Low temperature overpressure prevention is most critical during shutdown when the RCS is water solid, and a mass or heat input transient can cause a very rapid increase in RCS pressure when little or no time allows operator action to mitigate the event.

ACTIONS

A.1

With no pressurizer code safety valves OPERABLE and the SDCS Relief Valve INOPERABLE overpressurization is possible.

The 8 hours Completion Time to be in MODE 5 and vented through a greater than or equal to 5.6 inch vent reflects the importance of maintaining overpressure protection of the RCS.

(continued)

INSERT "A" for LCO 3 4 12 2 (Bases)

For LCO 3.4.12.2

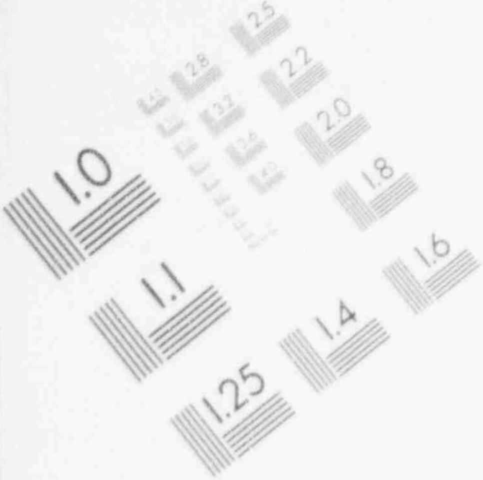
INSERT "A"

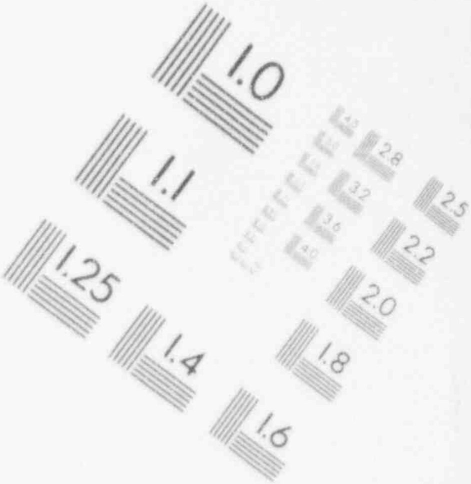
B.1 and B.2

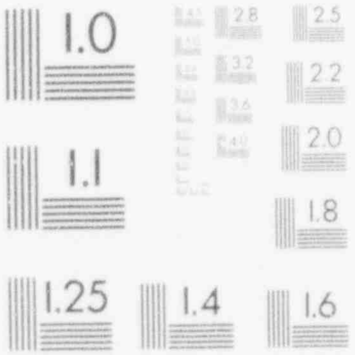
The 24-hour Allowable Outage Time (AOT) for a single channel SDCS Relief Valve isolation valve(s) increases the availability of the LTOP system to mitigate low temperature overpressure transients especially during MODES 5 and 6 when the potential for these transients are highest (RCS temperatures between 80°F and 190°F and the RCS is water-solid). The 24-hour AOT implements the guidance provided in Generic Letter 90-06

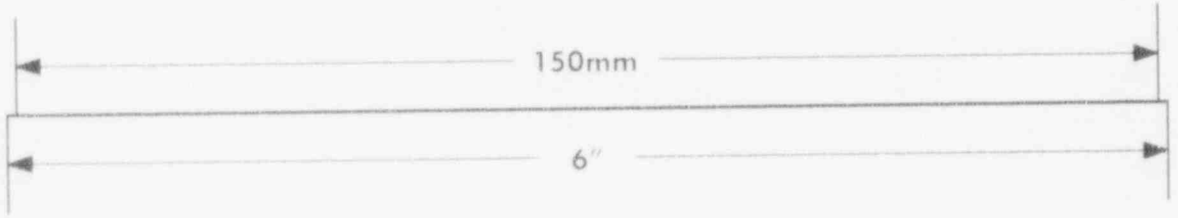
1

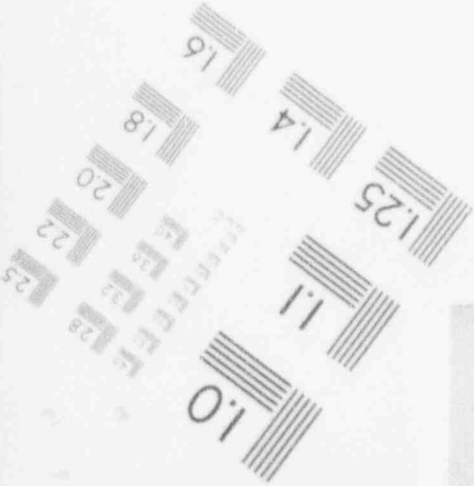
IMAGE EVALUATION TEST TARGET (MT-3)

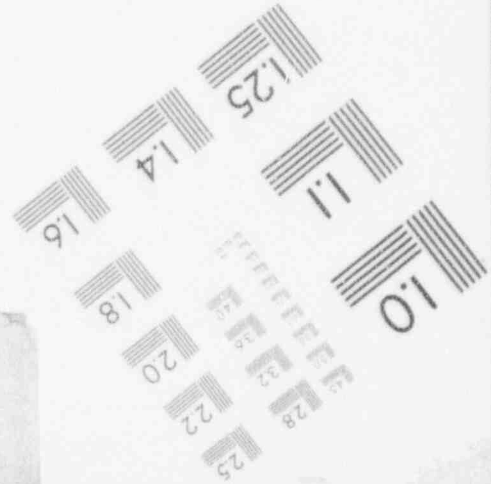












BASES

APPLICABLE SAFETY ANALYSES (continued)

this analysis is used to assess changes to the facility that could affect RCS specific activity as they relate to the acceptance limits.

The rise in pressure in the ruptured SG causes radioactively contaminated steam to discharge to the atmosphere through the atmospheric dump valves or the main steam safety valves. The atmospheric discharge stops when the turbine bypass to the condenser removes the excess energy to rapidly reduce the RCS pressure and close the valves. The unaffected SG removes core decay heat by venting steam until the cooldown ends.

The safety analysis shows the radiological consequences of an SGTR accident are within a small fraction of the Reference 1 dose guideline limits. Operation with iodine specific activity levels greater than the LCO limit is permissible, if the activity levels do not exceed the limits shown in Figure 3.4.16-1 for more than 48 hours.

The remainder of the above limit permissible iodine levels shown in Figure 3.4.16-1 are acceptable because of the low probability of an SGTR accident occurring during the established 48 hour time limit. The occurrence of an SGTR accident at these permissible levels could increase the site boundary dose levels, but still be within 10 CFR 100 dose guideline limits.

RCS specific activity satisfies Criterion 2 of the NRC Policy Statement.

LCO

STET

The specific iodine activity in the Primary Coolant is limited to 1.0 μCi/gm DOSE EQUIVALENT I-131, and the gross specific activity of radionuclides other than iodines in the primary coolant is limited to the number of μCi/gm equal 100 divided by E (average disintegration energy of the s of the average beta and gamma energies of the coolant nuclides). The limit on DOSE EQUIVALENT I-131 ensures t 2 hour thyroid dose to an individual at the site boundar during the Design Basis Accident (DBA) will be a small fraction of the allowed thyroid dose. The limit on gros specific activity ensures the 2 hour whole body dose to individual at the site boundary during the DBA will be small fraction of the allowed whole body dose.

(continued)

ACTIONS (continued)

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 3.7.1.1

This SR verifies the OPERABILITY of the MSSVs by the verification of each MSSV lift setpoints in accordance with the inservice testing program. The ASME Code, Section XI (Ref. 4), requires that safety and relief valve tests be performed in accordance with ANSI/ASME OM-1-1987 (Ref. 5). According to Reference 5, the following tests are required for MSSVs:

a. Visual examination;

b. Seat tightness determination;

c. Setpoint pressure determination (lift setting); and

d. Compliance with owner's seat tightness criteria.

9

The ANSI/ASME Standard requires that all valves be tested each subsequent 10 year period, with a minimum of 20% of the valves tested within any 48 months. The ASME Code specifies the activities and frequencies necessary to satisfy the requirements.

This SR is modified by a Note that allows entry into and operation in MODE 3 prior to performing the SR. This is to allow testing of the MSSVs at hot conditions. The MSSVs may be either bench tested or tested in situ at hot conditions using an assist device to simulate lift pressure. If the MSSVs are not tested at hot conditions, the lift setting pressure shall be corrected to ambient conditions of the valve at operating temperature and pressure.

(continued)

APPLICABLE SAFETY ANALYSES (continued)

e. The MSIVs are also utilized during other events such as a feedwater line break. These events are less limiting so far as MSIV OPERABILITY is concerned.

The MSIVs satisfy Criterion 3 of the NRC Policy Statement.

LCO

This LCO requires that the MSIV in each of the two steam lines be OPERABLE. The MSIVs are considered OPERABLE when the isolation times are within limits, and they close on an isolation actuation signal.

This LCO provides assurance that the MSIVs will perform their design safety function to mitigate the consequences of accidents that could result in offsite exposures comparable to the 10CFR 100 (Ref. 4) limits.

APPLICABILITY

The MSIVs must be OPERABLE in MODE 1 and in MODES 2 and 3 except when all MSIVs are closed and deactivated when there is significant mass and energy in the RCS and steam generators. When the MSIVs are closed, they are already performing their safety function.

In MODE 4, the steam generator energy is low; therefore, the MSIVs are not required to be OPERABLE.

In MODES 5 and 6, the steam generators do not contain much energy because their temperature is below the boiling point of water; therefore, the MSIVs are not required for isolation of potential high energy secondary system pipe breaks in these MODES.

ACTIONS

be made to the MSIV with the unit hot. The 8 hour Completion Time is reasonable, considering the probability of an accident occurring during the time period that would require closure of the MSIVs.

Move to [*](page B 3.7-11).
this paragraph

(continued)

ACTIONS (continued)

A.1

With one MSIV inoperable in MODE 1, time is allowed to restore the component to OPERABLE status. Some repairs can [*] The 8 hour Completion Time is greater than that normally allowed for containment isolation valves because the MSIVs are valves that isolate a closed system penetrating containment. These valves differ from other containment isolation valves in that the closed system provides an additional means for containment isolation.

B.1

If the MSIV cannot be restored to OPERABLE status within 8 hours, 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 MODE 2 within 6 hours and Condition C would be entered. The Completion Time is reasonable, based on operating experience, to reach MODE 2, and close the MSIVs in an orderly manner and without challenging unit systems.

C.1, and C.2

Condition C is modified by a Note indicating that separate Condition entry is allowed for each MSIV.

Since the MSIVs are required to be OPERABLE in MODES 2 and 3, the inoperable MSIVs may either be restored to OPERABLE status or closed. When closed, the MSIVs are already in the position required by the assumptions in the safety analysis.

The 8 hour Completion Time is consistent with that allowed in Condition A.

Inoperable MSIVs that cannot be restored to OPERABLE status within the specified Completion Time, but are closed, must be verified on a periodic basis to be closed. This is necessary to ensure that the assumptions in the safety analysis remain valid. The 7 day Completion Time is reasonable, based on engineering judgment, MSIV status indications available in the control room, and other indications available in the control room, and other

(continued)

ACTIONS

A.1

Required Action A.1 is modified by a Note indicating that LCO 3.0.4 does not apply.

With one required ADV inoperable. action must be taken to restore the OPERABLE status within 72 hours.

B.1

With two ADVs inoperable, action must be taken to restore one of the ADVs to OPERABLE status. As the block valve can be closed to isolate an ADV, some repairs may be possible with the unit at power. The 24 hour Completion Time is reasonable to repair inoperable ADVs, based on the availability of the Steam Bypass System and MSSVs, and the low probability of an event occurring during this period that requires the ADVs.

C.1

If backup nitrogen gas supply system capacity for each ADV is less than or equal to 8 hours, action should be taken to restore nitrogen gas supply system capacity in 72 hours. The backup nitrogen capacity is controlled to a minimum accumulator pressure of 1050 psig. This pressure represents enough backup nitrogen gas system capacity for each ADV to have up to 8 hours of pneumatic operation. This time period is consistent and conservative relative to the SONGS Units 2 and 3 emergency operating instructions.

The completion time of 72 hours is based on operating experience and on the fact that normal operating instrument air supply system is still available.

(continued)

BASES

ACTIONS

B.1 and B.2 (continued)

Operating experience shows that the likelihood of Primary Plant Makeup Storage Tank level dropping below 66% (which corresponds to an allowable CCW leakage of 18 gpm based on Figure 3.7.7.1-1) is extremely low. Also, a Probabilistic Risk Assessment (PRA) was performed to assess the increased risk of core damage from an 8 hour allowed outage time for two trains of the CCW Safety Related Makeup System. The PRA indicated that the increased risk of core damage from an 8 hour allowed outage time is less than 1×10^{-6} per year. This increase in core damage risk is considered acceptably small.

C.1 and C.2

In MODES 1, 2, 3, and 4, two CCW System critical loops provide cooling to a number of safety related systems, such as HPSI, LPSI, shutdown cooling, emergency chillers, etc. The CCW Safety Related Makeup System is a support system for the CCW System. Two CCW Safety Related Makeup flow paths are required to provide makeup to the two CCW critical loops. If one CCW Safety Related Makeup flow path can not be restored to OPERABLE status in seven days, the Unit must be placed in a MODE in which the LIMITING CONDITION FOR OPERATION does not apply.

To achieve this status, the Unit must be placed in at least HOT STANDBY within the next 6 hours, and in COLD SHUTDOWN within ~~30~~ 36 hours.

Similarly, action should be taken if the PPMU Tank level is below that required for two CCW critical loops operation and/or both CCW Safety Related Makeup flow paths are inoperable. If both the PPMU Tank level and at least one flow path are not OPERABLE within 8 hours, the Unit must then be placed in a MODE in which the LIMITING CONDITION FOR OPERATION does not apply. To achieve this status, the Unit must be placed in at least HOT STANDBY within the next 6 hours, and in COLD SHUTDOWN within 30 hours.

The allowed completion time is consistent with other Technical Specification completion time requirements to

(continued)

BACKGROUND (continued)

related equipment is always operable to handle all design basis events.

If redundant pieces of safety related equipment are located in the same room and the room has redundant emergency cooling, such as the spent fuel pool (SFP) pumps, loss of one source of emergency cooling does not render either pump inoperable. The 7 day completion time of the REQUIRED ACTION A.1 would be in effect due to the loss of one source of emergency cooling. Since TS 3.7.10 establishes allowable outage times for the ECWS, it is not necessary to declare the safety related equipment cooled by the ECWS inoperable during the allowable outage times (this assumes the normal cooling is operable).

If an ECWS train is inoperable due to an inoperable room cooler, other than a CREACUS cooler, then the associated CREACUS train is considered operable provided the ECWS surveillances are maintained current. If an ECWS train is inoperable due to an inoperable chiller or pump then the associated CREACUS train is inoperable and TS 3.7.11 applies. An inoperable room cooler does not affect the capability of the ECWS to provide chilled water to the CREACUS coolers. An inoperable chiller or chilled water pump affects the capability of the system to provide chilled water to CREACUS.

APPLICABLE SAFETY ANALYSES

The design basis of the ECW System is to remove the post accident heat load from ESF spaces following a DBA coincident with a loss of offsite power. Each train provides chilled water to the HVAC units at the design temperature and flow rate.

The maximum heat load in the ESF pump room area occurs during the recirculation phase following a loss of coolant accident. During recirculation, hot fluid from the containment sump is supplied to the high pressure safety injection and containment spray pumps. This heat load to the area atmosphere must be removed by the ECW System to ensure that these pumps remain OPERABLE.

The ECW satisfies Criterion 3 of the NRC Policy Statement.

(continued)

ACTIONS
(continued)

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

In MODE 5 or 6, or during movement of irradiated fuel assemblies, if Required Action A.1 cannot be completed within the required Completion Time, the OPERABLE CREACUS train must be immediately placed in the emergency mode of operation. This action ensures that the remaining train is OPERABLE, that no failures preventing automatic actuation will occur, and that any active failure will be readily detected.

An alternative to Required Action C.1 is to immediately suspend activities that could result in a release of radioactivity that might require isolation of the control room. This places the unit in a condition that minimizes the accident risk. This does not preclude the movement of fuel assemblies to a safe position.

D.1

If both CREACUS trains are inoperable in MODE 1, 2, 3, or 4, the CREACUS may not be capable of performing the intended function and the unit is in a condition outside the accident analyses. Therefore, LCO 3.0.3 must be entered immediately.

E.1 and E.2

When in MODES 5 or 6, or during movement of irradiated fuel assemblies with two trains inoperable, action must be taken immediately to suspend activities that could result in a release of radioactivity that might enter the control room. This places the unit in a condition that minimizes the accident risk. This does not preclude the movement of fuel to a safe position.

SURVEILLANCE
REQUIREMENTS

SR 3.7.11.1

Standby systems should be checked periodically to ensure that they function properly. Since the environment and normal operating conditions on this system are not severe, testing each train once every month provides an adequate check on this system.

(continued)

B 3.7 PLANT SYSTEMS

B 3.7.14 Fuel Handling Building Post-Accident Cleanup Filter System

BASES

BACKGROUND

The Fuel Handling Building Post-Accident Cleanup Filter System filters airborne radioactive particulates and gases from the area of the fuel pool following a fuel handling accident. The Fuel Handling Building Post-Accident Cleanup Filter System, in conjunction with other normally operating systems, also provides environmental control of temperature in the fuel pool area.

The Fuel Handling Building Post-Accident Cleanup Filter System consists of two independent, redundant trains. Each train consists of a heater, a prefilter a high efficiency particulate air (HEPA) filter, an activated charcoal adsorber section for removal of gaseous activity (principally iodines), and a fan. Ductwork, valves or dampers, and instrumentation also form part of the system, as well as heaters, functioning to reduce the relative humidity of the air stream. A second bank of HEPA filters follows the adsorber section to collect carbon fines and provide backup in case of failure of the main HEPA filter bank. The downstream HEPA filter is not credited in the analysis, but serves to collect charcoal fines, and to back up the upstream HEPA filter should it develop a leak. The system initiates filtered ventilation of the fuel handling building following receipt of a high radiation signal.

The Fuel Handling Building Post-Accident Cleanup Filter System is a standby system, part of which may also be operated during normal unit operations. Upon receipt of the actuating signal, the fuel handling building is isolated, and the stream of ventilation air discharges through the system filter trains. The prefilters remove any large particles in the air, to prevent excessive loading of the HEPA filters and charcoal adsorbers.

Operation of the FHB normal HVAC system with one PACFS unit operating and the other unit inoperable is permissible provided both radiation monitors RT-7823 and 7822 and their associated circuitry remain OPERABLE.

(continued)

PP to -73

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BACKGROUND (continued)

Distribution System. Within 77 seconds after the initiating signal is received, all automatic and permanently connected loads needed to recover the unit or maintain it in a safe condition are returned to service via the programmed time interval load sequence.

The onsite standby power source for each 4.16 kV ESF bus is a dedicated DG. DGs G002 and G003 are dedicated to ESF buses A04 and A06, respectively. A DG starts automatically on a safety injection actuation signal (SIAS) (i.e., low pressurizer pressure or high containment pressure signals) or on an ESF bus degraded voltage or undervoltage signal. After the DG has started, it will automatically tie to its respective bus after offsite power is tripped as a consequence of ESF bus undervoltage or degraded voltage, independent of or coincident with an SIAS signal. The DGs will also start and operate in the standby mode without tying to the ESF bus on an SIAS alone. Following the trip of offsite power, an undervoltage signal strips nonpermanent loads from the ESF bus. When the DG is tied to the ESF bus, loads are then sequentially connected to its respective ESF bus by the programmed time interval load sequence. The sequencing logic controls the permissive and starting signals to motor breakers to prevent overloading the DG by automatic load application.

In the event of a loss of preferred power, the ESF electrical loads are automatically connected to the DGs in sufficient time to provide for safe reactor shutdown and to mitigate the consequences of a Design Basis Accident (DBA) such as a loss of coolant accident (LOCA).

Certain required unit loads are returned to service in a predetermined sequence in order to prevent overloading the DG in the process. Within 77 seconds after the initiating signal is received, all loads needed to recover the unit or maintain it in a safe condition are returned to service.

Ratings for Train A and Train B DGs satisfy the requirements of Regulatory Guide 1.9 (Ref. 3). The continuous service rating of each DG is 4700 kW with 10% overload permissible for up to 2 hours in any 24 hour period. The ESF loads that are powered from the 4.16 kV ESF buses are listed in Reference 2.

However, for standby class of service like the San Onofre DGs the manufacturer allows specific overload values up to 116.1% of continuous duty rating based on the total hours the DG is operated per year.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.1.2 and SR 3.8.1.7 (continued)

SR 3.8.1.7 requires that, at a 184 day Frequency, the DG starts from standby conditions and achieves required voltage and frequency within 10 seconds. The 10 second start requirement supports the assumptions of the design basis LOCA analysis in the UFSAR, Chapter 15 (Ref. 5).

The 10 second start requirement is not applicable to SR 3.8.1.2 (see Note 3) when a modified start procedure as described above is used.

Since SR 3.8.1.7 requires a 10 second start, it is more restrictive than SR 3.8.1.2 and it may be performed in lieu of SR 3.8.1.2. This is the intent of Note 1 of SR 3.8.1.2.

The normal 31 day Frequency for SR 3.8.1.2 (see Table 3.8.1-1, "Diesel Generator Test Schedule," in the accompanying LCO) and the ~~is consistent with Regulatory Guide 1.9 (Ref. 3). The~~ 184 day Frequency for SR 3.8.1.7 ~~is a reduction in cold testing consistent with Generic Letter 84-15 (Ref. 7) and~~ are consistent with Regulatory Guide 1.9 (Ref. 3). These Frequencies provide adequate assurance of DG OPERABILITY, while minimizing degradation resulting from testing.

SR 3.8.1.3

This Surveillance verifies that the DGs are capable of synchronizing with the offsite electrical system and accepting loads greater than or equal to the equivalent of the maximum expected accident loads listed in Reference 2. A minimum run time of 60 minutes is required to stabilize engine temperatures, while minimizing the time that the DG is connected to the offsite source.

Although no power factor requirements are established by this SR, the DG is normally operated at a power factor between 0.8 lagging and 1.0. The 0.8 value is the design rating of the machine, while 1.0 is an operational limitation to ensure circulating currents are minimized.

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.1.3 (continued)

The normal 31 day Frequency for this Surveillance (Table 3.8.1-1) is consistent with Regulatory Guide 1.9 (Ref. 3).

This SR is modified by four Notes. Note 1 indicates that diesel engine runs for this Surveillance may include gradual loading, as recommended by the manufacturer, so that mechanical stress and wear on the diesel engine are minimized. Note 2 states that momentary transients because of changing bus loads do not invalidate this test. Similarly, momentary power factor transients above the limit will not invalidate the test. Note 3 indicates that this Surveillance should be conducted on only one DG at a time in order to avoid common cause failures that might result from offsite circuit or grid perturbations. Note 4 stipulates a prerequisite requirement for performance of this SR. A successful DG start must precede this test to credit satisfactory performance.

SR 3.8.1.4

This SR provides verification that the level of fuel oil in the day tank is at or above the level at which fuel oil is automatically added. The level is expressed as an equivalent volume in ~~gallons~~ inches, and is selected to ensure adequate fuel oil for a minimum of 1 hour of DG operation at full load plus 10%.

The 31 day Frequency is adequate to assure that a sufficient supply of fuel oil is available, since low level alarms are provided and unit operators would be aware of any large use of fuel oil during this period.

SR 3.8.1.5

Microbiological fouling is a major cause of fuel oil degradation. There are numerous microorganisms that can grow in fuel oil and cause fouling, but all must have a water environment in order to survive. Removal of water from the fuel oil day tanks once every 31 days eliminates the necessary environment for microbial survival in the

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SURVEILLANCE REQUIREMENTS

SR 3.8.1.9 (continued)

recommendations for response during load sequence intervals. The 4 seconds specified is equal to 80% of a typical 5 second load sequence interval associated with sequencing of the largest load. The voltage and frequency specified are consistent with the design range of the equipment powered by the DG. SR 3.8.1.9.a corresponds to the maximum frequency excursion, while SR 3.8.1.9.b and SR 3.8.1.9.c are steady state voltage and frequency values to which the system must recover following load rejection. The 24 month Frequency is consistent with the recommendation of Regulatory Guide 1.9 (Ref. 3).

In order to ensure that the DG is tested under load conditions that are as close to design basis conditions as possible, testing is performed using design basis kW loading and maximum kVAR loading permitted during testing. These loadings represent the inductive loading that the DG would experience to the extent practicable and is consistent with the intent of Regulatory Guide 1.9 (Ref. 3).

This SR is modified by a Note which acknowledges that credit may be taken for unplanned events that satisfy this SR.

94.5%

SR 3.8.1.10

This Surveillance demonstrates the DG capability to reject a load equal to 90% to 100% of its continuous rating without overspeed tripping or exceeding the predetermined voltage limits. The DG full load rejection may occur because of a system fault or inadvertent breaker tripping. This Surveillance ensures proper engine generator load response under the simulated test conditions. This test simulates the loss of the total connected load that the DG experiences following a full load rejection and verifies that the DG will not trip upon loss of the load. These acceptance criteria provide DG damage protection. While the DG is not expected to experience this transient during an event and continues to be available, this response ensures that the DG is not degraded for future application, including reconnection to the bus if the trip initiator can be corrected or isolated. These loads and limits are consistent with Regulatory Guide 1.9 (Ref. 3).

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.1.10 (continued)

In order to ensure that the DG is tested under load conditions that are as close to design basis conditions as possible, testing is performed using design basis kW loading and maximum kVAR loading permitted during testing. These loadings represent the inductive loading that the DG would experience to the extent practicable and is consistent with the intent of Regulatory Guide 1.9 (Ref. 3).

The 24 month Frequency is consistent with the recommendation of Regulatory Guide 1.9 (Ref. 3) and is intended to be consistent with expected fuel cycle lengths.

This SR is modified by a Note which acknowledges that credit may be taken for unplanned events that satisfy this SR.

SR 3.8.1.11

As required by Regulatory Guide 1.9 (Ref. 3), this Surveillance demonstrates the as designed operation of the standby power sources during loss of the offsite source. This test verifies all actions encountered from the loss of offsite power, including shedding of the nonessential loads and energization of the emergency buses and respective loads from the DG. It further demonstrates the capability of the DG to automatically achieve the required voltage and frequency within the specified time.

The DG auto-start time of 10 seconds is derived from requirements of the accident analysis to respond to a design basis large break LOCA. The frequency should be restored to within 2% of nominal following a load sequence step. The Surveillance should be continued for a minimum of 5 minutes in order to demonstrate that all starting transients have decayed and stability has been achieved.

The requirement to verify the connection and power supply of permanent and auto-connected loads is intended to satisfactorily show the relationship of these loads to the DG loading logic. In certain circumstances, many of these loads cannot actually be connected or loaded without undue hardship or potential for undesired operation.

(continued)

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.3 Diesel Fuel Oil, Lube Oil, and Starting Air

assuming the maximum load demand is supplied by one DG.

BASES

BACKGROUND

Each diesel generator (DG) is provided with a storage tank having a fuel oil capacity sufficient to operate that diesel for a period of 7 days, while the DG is supplying maximum post loss of coolant accident load demand as discussed in the UFSAR, Section 9.5.4.2 (Ref. 1). The maximum load demand is calculated ~~using the assumption that at least two DGs are available.~~ This onsite fuel oil capacity is sufficient to operate the DGs for longer than the time to replenish the onsite supply from outside sources.

Fuel oil is transferred from storage tank to day tank by either of two transfer pumps associated with each storage tank. Redundancy of pumps and piping precludes the failure of one pump, or the rupture of any pipe, valve, or tank to result in the loss of more than one DG. All outside tanks, pumps, and piping are located underground.

For proper operation of the standby DGs, it is necessary to ensure the proper quality of the fuel oil. Regulatory Guide 1.137 (Ref. 2) addresses the recommended fuel oil practices as supplemented by ANSI N195-1976 (Ref. 3). The fuel oil properties governed by these SRs are the water and sediment content, the kinematic viscosity, and impurity level.

San Onofre has a Diesel Fuel Oil (DFO) testing program which ensures proper fuel oil quality. The program includes purchasing, receipt testing of new fuel oil, and periodic analyses of the stored fuel. San Onofre is not committed to the fuel analysis portion of Regulatory Guide 1.137 (Ref. 2) or ANSI N195-1976 (Ref. 3); however, these standards were utilized as guidance in the development of the DFO testing program.

The DG lubrication system is designed to provide sufficient lubrication to permit proper operation of its associated DG under all loading conditions. The system is required to circulate the lube oil to the diesel engine working surfaces and to remove excess heat generated by friction during operation. Each engine oil sump contains an inventory capable of supporting a minimum of 7 days of operation. The onsite storage in addition to the engine oil sump is sufficient to ensure 7 days of continuous operation. This supply is sufficient supply to allow the operator to replenish lube oil from outside sources.

Each DG has an air start system with adequate capacity for five successive start attempts on the DG without recharging the air start receiver(s).

(continued)

BASES

APPLICABILITY (continued)

air are required to be within limits when the associated DG is required to be OPERABLE.

ACTIONS

A.1

In this Condition, the 7 day fuel oil supply (89% level) for a DG is not available. However, the Condition is restricted to fuel oil level reductions that maintain at least a 6 day supply (76% level). These circumstances may be caused by events such as full load operation required after an inadvertent start while at minimum required level; or feed and bleed operations, which may be necessitated by increasing particulate levels or any number of other oil quality degradations. This restriction allows sufficient time for obtaining the requisite replacement volume and performing the analyses required prior to addition of fuel oil to the tank. A period of 48 hours is considered sufficient to complete restoration of the required level prior to declaring the DG inoperable. This period is acceptable based on the remaining capacity (> 6 days), the fact that procedures will be initiated to obtain replenishment, and the low probability of an event during this brief period.

TP

The analyses for the fuel oil are based upon the requirements in gallons. The percentage figures are provided because the fuel oil level indicators in the control room are marked in percentages not in gallons.

B.1

With lube oil inventory ~~< 413 gal for the 20 cylinder engine and < 278 gal for the 16 cylinder engine~~ less than the TSmin marking in the dipstick, sufficient lubricating oil to support 7 days of continuous DG operation at full load conditions may not be available. However, the Condition is restricted to lube oil volume reductions that maintain at least a 6 day supply (greater than or equal to the TSinop marking in the dipstick). This restriction allows sufficient time to obtain the requisite replacement volume. A period of 48 hours is considered sufficient to complete restoration of the required volume prior to declaring the DG inoperable. This period is acceptable based on the remaining capacity (> 6 days), the low rate of usage, the fact that procedures will be initiated to obtain replenishment, and the low probability of an event during this brief period.

(continued)

BASES

ACTIONS (continued)

INSERT "B"

D ~~C~~.1

This Condition is entered as a result of a failure to meet the acceptance criterion of SR 3.8.3.3. Normally, trending of particulate levels allows sufficient time to correct high particulate levels prior to reaching the limit of acceptability. Poor sample procedures (bottom sampling), contaminated sampling equipment, and errors in laboratory analysis can produce failures that do not follow a trend. Since the presence of particulates does not mean failure of the fuel oil to burn properly in the diesel engine, and particulate concentration is unlikely to change significantly between Surveillance Frequency intervals, and proper engine performance has been recently demonstrated (within 31 days), it is prudent to allow a brief period prior to declaring the associated DG inoperable. The 7 day Completion Time allows for further evaluation, resampling, and re-analysis of the DG fuel oil.

E ~~D~~.1

With the new fuel oil properties defined in the Bases for SR 3.8.3.3 not within the required limits, a period of 30 days is allowed for restoring the stored fuel oil properties. This period provides sufficient time to test the stored fuel oil to determine that the new fuel oil, when mixed with previously stored fuel oil, remains acceptable, or restore the stored fuel oil properties. This restoration may involve feed and bleed procedures, filtering, or combinations of these procedures. Even if a DG start and load was required during this time interval and the fuel oil properties were outside limits, there is a high likelihood that the DG would still be capable of performing its intended function.

F ~~E~~.1

With starting air receiver pressure < 175 psig, sufficient capacity for five successive DG start attempts does not exist. However, as long as the receiver pressure is ≥ 136 psig, there is adequate capacity for at least one start attempt, and the DG can be considered OPERABLE while the air receiver pressure is restored to the required limit. A period of 48 hours is considered sufficient to complete

(continued

INSERT "B"

C.1

In this Condition, the 7 day fuel oil supply (72% level) for a DG during Mode 5 or 6 is not available. However, the Condition is restricted to fuel oil level reductions that maintain at least a 6 day supply (63% level). These circumstances may be caused by events such as full load operation required after an inadvertent start while at minimum required level; or feed and bleed operations, which may be necessitated by increasing particulate levels or any number of other oil quality degradations. This restriction allows sufficient time for obtaining the requisite replacement volume and performing the analyses required prior to addition of fuel oil to the tank. A period of 48 hours is considered sufficient to complete restoration of the required level prior to declaring the DG inoperable. This period is acceptable based on the remaining capacity (> 6 days), the fact that procedures will be initiated to obtain replenishment, and the low probability of an event during this brief period.

BASES

ACTIONS

F~~E~~.1 (continued)

restoration to the required pressure prior to declaring the DG inoperable. This period is acceptable based on the remaining air start capacity, the fact that most DG starts are accomplished on the first attempt, and the low probability of an event during this brief period.

G~~F~~.1

With a Required Action and associated Completion Time not met, or one or more DGs with diesel fuel oil or lube oil not within limits for reasons other than addressed by Conditions A through E F, the associated DG may be incapable of performing its intended function and must be immediately declared inoperable.

SURVEILLANCE REQUIREMENTS

SR 3.8.3.1

This SR provides verification that there is an adequate inventory of fuel oil (≥89% in Mode 1, 2, 3, or 4 and ≥72% in Mode 5 or 6) in the storage tanks to support each DG's operation for 7 days at full load. The 7 day period is sufficient time to place the unit in a safe shutdown condition and to bring in replenishment fuel from an offsite location.

The 31 day Frequency is adequate to ensure that a sufficient supply of fuel oil is available, since low level alarms are provided and unit operators would be aware of any large uses of fuel oil during this period.

SR 3.8.3.2

This Surveillance ensures that sufficient lube oil inventory is available to support at least 7 days of full load operation for each DG. The TS min (413 gal for the 20 cylinder engine and 370 gal for the 16 cylinder engine) requirements are based on the DG manufacturer consumption values for the run time of the DG. Implicit in this SR is the requirement to verify the capability to transfer the lube oil from its storage location to the DG, when the DG lube oil sump does not hold adequate inventory for 7 days of full load

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.3.2 (continued)

operation without the level reaching the manufacturer recommended minimum level.

A 31 day Frequency is adequate to ensure that a sufficient lube oil supply is onsite, since DG starts and run time are closely monitored by the unit staff.

SR 3.8.3.3

The tests listed below are a means of determining whether new fuel oil is of the appropriate grade and has not been contaminated with substances that would have an immediate, detrimental impact on diesel engine combustion. If results from these tests are within acceptable limits, the fuel oil may be added to the storage tanks without concern for contaminating the entire volume of fuel oil in the storage tanks. These tests are to be conducted prior to adding the new fuel to the storage tank(s), but in no case is the time between receipt of new fuel and conducting the tests to exceed 31 days. The tests, limits, and applicable ASTM Standards are as follows:

a. Sample the new fuel oil in accordance with ASTM D4057-81 (Ref. 6);

b. Verify in accordance with the tests specified in ASTM D975-81 (Ref. 6) that the sample has a kinematic viscosity at 40°C of ≥ 1.9 centistokes and ≤ 4.1 centistokes, a water and sediment content of ≤ 0.05% by volume, and a flash point of ≥ 125°F; and

c. Verify in accordance with ASTM D287-82 that the sample has an API gravity at 60°F of ≥27° and ≤39°.

¶ Failure to meet any of the above limits is cause for rejecting the new fuel oil, but does not represent a failure to meet the LCO concern since the fuel oil is not added to the storage tanks.

Within 31 days following the initial new fuel oil delivery, the fuel oil is analyzed to establish that the other properties specified in Table 1 of ASTM D975-81 (Ref. 6) are met when tested in accordance with ASTM D975-81, except that the analysis for 1) sulfur may be performed in accordance with ASTM D1266, D1552, D2622, D3120, or D4294 and 2) a calculated cetane index may be determined in accordance with ASTM D976.

The 31 day period is acceptable because the fuel oil properties of interest, even if they were not within stated limits, would not have an immediate effect on DG operation. This Surveillance ensures the availability of high quality fuel oil for the DGs.

Fuel oil degradation during long term storage ~~shows up as~~ may be indicated by an increase in particulate, due mostly to oxidation. The

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.3.3 (continued)

presence of particulate does not mean the fuel oil will not burn properly in a diesel engine. The particulate can cause fouling of filters and fuel oil injection equipment, however, which can cause engine failure.

At least once per 92 days total particulate contamination of stored fuel ~~Particulate concentrations~~ should be determined in accordance with ASTM D2276-83, Method A (Ref. 6). This method involves a gravimetric determination of total particulate concentration in the fuel oil and has a limit of ≤ 10 mg/L. It is acceptable to obtain a field sample for subsequent laboratory testing in lieu of field testing.

The Frequency of this test takes into consideration fuel oil degradation trends that indicate that particulate concentration is unlikely to change significantly between Frequency intervals.

SR 3.8.3.4

This Surveillance ensures that, without the aid of the refill compressor, sufficient air start capacity for each DG is available. The system design requirements provide for a minimum of five engine start cycles without recharging. The start cycle air usage has been determined by actual testing. ~~is defined by the DG vendor, but usually is measured in terms of time (seconds of cranking) or engine cranking speed.~~ The pressure specified in this SR is intended to reflect the lowest value at which the five starts can be accomplished.

The 31 day Frequency takes into account the capacity, capability, redundancy, and diversity of the AC sources and other indications available in the control room, including alarms, to alert the operator to below normal air start pressure.

SR 3.8.3.5

Microbiological fouling is a major cause of fuel oil degradation. There are numerous microorganisms that can grow in fuel oil and cause fouling, but all must have a water environment in order to survive. Removal of water from the fuel storage tanks once every 31 days eliminates

(continue

BASES

REFERENCES (continued)

6. ASTM Standards: D4057-81; D975-81; D2276-83.

7. ASME, Boiler and Pressure Vessel Code, Section XI.

D1266- ; D1552- ;
D2622- ; D4294- ;
D976- ;

BASES

LCO (continued)

An OPERABLE DC electrical power subsystem requires the required battery and associated charger to be operating and connected to the associated DC bus.

APPLICABILITY

The DC electrical power sources are required to be OPERABLE in MODES 1, 2, 3, and 4 to ensure safe unit operation and to ensure that:

a. Acceptable fuel design limits and reactor coolant pressure boundary limits are not exceeded as a result of AOOs or abnormal transients; and

b. Adequate core cooling is provided, and containment integrity and other vital functions are maintained in the event of a postulated DBA.

The DC electrical power requirements for MODES 5 and 6 are addressed in the Bases for LCO 3.8.5, "DC Sources – Shutdown."

ACTIONS

A.1 and B.1

Condition A or B represents one train with a loss of ability to completely respond to an event, and a potential loss of ability to remain energized during normal operation. It is therefore, imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for complete loss of DC power to the affected train. The 2 hour limit for Condition A is consistent with the allowed time for an inoperable DC distribution system train. This 2 hour limit is appropriate for 125 VDC Trains A and B because these trains supply the majority of the required safety related loads. The 72 hour limit for Condition B is consistent with the allowed time for Trains C and D as determined from a San Onofre Units 2 and 3 probabilistic risk assessment (PRA).

If one of the required DC electrical power subsystems is inoperable (e.g., inoperable battery, inoperable battery charger, or inoperable battery charger and associated inoperable battery), the remaining DC electrical power subsystem has the capacity to support a safe shutdown and to mitigate an accident condition. Since a subsequent worst case single failure would, however, result in the loss of two of the remaining 125 VDC electrical power subsystems with attendant loss of ESF functions, continued power operation should not exceed 2 hours for Trains A or B and 72 hours for Trains C or D. The 2 hour Completion Time for Trains A or B is based on Regulatory Guide 1.93 (Ref. 8) and reflects

(continued)

BASES

ACTIONS

~~A.1~~ A.1 and B.1 (continued)

The 72 hour Completion Time is based on a PRA which determined that the resulting increase in risk of core damage due to unavailability of Trains C or D is significantly low. The resulting increase in risk of core damage from a year long outage of Train C or D is calculated to be approximately 1.9E-6 per year. A single 72 hour outage of Train C or Train D represents a 0.05% (1.6E-8) increase in the total core damage from internal events as calculated in the San Onofre Units 2 and 3 Individual Plant Examination (IPE). Both the 2 hour and 72 hour Completion Times reflect a reasonable time to assess unit status as a function of the inoperable DC electrical power subsystem and, if the DC electrical power subsystem is not restored to OPERABLE status, to prepare to effect an orderly and safe unit shutdown.

~~B~~ C.1 and ~~B~~ C.2

If the inoperable DC electrical power subsystem cannot be restored to OPERABLE status within the required Completion Time, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems. The Completion Time to bring the unit to MODE 5 is consistent with the time required in Regulatory Guide 1.93 (Ref. 8).

D ~~C~~.1

Condition ~~B~~ D represents one train with a loss of ability to completely respond to a long term event, and a potential loss of ability to remain energized during normal operation. Since eventual failure of the battery to maintain the required battery cell parameters is highly probable, it is imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for complete loss of DC power to the affected train. The additional time provided by the Completion Time is consistent with the battery's capability to maintain its short term capability to respond to a design basis event. A note is added to take exception to the allowance of LCO 3.0.4 to enter Modes or other specified conditions in the Applicability. Even though Condition ~~C~~ D Required Actions do not require a plant shutdown or require exiting the Modes or other specified conditions in the Applicability, the condition of the DC system is not such that extended operation is expected. Therefore, the note requires restoration of the inoperable battery charger to OPERABLE status prior to increasing power. This exception is not intended to preclude the allowance of LCO 3.0.4 to always enter Modes or other

(continued)

BASES

ACTIONS

~~C~~D.1 (continued)

specified conditions in the Applicability as a result of a plant shutdown.

~~D~~E.1

If the battery cell parameters cannot be maintained within Category A limits, the short term capability of the battery is also degraded and the battery must be declared inoperable.

SURVEILLANCE REQUIREMENTS

SR 3.8.4.1

Verifying battery terminal voltage while on float charge for the batteries helps to ensure the effectiveness of the charging system and the ability of the batteries to perform their intended function. Float charge is the condition in which the charger is supplying the continuous charge required to overcome the internal losses of a battery (or battery cell) and maintain the battery (or a battery cell) in a fully charged state. The voltage requirements are based on the nominal design voltage of the battery and are consistent with the initial voltages assumed in the battery sizing calculations. The 7 day Frequency is consistent with manufacturer recommendations and IEEE-450 (Ref. 9).

SR 3.8.4.2

Visual inspection to detect corrosion of the battery cells and connections, or measurement of the resistance of each intercell, interrack, intertier, and terminal connection, provides an indication of physical damage or abnormal deterioration that could potentially degrade battery performance.

The limits established for this SR must be no more than 20% above the resistance as measured during installation or not above the ceiling value established by the manufacturer.

The Surveillance Frequency for these inspections, which can detect conditions that can cause power losses due to resistance heating, is 92 days. This Frequency is

(continued)

60

SURVEILLANCE REQUIREMENTS

SR 3.8.4.7 (continued)

This SR is modified by two Notes. Note 1 allows the once per 72 months performance of SR 3.8.4.8 in lieu of SR 3.8.4.7. This substitution is acceptable because SR 3.8.4.8 represents a more severe test of battery capacity than does SR 3.8.4.7. Note 2 acknowledges that credit may be taken for unplanned events that satisfy this SR.

SR 3.8.4.8

A battery performance test is a test of constant current capacity of a battery, normally done in the "as found" condition, after having been in service, to detect any change in the capacity determined by the acceptance test. The test is intended to determine overall battery degradation due to age and usage.

The acceptance criteria for this Surveillance are consistent with IEEE-450 (Ref. 9) and IEEE-485 (Ref. 5). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements.

60

The Surveillance Frequency for this test is 72 months, or every 12 months if the battery shows degradation or has reached 85% of its expected life. Degradation is indicated, according to IEEE-450 (Ref. 9), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is below 90% of the manufacturer's rating. ~~The 72 month surveillance frequency is intended to ensure the surveillance will occur on a refueling cycle outage based on the expected 24 month refueling cycle.~~

This SR is modified by a Note which acknowledges that credit may be taken for unplanned events that satisfy this SR.

REFERENCES

1. 10 CFR.50, Appendix A, GDC 17.
2. Regulatory Guide 1.6, March 10, 1971.

(continued)

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

The Category A limit specified for specific gravity for each pilot cell is ≥ 1.200 (0.015 below the manufacturer fully charged nominal specific gravity or a battery charging current that had stabilized at a low value). This value is characteristic of a charged cell with adequate capacity. According to IEEE-450 (Ref. 3), the specific gravity readings are based on a temperature of 77°F (25°C).

The specific gravity readings are corrected for actual electrolyte temperature and level. For each 3°F (1.67°C) above 77°F (25°C), 1 point (0.001) is added to the reading; 1 point is subtracted for each 3°F below 77°F. The specific gravity of the electrolyte in a cell increases with a loss of water due to electrolysis or evaporation. Footnote b to Table 3.8.6-1 requires the above mentioned correction for electrolyte level and temperature, with the exception that level correction is not required when battery charging current is < 2 amps on float charge. This current provides, in general, an indication of overall battery condition.

Because of specific gravity gradients that are produced during the recharging process, delays of several days may occur while waiting for the specific gravity to stabilize. A stabilized charging current at the charging voltage is an acceptable alternative to specific gravity measurement for determining the state of charge of the designated pilot cell. This phenomenon is discussed in IEEE-450 (Ref. 3). Footnote c to Table 3.8.6-1 allows the float charge current to be used as an alternate to specific gravity for up to 7 days following a battery equalizing recharge.

Category B defines the normal parameter limits for each connected cell. The term "connected cell" excludes any battery cell that may be jumpered out.

The Category B limits specified for electrolyte level and float voltage are the same as those specified for Category A and have been discussed above. The Category B limit specified for specific gravity for each connected cell is ≥ 1.195 (0.020 below the manufacturer fully charged, nominal specific gravity) with the average of all connected cells > 1.205 (0.010 below the manufacturer fully charged, nominal specific gravity). These values are based on

≥

(continued)

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.7 Inverters – Operating

125

BASES

BACKGROUND

The inverters are the preferred source of power for the AC vital buses because of the stability and reliability they achieve in being powered from the 120 VDC battery source. The function of the inverter is to convert DC electrical power to AC electrical power, thus providing an uninterruptible power source for the instrumentation and controls for the Reactor Protective System (RPS) and the Engineered Safety Feature Actuation System (ESFAS). Specific details on inverters and their operating characteristics are found in the UFSAR, Chapter 8 (Ref. 1).

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the UFSAR, Chapter 6 (Ref. 2) and Chapter 15 (Ref. 3), assume Engineered Safety Feature systems are OPERABLE. The DC to AC inverters are designed to provide the required capacity, capability, redundancy, and reliability to ensure the availability of necessary power to the RPS and ESFAS instrumentation and controls so that the fuel, Reactor Coolant System, and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for Section 3.2, Power Distribution Limits; Section 3.4, Reactor Coolant System (RCS); and Section 3.6, Containment Systems.

The OPERABILITY of the inverters is consistent with the initial assumptions of the accident analyses and is based on meeting the design basis of the unit. This includes maintaining required AC vital buses OPERABLE during accident conditions in the event of:

a. An assumed loss of all offsite AC electrical power or all onsite AC electrical power; and

b. A worst case single failure.

Inverters are a part of the distribution system and, as such, satisfy Criterion 3 of the NRC Policy Statement.

(continued)

BASES (continued)

LCO

The inverters ensure the availability of AC electrical power for the systems instrumentation required to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated DBA.

Maintaining the required inverters OPERABLE ensures that the redundancy incorporated into the design of the RPS and ESFAS instrumentation and controls is maintained. The four battery powered inverters (one per train) are required to be OPERABLE to ensure an uninterruptible supply of AC electrical power to the AC vital buses even if the 4.16 kV safety buses are de-energized.

OPERABLE inverters require the associated AC vital bus to be powered by the inverter, which has the correct DC voltage (105-140 V) applied from a battery to the inverter input, and inverter output AC voltage within tolerances.

This LCO is modified by a Note that allows Train A or Train B inverter to be disconnected from its battery for ≤ 24 hours, if the associated vital bus is powered from a Class 1E constant voltage transformer during the period and all other inverters are operable. This allows an equalizing charge to be placed on one battery. If the inverter(s) were not disconnected, the resulting voltage condition might damage the inverter(s). These provisions minimize the loss of equipment that would occur in the event of a loss of offsite power. The 24 hour time period for the allowance minimizes the time during which a loss of offsite power could result in the loss of equipment energized from the affected AC vital bus while taking into consideration the time required to perform an equalizing charge on the battery bank. When utilizing the allowance, if one or more of the provisions is not met (e.g., 24 hour or 72 hour time period exceeded), LCO 3.0.3 must be entered immediately.

The same Note allows either Train C or Train D inverter to be disconnected from its battery for ≤72 hours as long as all other inverters are operable.

The intent of this Note is to limit the number of inverters that may be disconnected. Only those inverters associated with the single battery undergoing an equalizing charge may be disconnected. All other inverters must be aligned to their associated batteries, regardless of the number of inverters or unit design.

(continued)

BASES (continued)

APPLICABILITY

The inverters are required to be OPERABLE in MODES 1, 2, 3, and 4 to ensure that:

a. Acceptable fuel design limits and reactor coolant pressure boundary limits are not exceeded as a result of AOOs or abnormal transients; and

b. Adequate core cooling is provided, and containment OPERABILITY and other vital functions are maintained in the event of a postulated DBA.

Inverter requirements for MODES 5 and 6 are covered in the Bases for LCO 3.8.8, "Inverters – Shutdown."

ACTIONS

A.1 and A.2

Required Action A.1 is modified by a Note, which states to enter the applicable conditions and Required Actions of LCO 3.8.9, "Distribution Systems – Operating," when Condition A is entered with ~~an~~ either Train A or Train B AC vital bus de-energized. This ensures the vital bus is returned to OPERABLE status within 2 hours.

Required Action A.2 allows 24 hours to fix the inoperable Train A or Train B inverter and return it to service. The 24 hour limit is based upon engineering judgment, taking into consideration the time required to repair an inverter and the additional risk to which the unit is exposed because of the inverter inoperability. This has to be balanced against the risk of an immediate shutdown, along with the potential challenges to safety systems such a shutdown might entail. When the AC vital bus is powered from its constant voltage source, it is relying upon interruptible AC electrical power sources (offsite and onsite). The uninterruptible, battery backed inverter source to the AC vital buses is the preferred source for powering instrumentation trip setpoint devices.

INSERT "D" ¶

C ~~B~~.1 and C ~~B~~.2

If the inoperable devices or components cannot be restored to OPERABLE status within the required Completion Time, 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

(continued)

INSERT "D"

B.1

Required Action B.1 is modified by a Note, which states to enter the applicable conditions and Required Actions of LCO 3.8.9, "Distribution Systems-Operating," when Condition B is entered with either Train C or Train D AC vital bus de-energized. This ensures the vital bus is returned to OPERABLE status within 72 hours. The 72 hour limit is based on the results of a probabilistic risk assessment which determined that the resulting increase in risk of core damage due to the unavailability of Train C or D is significantly low. The resulting increase in risk of core damage from a year long outage of Train C or D is calculated to be approximately 1.9E-6 per year. A single 72 hour outage of Train C or D represents a 0.05% (1.6E-8) increase in the total core damage from internal events as calculated in the San Onofre Units 2 and 3 Individual Plant Examination.

BASES

ACTIONS

~~B~~C.1 and ~~B~~C.2 (continued)

at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

SURVEILLANCE REQUIREMENTS

SR 3.8.7.1

This Surveillance verifies that the inverters are functioning properly with all required circuit breakers closed and AC vital buses energized from the inverter. The verification of proper voltage output ensures that the required power is readily available for the instrumentation of the RPS and ESFAS connected to the AC vital buses. The 7 day Frequency takes into account the redundant capability of the inverters and other indications available in the control room that alert the operator to inverter malfunctions.

REFERENCES

1. UFSAR, Chapter 8.
2. UFSAR, Chapter 6.
3. UFSAR, Chapter 15.

BASES

ACTIONS

A.1 (continued)

train by stabilizing the unit, and on restoring power to the affected train. The 8 hour time limit before requiring a unit shutdown in this condition is acceptable because of:

a. The potential for decreased safety if the unit operator's attention is diverted from the evaluations and actions necessary to restore power to the affected train, to the actions associated with taking the unit to shutdown within this time limit; and

b. The potential for an event in conjunction with a single failure of a redundant component in the train with AC power.

B.1

With ~~one~~ either Train A or Train B AC vital bus inoperable, the remaining OPERABLE AC vital buses are capable of supporting the minimum safety functions necessary to shut down the unit and maintain it in the safe shutdown condition. Overall reliability is reduced, however, since an additional single failure could result in the minimum required ESF functions not being supported. Therefore, the required AC vital bus must be restored to OPERABLE status within 2 hours.

Condition B represents ~~one~~ either Train A or Train B AC vital bus without power; potentially both the DC source and the associated AC source are nonfunctioning. In this situation, the unit is significantly more vulnerable to a complete loss of all noninterruptible power. It is, therefore, imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for loss of power to the remaining vital buses, and restoring power to the affected vital bus.

This 2 hour limit is more conservative than Completion Times allowed for the vast majority of components that are without adequate vital AC power.

The 2 hour Completion Time takes into account the importance to safety of restoring the AC vital bus to OPERABLE status, the redundant capability afforded by the other OPERABLE vital buses, and the low probability of a DBA occurring during this period.

(continued)

BASES

ACTIONS
(continued)

IP

INSERT
"G"

D ~~E~~.1

With the Train A or Train B DC bus in one train inoperable, the remaining DC electrical power distribution subsystems are capable of supporting the minimum safety functions necessary to shut down the reactor and maintain it in a safe shutdown condition, assuming no single failure. The overall reliability is reduced, however, because a single failure in the remaining DC electrical power distribution subsystem could result in the minimum required ESF functions not being supported. Therefore, the required DC bus must be restored to OPERABLE status within 2 hours.

Condition ~~E~~ D represents ~~one train~~ Train A or Train B without adequate DC power; potentially both with the battery significantly degraded and the associated charger nonfunctioning. In this situation, the unit is significantly more vulnerable to a complete loss of all DC power. It is, therefore, imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for loss of power to the remaining trains and restoring power to the affected train.

This 2 hour limit is more conservative than Completion Times allowed for the vast majority of components which would be without power.

The 2 hour Completion Time for Train A or Train B DC buses is consistent with Regulatory Guide 1.93 (Ref. 3).

IP

INSERT
"H"

F ~~D~~.1 and F ~~D~~.2

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

(continued)

INSERT "G"

C.1

With either Train C or Train D AC vital bus inoperable, the remaining OPERABLE AC vital buses are capable of supporting the minimum safety functions necessary to shut down the unit and maintain it in the safe shutdown condition. Overall reliability is reduced, however, since an additional single failure could result in the minimum required ESF functions not being supported. Therefore, the required AC vital bus must be restored to OPERABLE status within 72 hours.

Condition C represents either one of the Train C or Train D AC vital bus without power; potentially both the DC source and the associated AC source are nonfunctioning. In this situation, the unit is significantly more vulnerable to a complete loss of all noninterruptible power. It is, therefore, imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for loss of power to the remaining vital buses, and restoring power to the affected vital bus.

The 72 hour Completion Time is based on the results of a probabilistic risk assesment which determined the low significance of the risks involved due to the unavailability of Train C or Train D AC vital bus when compared to Train A or B AC vital bus unavailability. This completion time also takes into account the importance to safety of restoring the AC vital bus to OPERABLE status, the redundant capability afforded by the other OPERABLE vital buses, and the low probability of a DBA occurring during this period.

INSERT "H"

E.1

With either Train C or Train D DC bus inoperable, the remaining DC electrical power distribution subsystems are capable of supporting the minimum safety functions necessary to shut down the reactor and maintain it in a safe shutdown condition, assuming no single failure. The overall reliability is reduced, however, because a single failure in the remaining DC electrical power distribution subsystem could result in the minimum required ESF functions not being supported. Therefore, the required DC bus must be restored to OPERABLE status within 72 hours.

Condition D represents Train C or Train D without adequate DC power; potentially both with the battery significantly degraded and the associated charger nonfunctioning. In this situation, the unit is significantly more vulnerable to a complete loss of all DC power. It is, therefore, imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for loss of power to the remaining trains and restoring power to the affected train.

The 72 hour Completion Time for Train C or Train D DC bus is consistent with the results of a probabilistic risk assesment which determined the low significance of the risk involved due to the unavailability of Train C or Train D AC vital bus when compared to Train A or B AC vital bus unavailability. This completion time also takes into account the importance to safety of restoring the AC vital bus to OPERABLE status, the redundant capability afforded by the other OPERABLE vital buses, and the low probability of a DBA occurring during this period.

BASES

LCO (continued)

COLR ensures a core k_{eff} of ≤ 0.95 is maintained during fuel handling operations. Violation of the LCO could lead to an inadvertent criticality during MODE 6.

APPLICABILITY

This LCO is applicable in MODE 6 to ensure that the fuel in the reactor vessel will remain subcritical. The required boron concentration ensures a $k_{eff} \leq 0.95$. Above MODE 6, LCO 3.1.1, "SHUTDOWN MARGIN (SDM) – $T_{avg} > 200°F$," and LCO 3.1.2, "SHUTDOWN MARGIN – $T_{avg} \leq 200°F$," ensure that an adequate amount of negative reactivity is available to shut down the reactor and to maintain it subcritical.

ACTIONS

A.1 and A.2

Continuation of CORE ALTERATIONS or positive reactivity additions (including actions to reduce boron concentration) is contingent upon maintaining the unit in compliance with the LCO. If the boron concentration of any coolant volume in the RCS, or the refueling canal is less than its limit, all operations involving CORE ALTERATIONS or positive reactivity additions must be suspended immediately.

INSERT

Temperature fluctuations need not be considered when suspending positive reactivity additions

Small temperature fluctuations associated with maintaining the plant status are permissible provided they remain within limits established by Station Technical for the plant conditions.

Suspension of CORE ALTERATIONS and positive reactivity additions shall not preclude moving a component to a safe position.

A.3

In addition to immediately suspending CORE ALTERATIONS or positive reactivity additions, boration to restore the concentration must be initiated immediately.

In determining the required combination of boration flow rate and concentration, there is no unique design basis event that must be satisfied. The only requirement is to restore the boron concentration to its required value as

(continued)

APPLICABILITY

In MODE 6, the SRMs must be OPERABLE to determine changes in core reactivity. There is no other direct means available to check core reactivity levels.

In MODES 3, 4, and 5, the installed source range detectors and circuitry are required to be OPERABLE by LCO 3.3.13, "Source Range Monitors."

ACTIONS

A.1 and A.2

With only one SRM OPERABLE, redundancy has been lost. Since these instruments are the only direct means of monitoring core reactivity conditions, CORE ALTERATIONS and positive reactivity additions must be suspended immediately. Performance of Required Action A.1 shall not preclude completion of movement of a component to a safe position.

INSERT

Temperature fluctuations need not be considered when suspending positive reactivity additions

Small temperature fluctuations associated with maintaining the plant status are permissible provided they remain within limits established by Station Technical for the plant conditions.

B.1

With no SRM OPERABLE, actions to restore a monitor to OPERABLE status shall be initiated immediately. Once initiated, actions shall be continued until an SRM is restored to OPERABLE status.

B.2

With no SRM OPERABLE, there is no direct means of detecting changes in core reactivity. However, since CORE ALTERATIONS and positive reactivity additions are not to be made, the core reactivity condition is stabilized until the SRMs are OPERABLE. This stabilized condition is determined by performing SR 3.9.1.1 to verify that the required boron concentration exists.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.9.3.2

requirements. These surveillances performed during MODE 6 will ensure that the valves are capable of closing after postulated fuel handling accident to limit a release of fission product radioactivity from the containment.

REFERENCE

1. UFSAR, Section 15.7.3.4.

(continued)

BASES

APPLICABLE SAFETY ANALYSES

If the reactor coolant temperature is not maintained below 200°F, boiling of the reactor coolant could result. This could lead to inadequate cooling of the reactor fuel due to a resulting loss of coolant in the reactor vessel. Additionally, boiling of the reactor coolant could lead to a reduction in boron concentration in the coolant due to the boron plating out on components near the areas of the boiling activity, and because of the possible addition of water to the reactor vessel with a lower boron concentration than is required to keep the reactor subcritical. The loss of reactor coolant and the reduction of boron concentration in the reactor coolant would eventually challenge the integrity of the fuel cladding, which is a fission product barrier. One train of the SDC System is required to be operational in MODE 6, with the water level ≥ 23 ft above the top of the reactor vessel flange, to prevent this challenge. The LCO does permit de-energizing of the SDC pump for short durations under the condition that the boron concentration is not diluted. This conditional de-energizing of the SDC pump does not result in a challenge to the fission product barrier.

SDC and Coolant Circulation—High Water Level satisfies Criterion ~~2~~ 3 of the NRC Policy Statement.

LCO

Only one SDC loop is required for decay heat removal in MODE 6, with water level ≥ 23 ft above the top of the reactor vessel flange. Only one SDC loop is required because the volume of water above the reactor vessel flange provides backup decay heat removal capability. At least one SDC loop must be in operation to provide:

a. Removal of decay heat;

b. Mixing of borated coolant to minimize the possibility of a criticality; and

c. Indication of reactor coolant temperature.

An OPERABLE SDC loop includes an SDC pump, a heat exchanger, valves, piping, instruments, and controls to ensure an OPERABLE flow path and to determine the low end temperature.

(continued)

ATTACHMENT "D"
(Marked-Up Proposed Table of Contents and Bases)
Unit 3

TABLE OF CONTENTS

(continued)

(continued)

(continued)

APPLICABLE SAFETY ANALYSIS (continued)

pressure, linear heat rate, and the DNBR do not exceed allowable limits.

The startup of an inactive RCP will not result in a "cold water" criticality, even if the maximum difference in temperature exists between the SG and the core. The maximum positive reactivity addition that can occur due to an inadvertent RCP start is less than half the minimum required SDM. An idle RCP cannot, therefore, produce a return to power from the hot standby condition.

The ~~withdrawal~~ ejection of a CEA~~s~~ from subcritical or low power Conditions adds reactivity to the reactor core, causing both the core power level and heat flux to increase with corresponding increases in reactor coolant temperatures and pressure. The ~~withdrawal~~ ejection of a CEA~~s~~ also produces a time dependent redistribution of core power.

The SDM satisfies Criterion 2 of the NRC Policy Statement.

LCO

The MSLB (Ref. 2) and the boron dilution (Ref. 3) accidents are the most limiting analyses that establish the SDM value of the LCO. For MSLB accidents, if the LCO is violated, there is a potential to exceed the DNBR limit and to exceed 10 CFR 100, "Reactor Site Criterion," limits (Ref. 4). For the boron dilution accident, if the LCO is violated, then the minimum required time assumed for operator action to terminate dilution may no longer be applicable.

SDM is a core physics design condition that can be ensured through CEA positioning (regulating and shutdown CEAs) and through the soluble boron concentration.

APPLICABILI

In MODES 3 and 4, the SDM requirements are applicable to provide sufficient negative reactivity to meet the assumptions of the safety analyses discussed above. In MODES 1 and 2, SDM is ensured by complying with LCO 3.1.6, "Shutdown Control Element Assembly (CEA) Insertion Limits," and LCO 3.1.7. If the insertion limits of LCO 3.1.6 or LCO 3.1.7 are not being complied with, SDM is not automatically violated. The SDM must be calculated by performing a reactivity balance calculation (considering the

(continued)

BACKGROUND (continued)

Element Assembly (CEA) Insertion Limits." When the unit is in the shutdown and refueling modes, the SDM requirements are met by means of adjustments to the RCS boron concentration.

APPLICABLE SAFETY ANALYSES

The minimum required SDM is assumed as an initial condition in safety analysis. The safety analysis (Ref. 2) establishes an SDM that ensures specified acceptable fuel design limits are not exceeded for normal operation and AOOs with the assumption of the highest worth CEA stuck out following a reactor trip. When the CEAs are all verified to be inserted, by both open reactor trip breakers and the CEA position indications, it is not required to assume that the highest reactivity worth CEA is stuck out. Specifically, for MODE 5, the primary safety analysis that relies on the SDM limits is the boron dilution analysis.

The acceptance criteria for the SDM requirements are that the specified acceptable fuel design limits are maintained. This is done by ensuring that:

a. The reactor can be made subcritical from all operating conditions, transients, and Design Basis Events;

b. The reactivity transients associated with postulated accident conditions are controllable within acceptable limits (departure from nucleate boiling ratio, fuel centerline temperature limits for AOOs, and ≤ 280 cal/gm energy deposition for the CEA ejection accident); and

c. The reactor will be maintained sufficiently subcritical to preclude inadvertent criticality in the shutdown condition.

An inadvertent boron dilution is a moderate frequency incident as defined in Reference 2. The core is initially subcritical with all CEAs inserted. A Chemical and Volume Control System malfunction occurs, which causes unborated water to be pumped to the RCS ~~via three charging pumps~~.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.1.2.1 (continued)

d. Fuel burnup based on gross thermal energy generation;

e. Xenon concentration;

f. Samarium concentration; and

g. Isothermal temperature coefficient (ITC).

Using the ITC accounts for Doppler reactivity in this calculation because the reactor is subcritical, and the fuel temperature will be changing at the same rate as that of the RCS.

INSERT

The Frequency of 24 hours is based on the generally slow change in required boron concentration, and it allows sufficient time for the operator to collect the required data, which includes performing a boron concentration analysis, and complete the calculation.

REFERENCES

1. 10 CFR 50, Appendix A, GDC 26.
2. FSAR, Section 15.4.1.4.

(continued)

INSERT

The reactivity effects of items c, d, e, and f above, are nominally constant, and are bound while the RCS boron concentration is maintained greater than the refueling boron concentration specified for MODE 6 and all CEAs inserted.

Therefore, a SDM ≥ 3.0% is assured by determining at least once per 24 hours that:

a. The core has not been critical since the refueling (e.g. factors c through f are unchanged).

b. The reactor coolant system boron concentration is greater than or equal to the refueling boron concentration required by TS 3.9.1(?).

c. All CEAs are inserted.

d. No more than one charging pump is functional, by verifying that power is removed from the remaining charging pumps, when the reactor coolant level is below the hot leg centerline.

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.3 Reactivity Balance

BASES

BACKGROUND

According to GDC 26, GDC 28, and GDC 29 (Ref. 1), reactivity shall be controllable, such that, subcriticality is maintained under cold conditions, and acceptable fuel design limits are not exceeded during normal operation and anticipated operational occurrences. Therefore, a reactivity balance is used to compare the predicted versus measured core reactivity during power operation. The periodic confirmation of core reactivity is necessary to ensure that Design Basis Accident (DBA) and transient safety analyses remain valid. A large reactivity difference could be the result of unanticipated changes in fuel, control element assembly (CEA) worth, or operation at Conditions not consistent with those assumed in the predictions of core reactivity, and could potentially result in a loss of SDM or violation of acceptable fuel design limits. Comparing predicted versus measured core reactivity validates the nuclear methods used in the safety analysis and supports the SDM demonstrations (LCO 3.1.1, "SHUTDOWN MARGIN (SDM) – T_{avg} > 200°F") in ensuring the reactor can be brought safely to cold, subcritical conditions.

When the reactor core is critical or in normal power operation, a reactivity balance exists and the net reactivity is zero. A comparison of predicted and measured reactivity is convenient under such a balance, since parameters are being maintained relatively stable under steady state power conditions. The positive reactivity inherent in the core design is balanced by the negative reactivity of the control components, thermal feedback, neutron leakage, and materials in the core that absorb neutrons, such as burnable absorbers producing zero net reactivity. Excess reactivity can be inferred from the critical boron curve, which provides a prediction of the soluble boron concentration in the Reactor Coolant System (RCS) versus cycle burnup. Periodic measurement of the RCS boron concentration for comparison with the predicted value with other variables fixed (such as CEA height, temperature, and power) provides a convenient method of ensuring that core reactivity is within design expectations, and that the calculational models used to generate the safety analysis are adequate.

(continued)

BACKGROUND (continued)

In order to achieve the required fuel cycle energy output, the uranium enrichment in the new fuel loading and in the fuel remaining from the previous cycle(s), provides excess positive reactivity beyond that required to sustain steady state operation throughout the cycle. When the reactor is critical at RTP ~~and moderator temperature~~, the excess positive reactivity is compensated by burnable absorbers, CEAs, whatever neutron poisons (mainly xenon and samarium) are present in the fuel, and the RCS boron concentration.

When the core is producing THERMAL POWER, the fuel is being depleted and excess reactivity is decreasing. As the fuel depletes, the RCS boron concentration is reduced to decrease negative reactivity and maintain constant THERMAL POWER. The critical boron curve is based on steady state operation at RTP. Therefore, deviations from the predicted boron letdown curve may indicate deficiencies in the design analysis, deficiencies in the calculational models, or abnormal core conditions, and must be evaluated.

APPLICABLE SAFETY ANALYSES

Accurate prediction of core reactivity is either an explicit or implicit assumption in the accident analysis evaluations. Every accident evaluation (Ref. 2) is, therefore, dependent upon accurate evaluation of core reactivity. In particular, SDM, and reactivity transients such as CEA withdrawal accidents or CEA ejection accidents, are very sensitive to accurate prediction of core reactivity. These accident analysis evaluations rely on computer codes that have been qualified against available test data, operating plant data, and analytical benchmarks. Monitoring reactivity balance additionally ensures that the nuclear methods provide an accurate representation of the core reactivity.

Design calculations and safety analyses are performed for each fuel cycle for the purpose of predetermining reactivity behavior and the RCS boron concentration requirements for reactivity control during fuel depletion.

The comparison between measured and predicted initial core reactivity provides a normalization for calculational models used to predict core reactivity. If the measured and predicted RCS boron concentrations for identical core conditions at beginning of cycle (BOC) do not agree, then

(continued)

APPLICABLE SAFETY ANALYSES (continued)

the assumptions used in the reload cycle design analysis or the calculational models used to predict soluble boron requirements may not be accurate. If reasonable agreement between measured and predicted core reactivity exists at BOC, then the prediction may be normalized to the measured boron concentration. Thereafter, any significant deviations in the measured boron concentration from the predicted critical boron curve that develop during fuel depletion may be an indication that the calculational model is not adequate for core burnups beyond BOC, or that an unexpected change in core conditions has occurred.

The normalization of predicted RCS boron concentration to the measured value is to be performed prior to reaching 60 EFPD following startup from a refueling outage, with the CEAs in their normal positions for power operation. The normalization is performed near BOC, so that core reactivity relative to predicted values can be continually monitored and evaluated as core conditions change during the cycle.

The reactivity balance satisfies Criterion 2 of the NRC Policy Statement.

LCO

Large differences between actual and predicted core reactivity may indicate that the assumptions of the DBA and transient analyses are no longer valid, or that the uncertainties in the nuclear design methodology are larger than expected. A limit on the reactivity balance of ± 1% Δk/k has been established, based on engineering judgment. A ±1% Δk/k deviation in reactivity from that predicted is larger than expected for normal operation, and should therefore be evaluated.

When measured core reactivity is within ±1% Δk/k of the predicted value at steady state thermal conditions, the core is considered to be operating within acceptable design limits. Since deviations from the limit are normally detected by comparing predicted and measured steady state RCS critical boron concentrations, the difference between measured and predicted values would be approximately 100 ppm (depending on the boron worth) before the limit is reached.

(continued)

BASES

LCO
(continued)

These values are well within the uncertainty limits for analysis of boron concentration samples, so that spurious violations of the limit due to uncertainty in measuring the RCS boron concentration are unlikely.

APPLICABILITY

The limits on core reactivity must be maintained during MODES 1 and 2 because a reactivity balance must exist when the reactor is critical or producing THERMAL POWER. As the fuel depletes, core conditions are changing, and confirmation of the reactivity balance ensures the core is operating as designed. This Specification does not apply in MODES 3, 4, and 5 because the reactor is shut down and the reactivity balance is not changing.

In MODE 6, fuel loading results in a continually changing core reactivity. Boron concentration requirements (LCO 3.9.1, "Boron Concentration") ensure that fuel movements are performed within the bounds of the safety analysis. A SDM demonstration is required by the LCS during the first startup following operations that could have altered core reactivity (e.g., fuel movement, or CEA replacement, or shuffling).

ACTIONS

A.1 and A.2

Should an anomaly develop between measured and predicted core reactivity, an evaluation of the core design and safety analysis must be performed. Core conditions are evaluated to determine their consistency with input to design calculations. Measured core and process parameters are evaluated to determine that they are within the bounds of the safety analysis, and safety analysis calculational models are reviewed to verify that they are adequate for representation of the core conditions. The required Completion Time of 72 hours is based on the low probability of a DBA occurring during this period, and allows sufficient time to assess the physical condition of the reactor and complete the evaluation of the core design and safety analysis.

Following evaluations of the core design and safety analysis, the cause of the reactivity anomaly may be

(continued)

ACTIONS

A.1 and A.2 (continued)

resolved. If the cause of the reactivity anomaly is a mismatch in core conditions at the time of RCS boron concentration sampling, then a recalculation of the RCS boron concentration requirements may be performed to demonstrate that core reactivity is behaving as expected. If an unexpected physical change in the condition of the core has occurred, it must be evaluated and corrected, if possible. If the cause of the reactivity anomaly is in the calculation technique, then the calculational models must be revised to provide more accurate predictions. If any of these results are demonstrated and it is concluded that the reactor core is acceptable for continued operation, then the boron letdown curve may be renormalized, and power operation may continue. If operational restrictions or additional SRs are necessary to ensure the reactor core is acceptable for continued operation, then they must be defined.

The required Completion Time of 72 hours is adequate for preparing whatever operating restrictions or Surveillances that may be required to allow continued reactor operation.

B.1

If the core reactivity cannot be restored to within ±1% Δk/k, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours. If the SDM for MODE 3 is not met, then boration as required by TS 3.1.1.1 ACTION A.1 would occur. 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 3.1.3.1

Core reactivity is verified by periodic comparisons of measured and predicted RCS boron concentrations. The comparison is made considering that other core conditions are fixed or stable including CEA position, moderator temperature, fuel temperature, fuel depletion, xenon concentration, and samarium concentration.

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.1.3.1 (continued)

The SR is modified by three Notes. The first Note indicates that the normalization of predicted core reactivity to the measured value (if performed) may take place within the first 60 effective full power days (EFPD) after each fuel loading. This allows sufficient time for core conditions to reach steady state, but prevents operation for a large fraction of the fuel cycle without establishing a benchmark for the design calculations. The required subsequent Frequency of every 31 EFPD following the initial 60 EFPD after entering MODE 1, is acceptable, based on the slow rate of core changes due to fuel depletion and the presence of other indicators for prompt indication of an anomaly. A Note, "Only required after 60 EFPD," is added to the Frequency column to allow this. The Second Note indicates that the performance of SR 3.1.3.1 is not required prior to entering MODES 1 or 2. This Note is required to allow entry into MODES 1 or 2 to verify core reactivity because Applicability is for MODES 1 and 2.

REFERENCES

1. 10 CFR 50, Appendix A, GDC 26, GDC 28, and GDC 29.
2. SONGS Units 2 and 3 UFSAR, Section 15.

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.5 Control Element Assembly (CEA) Alignment

BASES

BACKGROUND

The OPERABILITY (e.g., trippability) of the shutdown and regulating CEAs is an initial assumption in all safety analyses that assume CEA insertion upon reactor trip. Maximum CEA misalignment is an initial assumption in the safety analyses that directly affects core power distributions and assumptions of available SDM.

The applicable criteria for these reactivity and power distribution design requirements are 10 CFR 50, Appendix A, GDC 10 and GDC 26 (Ref. 1) and 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Cooled Nuclear Power Plants" (Ref. 2).

Mechanical or electrical failures may cause a CEA to become inoperable or to become misaligned from its group. CEA inoperability or misalignment may cause increased power peaking, due to the asymmetric reactivity distribution and a reduction in the total available CEA worth for reactor shutdown. Therefore, CEA alignment and operability are related to core operation in design power peaking limits and the core design requirement of a minimum SDM.

Limits on CEA alignment and operability have been established, and all CEA positions are monitored and controlled during power operation to ensure that the power distribution and reactivity limits defined by the design power peaking and SDM limits are preserved.

CEAs are moved by their control element drive mechanisms (CEDMs). Each CEDM moves its CEA one step (approximately ¾ inch) at a time, but at varying rates (~~steps per minute~~ 30 inches/min full Length CEAs and 20 inches/min for Part length CEAs) depending on the signal output from the Control Element Drive Mechanism Control System (CEDMCS).

The CEAs are arranged into groups that are radially symmetric. Therefore, movement of the CEAs does not introduce radial asymmetries in the core power distribution. The shutdown and regulating CEAs provide the required reactivity worth for immediate reactor shutdown upon a reactor trip. The regulating CEAs also provide reactivity (power level) control during normal operation and

(continued)

BACKGROUND (continued)

transients. ~~Their movement may be automatically controlled by the Reactor Regulating System.~~ Part length CEAs are not credited in the safety analyses for shutting down the reactor, as are the regulating and shutdown groups. The part length CEAs are used ~~solely~~ for ASI control and reactivity (power level) control during normal operation and transients. The axial position of shutdown and regulating CEAs is indicated by two separate and independent systems, which are the Plant Computer CEA Position Indication System and the Reed Switch Position Indication System.

The Plant Computer CEA Position Indication System counts the commands sent to the CEA gripper coils from the CEDMCS that moves the CEAs. There is one step counter for each group of CEAs. Individual CEAs in a group all receive the same signal to move and should, therefore, all be at the same position indicated by the group step counter for that group. The Plant Computer CEA Position Indication System is considered highly precise (± one step or ± ¾ inch). If a CEA does not move one step for each command signal, the step counter will still count the command and incorrectly reflect the position of the CEA.

The Reed Switch Position Indication System provides a highly accurate indication of actual CEA position, but at a lower precision than the step counters. This system is ~~based on inductive analog signals from~~ a series of reed switches spaced along a tube with a center to center distance of 1.5 inches, which is two steps. To increase the reliability of the system, there are redundant reed switches at each position.

APPLICABLE SAFETY ANALYSES

CEA misalignment accidents are analyzed in the safety analysis (Ref. 3). The accident analysis defines CEA misoperation as any event, with the exception of sequential group withdrawals, which could result from a single malfunction in the reactivity control systems. For example, CEA misalignment may be caused by a malfunction of the CEDM, CEDMCS, or by operator error. A stuck CEA may be caused by mechanical jamming of the CEA fingers or of the gripper. Inadvertent withdrawal of a single CEA may be caused by ~~opening of the electrical circuit of the CEDM holding coil for a full length or part length CEA.~~ A dropped CEA
a single malfunction of the CEDMCS or by operator error

(continued)

APPLICABLE SAFETY ANALYSES (continued)

subgroup could be caused by an electrical failure in the CEA coil power programmers.

The acceptance criteria for addressing CEA inoperability or misalignment are that:

a. There shall be no violations of:

   1. specified acceptable fuel design limits, or
   2. Reactor Coolant System (RCS) pressure boundary integrity; and

b. The core must remain subcritical after accident transients.

Three types of misalignment are distinguished. During movement of a group, one CEA may stop moving while the other CEAs in the group continue. This condition may cause excessive power peaking. The second type of misalignment occurs if one CEA fails to insert upon a reactor trip and remains stuck fully withdrawn. This condition requires an evaluation to determine that sufficient reactivity worth is held in the remaining CEAs to meet the SDM ~~requirement with the maximum worth CEA stuck fully withdrawn~~ (Ref. 5). If a CEA is stuck in the fully withdrawn position, its worth is added to the SDM requirement, since the safety analysis does not take two stuck CEAs into account. The third type of misalignment occurs when one CEA drops partially or fully into the reactor core. This event causes an initial power reduction followed by a return towards the original power due to positive reactivity feedback from the negative moderator temperature coefficient. Increased peaking during the power increase may result in excessive local linear heat rates (LHRs).

Another type of misalignment occurs if one CEA fails to insert upon a reactor trip and remains stuck fully withdrawn. This condition is assumed in the evaluation to determine that the required SDM is met with the maximum worth CEA also fully withdrawn (Ref. 5). 6

(continued)

APPLICABLE ANALYSES (continued)

The effect of any misoperated CEA on the core power SAFETY distribution will be assessed by the CEA calculators, and an appropriately augmented power distribution penalty factor will be supplied as input to the core protection calculators (CPCs). As the reactor core responds to the reactivity changes caused by the misoperated CEA and the ensuing reactor coolant and Doppler feedback effects, the CPCs will initiate a low DNBR or high local power density trip signal if specified acceptable fuel design limits (SAFDLs) are approached.

Since the CEA drop incidents result in the most rapid approach to SAFDLs caused by a CEA misoperation, the accident analysis analyzed a single full length CEA drop, a single part length CEA drop, and a part length CEA subgroup drop. The most rapid approach to the DNBR SAFDL may be caused by either a single full length drop or a part length CEA subgroup drop depending upon initial conditions. The most rapid approach to the fuel centerline melt SAFDL is caused by a single part length CEA drop.

In the case of the full length CEA drop, a prompt decrease in core average power and a distortion in radial power are initially produced, which when conservatively coupled result in local power and heat flux increases, and a decrease in DNBR. For plant operation within the DNBR and local power density (LPD) LCOs, DNBR and LPD trips can normally be avoided on a dropped CEA.

For a part length CEA subgroup drop, a distortion in power distribution, and a decrease in core power are produced. As the dropped part length CEA subgroup is detected, an appropriate power distribution penalty factor is ~~supplied to~~ determined by the CPCs, and a reactor trip signal on low DNBR ~~is~~ may be generated. For the part length CEA drop, both core average power and three dimensional peak to average power density increase promptly. As the dropped part length CEA is detected, core power and an appropriately augmented power distribution penalty factor are supplied to the CPCs.

(continued)

BASES (continued)

ACTIONS

A.1, A.2.1, A.2.2, A.3.1, ~~and~~ 6 A.3.2, B.1, B.2.1, B.2.2, and B.3

A CEA may become misaligned, yet remain trippable. In this condition, the CEA can still perform its required function of adding negative reactivity should a reactor trip be necessary.

If one or more regulating CEAs are misaligned by 7 inches but trippable, continued operation in MODES 1 and 2 may continue, provided, within 1 hour, the power is reduced in accordance with Figure 3.1.5-1, and SDM is ≥ 5.15% Δk/k, and within 2 hours the misaligned CEA(s) is aligned within 7 inches of its group or the misaligned CEA's group is aligned within 7 inches of the misaligned CEA(s). 6

Xenon redistribution in the core starts to occur as soon as a CEA becomes misaligned. Reducing THERMAL POWER in accordance with ~~Figure 3.1.5-1 (in the accompanying LCO)~~ 6 the COLR ensures acceptable power distributions are maintained (Ref. 6). For small misalignments (< 7 inches) of ~~the~~ 6 a CEA~~s~~ 6, there is:

a. A small effect on the time dependent long term power distributions relative to those used in generating LCOs and limiting safety system settings (LSSS) setpoints;

b. A small effect on the available SDM; and

c. A small effect on the ejected CEA worth used in the accident analysis.

With a large CEA misalignment (≥ 7 inches), however, this misalignment would cause distortion of the core power distribution. This distortion may, in turn, have a significant effect on:

a. The available SDM;

b. The time dependent, long term power distributions relative to those used in generating LCOs and LSSS setpoints; and

c. The ejected CEA worth used in the accident analysis.

(continued)

ACTIONS

B.1, B.2.1, B.2.2, and B.3

A.1, A.2.1, A.2.2, A.3.1, ~~and~~ A.3.2, (continued)

Therefore, this condition is limited to the single CEA misalignment, while still allowing 2 hours for recovery.

In both cases, a 2 hour time period is sufficient to:

a. Identify cause of a misaligned CEA;

b. Take appropriate corrective action to realign the CEAs; and

c. Minimize the effects of xenon redistribution.

In this condition, an additional allowance must be made for the worth of the affected CEA when calculating the available SDM. With one or more misaligned CEAs, SDM must be verified for CEAs at the existing nonaligned positions. SDM is calculated by performing a reactivity balance calculation according to procedure, considering the listed effects in SR 3.1.1.1. This is necessary since the OPERABLE CEAs must still meet the single failure criterion. If additional negative reactivity is required to provide the necessary SDM, it must be provided by increasing the RCS boron concentration. One hour allows sufficient time to perform the SDM calculation and make any required boron adjustment to the RCS.

6

B.1, B.2.1, B.2.2, and B.3

If one or more shutdown CEAs are misaligned by > 7 inches but trippable, continued operation in MODES 1 and 2 may continue, provided, within 1 hour, the power is reduced in accordance with Figure 3.1.5-1, and SDM is ≥ 5.15% Δk/k, and within 2 hours the misaligned CEA(s) is aligned within 7 inches of its group.

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

6

If one or more part length CEAs are misaligned by > 7 inches continued operation in MODES 1 and 2 may continue, provided power is reduced in accordance with the appropriate figure within 1 hour, and within 2 hours the misaligned CEA(s) is

(continued)

6

ACTIONS

C.1, C.2.1, and C.2.2 (continued)

restored to within 7 inches of its group, or the misaligned CEA's group is aligned within 7 inches of the misaligned CEA.

Although a part length CEA has less of an effect on core flux than a full length CEA, a misaligned part length CEA will still result in xenon redistribution and affect core power distribution. Requiring realignment within 2 hours minimizes these effects and ensures acceptable power distribution is maintained.

D.1

The ACTION statements applicable to inoperable CEA position indicators permit continued operations when the positions of CEAs with inoperable position indicators can be verified by the "Full In" or "Full Out" limits. Setting the "RSPT/CEAC Inoperable" addressable constant in the CPCs to indicate to the CPCs that one or both of the CEACs is inoperable does not necessarily constitute the inoperability of the RSPT rod indications from the respective CEAC. Operability of the CEAC rod indications is determined from the normal surveillance.

E.1

If a Required Action or associated Completion Time of Condition A, Condition B, Condition C or Condition D is not met, one regulating or shutdown CEA is untrippable, or more than one full length or part length CEA misaligned, the unit is required to be brought to MODE 3. By being brought to MODE 3, the unit is brought outside its MODE of applicability.

When a Required Action cannot be completed within the required Completion Time, a controlled shutdown should be commenced. The allowed Completion Time of 6 hours is reasonable, based on operating experience, for reaching MODE 3 from full power conditions in an orderly manner and without challenging plant systems.

If a CEA is untrippable, it is not available for reactivity insertion during a reactor trip. With an untrippable CEA,

(continued)

ACTIONS

E.1 (continued)

meeting the insertion limits of LCO 3.1.6, "Shutdown Control Element Assembly (CEA) Insertion Limits," and LCO 3.1.7, "Regulating Control Element Assembly (CEA) Insertion Limits," does not ensure that adequate SDM exists. Therefore, the plant must be shut down in order to evaluate the SDM required boron concentration and power level for critical operation.

Continued operation is not allowed in the case of more than one CEA(s) misaligned from any other CEA, in its group by > 7 inches, or with one full length CEA~~s~~ untrippable. This is because these cases are indicative of a ~~loss of SDM and~~ core power distribution~~, and a loss of safety functions~~ ~~respectively,~~ outside the initial conditions assumed in the safety analysis.

SURVEILLANCE REQUIREMENTS

SR 3.1.5.1

Verification that individual CEA positions are within 7 inches (indicated reed switch positions) of all other CEAs in the group at a 12 hour Frequency allows the operator to detect a CEA that is beginning to deviate from its expected position. The specified Frequency takes into account other CEA position information that is continuously available to the operator in the control room, so that during actual CEA motion, deviations can immediately be detected.

SR 3.1.5.2

OPERABILITY of at least two CEA position indicator channels is required to determine CEA positions, and thereby ensure compliance with the CEA alignment and insertion limits. The CEA full in and full out limits provide an additional independent means for determining the CEA positions when the CEAs are at either their fully inserted or fully withdrawn positions.

SR 3.1.5.3

Verifying each full length CEA is trippable would require that each CEA be tripped. In MODES 1 and 2 tripping each

(continued)

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.6 Shutdown Control Element Assembly (CEA) Insertion Limits

BASES

BACKGROUND

The insertion limits of the shutdown CEAs are initial assumptions in all safety analyses that assume CEA insertion upon reactor trip. The insertion limits directly affect core power distributions and assumptions of available SDM, ejected CEA worth, and initial reactivity insertion rate.

The applicable criteria for these reactivity and power distribution design requirements are 10 CFR 50, Appendix A, GDC 10, "Reactor Design," and GDC 26, "Reactivity Limits" (Ref. 1), and 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors" (Ref. 2). Limits on shutdown CEA insertion have been established, and all CEA positions are monitored and controlled during power operation to ensure that the reactivity limits, ejected CEA worth, and SDM limits are preserved.

The shutdown CEAs are arranged into groups that are radially symmetric. Therefore, movement of the shutdown CEAs does not introduce radial asymmetries in the core power distribution. The shutdown and regulating CEAs provide the required reactivity worth for immediate reactor shutdown upon a reactor trip.

The design calculations are performed with the assumption that the shutdown CEAs are withdrawn prior to the regulating CEAS. The shutdown CEAs can be fully withdrawn without the core going critical. This provides available negative reactivity for SDM in the event of boration errors. The shutdown CEAs are controlled manually ~~or automatically~~ by the control room operator. During normal unit operation, the shutdown CEAs are fully withdrawn. The shutdown CEAs must be completely withdrawn from the core prior to withdrawing regulating CEAs during an approach to criticality. The shutdown CEAs are then left in this position until receipt of a reactor trip signal and they are inserted into the reactor core to add negative reactivity and shutdown the reactor.

(continued)

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.7 Regulating Control Element Assembly (CEA) Insertion Limits

BASES

BACKGROUND

The insertion limits of the regulating CEAs are initial assumptions in all safety analyses that assume CEA insertion upon reactor trip. The insertion limits directly affect core power distributions, assumptions of available SDM, and initial reactivity insertion rate. The applicable criteria for these reactivity and power distribution design requirements are 10 CFR 50, Appendix A, GDC 10, "Reactor Design," and GDC 26, "Reactivity Limits" (Ref. 1), and 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors" (Ref. 2).

Limits on regulating CEA insertion have been established, and all CEA positions are monitored and controlled during power operation to ensure that the power distribution and reactivity limits defined by the design power peaking, ejected CEA worth, reactivity insertion rate, and SDM limits are preserved.

The regulating CEA groups operate with a predetermined amount of position overlap, in order to approximate a linear relation between CEA worth and position ~~(integral CEA worth)~~. The regulating CEA groups are withdrawn and operate in a predetermined sequence. Specification 3.1.7 and the core protection calculators will not permit a lower numbere group (e.g.: Group 5) to be inserted more than a higher numbered group (e.g.: Group 6). The group sequence and overlap limits are specified in the COLR.

The regulating CEAs are used for precise reactivity control of the reactor. The positions of the regulating CEAs are manually controlled. They are capable of adding reactivity very quickly (compared to borating or diluting).

The power density at any point in the core must be limited to maintain specified acceptable fuel design limits, including limits that preserve the criteria specified in 10 CFR 50.46 (Ref. 2). Together, LCO 3.1.7; LCO 3.2.4, "Departure from Nucleate Boiling Ratio (DNBR)"; and LCO 3.2.5, "AXIAL SHAPE INDEX (ASI)," provide limits on control component operation and on monitored process variables to ensure the core operates within LCO 3.2.1,

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

increased power peaking and corresponding increased local LHRs.

The SDM requirement is ensured by limiting the regulating and shutdown CEA insertion limits, so that the allowable inserted worth of the CEAs is such that sufficient reactivity is available in the CEAs to shut down the reactor to hot zero power with a reactivity margin that assumes the maximum worth CEA remains fully withdrawn upon trip (Ref. 4).

Operation at the insertion limits or ASI may approach the maximum allowable linear heat generation rate or peaking factor, with the allowed T_q present. Operation at the insertion limit may also indicate the maximum ejected CEA worth could be equal to the limiting value in fuel cycles that have sufficiently high ejected CEA worths.

The regulating and shutdown CEA insertion limits ensure that safety analyses assumptions for reactivity insertion rate, SDM, ejected CEA worth, and power distribution peaking factors are preserved (Ref. 5).

The regulating CEA insertion limits satisfy Criterion 2 of the NRC Policy Statement.

LCO

The limits on regulating CEA sequence, ~~overlap,~~ and physical insertion, as defined in the COLR, must be maintained because they serve the function of preserving power distribution, ensuring that the SDM is maintained, ensuring that ejected CEA worth is maintained, and ensuring adequate negative reactivity insertion on trip. The overlap between regulating banks provides more uniform rates of reactivity insertion and withdrawal. ~~and is imposed to maintain acceptable power peaking during regulating CEA motion.~~

The power dependent insertion limit (PDIL) alarm circuit is required to be OPERABLE for notification that the CEAs are outside the required insertion limits. When the PDIL alarm circuit is inoperable, the verification of CEA positions is increased to ensure improper CEA alignment is identified before unacceptable flux distribution occurs.

The overlap of the Regulating groups may be increased, provided that the sequence of regulating group movement and the insertion limits are satisfied.

(continued)

BASES (continued)

APPLICABILITY

The regulating CEA sequence, overlap, and physical insertion limits shall be maintained with the reactor in MODES 1 and 2. These limits must be maintained, since they preserve the assumed power distribution, ejected CEA worth~~,~~ and SDM~~, and reactivity rate insertion~~ assumptions. Applicability in MODES 3, 4, and 5 is not required, since neither the power distribution nor ejected CEA worth assumptions would be exceeded in these MODES. SDM is preserved in MODES 3, 4, and 5 by adjustments to the soluble boron concentration.

This LCO is modified by a Note indicating the LCO requirement is suspended during SR 3.1.5.3. This SR verifies the freedom of the CEAs to move, and requires the regulating CEAs to move below the LCO limits, which would normally violate the LCO.

ACTIONS

A.1.1, A.1.2, A.2.1, and A.2.2

Operation beyond the transient insertion limit may result in a loss of SDM and excessive peaking factors. If the regulating CEA insertion limits are not met, then SDM must be verified by performing a reactivity balance calculation, considering the listed reactivity effects in Bases Section SR 3.1.1.1. One hour is sufficient time for conducting the calculation and commencing boration if the SDM is not within limits. The transient insertion limit should not be violated during normal operation. ~~this violation~~ However, violations may occur during transients when the operator is manually controlling the CEAs in response to changing plant conditions. When the regulating groups are inserted beyond the transient insertion limits, actions must be taken to either withdraw the regulating groups ~~beyond~~ above the limits or to reduce THERMAL POWER to less than or equal to that allowed for the actual CEA insertion limit. Two hours provides a reasonable time to accomplish this, allowing the operator to deal with current plant conditions while limiting peaking factors to acceptable levels.

B.1 and B.2

If the CEAs are inserted between the long term steady state insertion limits and the transient insertion limits for

(continued)

ACTIONS

B.1 and B.2 (continued)

intervals > 4 hours per 24 hour period, ~~and the short term steady state insertion limits are exceeded,~~ peaking factors can develop that are of immediate concern (Ref. 6).

Additionally, since the CEAs can be in this condition without misalignment, penalty factors are not ~~inserted in~~ generated by the core protection calculators to compensate for the developing peaking factors. Verifying the short term steady state insertion limits are not exceeded ensures that the peaking factors that do develop are within those allowed for continued operation. Fifteen minutes provides adequate time for the operator to verify if the short term steady state insertion limits are exceeded.

Experience has shown that rapid power increases in areas of the core, in which the flux has been depressed, can result in fuel damage as the LHR in those areas rapidly increases. Restricting the rate of THERMAL POWER increases to ≤ 5% RTP per hour, following CEA insertion beyond the long term steady state insertion limits, ensures the power transients experienced by the fuel will not result in fuel failure (Ref. 7).

C.1

With the regulating CEAs inserted between the long term steady state insertion limit and the transient insertion limit ~~and with the core approaching the~~ for greater than 5 effective full power days (EFPD) per 30 EFPD, or 14 EFPD per 365 EFPD limits, the core ~~approaches the acceptable limits placed on operation with~~ may develop flux patterns outside those assumed in the long term burnup assumptions. In this case, the CEAs must be returned to within the long term steady state insertion limits, or the core must be placed in a condition in which the abnormal fuel burnup cannot continue. A Completion Time of 2 hours is a reasonable time to return the CEAs to within the long term steady state insertion limits.

The required Completion Time of 2 hours from initial discovery of a regulating CEA group outside the limits until its restoration to within the long term steady state limits, shown on the figures in the COLR, allows sufficient time for

(continued)

ACTIONS

C.1 (continued)

borated water to enter the Reactor Coolant System from the chemical addition and makeup systems, and to cause the regulating CEAs to withdraw to the acceptable region. It is reasonable to continue operation for 2 hours after it is discovered that the 5 EFPD ~~day~~ or 14 ~~days~~ EFPD limit has been exceeded. This Completion Time is based on limiting the potential xenon redistribution, the low probability of an accident, and the steps required to complete the action.

D.1.1, D.1.2, D.2.1, and D.2.2

If the regulating CEA insertion limits are not met, then SDM must be verified by performing a reactivity balance calculation, considering the effects in SR 3.1.1.1 bases. One hour is sufficient time for conducting the calculation and commencing boration if the SDM is not within limits.

With the Core Operating Limit Supervisory System out of service, operation beyond the short term steady state insertion limits can result in peaking factors that could approach the DNB or local power density trip setpoints. Eliminating this condition within 2 hours limits the magnitude of the peaking factors to acceptable levels (Ref. 8). Restoring the CEAs to within the limit or reducing THERMAL POWER to that fraction of RTP that is allowed by CEA group position, using the limits specified in the COLR, ensures acceptable peaking factors are maintained.

E.1

With the PDIL circuit inoperable, performing SR 3.1.7.1 within 1 hour and every 4 hours thereafter ensures improper CEA alignments are identified before unacceptable flux distributions occur.

F.1

When a Required Action cannot be completed within the required Completion Time, a controlled shutdown should be commenced. The allowed Completion Time of 6 hours is

(continued)

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.8 Part Length Control Element Assembly (CEA) Insertion Limits

BASES

BACKGROUND

The insertion limits of the part length CEAs are initial assumptions in all safety analyses. The insertion limits directly affect core power distributions. The applicable criteria for these power distribution design requirements are 10 CFR 50, Appendix A, GDC 10, "Reactor Design" (Ref. 1), and 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Plants" (Ref. 2). Limits on part length CEA insertion have been established, and all CEA positions are monitored and controlled during power operation to ensure that the power distribution defined by the design power peaking limits is preserved.

The ~~regulating~~ part length CEAs are used for precise reactivity control of the reactor. The positions of the ~~regulating~~ part length CEAs are manually controlled. They are capable of adding reactivity very quickly (compared to borating or diluting).

The power density at any point in the core must be limited to maintain specified acceptable fuel design limits, including limits that preserve the criteria specified in 10 CFR 50.46 (Ref. 2). Together, LCO 3.1.8, "~~Regulating~~ Part length Control Element Assembly (CEA) Insertion Limits"; ~~LCO 3.1.8;~~ LCO 3.2.4, "Departure From Nucleate Boiling Ratio (DNBR)"; and LCO 3.2.5, "AXIAL SHAPE INDEX (ASI)," provide limits on control component operation and on monitored process variables to ensure the core operates within the linear heat rate (LHR) (LCO 3.2.1, "Linear Heat Rate (LHR)"); planar peaking factor (F_{xy}) (LCO 3.2.2, "Planar Radial Peaking Factors (F_{xy})"); and LCO 3.2.4 limits in the COLR.

Operation within the limits given in ~~Figure 3.1-3~~ of the COLR prevents power peaks that would exceed the loss of coolant accident (LOCA) limits derived by the Emergency Core Cooling Systems analysis. Operation within the F_{xy} and departure from nucleate boiling (DNB) limits given in the COLR prevents DNB during a loss of forced reactor coolant flow accident.

The establishment of limiting safety system settings and LCOs requires that the expected long and short term behavior

(continued)

APPLICABLE SAFETY ANALYSES (continued)

d. The CEAs must be capable of shutting down the reactor with a minimum required SDM, with the highest worth CEA stuck fully withdrawn, GDC 26 (Ref. 1).

Regulating CEA position, part length CEA position, ASI, and T_q are process variables that together characterize and control the three dimensional power distribution of the reactor core.

Fuel cladding damage does not occur when the core is operated outside these LCOs during normal operation. However, fuel cladding damage could result, should an accident occur with simultaneous violation of one or more of these LCOs. Changes in the power distribution can cause increased power peaking and corresponding increased local LHRs.

The part length CEA insertion limits ensure that safety analyses assumptions for ejected CEA worth and power distribution peaking factors are preserved.

The ~~regulating~~ part length CEA insertion limits satisfy Criterion 2 of the NRC Policy Statement. The part length CEAs are required due to the potential peaking factor violations that could occur if part length CEAs exceed insertion limits.

6

LCO

The limits on part length CEA insertion, as defined in the COLR, must be maintained because they serve the function of preserving power distribution and ensuring that ejected CEA worth is maintained within limits.

APPLICABILITY

The part length insertion limits shall be maintained with the reactor in MODE 1 > 20% RTP. These limits must be maintained, since they preserve the assumed power distribution and ejected CEA worth are within limits. Applicability below 20% RTP and in lower MODES is not required, since the power distribution assumptions would not be exceeded in these MODES.

This LCO has been modified by a Note suspending the LCO requirement while exercising part length CEAs. Exercising part length CEAs may require moving them outside their insertion limits.

(continued)

B 3.1 REACTIVITY CONTROL SYSTEM

B 3.1.9 Boration Systems - Operating

BASES

The boron injection system ensures that negative reactivity control is available during each mode of facility operation. The components required to perform this function include 1) borated water sources, 2) charging pumps, 3) separate flow paths, 4) boric acid makeup pumps, and 5) an emergency power supply from OPERABLE diesel generators.

With the RCS average temperature above 200°F, a minimum of two separate and redundant boron injection systems are provided to ensure single functional capability the event an assumed failure renders one of the systems inoperable Allowable out-of-service periods ensure that minor component repair or corrective action may be completed without undue risk to overall facility safety from injection system failures during the repair period.

The boration capability of either system is sufficient to provide a SHUTDOWN MARGIN from expected operating conditions of 3.0% delta k/k after xenon decay and cooldown to 200°F. The maximum expected boration capability requirements occurs at EOL from full power equilibrium xenon conditions and requires boric acid solution from the boric acid makeup tanks in the allowable concentration and volumes of Specification 3.1.9 plus approximately 13,000 gallons of 2350 ppm borated water from the refueling water tank or approximately 26,000 gallons of 2350 ppm borated water from the refueling water tank alone. 6

With the RCS temperature below 200°F one injection system is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the additional restrictions prohibiting CORE ALTERATIONS and positive reactivity changes in the event the single injection system becomes inoperable. 6

The boron capability required below 200°F is based upon providing a 3% delta K/k SHUTDOWN MARGIN after xenon decay and cooldown from 200°F to 140°F. This condition requires 4150 gallons of 2350 ppm borated water from either the refueling water tank or boric acid solution from a boric acid makeup tank.

The water volume limits are specified relative to the top of the highest suction connection to the tank. (Water volume below this datum is not considered recoverable for purposes of this specification.) Vortexing, internal structures and instrument error are considered in determining the tank level corresponding to the specified water volume limits.

(continued)

BASES (continued)

6

The OPERABILITY of one boron injection system during REFUELING ensures that this system is available for reactivity control while in MODE 6.

The limits on water volume and boron concentration of the RWST also ensure a pH value greater than 7.0 for the solution recirculated within containment after a LOCA. This pH minimizes the effect of chloride and caustic stress corrosion on mechanical systems and components. The maximum RWST volume is not specified since analysis of pH limits and containment flooding post-LOCA considered RWST overflow conditions.

B 3.1 REACTIVITY CONTROL SYSTEM

B 3.1.10 Boration Systems - Shutdown

BASES

The boron injection system ensures that negative reactivity control is available during each mode of facility operation. The components required to perform this function include 1) borated water sources, 2) charging pumps, 3) separate flow paths, 4) boric acid makeup pumps, and 5) an emergency power supply from OPERABLE diesel generators.

6

With the RCS average temperature above 200°F, a minimum of two separate and redundant boron injection systems are provided to ensure single functional capability the event an assumed failure renders one of the systems inoperable. Allowable out-of-service periods ensure that minor component repair or corrective action may be completed without undue risk to overall facility safety from injection system failures during the repair period.

6

The boration capability of either system is sufficient to provide a SHUTDOWN MARGIN from expected operating conditions of 3.0% delta k/k after xenon decay and cooldown to 200°F. The maximum expected boration capability requirements occurs at EOL from full power equilibrium xenon conditions and requires boric acid solution from the boric acid makeup tanks in the allowable concentration and volumes of Specification 3.1.9 plus approximately 13,000 gallons of 2350 ppm borated water from the refueling water tank or approximately 26,000 gallons of 2350 ppm borated water from the refueling water tank alone.

With the RCS temperature below 200°F one injection system is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the additional restrictions prohibiting CORE ALTERATIONS and positive reactivity changes in the event the single injection system becomes inoperable. When suspending positive reactivity changes temperature fluctuations do not need to be considered.

The boron capability required below 200°F is based upon providing a 3% delta K/k SHUTDOWN MARGIN after xenon decay and cooldown from 200°F to 140°F. This condition requires 4150 gallons of 2350 ppm borated water from either the refueling water tank or boric acid solution from a boric acid makeup tank.

6

The water volume limits are specified relative to the top of the highest suction connection to the tank. (Water volume below this datum is not considered recoverable for purposes of this specification.) Vortexing, internal structures and instrument error are considered in determining the tank level corresponding to the specified water volume limits.

(continued)

B 3.1 REACTIVITY CONTROL SYSTEM

B 3.1.11 Borated Water Sources - Shutdown

BASES

The boron injection system ensures that negative reactivity control is available during each mode of facility operation. The components required to perform this function include 1) borated water sources, 2) charging pumps, 3) separate flow paths, 4) boric acid makeup pumps, and %0 an emergency power supply from OPERABLE diesel generators.

With the RCS average temperature above 200°F, a minimum of two separate and redundant boron injection systems are provided to ensure single functional capability the event an assumed failure renders one of the systems inoperable. Allowable out-of-service periods ensure that minor component repair or corrective action may be completed without undue risk to overall facility safety from injection system failures during the repair period.

The boration capability of either system is sufficient to provide a SHUTDOWN MARGIN from expected operating conditions of 3.0% delta k/k after xenon decay and cooldown to 200°F. The maximum expected boration capability requirements occurs at EOL from full power equilibrium xenon conditions and requires boric acid solution from the boric acid makeup tanks in the allowable concentration and volumes of Specification 3.1.11 plus approximately 13,000 gallons of 2350 ppm borated water from the refueling water tank or approximately 26,000 gallons of 2350 ppm borated water from the refueling water tank alone.

With the RCS temperature below 200°F one injection system is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the additional restrictions prohibiting CORE ALTERATIONS and positive reactivity changes in the event the single injection system becomes inoperable.

The boron capability required below 200°F is based upon providing a 3% delta K/k SHUTDOWN MARGIN after xenon decay and cooldown from 200°F to 140°F. This condition requires 4150 gallons of 2350 ppm borated water from either the refueling water tank or boric acid solution from a boric acid makeup tank.

The water volume limits are specified relative to the top of the highest suction connection to the tank. (Water volume below this datum is not considered recoverable for purposes of this specification.) Vortexing, internal structures and instrument error are considered in determining the tank level corresponding to the specified water volume limits.

Without the required source of borated water positive reactivity changes are suspended without consideration of temperature fluctuations.

(continued)

BASES (continued)

The OPERABILITY of one boron injection system during REFUELING ensures that this system is available for reactivity control while in MODE 6.

The limits on water volume and boron concentration of the RWST also ensure a pH value greater than 7.0 for the solution recirculated within containment after a LOCA. This pH minimizes the effect of chloride and caustic stress corrosion on mechanical systems and components. The maximum RWST volume is not specified since analysis of pH limits and containment flooding post-LOCA considered RWST overflow conditions.

6

BASES

core are consistent with the design predictions and that the core can be operated as designed (Ref. 4).

PHYSICS TESTS procedures are written and approved in accordance with established formats. The procedures include all information necessary to permit a detailed execution of testing required to ensure that the design intent is met. PHYSICS TESTS are performed in accordance with these procedures and test results are approved prior to continued power escalation and long term power operation. Examples of PHYSICS TESTS include determination of critical boron concentration, CEA group worths, reactivity coefficients, flux symmetry, and core power distribution.

APPLICABLE SAFETY ANALYSES

It is acceptable to suspend certain LCOs for PHYSICS TESTS because ~~fuel damage criteria are not exceeded. Even if an accident occurs during PHYSICS TESTS with one or more LCOs suspended, fuel damage criteria are preserved because~~ additional ~~adequate~~ limits on power level ~~distribution~~ and shutdown capability are maintained during PHYSICS TESTS.

Reference 5 defines the requirements for initial testing of the facility, including PHYSICS TESTS. Requirements for reload fuel cycle PHYSICS TESTS are defined in ANSI/ANS-19.6.1-1985 (Ref. 4). PHYSICS TESTS for reload fuel cycles are given in Table 1 of ANSI/ANS-19.6.1-1985. Although these PHYSICS TESTS are generally accomplished within the limits of all LCOs, conditions may occur when one or more LCOs must be suspended to make completion of PHYSICS TESTS possible or practical. This is acceptable as long as the fuel design criteria are not violated. As long as the linear heat rate (LHR) remains within its limit, fuel design criteria are preserved.

In this test, the following LCOs are suspended:

a. LCO 3.1.1, "SHUTDOWN MARGIN (SDM) – $T_{avg} > 200°F$"; and

b. LCO 3.1.4, "Moderator Temperature Coefficient (MTC)";

c. LCO 3.1.5, "Control Element Assembly (CEA) Alignment";

d. LCO 3.1.6, "Shutdown Control Element Assembly (CEA) Insertion Limits";

BASES

e. LCO 3.1.7, "Regulating Control Element Assembly (CEA) Insertion Limits."

f. LCO 3.1.8, "Part Length CEA Insertion Limits";

g. LCO 3.3.1, "RPS Instrumentation - Operating," Table 3.3.1-1, ALLOWABLE VALUE for FUNCTION 2 and footnote (d) for FUNCTIONS 14 and 15.

Therefore, this LCO places limits on the minimum amount of CEA worth required to be available for reactivity control when CEA worth measurements are performed.

groupø height

The individual LCOs cited above govern SDM, CEA group/height, insertion, and alignment and MTC. Additionally, the/LCOs the ø LCO governing Reactor Coolant System (RCS) flow, reactor inlet temperature T_c, and pressurizer pressure contribute to maintaining departure from nucleate boiling (DNB) parameter limits. The initial condition criteria for accidents sensitive to core power distribution are preserved by the LHR and DNB parameter limits. The criteria for the loss of coolant accident (LOCA) are specified in 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors" (Ref. 6). The criteria for the loss of forced reactor coolant flow accidents are specified in Reference 7. Operation within the LHR limit preserves the LOCA criteria; operation within the DNB parameter limits preserves the loss of flow criteria.

SRs are conducted as necessary to ensure that LHR and DNB parameters remain within limits during PHYSICS TESTS. Performance of these SRs allows PHYSICS TESTS to be conducted without decreasing the margin of safety.

APPLICABLE SAFETY ANALYSIS (continued)

Requiring that shutdown reactivity equivalent to at least the highest estimated CEA worth (of those CEAs actually withdrawn) be available for trip insertion from the OPERABLE CEAs, provides a high degree of assurance that shutdown capability is maintained for the most challenging postulated accident, a stuck CEA. Since LCO 3.1.1 is suspended, however, there is not the same degree of assurance during this test that the reactor would always be shut down if the highest worth CEA was stuck out and calculational uncertainties or the estimated highest CEA worth was not as expected (the single failure criterion is not met). Thissituation is judged acceptable, however, because it is unlikely ~~specified acceptable fuel damage limits are still met.~~ The

ø that a design basis event will occur during the time that this STE is in effect.

BASES

risk of experiencing a stuck CEA and subsequent criticality is reduced during this PHYSICS TEST exception by the requirements to determine CEA positions every 2 hours; by the trip of each CEA to be withdrawn within 7 days prior to suspending the SDM; and by ensuring that shutdown reactivity equivalent to the reactivity worth of the estimated highest worth withdrawn CEA (Ref. 5) is available every 2 hours.

PHYSICS TESTS include measurement of core parameters or exercise of control components that affect process variables. Among the process variables involved are total planar radial peaking factor, total integrated radial peaking factor, T_q, and ASI, which represent initial condition input (power peaking) to the accident analysis. Also involved are the shutdown and regulating CEAs, which affect power peaking and are required for shutdown of the reactor. The limits for these variables are specified for each fuel cycle in the COLR.

PHYSICS TESTS meet the criteria for inclusion in the Technical Specifications since the components and process variable LCOs suspended during PHYSICS TESTS meet Criteria 1, 2, and 3 of the NRC Policy Statement.

LCO

This LCO provides that a minimum amount of CEA worth is immediately available for reactivity control when ~~CEA worth~~ PHYSICS TESTS ~~measurement tests~~ are performed. This STE is required to permit the periodic verification of the actual versus predicted core reactivity condition occurring as a result of fuel burnup or fuel cycling operations. The requirements of LCO 3.1.1, LCO 3.1.4, LCO 3.1.5, LCO 3.1.6, LCO 3.1.7, LCO 3.1.8, and LCO 3.3.1 (Adjustment of 10^{-4}% Bistable to ≤5% and Adjustment of Hi Log Power Trip to ≤5%) may be suspended.

APPLICABILITY

This LCO is applicable in MODES 2 and 3. Although PHYSICS TESTS are conducted in MODE 2, sufficient negative reactivity is inserted during the performance of surveillance 3.1.12.2 to result in temporary entry into MODE 3. Because the intent is to immediately return to

MODE 2 to continue PHYSICS TESTS ~~CEA worth measurements~~, the STE allows limited operation to 6 consecutive hours in MODE 3 as indicated by the Note, without having to borate to meet the SDM requirements of LCO 3.1.1.

ACTIONS

A.1

With any CEA not fully inserted and less than the minimum required reactivity equivalent available for insertion, or with all CEAs inserted and the reactor subcritical by less than the reactivity equivalent of the highest worth withdrawn CEA, restoration of the minimum SDM requirements must be accomplished by increasing the RCS boron concentration. The required Completion Time of 15 minutes for initiating boration allows the operator sufficient time to align the valves and start the boric acid pumps and is consistent with the Completion Time of LCO 3.1.1.

SURVEILLANCE REQUIREMENTS

SR 3.1.12.1

Verification of the position of each partially or fully withdrawn full length or part length CEA provides assurance that the CEAs are in the expected positions through the PHYSICS TESTS. A 2 hour Frequency is sufficient to verify that each CEA position is acceptable.

SR 3.1.12.2

Prior demonstration that each CEA to be withdrawn from the core during PHYSICS TESTS is capable of full insertion, when tripped from at least a 50% withdrawn position, ensures that the CEA will insert on a trip signal. The 7 day Frequency ensures that the CEAs are OPERABLE prior to reducing SDM to less than the limits of LCO 3.1.1.

2

SURVEILLANCE REQUIREMENTS (continued)

SR 3.1.12.3

Verifying that the required shutdown reactivity equivalent of at least the highest estimated CEA worth (of those CEAs actually withdrawn) is available ensures that the shutdown capability is preserved. A 2 hour Frequency is sufficient to verify the appropriate acceptance criteria.

core are consistent with the design predictions and that the core can be operated as designed (Ref. 4).

BACKGROUND (continued)

PHYSICS TESTS procedures are written and approved in accordance with established formats. The procedures include all information necessary to permit a detailed execution of testing required to ensure that design intent is met. PHYSICS TESTS are performed in accordance with these procedures and test results are approved prior to continued power escalation and long term power operation.

Examples of PHYSICS TESTS include determination of critical boron concentration, CEA group worths, reactivity coefficients, flux symmetry, and core power distribution.

APPLICABLE SAFETY ANALYSES

It is acceptable to suspend certain LCOs for PHYSICS TESTS because ~~fuel damage criteria are not exceeded. Even if an accident occurs during PHYSICS TESTS with one or more LCOs suspended, fuel damage criteria are preserved because the~~ additional limits on ~~linear heat rate is~~ Power level and Power distribution are maintained during PHYSICS TESTS.

Reference 5 defines requirements for initial testing of the facility, including PHYSICS TESTS. Requirements for reload fuel cycle PHYSICS TESTS are defined in ANSI/ANS-19.6.1-1985 (Ref. 4). Although these PHYSICS TESTS are generally accomplished within the limits of all LCOs, conditions may occur when one or more LCOs must be suspended to make completion of PHYSICS TESTS possible or practical. This is acceptable as long as the fuel design criteria are not violated. As long as the linear heat rate (LHR) remains within its limit, fuel design criteria are preserved.

During PHYSICS TESTS, the following LCOs may be suspended:

LCO 3.1.7, "Regulating Control Element Assembly (CEA) Insertion Limits (F_{xy}^T)";
LCO 3.1.8, "Part Length Control Element Assembly (CEA) Insertion Limits";
LCO 3.2.2, "Planar Radial Peaking Factors";
LCO 3.2.3, "AZIMUTHAL POWER TILT (T_q)"; and
LCO 3.2.5, "Axial Shape Index".

(continued)

APPLICABLE SAFETY ANALYSES (continued)

The safety analysis (Ref. 6) places limits on allowable THERMAL POWER during PHYSICS TESTS and requires that the LHR parameter be maintained within limits. The power plateau of ≤ 85% RTP ensures that LHR is maintained within acceptable limits.

The individual LCOs governing CEA group ~~height,~~ insertion ~~and alignment,~~ ASI, total planar radial peaking factor, ~~total integrated radial peaking factor,~~ and T_q, preserve the LHR limits. Additionally, the LCOs governing Reactor Coolant System (RCS) flow, reactor inlet temperature (T_c), and pressurizer pressure contribute to maintaining DNB parameter limits. The initial condition criteria for accidents sensitive to core power distribution are preserved by the LHR and DNB parameter limits. The criteria for the loss of coolant accident (LOCA) are specified in 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors" (Ref. 7). The criteria for the loss of forced reactor coolant flow accident are specified in Reference 7. Operation within the LHR limit preserves the LOCA criteria; operation within the DNB parameter limits preserves the loss of flow criteria.

During PHYSICS TESTS, one or more of the LCOs that normally preserve the LHR and DNB parameter limits may be suspended. The results of the accident analysis are not adversely impacted, however, if LHR is verified to be within its limit while the LCOs are suspended. Therefore, SRs are placed as necessary to ensure that LHR remains within its limit during PHYSICS TESTS. Performance of these Surveillances allows PHYSICS TESTS to be conducted without decreasing the margin of safety.

PHYSICS TESTS include measurement of core parameters or exercise of control components that affect process variables. Among the process variables involved are total planar radial peaking factor, ~~total integrated radial peaking factor,~~ T_q, and ASI, which represent initial condition input (power peaking) to the accident analysis. Also involved are the ~~shutdown~~ and regulating CEAs, which affect power peaking and are required for shutdown of the reactor. The limits for these variables are specified for each fuel cycle in the COLR.

part length

(continued)

APPLICABLE SAFETY ANALYSES (continued)

PHYSICS TESTS meet the criteria for inclusion in the Technical Specifications, since the component and process variable LCOs suspended during PHYSICS TESTS meet Criteria 1, 2, and 3 of the NRC Policy Statement.

LCO

This LCO permits individual CEA~~s~~ groups to be positioned outside of their normal group heights and insertion limits during the performance of PHYSICS TESTS, such as those required to:

a. Measure CEA worth;

b. Determine the reactor stability index and damping factor under xenon oscillation conditions;

c. Determine power distributions for rodded CEA configurations;

d. Measure rod shadowing factors; and

e. Measure temperature and power coefficients.

Additionally, it permits the center CEA to be misaligned during PHYSICS TESTS to determine the isothermal temperature coefficient (ITC), MTC, and power coefficient.

The requirements of LCO 3.1.7, LCO 3.1.8, LCO 3.2.2, LCO 3.2.3, and LCO 3.2.5 may be suspended during the performance of PHYSICS TESTS provided:

a. THERMAL POWER is restricted to test power plateau, which shall not exceed 85% RTP; and

b. LHR does not exceed the limit specified in the COLR.

APPLICABILITY

This LCO is applicable in MODE 1 because the reactor must be critical at various THERMAL POWER levels to perform the PHYSICS TESTS described in the LCO section. Limiting the test power plateau to ≤ 85% RTP ensures that LHR is maintained within acceptable limits.

(continued)

BASES (continued)

ACTIONS

A.1

If THERMAL POWER exceeds the test power plateau in MODE 1, THERMAL POWER must be reduced to restore the additional thermal margin provided by the reduction. The 15 minute Completion Time ensures that prompt action shall be taken to reduce THERMAL POWER to within acceptable limits.

B.1

If the LHR requirement is not met, THERMAL POWER must be reduced promptly. A Completion Time of 15 minutes is adequate for an operator to correctly align and start the required systems and components. Power reduction will continue until the LHR is within the limit.

C.1 and C.2

If Required Action A.1 or B.1 cannot be completed within the required Completion Time, PHYSICS TESTS must be suspended within 1 hour, and the reactor must be brought to MODE 3. Allowing 1 hour for suspending PHYSICS TESTS allows the operator sufficient time to change any abnormal CEA configuration back to within the limits of LCO 3.1.7 and LCO 3.1.8. Bringing the reactor to MODE 3 within 6 hours increases thermal margin and is consistent with the Required Actions of the power distribution LCOs. The required Completion Time of 6 hours is adequate for performing a controlled shutdown from full power conditions in an orderly manner and without challenging plant systems, and is consistent with the power distribution LCO Completion Times.

SURVEILLANCE REQUIREMENTS

SR 3.1.13.1

Verifying that THERMAL POWER is equal to or less than that allowed by the test power plateau, as specified in the PHYSICS TEST procedure ~~and required by the safety analysis,~~ ensures that adequate LHR margin is maintained while LCOs are suspended. The 1 hour Frequency is sufficient, based upon the slow rate of power change and increased operational controls in place during PHYSICS TESTS. Monitoring LHR ensures that the limits are not exceeded.

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.14 Special Test Exceptions (STE) – Center CEA Misalignment and Regulating CEA insertion Limits

BASES

BACKGROUND

The primary purpose of the Center CEA Misalignment and Regulating CEA insertion Limits STE is to permit relaxation of existing LCOs to allow the performance of PHYSICS TESTS. These tests are conducted to determine the isothermal temperature coefficient, moderator temperature coefficient and power coefficient.

Section XI of 10 CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Processing Plants" (Ref. 1), requires that a test program be established to ensure that structures, systems, and components will perform satisfactorily in service. All functions necessary to ensure that specified design conditions are not exceeded during normal operation and anticipated operational occurrences must be tested. Testing is required as an integral part of the design, fabrication, construction, and operation of the power plant. Requirements for notification of the NRC, for the purpose of conducting tests and experiments, are specified in 10 CFR 50.59, "Changes, Tests, and Experiments" (Ref. 2).

The key objectives of a test program are to (Ref. 3):

a. Ensure that the facility has been adequately designed;

b. Validate the analytical models used in design and analysis;

c. Verify assumptions used for predicting plant response;

d. Ensure that installation of equipment in the facility has been accomplished in accordance with the design; and

e. Verify that operating and emergency procedures are adequate.

(continued)

BASES

BACKGROUND (continued)

To accomplish these objectives, testing is required prior to initial criticality and after each refueling shutdown during startup, low power operation, power ascension, and at power operation. The PHYSICS TESTS requirements for reload fuel cycles ensure that the operating characteristics of the core are consistent with the design predictions and that the core can be operated as designed (Ref. 4).

PHYSICS TESTS procedures are written and approved in accordance with established formats. The procedures include all information necessary to permit a detailed execution of testing required to ensure that the design intent is met. PHYSICS TESTS are performed in accordance with these procedures and test results are approved prior to continued power escalation and long term power operation. Examples of PHYSICS TESTS include determination of critical boron concentration, CEA group worths, reactivity coefficients, flux symmetry, and core power distribution.

APPLICABLE SAFETY ANALYSES

It is acceptable to suspend certain LCOs for PHYSICS TESTS because fuel damage criteria are not exceeded. Even if an accident occurs during PHYSICS TESTS with one or more LCOs suspended, fuel damage criteria are preserved because adequate limits on power distribution and shutdown capability are maintained during PHYSICS TESTS.

Reference 5 defines the requirements for initial testing of the facility, including PHYSICS TESTS. Requirements for reload fuel cycle PHYSICS TESTS are defined in ANSI/ANS-19.6.1-1985 (Ref. 4). PHYSICS TESTS for reload fuel cycles are given in Table 1 of ANSI/ANS-19.6.1-1985. Although these PHYSICS TESTS are generally accomplished within the limits of all LCOs, conditions may occur when one or more LCOs must be suspended to make completion of PHYSICS TESTS possible or practical. This is acceptable as long as the fuel design criteria are not violated. As long as the linear heat rate (LHR) and departure from ~~nuclear~~ nucleate boiling ratio (DNBR) remains within their limits, fuel design criteria are preserved.

(continued)

BASES

BACKGROUND

Measurement Channels (continued)

bistables, and most provide indication in the control room. Measurement channels used as an input to the RPS are not used for control functions. There are some measurement channels that provide an input to a common RPS/ESFAS bistable within the same RPS channel. When a channel monitoring a parameter exceeds a predetermined setpoint, indicating an unsafe condition, the bistable monitoring the parameter in that channel will trip. Tripping bistables monitoring the same parameter in two or more channels will de-energize Matrix Logic, which in turn de-energizes the Initiation Logic. This causes all eight RTCBs to open, interrupting power to the CEAs, allowing them to fall into the core.

Three of the four measurement and bistable channels are necessary to meet the redundancy and testability of 10 CFR 50, Appendix A, GDC 21 (Ref. 1). The fourth channel provides additional flexibility by allowing one channel to be removed from service (trip channel bypass) for maintenance or testing while still maintaining a minimum two-out-of-three logic. Thus, even with a channel inoperable, no single additional failure in the RPS can either cause an inadvertent trip or prevent a required trip from occurring.

Adequate channel to channel independence includes physical and electrical independence of each channel from the others. This allows operation in two-out-of-three logic with one channel removed from service until following the next MODE 5 entry. Since no single failure will either cause or prevent a protective system actuation, and no protective channel feeds a control, this arrangement meets the requirements of IEEE Standard 279-1971 (Ref. 4).

The CPCs perform the calculations required to derive the DNBR and LPD parameters and their associated RPS trips. Four separate CPCs perform the calculations independently, one for each of the four RPS channels. The CPCs provide outputs to drive display indications (DNBR margin, LPD margin, and calibrated neutron flux power levels) and provide DNBR – Low and LPD – High pretrip and trip signals. The CPC channel outputs for the DNBR – Low and LPD – High trips operate contacts in the Matrix Logic in a manner identical to the other RPS trips.

(continued)

BASES

BACKGROUND

RPS Logic (continued)

When a coincidence occurs in two RPS channels, all four matrix relays in the affected matrix de-energize. This in turn de-energizes all four breaker control relays, which simultaneously de-energize the undervoltage and energize the shunt trip attachments in all eight RTCBs, tripping them open.

Matrix Logic refers to the matrix power supplies, trip channel bypass contacts, and interconnecting matrix wiring between bistable relay cards, up to but not including the matrix relays.

The Initiation Logic consists of the trip ~~path power~~ source, matrix relays and their associated contacts, all interconnecting wiring, and solid state ~~(auxiliary)~~ relays through the K-relay contacts in the RTCB control circuitry.

It is possible to change the two-out-of-four RPS Logic to a two-out-of-three logic for a given input parameter in one channel at a time by trip channel bypassing select portions of the Matrix Logic. Trip channel bypassing a bistable effectively shorts the bistable relay contacts in the three matrices associated with that channel. Thus, the bistables will function normally, producing normal trip indication and annunciation, but a reactor trip will not occur unless two additional channels indicate a trip condition. Trip channel bypassing can be simultaneously performed on any number of parameters in any number of channels, providing each parameter is bypassed in only one channel at a time. An interlock prevents simultaneous trip channel bypassing of the same parameter in more than one channel. Trip channel bypassing is normally employed during maintenance or testing.

Two-out-of-three logic also prevents inadvertent trips caused by any single channel failure in a trip condition.

In addition to the trip channel bypasses, there are also operating bypasses on select RPS trips. These bypasses are enabled manually in all four RPS channels when plant conditions do not warrant the specific trip protection. All operating bypasses are automatically removed when enabling

(continued)

BASES

BACKGROUND

RPS Logic (continued)

bypass conditions are no longer satisfied. Operating bypasses are normally implemented in the bistable, so that normal trip indication is also disabled. Trips with operating bypasses include Pressurizer Pressure – Low, Logarithmic Power Level – High, Reactor Coolant Flow – Low, and CPC (DNBR – Low and LPD – High).

Reactor Trip Circuit Breakers (RTCBs)

The reactor trip switchgear, addressed in LCO 3.3.4, consists of eight RTCBs, which are operated in four sets of two breakers (four channels). Power input to the reactor trip switchgear comes from two full capacity MG sets operated in parallel, such that the loss of either MG set does not de-energize the CEDMs. There are two separate CEDM power supply buses, each bus powering half of the CEDMs. Power is supplied from the MG sets to each bus via two redundant paths (trip legs). Trip legs 1A and 1B supply power to CEDM bus 1. Trip legs 2A and 2B supply power to CEDM bus 2. This ensures that a fault or the opening of a breaker in one trip leg (i.e., for testing purposes) will not interrupt power to the CEDM buses.

Each of the four trip legs consists of two RTCBs in series. The two RTCBs within a trip leg are actuated by separate initiation circuits.

The eight RTCBs are operated as four sets of two breakers (four channels). For example, if a breaker receives an open signal in trip leg A (for CEDM bus 1), an identical breaker in trip leg B (for CEDM bus 2) will also receive an open signal. This arrangement ensures that power is interrupted to both CEDM buses, thus preventing trip of only half of the CEAs (a half trip). Any one inoperable breaker in a channel will make the entire channel inoperable.

Each set of RTCBs is operated by either a manual reactor trip push button or an RPS ~~actuated~~ initiated K-relay. There are four Manual Trip push buttons, arranged in two sets of two. Depressing both push buttons in either set will result in a reactor trip.

(continued)

BACKGROUND

Reactor Trip Circuit Breakers (RTCBs) (continued)

When a Manual Trip is ~~initiated~~ actuated using the control room push buttons, the RPS trip paths and K-relays are bypassed, and the RTCB undervoltage and shunt trip attachments are actuated independent of the RPS.

Manual Trip circuitry includes the push button and interconnecting wiring to both RTCBs necessary to actuate both the undervoltage and shunt trip attachments but excludes the K-relay contacts and their interconnecting wiring to the RTCBs, which are considered part of the Initiation Logic.

Functional testing of the entire RPS, from bistable input through the opening of individual sets of RTCBs, can be performed either at power or shutdown and is normally performed on a quarterly basis. UFSAR, Section 7.2 (Ref. 8), explains RPS testing in more detail.

APPLICABLE SAFETY ANALYSES

Design Basis Definition

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

- The associated actuation will occur when the parameter monitored by each channel reaches its setpoint and the specific coincidence logic is satisfied;
- Separation and redundancy are maintained to permit a channel to be out of service for testing or maintenance while still maintaining redundancy within the RPS instrumentation network.

Each of the analyzed accidents and transients can be detected by one or more RPS Functions. The accident analysis takes credit for most of the RPS trip Functions. Those functions for which no credit is taken, termed equipment protective functions, are not needed from a safety perspective.

(continued)

APPLICABLE SAFETY ANALYSES (continued)

2. Logarithmic Power Level – High

The Logarithmic Power Level – High trip protects the integrity of the fuel cladding and helps protect the RCPB in the event of an unplanned criticality from a shutdown condition.

In MODES 2, 3, 4, and 5, with the RTCBs closed and the CEA Drive System capable of CEA withdrawal, protection is required for CEA withdrawal events originating when THERMAL POWER is < 1E-4% RTP. For events originating above this power level, other trips provide adequate protection.

MODES 3, 4, and 5, with the RTCBs closed, are addressed in LCO 3.3.2, "Reactor Protective System (RPS) Instrumentation – Shutdown."

In MODES 3, 4, or 5, with the RTCBs open or the CEAs not capable of withdrawal, the Logarithmic Power Level – High trip does not have to be OPERABLE. However, the indication and alarm portion of two logarithmic channels must be OPERABLE to ensure proper indication of neutron population and to indicate a boron dilution event. The indication and alarm functions are addressed in LCO 3.3.13, "Logarithmic Power Monitoring Channels."

3. Pressurizer Pressure – High

The Pressurizer Pressure – High trip provides protection for the high RCS pressure SL. In conjunction with the pressurizer safety valves and the main steam safety valves (MSSVs), it provides protection against overpressurization of the RCPB during the following events:

- Loss of Electrical Load Without a Reactor Trip Being Generated by the Turbine Trip (AOO);
- Loss of Condenser Vacuum (AOO);
- CEA Withdrawal From Low Power Conditions (AOO);
- Chemical and Volume Control System Malfunction (AOO)~~; and~~

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

4. Pressurizer Pressure – Low

The Pressurizer Pressure – Low trip is provided to trip the reactor to assist the ESF System in the event of loss of coolant accidents (LOCAs). During a LOCA, the SLs may be exceeded; however, the consequences of the accident will be acceptable. A Safety Injection Actuation Signal (SIAS) and CCAS are initiated simultaneously.

5. Containment Pressure – High

The Containment Pressure – High trip prevents exceeding the containment design pressure psig during a design basis LOCA or main steam line break (MSLB) accident. During a LOCA or MSLB the SLs may be exceeded; however, the consequences of the accident will be acceptable. An SIAS, CCAS, CIAS are initiated simultaneously.

6, 7. Steam Generator Pressure – Low

The Steam Generator #1 Pressure – Low and Steam Generator #2 Pressure – Low trips prevent a reactor power excursion due to the positive reactivity insertion to the core due to the cooldown by shutting down the reactor. ~~provide protection against an excessive rate of heat extraction from the steam generators and resulting rapid, uncontrolled cooldown of the RCS.~~ This trip is needed to shut down the reactor and assist the ESF System in the event of an MSLB or main feedwater line break accident. A main steam isolation signal (MSIS) is initiated simultaneously.

8, 9. Steam Generator Level – Low

The Steam Generator #1 Level – Low and Steam Generator #2 Level – Low trips ensure that a reactor trip signal is generated for the following events to help prevent exceeding the design pressure of the RCS due to the loss of the heat sink:

- Inadvertent Opening of a Steam Generator Atmospheric Dump Valve (AOO);

(continued)

LCO

2. Logarithmic Power Level – High (continued)

MODE 3, 4, or 5 when the RTCBs are shut and the CEA Drive System is capable of CEA withdrawal.

The MODES 3, 4, and 5 Condition is addressed in LCO 3.3.2.

The Allowable Value is high enough to provide an operating envelope that prevents unnecessary Logarithmic Power Level – High reactor trips during normal plant operations. The Allowable Value is low enough for the system to maintain a margin to unacceptable fuel cladding damage should a CEA withdrawal event occur.

The Logarithmic Power Level – High trip may be bypassed when THERMAL POWER is above 1E-4% RTP to allow the reactor to be brought to power during a reactor startup. This bypass is automatically removed when THERMAL POWER decreases below 1E-4% RTP. Above 1E-4% RTP, the Linear Power Level – High and Pressurizer Pressure – High trips provide protection for reactivity transients.

The trip may be manually bypassed during physics testing pursuant to LCO ~~3.4.17~~ 3.1.12, "~~RCS Loops – Test Exceptions~~ Special Test Exceptions - MODES 2 and 3." During this testing, the Linear Power Level – High trip and administrative controls provide the required protection.

3. Pressurizer Pressure – High

This LCO requires four channels of Pressurizer Pressure – High to be OPERABLE in MODES 1 and 2.

The Allowable Value is set below the nominal lift setting of the pressurizer code safety valves, and its operation avoids the undesirable operation of these valves during normal plant operation. In the event of a complete loss of electrical load from 100% power, this setpoint ensures the reactor trip will take place, thereby limiting further heat input to the RCS and consequent pressure rise. The pressurizer safety valves may lift to prevent overpressurization of the RCS.

(continued)

LCO 8, 9. Steam Generator Level – Low (continued)

cause a reactor trip during normal plant operations. The same bistable providing the reactor trip also initiates emergency feedwater to the affected generator via the Emergency Feedwater Actuation Signals (EFAS). The minimum setpoint is governed by EFAS requirements. The reactor trip will remove the heat source (except decay heat), thereby conserving the reactor heat sink.

This trip and the Steam Generator (1 and 2) Level – High trip may be manually bypassed simultaneously when cold leg temperature is below the specified limit to allow for CEA withdrawal during testing. The bypass is automatically removed when cold leg temperature reaches 200°F.

10. Reactor Coolant Flow – Low

This LCO requires four channels of Reactor Coolant Flow – Low to be OPERABLE in MODES 1 and 2. The Allowable Value is set low enough to allow for slight variations in reactor coolant flow during normal plant operations while providing the required protection. Tripping the reactor ensures that the resultant power to flow ratio provides adequate core cooling to maintain DNBR under the expected pressure conditions for this event.

The Reactor Coolant Flow – Low trip may be manually bypassed when reactor power is less than 1E-4% RTP. This allows for de-energization of one or more RCPs (e.g., for plant cooldown), while maintaining the ability to keep the shutdown CEA banks withdrawn from the core if desired.

LCO 3.4.5, "RCS Loops – MODE 3," LCO 3.4.6, "RCS Loops – MODE 4," and LCO 3.4.7, "RCS Loops – MODE 5, Loops Filled," ensure adequate RCS flow rate is maintained. The bypass is automatically removed when THERMAL POWER increases above 1E-4% RTP, as sensed by the wide range (logarithmic) nuclear instrumentation. When below the power range, the Reactor Coolant Flow – Low is not required for plant protection.

(continued)

LCO (continued)

11. Local Power Density – High

This LCO requires four channels of LPD – High to be OPERABLE.

The LCO on the CPCs ensures that the SLs are maintained during all AOOs and the consequences of accidents are acceptable.

A CPC is not considered inoperable if CEAC inputs to the CPC are inoperable. The Required Actions required in the event of CEAC channel failures ensure the CPCs are capable of performing their safety Function.

The CPC channels may be manually bypassed below 1E-4% RTP, as sensed by the logarithmic nuclear instrumentation. This bypass is enabled manually in all four CPC channels when plant conditions do not warrant the trip protection. The bypass effectively removes the DNBR – Low and LPD – High trips from the RPS Logic circuitry. The operating bypass is automatically removed when enabling bypass conditions are no longer satisfied.

This operating bypass is required to perform a plant startup, since both CPC generated trips will be in effect whenever shutdown CEAs are inserted. It also allows system tests at low power with Pressurizer Pressure – Low or RCPs off.

During special testing pursuant to LCO ~~3.1.10,~~ 3.1.12 the CPC channels may be manually bypassed when THERMAL POWER is below 5% RTP to allow special testing without generating a reactor trip.

12. Departure from Nucleate Boiling Ratio (DNBR) – Low

This LCO requires four channels of DNBR – Low to be OPERABLE.

The LCO on the CPCs ensures that the SLs are maintained during all AOOs and the consequences of accidents are acceptable.

(continued)

LCO

12. Departure from Nucleate Boiling Ratio (DNBR) – Low (continued)

A CPC is not considered inoperable if CEAC inputs to the CPC are inoperable. The Required Actions required in the event of CEAC channel failures ensure the CPCs are capable of performing their safety Function.

The CPC channels may be manually bypassed below 1E-4% RTP, as sensed by the logarithmic nuclear instrumentation. This bypass is enabled manually in all four CPC channels when plant conditions do not warrant the trip protection. The bypass effectively removes the DNBR – Low and LPD – High trips from the RPS logic circuitry. The operating bypass is automatically removed when enabling bypass conditions are no longer satisfied.

This operating bypass is required to perform a plant startup, since both CPC generated trips will be in effect whenever shutdown CEAs are inserted. It also allows system tests at low power with Pressurizer Pressure – Low or RCPs off.

During special testing pursuant to LCO ~~3.1.10~~ 3.1.12, the CPC channels may be manually bypassed when THERMAL POWER is below 5% RTP to allow special testing without generating a reactor trip.

Bypasses

The LCO on bypass permissive removal channels requires that the automatic bypass removal feature of all four operating bypass channels be OPERABLE for each RPS Function with an operating bypass in the MODES addressed in the specific LCO for each Function. All four bypass removal channels must be OPERABLE to ensure that none of the four RPS channels are inadvertently bypassed.

This LCO applies to the bypass removal feature only. If the bypass enable Function is failed so as to prevent entering a bypass condition, operation may continue. In the case of the Logarithmic Power Level – High trip (Function 2), the absence of a bypass will limit maximum power to below the trip setpoint.

(continued)

BASES

APPLICABILITY

Most RPS trips are required to be OPERABLE in MODES 1 and 2 because the reactor is critical in these MODES. The reactor trips are designed to take the reactor subcritical, which maintains the SLs during AOOs and assists the ESFAS in providing acceptable consequences during accidents. Most trips are not required to be OPERABLE in MODES 3, 4, and 5. In MODES 3, 4, and 5, the emphasis is placed on return to power events. The reactor is protected in these MODES by ensuring adequate SDM. Exceptions to this are:

- The Logarithmic Power Level – High trip, RPS Logic RTCBs, and Manual Trip are required in MODES 3, 4, and 5, with the RTCBs closed, to provide protection for boron dilution and CEA withdrawal events.

The Logarithmic Power Level – High trip in these lower MODES is addressed in LCO 3.3.2. The Logarithmic Power Level – High trip is bypassed prior to MODE 1 entry and is not required in MODE 1. The RPS Logic in MODES 1, 2, 3, 4, and 5 is addressed in LCO 3.3.4.

ACTIONS

The most common causes of channel inoperability are outright failure or drift of the bistable or process module sufficient to exceed the allowable value determined ~~tolerance allowed~~ by the plant specific setpoint analysis. Typically, the drift is found to be small and results in a delay of actuation rather than a total loss of function. This determination is generally made during the performance of a CHANNEL FUNCTIONAL TEST when the process instrument is set up for adjustment to bring it to within setting tolerance ~~specification~~. If the trip setpoint is less conservative than the Allowable Value in Table 3.3.1-1, the channel is declared inoperable immediately, and the appropriate Condition(s) must be entered immediately.

In the event a channel's trip setpoint is found nonconservative with respect to the Allowable Value, or the transmitter, instrument loop, signal processing electronics, or RPS bistable trip unit is found inoperable, then all affected functions provided by that channel must be declared inoperable, and the unit must enter the Condition for the particular protection Function affected.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.4 (continued)

located in the control room to detect deviations in channel outputs. The Frequency is modified by a Note indicating this Surveillance need only be performed within 12 hours after reaching 20% RTP. The 12 hours after reaching 20% RTP is required for plant stabilization, data taking, and flow verification. The secondary calorimetric is inaccurate at lower power levels. A second Note in the SR indicates the SR may be suspended during PHYSICS TESTS. The conditional suspension of the daily calibrations under strict administrative control is necessary to allow special testing to occur.

SR 3.3.1.5

The RCS flow rate indicated by each CPC is verified to be less than or equal to the RCS total flow rate every ~~31~~ 92 days. The Note indicates the Surveillance is performed prior to exceeding 85% RTP; or within 12 hours after THERMAL POWER is ≥ 85% RTP. This check (and, if necessary, the adjustment of the CPC addressable flow constant coefficients) ensures that the DNBR setpoint is conservatively adjusted with respect to actual flow indications as determined by a calorimetric calculation. Operating experience has shown the specified Frequency is adequate, as instrument drift is minimal and changes in actual flow rate are minimal over core life.

SR 3.3.1.6

The three vertically mounted excore nuclear instrumentation detectors in each channel are used to determine APD for use in the DNBR and LPD calculations. Because the detectors are mounted outside the reactor vessel, a portion of the signal from each detector is from core sections not adjacent to the detector. SR 3.3.1.6 ensures that the preassigned gains are still proper.

The 92 day Frequency is adequate because the demonstrated long term drift of the instrument channels is minimal.

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.7

A CHANNEL FUNCTIONAL TEST on each channel is performed every 92 days to ensure the entire channel will perform its intended function when needed. The SR is modified by two Notes. Note 1 is a requirement to verify the correct CPC addressable constant values are installed in the CPCs when the CPC CHANNEL FUNCTIONAL TEST is performed. Note 2 allows the CHANNEL FUNCTIONAL TEST for the Logarithmic Power Level—High channels to be performed 2 hours after power drops below 1E-4% RTP and is required to be performed only if the RTCBs are closed. Not required if performed within the surveillance interval.

~~In addition to power supply tests~~, the RPS CHANNEL FUNCTIONAL TEST consists of three overlapping tests as described in Reference 8. These tests verify that the RPS is capable of performing its intended function, from bistable input through the RTCBs. They include:

Bistable Tests

A test signal is superimposed on the input in one channel at a time to verify that the bistable trips within the specified tolerance around the setpoint. This is done with the affected RPS channel trip channel bypassed.

The requirements for this ~~review~~ verification are outlined in Reference 9.

Matrix Logic Tests

Matrix Logic tests are addressed in LCO 3.3.4. This test is performed one matrix at a time. It verifies that a coincidence in the two input channels for each Function removes power from the matrix relays. During testing, holding power is applied to the matrix relay test coils and prevents the matrix relay contacts from assuming their de-energized state. This test will detect any short circuits around the bistable contacts in the coincidence logic, such as may be caused by faulty bistable relay or trip channel bypass contacts.

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.1.8 (continued)

between successive tests. Measurement error determination, setpoint error determination, and calibration adjustment must be performed consistent with the plant specific setpoint analysis. The channel shall be left calibrated consistent with the assumptions of the current plant specific setpoint analysis.

Operating experience has shown this Frequency to be satisfactory. The detectors are excluded from CHANNEL CALIBRATION because they are passive devices with minimal drift and because of the difficulty of simulating a meaningful signal. Slow changes in ~~detector sensitivity~~ leakage of neutrons with core burnup are compensated for by performing the daily calorimetric calibration (SR 3.3.1.4) and the quarterly linear subchannel gain check (SR 3.3.1.6). In addition, the associated control room indications are monitored by the operators.

SR 3.3.1.9

SR 3.3.1.9 is the performance of a CHANNEL CALIBRATION every 24 months.

CHANNEL CALIBRATION is a complete check of the instrument channel including the sensor. The Surveillance verifies that the channel responds to a measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drift between successive calibrations to ensure that the channel remains operational between successive tests. Measurement error determination, setpoint error determination, and calibration adjustment must be performed consistent with the plant specific setpoint analysis. The channel shall be left calibrated consistent with the assumptions of the current plant specific setpoint analysis.

The Frequency is based upon the assumption of a 24 month calibration interval for the determination of the magnitude of equipment drift in the setpoint analysis as well as operating experience and consistency with the typical 24 month fuel cycle.

The Surveillance is modified by a Note to indicate that the neutron detectors are excluded from CHANNEL CALIBRATION

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.1.9 (continued)

because they are passive devices with minimal drift and because of the difficulty of simulating a meaningful signal. Slow changes in ~~detector sensitivity~~ leakage of neutrons with core burnup are compensated for by performing the daily calorimetric calibration (SR 3.3.1.4) and the quarterly linear subchannel gain check (SR 3.3.1.6).

SR 3.3.1.10

Every 24 months, a CHANNEL FUNCTIONAL TEST is performed on the CPCs. The CHANNEL FUNCTIONAL TEST shall include the injection of a signal as close to the sensors as practicable to verify OPERABILITY including alarm and trip Functions.

The basis for the 24 month Frequency is that the CPCs perform a continuous self monitoring function that eliminates the need for frequent CHANNEL FUNCTIONAL TESTS. This CHANNEL FUNCTIONAL TEST essentially validates the self monitoring function and checks for a small set of failure modes that are undetectable by the self monitoring function. Operating experience has shown that undetected CPC or CEAC failures do not occur in any given 24 month interval.

SR 3.3.1.11

The three excore detectors used by each CPC channel for axial flux distribution information are far enough from the core to be exposed to flux from all heights in the core, although it is desired that they only read their particular level. The CPCs adjust for this flux overlap by using shape annealing matrix elements in the CPC software.

After refueling, it is necessary to re-establish the shape annealing matrix elements for the excore detectors based on more accurate incore detector readings. This is necessary because refueling could possibly produce a significant change in the shape annealing matrix coefficients.

Incore detectors are inaccurate at low power levels < 15%. THERMAL POWER should be significant but < 85% to perform an accurate axial shape calculation used to derive the shape annealing matrix elements.

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SURVEILLANCE REQUIREMENTS

SR 3.3.1.11 (continued)

By restricting power to ≤ 85% until shape annealing matrix elements are verified, excessive local power peaks within the fuel are avoided. Operating experience has shown this Frequency to be acceptable.

SR 3.3.1.12

SR 3.3.1.12 is a CHANNEL FUNCTIONAL TEST similar to SR 3.3.1.7, except SR 3.3.1.12 is applicable only to bypass functions and is performed once within 92 days prior to each startup. Proper operation of bypass permissives is critical during plant startup because the bypasses must be in place to allow startup operation and must be removed at the appropriate points during power ascent to enable certain reactor trips. Consequently, the appropriate time to verify bypass removal function OPERABILITY is just prior to startup. The allowance to conduct this Surveillance within 92 days of startup is based on the reliability analysis # presented in topical report CEN-327, "RPS/ESFAS Extended Test Interval Evaluation" (Ref. 9). Once the operating bypasses are removed, the bypasses must not fail in such a way that the associated trip Function gets inadvertently bypassed. This feature is verified by the trip Function CHANNEL FUNCTIONAL TEST, SR 3.3.1.7.

Therefore, further testing of the bypass function after startup is unnecessary.

SR 3.3.1.13

This SR ensures that the RPS RESPONSE TIMES are verified to be less than or equal to the maximum values assumed in the safety analysis. Individual component response times are not modeled in the analyses. The analyses model the overall or total elapsed time, from the point at which the parameter exceeds the trip setpoint value at the sensor to the point at which the RTCBs open. Response times are conducted on an 24 month STAGGERED TEST BASIS. This results in the interval between successive surveillances of a given channel of n x 24 months, where n is the number of channels in the function. The Frequency of 24 months is based upon operating experience, which has shown that random failures

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.13 (continued)

of instrumentation components causing serious response time degradation, but not channel failure, are infrequent occurrences. Also, response times cannot be determined at power, since equipment operation is required. Testing may be performed in one measurement or in overlapping segments, with verification that all components are tested.

A Note is added to indicate that the neutron detectors are excluded from RPS RESPONSE TIME testing because they are passive devices with minimal drift and because of the difficulty of simulating a meaningful signal. Slow changes in ~~detector sensitivity~~ leakage of neutrons with core burnup are compensated for by performing the daily calorimetric calibration (SR 3.3.1.4).

REFERENCES

1. 10 CFR 20.

CR

2. 10 CFR 100.
3. NRC Safety Evaluation Report.
4. IEEE Standard 279-1971, April 5, 1972.
5. SONGS Units 2 and 3 UFSAR, Chapter 15.
6. 10 CFR 50.49.
7. PPS Setpoint Calculation CE-NPSD-570, Revision 3.
8. UFSAR, Section 7.2.
9. CEN-327, June 2, 1986, including Supplement 1, March 3, 1989.

(continued)

BASES

BACKGROUND (continued)

The acceptable limit during accidents is that the offsite dose shall be maintained within an acceptable fraction of 10 CFR 100 (Ref. 2) limits. Different accident categories allow 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 RPS is segmented into four interconnected modules. These modules are:

- Measurement channels;
- Bistable trip units;
- RPS Logic; and
- Reactor trip circuit breakers (RTCBs).

This LCO applies only to the Logarithmic Power Level – High trip in MODES 3, 4, and 5 with the RTCBs closed. In MODES 1 and 2, this trip Function is addressed in LCO 3.3.1, "Reactor Protective System (RPS) Instrumentation – Operating." LCO 3.3.13, "~~Logarithmic Power~~ Source Range Monitoring Channels," applies when the RTCBs are open. ~~In the case of LCO 3.3.13, the logarithmic channels are required for monitoring neutron flux, although~~ the trip Function is not ~~required~~.

Measurement Channels and Bistable Trip Units

The measurement channels providing input to the Logarithmic Power Level – High trip consist of the four logarithmic nuclear instrumentation channels detecting neutron flux leakage from the reactor vessel. Other aspects of the Logarithmic Power Level – High trip are similar to the other measurement channels and bistables. These are addressed in the Background section of LCO 3.3.1.

Functional testing of the entire RPS, from bistable input through the opening of individual sets of RTCBs, can be performed either at power or shutdown and is normally performed on a quarterly basis. Nuclear instrumentation can

(continued)

BASES (continued)

APPLICABLE SAFETY ANALYSES

be similarly tested. ~~FSAR,~~ Section 7.2 (Ref. 3), provides more detail on RPS testing. # The RPS functions to maintain the SLs during AOOs and mitigates the consequence of DBAs in all MODES in which the RTCBs are closed.

Each of the analyzed transients and accidents can be detected by one or more RPS Functions. Functions not specifically credited in the accident analysis were qualitatively credited in the safety analysis and the NRC staff approved licensing basis for the plant. Noncredited Functions include the Steam Generator Water Level – High ~~and the Loss of Load~~. The Steam Generator Water Level – High ~~and the Loss of Load trips are~~ trip s purely equipment protective, and ~~their~~ its use minimizes the potential for equipment damage.

The Logarithmic Power Level – High trip protects the integrity of the fuel cladding and helps protect the RCPB in the event of an unplanned criticality from a shutdown condition.

In MODES 2, 3, 4, and 5, with the RTCBs closed, and the Control Element Assembly (CEA) Drive System capable of CEA withdrawal, protection is required for CEA withdrawal events originating when THERMAL POWER is < 1E-4% RTP. For events originating above this power level, other trips provide adequate protection.

MODES 3, 4, and 5, with the RTCBs closed, are addressed in this LCO. MODE 2 is addressed in LCO 3.3.1.

In MODES 3, 4, or 5, with the RTCBs open or the CEAs not capable of withdrawal, the Logarithmic Power Level – High trip does not have to be OPERABLE. ~~However,~~ The indication and alarm portion ~~of two logarithmic channels~~ must be OPERABLE to ensure proper indication of ~~neutron population and to indicate a boron dilution event.~~ ~~The indication and alarm functions are addressed in LCO 3.3.13~~.

The RPS satisfies Criterion 3 of the NRC Policy Statement.

LCO

The LCO requires the Logarithmic Power Level – High RPS Function to be OPERABLE. Failure of any required portion of the instrument channel renders the affected channel(s) inoperable and reduces the reliability of the affected Function.

(continued)

BASES

LCO (continued)

and Pressurizer Pressure – High trips provide protection for reactivity transients.

The trip may be manually bypassed during physics testing pursuant to LCO 3.4.17, "RCS Loops – Test Exceptions." During this testing, the Linear Power Level – High trip and administrative controls provide the required protection.

APPLICABILITY

Most RPS trips are required to be OPERABLE in MODES 1 and 2 because the reactor is critical in these MODES. The trips are designed to take the reactor subcritical, which maintains the SLs during AOOs and assists the Engineered Safety Features Actuation System (ESFAS) in providing acceptable consequences during accidents. Most trips are not required to be OPERABLE in MODES 3, 4, and 5. In MODES 3, 4, and 5, the emphasis is placed on return to power events. The reactor is protected in these MODES by ensuring adequate SDM. Exceptions to this are:

- The Logarithmic Power Level – High trip, RPS Logic RTCBs, and Manual Trip are required in MODES 3, 4, and 5, with the RTCBs closed and any CEA capable of being withdrawn, to provide protection for boron dilution and CEA withdrawal events. The Logarithmic Power Level – High trip in these lower MODES is addressed in this LCO. The RPS Logic in MODES 1, 2, 3, 4, and 5 is addressed in LCO 3.3.4, "Reactor Protective System (RPS) Logic and Trip Initiation."

The Applicability is modified by a Note that allows the trip to be bypassed when THERMAL POWER is > 1E-4% RTP, and the bypass is automatically removed when THERMAL POWER is ≤ 1E-4% RTP.

ACTIONS

The most common causes of channel inoperability are outright failure or drift of the bistable or process module sufficient to exceed the tolerance allowed by the plant specific setpoint analysis. Typically, the drift is found to be small and results in a delay of actuation rather than a total loss of function. This determination is generally made during the performance of a CHANNEL FUNCTIONAL TEST

(continued)

SURVEILLANCE REQUIREMENTS (continued)

Matrix Logic Tests

Matrix Logic Tests are addressed in LCO 3.3.4. This test is performed one matrix at a time. It verifies that a coincidence in the two input channels for each Function removes power from the matrix relays. During testing holding power is applied to the matrix relay test coils and prevents the matrix relay contacts from assuming their de-energized state. This test will detect any short circuits around the bistable contacts in the coincidence logic, such as may be caused by faulty bistable relay or trip channel bypass contacts.

Trip Path Test

Trip path (Initiation Logic) tests are addressed in LCO 3.3.4. These tests are similar to the Matrix Logic tests except that test power is withheld from one matrix relay at a time, allowing the initiation circuit to de-energize, opening the affected set of RTCBs. The RTCBs must then be closed prior to testing the other three initiation circuits, or a reactor trip may result.

The Frequency of 92 days is based on the reliability analysis presented in topical report CEN-327, "RPS/ESFAS Extended Test Interval Evaluation" (Ref. 6). The excore channels use preassigned test signals to verify proper channel alignment. The excore logarithmic channel test signal is inserted into the preamplifier input, so as to test the first active element downstream of the detector.

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.2.4 (continued)

The Frequency is based upon the assumption of an 24 month calibration interval for the determination of the magnitude of equipment drift in the setpoint analysis and includes operating experience and consistency with the typical 24 month fuel cycle.

The Surveillance is modified by a Note to indicate that the neutron detectors are excluded from CHANNEL CALIBRATION because they are passive devices with minimal drift and because of the difficulty of simulating a meaningful signal. Slow changes in ~~detector sensitivit~~y leakage of neutrons with core burnup are compensated for by performing the daily calorimetric calibration (SR 3.3.1.4).

SR 3.3.2.5

This SR ensures that the RPS RESPONSE TIMES are verified to be less than or equal to the maximum values assumed in the safety analysis. Individual component response times are not modeled in the analyses. The analyses model the overall or total elapsed time, from the point at which the parameter exceeds the trip setpoint value at the sensor to the point at which the RTCBs open. Response times are conducted on a 24 month STAGGERED TEST BASIS. This results in the interval between successive tests of a given channel of n x 24 months, where n is the number of channels in the Function. The 24 month Frequency is based upon operating experience, which has shown that random failures of instrumentation components causing serious response time degradation, but not channel failure, are infrequent occurrences. Also, response times cannot be determined at power, since equipment operation is required. Testing may be performed in one measurement or in overlapping segments, with verification that all components are tested.

(continued)

BASES

BACKGROUND (continued)

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 RPS is segmented into four interconnected modules. These modules are:

- Measurement channels;
- Bistable trip units;
- RPS Logic; and
- Reactor trip circuit breakers (RTCBs).

This LCO addresses the CEACs. LCO 3.3.1, "Reactor Protective System (RPS) Instrumentation – Operating," provides a description of this equipment in the RPS.

The excore nuclear instrumentation, the core protection calculators (CPCs), and the CEACs are considered components in the measurement channels of the Linear Power Level – High, Logarithmic Power Level – High, DNBR – Low, and Local Power Density (LPD) – High trips. The CEACs are addressed by this Specification.

penalty

All four CPCs receive control element assembly (CEA) deviation penalty factors from each CEAC and use the larger of the ~~power~~ factors from the two CEACs in the calculation of DNBR and LPD. CPCs are further described in the Background section of LCO 3.3.1.

The CEACs perform the calculations required to determine the position of CEAs within their subgroups for the CPCs. Two independent CEACs compare the position of each CEA to its subgroup position. If a deviation is detected by either CEAC, an annunciator sounds and appropriate "penalty factors" are transmitted to all CPCs. These penalty factors conservatively adjust the effective operating margins to the DNBR – Low and LPD – High trips. Each CEAC also drives a single cathode ray tube (CRT), which is switchable between CEACs. The CRT displays individual CEA positions and current values of the penalty factors from the selected CEAC.

(continued)

ACTIONS

A.1 and A.2 (continued)

position of all CEAs and provides verification of the proper operation of the remaining CEAC. An OPERABLE CEAC will not generate penalty factors until deviations of ≥ 9.7 inches within a subgroup are encountered.

The Completion Time of once per 4 hours is adequate based on operating experience, considering the low probability of an undetected CEA deviation coincident with an undetected failure in the remaining CEAC within this limited time frame.

As long as Required Action A.1 is accomplished as specified, the inoperable CEAC can be restored to OPERABLE status within 7 days. The Completion Time of 7 days is adequate for most repairs, while minimizing risk, considering that dropped CEAs are detectable by the redundant CEAC, and other LCOs specify Required Actions necessary to maintain DNBR and LPD margin.

B.1, B.2, B.3, B.4, and B.5

Condition B applies if the Required Action and associated Completion Time of Required Action A are not met, or if both CEACs are inoperable. Actions associated with this Condition involve disabling the Control E'ement Drive Mechanism Control System (CEDMCS), while providing increased assurance that CEA deviations are not occurring and informing all OPERABLE CPC channels, via a software flag, that ~~both~~ CEAC(s) ~~are~~ failed. This will ensure that the large penalty factor associated with two CEAC failures will be applied to CPC calculations. The penalty factor for two failed CEACs is sufficiently large that power must be maintained significantly < 100% RTP if CPC generated reactor trips are to be avoided. The Completion Time of 4 hours is adequate to accomplish these actions while minimizing risks.

the applicable

is(are)

The Required Actions are as follows:

B.1

Meeting the DNBR margin requirements of LCO 3.2.4, "DNBR," ensures that power level and ASI are within a conservative region of operation based on actual core conditions.

(continued)

ACTIONS
(continued)

B.2

The "full out" CEA reed switches provide acceptable indication of CEA position. Therefore, the CEAs will remain fully withdrawn, except as required for specified testing or flux control via group #6. This verification ensures that undesired perturbations in local fuel burnup are prevented.

B.3

The "RSPT/CEAC Inoperable" addressable constant in each of the CPCs is set to indicate that ~~both~~ the applicable CEAC(s) ~~are~~ is (are) inoperable. This provides a conservative penalty factor to ensure that a conservative effective margin is maintained by the CPCs in the computation of DNBR and LPD trips.

B.4

The CEDMCS is placed and maintained in "OFF," except during CEA motion permitted by Required Action B.2, to prevent inadvertent motion and possible misalignment of the CEAs.

B.5

A comprehensive set of comparison checks on individual CEAs within groups must be made within 4 hours. Verification that each CEA is within 7 inches of other CEAs in its group provides a check that no CEA has deviated from its proper position within the group.

C.1

Condition C applies if the CPC channel B or C cabinet receives a high temperature alarm. There is one temperature sensor in each of the four CPC bays. Since CPC bays B and C also house CEAC calculators 1 and 2, respectively, a high temperature in either of these bays may also indicate a problem with the associated CEAC.

If a CPC channel B or C cabinet high temperature alarm is received, it is possible for the CEAC to be affected and not be completely reliable. Therefore, a CHANNEL FUNCTIONAL TEST must be performed within 12 hours. The Completion Time of 12 hours is adequate, considering the low probability of

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.3.4 (continued)

The Frequency is based upon the assumption of an 24 month calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis and includes operating experience and consistency with the typical 24 month fuel cycle.

SR 3.3.3.5

Every 24 months, a CHANNEL FUNCTIONAL TEST is performed on the CEACs. The CHANNEL FUNCTIONAL TEST shall include the injection of a signal as close to the sensors as practicable to verify OPERABILITY, including alarm and trip Functions.

The basis for the 24 month Frequency is that the CEACs perform a continuous self monitoring function that eliminates the need for frequent CHANNEL FUNCTIONAL TESTS. This CHANNEL FUNCTIONAL TEST essentially validates the self ~~7778~~monitoring function and checks for a small set of failure modes that are undetectable by the self monitoring function. Operating experience has shown that undetected CPC or CEAC failures do not occur in any given 24 month interval.

SR 3.3.3.6

The isolation characteristics of each CEAC CEA position isolation amplifier and each optical isolator for CEAC to CPC data transfer are verified once per refueling to ensure that a fault in a CEAC or a CPC channel will not render another CEAC or CPC channel inoperable. The CEAC CEA position isolation amplifiers, mounted in CPC cabinets A and D, prevent a CEAC fault from propagating back to CPC A or D. The optical isolators for CPC to CEAC data transfer prevent a fault originating in any CPC channel from propagating back to any CEAC through this data link.

The Frequency is based on plant operating experience with regard to channel OPERABILITY, which demonstrates the failure of a channel in any 24 month interval is rare.

(continued)

BACKGROUND

RPS Logic (continued)

each have six contacts in series, one from each matrix, and perform a logical OR function, opening the RTCBs if any one or more of the six logic matrices indicate a coincidence condition.

Each trip path is responsible for opening one set of two of the eight RTCBs. The RTCB control relays (K-relays), when de-energized, interrupt power to the breaker undervoltage trip attachments and simultaneously apply power to the shunt trip attachments on each of the two breakers. Actuation of either the undervoltage or shunt trip attachment is sufficient to open the RTCB and interrupt power from the motor generator (MG) sets to the control element drive mechanisms (CEDMs).

When a coincidence occurs in two RPS channels, all four matrix relays in the affected matrix de-energize. This in turn de-energizes all four breaker control relays, which simultaneously de-energize the undervoltage and energize the shunt trip attachments in all eight RTCBs, tripping them open.

Matrix Logic refers to the matrix power supplies, trip channel bypass contacts, and interconnecting matrix wiring between bistable relay cards, up to but not including the matrix relays.

The Initiation Logic consists of the trip path power source, matrix relays and their associated contacts, all interconnecting wiring, and solid state ~~(auxiliary)~~ relays through the K-relay contacts in the RTCB control circuitry.

It is possible to change the two-out-of-four RPS Logic to a two-out-of-three logic for a given input parameter in one channel at a time by trip channel bypassing select portions of the Matrix Logic. Trip channel bypassing a bistable effectively shorts the bistable relay contacts in the three matrices associated with that channel. Thus, the bistables will function normally, producing normal trip indication and annunciation, but a reactor trip will not occur unless two additional channels indicate a trip condition. Trip channel bypassing can be simultaneously performed on any number of

(continued)

BACKGROUND

RPS Logic (continued)

parameters in any number of channels, providing each parameter is bypassed in only one channel at a time. An interlock prevents simultaneous trip channel bypassing of the same parameter in more than one channel. Trip channel bypassing is normally employed during maintenance or testing.

Reactor Trip Circuit Breakers (RTCBs)

The reactor trip switchgear consists of eight RTCBs, which are operated in four sets of two breakers (four channels). Power input to the reactor trip switchgear comes from two full capacity MG sets operated in parallel such that the loss of either MG set does not de-energize the CEDMs. There are two separate CEDM power supply buses, each bus powering half of the CEDMs. Power is supplied from the MG sets to each bus via two redundant paths (trip legs). This ensures that a fault or the opening of a breaker in one trip leg (i.e., for testing purposes) will not interrupt power to the CEDM buses.

Each of the four trip legs consists of two RTCBs in series. The two RTCBs within a trip leg are actuated by separate initiation circuits.

The eight RTCBs are operated as four sets of two breakers (four channels). For example, if a breaker receives an open signal in trip leg A (for CEDM bus 1), an identical breaker in trip leg B (for CEDM bus 2) will also receive an open signal. This arrangement ensures that power is interrupted to both CEDM buses, thus preventing trip of only half of the control element assemblies (CEAs) (a half trip). Any one inoperable breaker in a channel will make the entire channel inoperable.

Each set of RTCBs is operated by either a Manual Trip push button or an RPS initiated ~~actuated K~~-relay. There are four Manual Trip push buttons, arranged in two sets of two. Depressing both push buttons in either set will result in a reactor trip.

(continued)

BASES

BACKGROUND

Reactor Trip Circuit Breakers (RTCBs) (continued)

When a Manual Trip is ~~initiated~~ actuated using the control room push buttons, the RPS trip paths and K-relays are bypassed, and the RTCB undervoltage and shunt trip attachments are actuated independent of the RPS.

Manual Trip circuitry includes the push button and interconnecting wiring to both RTCBs necessary to actuate both the undervoltage and shunt trip attachments, but excludes the K-relay contacts and their interconnecting wiring to the RTCBs, which are considered part of the Initiation Logic.

Functional testing of the entire RPS, from bistable input through the opening of the individual sets of RTCBs, can be performed either at power or shutdown and is normally performed on a quarterly basis. FSAR, Section 7.2 (Ref. 3), explains RPS testing in more detail.

APPLICABLE SAFETY ANALYSES

Reactor Protective System (RPS) Logic

The RPS Logic provides for automatic trip initiation to maintain the SLs during AOOs and assist the ESF systems in ensuring acceptable consequences during accidents. All transients and accidents that call for a reactor trip assume the RPS Logic is functioning as designed.

Reactor Trip Circuit Breakers (RTCBs)

All of the transient and accident analyses that call for a reactor trip assume that the RTCBs operate and interrupt power to the CEDMs.

Manual Trip

There are no accident analyses that take credit for the Manual Trip; however, the Manual Trip is part of the RPS circuitry. It is used by the operator to shut down the reactor whenever any parameter is rapidly trending toward its trip setpoint. A Manual Trip accomplishes the same results as any one of the automatic trip Functions.

(continued)

BASES

LCO

4. Manual Trip (continued)

Manual Trip push buttons are also provided at the reactor trip switchgear (locally) in case the control room push buttons become inoperable or the control room becomes uninhabitable. These are not part of the RPS and cannot be credited in fulfilling the LCO OPERABILITY requirements. Furthermore, LCO ACTIONS need not be entered due to failure of a local Manual Trip.

APPLICABILITY

The RPS Logic, RTCBs, and Manual Trip are required to be OPERABLE in any MODE when the CEAs are capable of being withdrawn off the bottom of the core (i.e., RTCBs closed and power available to the CEDMs). This ensures that the reactor can be tripped when necessary, but allows for maintenance and testing when the reactor trip is not needed.

In MODES 3, 4, and 5 with the RTCBs open, the CEAs are not capable of withdrawal and these Functions do not have to be OPERABLE. However, two ~~logarithmic power level~~ Source Range Monitoring channels must be OPERABLE to ensure proper indication of neutron population and to indicate a boron dilution event. This is addressed in LCO 3.3.13, "~~Logarithmic Power~~ Source Range Monitoring Channels."

ACTIONS

When the number of inoperable channels in a trip Function exceeds that specified in any related Condition associated with the same trip Function, then the plant is outside the safety analysis. Therefore, LCO 3.0.3 is immediately entered if applicable in the current MODE of operation.

A.1

Condition A applies if one Matrix Logic channel is inoperable in any applicable MODE. Loss of a single vital instrument bus will de-energize one of the two matrix power supplies in up to three matrices. This is considered a single matrix failure, providing the matrix relays associated with the failed power supplies de-energize as required. The above statement is supported by a Note.

(continued)

ACTIONS

D.1 (continued)

If the affected RTCB cannot be opened, Required Action E is entered. This would only occur if there is a failure in the Manual Trip circuitry or the RTCB(s).

E.1 and E.2

Condition E is entered if Required Actions associated with Condition A, B, or D are not met within the required Completion Time or, if for one or more Functions, more than one Manual Trip, Matrix Logic, Initiation Logic, or RTCB channel is inoperable for reasons other than Condition A or D.

If the RTCBs associated with the inoperable channel cannot be opened, the reactor must be shut down within 6 hours and all the RTCBs opened. A Completion Time of 6 hours is reasonable, based on operating experience, for reaching the required plant conditions from full power conditions in an orderly manner and without challenging plant systems and for opening RTCBs. All RTCBs should then be opened, placing the plant in a MODE where the LCO does not apply and ensuring no CEA withdrawal occurs.

SURVEILLANCE REQUIREMENTS

SR 3.3.4.1 and 3.3.4.2

A CHANNEL FUNCTIONAL TEST on each RPS Logic channel and RTCB channel is performed every 31 days and every 92 days respectively to ensure the entire channel will perform its intended function when needed.

The RPS CHANNEL FUNCTIONAL TEST consists of three overlapping tests as described in Reference 3. These tests verify that the RPS is capable of performing its intended function, from bistable input through the RTCBs. The first test, the bistable test, is addressed by SR 3.3.1.7 in LCO 3.3.1.

This SR addresses the two tests associated with the RPS Logic: Matrix Logic and Trip Path.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

Matrix Logic Tests

These tests are performed one matrix at a time. They verify that a coincidence in the two input channels for each Function removes power from the matrix relays. During testing, holding power is applied to the matrix relay test coils and prevents the matrix relay contacts from assuming their de-energized state. The Matrix Logic tests will detect any short circuits around the bistable contacts in the coincidence logic such as may be caused by faulty bistable relay or trip channel bypass contacts.

Trip Path Tests

These tests are similar to the Matrix Logic tests, except that test power is withheld from one matrix relay at a time, allowing the initiation circuit to de-energize, opening the affected set of RTCBs. The RTCBs must then be closed prior to testing the other three initiation circuits, or a reactor trip may result.

The Frequency of 92 days is based on the reliability analysis presented in topical report CEN-327, "RPS/ESFAS Extended Test Interval Evaluation" (Ref. 5).

SR 3.3.4.~~2~~ 3

Each RTCB is actuated by an undervoltage coil and a shunt trip coil. The system is designed so that either de-energizing the undervoltage coil or energizing the shunt trip coil will cause the circuit breaker to open. When an RTCB is opened, either during an automatic reactor trip or by using the manual push buttons in the control room, the undervoltage coil is de-energized and the shunt trip coil is energized. This makes it impossible to determine if one of the coils or associated circuitry is defective.

Therefore, once every 18 months, a CHANNEL FUNCTIONAL TEST is performed that individually tests all ~~four sets of~~ eight undervoltage coils and all eight ~~four sets of~~ shunt trip coils for each RTCB. During undervoltage coil testing, the shunt trip coils must remain de-energized, preventing their operation. Conversely, during shunt trip coil testing, the undervoltage coils must remain energized, preventing their operation. This Surveillance ensures that every undervoltage coil and

(continued)

BASES

SURVEILLANCE REQUIREMENTS

3
SR 3.3.4.~~2~~ (continued)

every shunt trip coil is capable of performing its intended function and that no single active failure of any RTCB component will prevent a reactor trip. ~~The 18 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power~~. Operating experience has shown these components usually pass the Surveillance when performed at the Frequency of once every 18 months.

SR 3.3.4.~~3~~4

A CHANNEL FUNCTIONAL TEST on the Manual Trip channels is performed prior to a reactor startup to ensure the entire channel will perform its intended function if required. The Manual Trip Function can only be tested at shutdown. However, the simplicity of this circuitry and the absence of drift concern make this Frequency adequate.

Additionally, operating experience has shown that these components usually pass the Surveillance when performed at a Frequency of once every 7 days prior to each reactor startup.

REFERENCES

1. 10 CFR 50, Appendix A.
2. 10 CFR 100.
3. SONGS Units 2 and 3 UFSAR, Section 7.2.
4. NRC Safety Evaluation Report.
5. CEN-327, June 2, 1986, including Supplement 1, March 3, 1989.

BASES

APPLICABLE SAFETY ANALYSES

If the reactor coolant temperature is not maintained below 200°F, boiling of the reactor coolant could result. This could lead to inadequate cooling of the reactor fuel due to a resulting loss of coolant in the reactor vessel. Additionally, boiling of the reactor coolant could lead to a reduction in boron concentration in the coolant due to the boron plating out on components near the areas of the boiling activity, and because of the possible addition of water to the reactor vessel with a lower boron concentration than is required to keep the reactor subcritical. The loss of reactor coolant and the reduction of boron concentration in the reactor coolant would eventually challenge the integrity of the fuel cladding, which is a fission product barrier. One train of the SDC System is required to be operational in MODE 6, with the water level ≥ 23 ft above the top of the reactor vessel flange, to prevent this challenge. The LCO does permit de-energizing of the SDC pump for short durations under the condition that the boron concentration is not diluted. This conditional de-energizing of the SDC pump does not result in a challenge to the fission product barrier.

SDC and Coolant Circulation—High Water Level satisfies Criterion ~~2~~ 3 of the NRC Policy Statement.

LCO

Only one SDC loop is required for decay heat removal in MODE 6, with water level ≥ 23 ft above the top of the reactor vessel flange. Only one SDC loop is required because the volume of water above the reactor vessel flange provides backup decay heat removal capability. At least one SDC loop must be in operation to provide:

a. Removal of decay heat;

b. Mixing of borated coolant to minimize the possibility of a criticality; and

c. Indication of reactor coolant temperature.

An OPERABLE SDC loop includes an SDC pump, a heat exchanger, valves, piping, instruments, and controls to ensure an OPERABLE flow path and to determine the low end temperature.

(continued)

BACKGROUND

Measurement Channels (continued)

Adequate channel to channel independence includes physical and electrical independence of each channel from the others. Furthermore, each channel must be energized from separate inverters and station batteries. ~~Plants that have~~ SONGS Units 2 and 3 has demonstrated adequate channel to channel independence and thus may operate in two-out-of-three logic configuration, with one channel removed from service, until following the next MODE 5 entry.

Since no single failure will either cause or prevent a protective system actuation, and no protective channel feeds a control channel, this arrangement meets the requirements of IEEE Standard 279-1971 (Ref. 4).

Bistable Trip Units

Bistable trip units, mounted in the Plant Protection System (PPS) cabinet, receive an analog input from the measurement channels, compare the analog input to trip setpoints, and provide contact output to the Matrix Logic for each ESFAS Function. They also provide local trip indication and remote annunciation.

There are four channels of bistables, designated A through D, for each ESFAS Function, one for each measurement channel. In cases where two ESF Functions share the same input and trip setpoint (e.g., containment pressure input to CIAS and SIAS), the same bistable may be used to satisfy both Functions. Similarly, bistables may be shared between the RPS and ESFAS (e.g., Pressurizer Pressure – Low input to the RPS and SIAS). Bistable output relays de-energize when a trip occurs, in turn de-energizing bistable relays mounted in the PPS relay card racks.

The contacts from these bistable relays are arranged into six coincidence matrices, comprising the Matrix Logic. If bistables monitoring the same parameter in at least two channels trip, the Matrix Logic will generate an ESF actuation (two-out-of-four logic).

(continued)

BACKGROUND

ESFAS Logic (continued)

four channels sense the same input parameter trip. This is called a two-out-of-four trip logic.

Bistable relay contact outputs from the four channels are configured into six logic matrices. Each logic matrix checks for a coincident trip in the same parameter in two bistable channels. The matrices are designated the AB, AC, AD, BC, BD, and CD matrices to reflect the bistable channels being monitored. Each logic matrix contains four normally energized matrix relays. When a coincidence is detected in the two channels being monitored by the logic matrix, all four matrix relays de-energize.

The matrix relay contacts are arranged into trip paths, with one relay contact from each matrix relay in each of the four trip paths. Each trip path controls two initiation relays. Each of the two initiation relays in each trip path controls a contact~~s~~ in the Actuation Logic for one train of ESF.

Each of the two channels of Actuation Logic, mounted in the Auxiliary Relay Cabinet (ARCs), is responsible for actuating one train of ESF equipment. Each ESF Function has separate Actuation Logic in each ARC.

The contacts from the Initiation Logic are configured in a selective two-out-of-four logic in the Actuation Logic, similar to the configuration employed by the RPS in the RTCBs. This logic controls ARC mounted subgroup relays, which are normally energized. Contacts from these relays, when de-energized, actuate specific ESF equipment.

When a coincidence occurs in two ESFAS channels, all four matrix relays in the affected matrix will de-energize. This in turn will de-energize all eight initiation relays, four used in each Actuation Logic.

Matrix Logic refers to the matrix power supplies, trip channel bypass contacts, and interconnecting matrix wiring between bistable relay cards, up to but not including the matrix relays. Matrix contacts on the bistable relay cards are excluded from the Matrix Logic definition, since they are addressed as part of the measurement channel.

(continued)

BASES

BACKGROUND

ESFAS Logic (continued)

shares an operating bypass with the Pressurizer Pressure — Low reactor trip.

Manual ESFAS initiation capability is provided for all functions except RAS to permit the operator to manually actuate an ESF System when necessary.

Two sets of two push buttons (located in the control room) for each ESF Function are provided, and each set actuates both trains. Each Manual Trip push button opens one trip path, de-energizing one set of two initiation relays, one affecting each train of ESF. Initiation relay contacts are arranged in a selective two-out-of-four configuration in the Actuation Logic. By arranging the push buttons in two sets of two, such that both push buttons in a set must be depressed, it is possible to ensure that Manual Trip will not be prevented in the event of a single random failure. Each set of two push buttons is designated a single channel in LCO 3.3.6.

APPLICABLE SAFETY ANALYSES

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 the secondary, or backup, actuation signal for one or more other accidents.

ESFAS protective Functions are as follows:

1. Safety Injection Actuation Signal

SIAS ensures acceptable consequences during large break loss of coolant accidents (LOCAs), small break LOCAs, control element assembly ejection accidents, and main steam line breaks (MSLBs) inside containment. To provide the required protection, either a high containment pressure or a low pressurizer pressure signal will initiate SIAS. SIAS initiates the Emergency Core Cooling Systems (ECCS) and performs several other functions such as initiating a

(continued)

APPLICABLE SAFETY ANALYSES

1. Safety Injection Actuation Signal (continued)

Containment Cooling Actuation Signal (CCAS), initiating control room isolation, and starting the diesel generators.

CCAS mitigates containment overpressurization when required by either a manual CCAS actuation or an automatic SIAS Function.

2. Containment Spray Actuation Signal

CSAS actuates containment spray, preventing containment overpressurization during large break LOCAs, small break LOCAs, and MSLBs or feedwater line breaks (FWLBs) inside containment. CSAS is initiated by high high containment pressure and an SIAS. This configuration reduces the likelihood of inadvertent containment spray.

3. Containment Isolation Actuation Signal

CIAS ensures acceptable mitigating actions during large and small break LOCAs, and MSLBs or FWLBs inside containment. CIAS is initiated by high containment pressure.

4. Main Steam Isolation Signal

steam generator

MSIS ensures acceptable consequences during an MSLB or FWLB (between the steam generator and the main feedwater check valve), either inside or outside containment. MSIS isolates both steam generators if either generator indicates a low pressure condition. This prevents an excessive rate of heat extraction and subsequent cooldown of the RCS during these events.

5. Recirculation Actuation Signal

At the end of the injection phase of a LOCA, the refueling water storage tank (RWST) will be nearly empty. Continued cooling must be provided by the ECCS to remove decay heat. The source of water for the ECCS pumps is automatically switched to the

(continued)

LCO

b. Pressurizer Pressure – Low (continued)

The Allowable Value for this trip is set low enough to prevent actuating the ESF Functions (SIAS) during normal plant operation and pressurizer pressure transients. The setting is high enough that, with the specified accidents, the ESF systems will actuate to perform as expected, mitigating the consequences of the accident.

The Pressurizer Pressure – Low trip setpoint, which provides SIAS, and RPS trip, may be manually decreased to a floor value of 300 psia to allow for a controlled cooldown and depressurization of the RCS without causing a reactor trip, or SIAS. The margin between actual pressurizer pressure and the trip setpoint must be maintained less than or equal to the specified value (400 psia) to ensure a reactor trip, and SIAS will occur if required during RCS cooldown and depressurization.

From this reduced setting, the trip setpoint will increase automatically as pressurizer pressure increases, tracking actual RCS pressure until the trip setpoint is reached.

When the trip setpoint has been lowered below the bypass permissive setpoint of ~~400~~ 472 psia, the Pressurizer Pressure – Low reactor trip, and SIAS actuation may be manually bypassed in preparation for shutdown cooling. When RCS pressure rises above the bypass removal setpoint, the bypass is automatically removed.

Bypass Removal

This LCO requires four channels of bypass removal for Pressurizer Pressure – Low to be OPERABLE in MODES 1, 2, and 3.

(continued)

BASES

LCO

Bypass Removal (continued)

Each of the four channels enables and disables the bypass capability for a single channel. Therefore, this LCO applies to the bypass removal feature only. If the bypass enable function is failed so as to prevent entering a bypass condition, operation may continue. Because the trip setpoint has a floor value of 300 psia, a channel trip will result if pressure is decreased below this setpoint without bypassing.

The bypass removal Allowable Value was chosen because MSLB events originating from below this setpoint add less positive reactivity than that which can be compensated for by required SDM.

2. Containment Spray Actuation Signal

~~CSAS is initiated either manually or automaticall~~y. For ~~an~~ automatic CSAS actuation, it is necessary to have a Containment Pressure – High High signal, coincident with an SIAS. The SIAS requirement should always be satisfied on a legitimate CSAS, since the Containment Pressure – High signal used in the SIAS will initiate before the Containment Pressure – High High. This ensures that a CSAS will not initiate unless required.

a. Containment Pressure – High High

This LCO requires four channels of Containment Pressure – High High to be OPERABLE in MODES 1, 2, and 3.

The Allowable Value for this trip is set high enough to allow for first response ESF systems (containment cooling systems) to attempt to mitigate the consequences of an accident before resorting to spraying borated water onto containment equipment. The setting is low enough to initiate CSAS in time to prevent containment pressure from exceeding design.

(continued)

LCO

a. Steam Generator Pressure – Low (continued)

The Allowable Value for this trip is set below the full load operating value for steam pressure so as not to interfere with normal plant operation. However, the setting is high enough to provide an MSIS (Function 4) during an excessive steam demand event. An excessive steam demand event causes the RCS to cool down, resulting in a positive reactivity addition to the core.

MSIS limits this cooldown by isolating both steam generators if the pressure in either drops below the trip setpoint. An RPS trip on Steam Generator Pressure – Low is initiated simultaneously, using the same bistable. The Steam Generator Pressure – Low bistable output is also used in the EFAS logic (Function 7) to aid in determining if a steam generator is intact.

The Steam Generator Pressure – Low trip setpoint may be manually decreased as steam generator pressure is reduced. This prevents an RPS trip or MSIS actuation during controlled plant cooldown. The margin between actual ~~pressurizer~~ steam generator pressure and the trip setpoint must be maintained less than or equal to the specified value of 200 psi to ensure a reactor trip and MSIS will occur when required. The setpoint will increase automatically to maintain the margin ≤ 200psi as steam generator pressure is increased

5. Recirculation Actuation Signal

a. Refueling Water Storage Tank Level – Low

This LCO requires four channels of RWST Level – Low to be OPERABLE in MODES 1, 2, 3, and 4.

The upper limit on the Allowable Value for this trip is set low enough to ensure RAS does not initiate before sufficient water is transferred to the containment sump. Premature recirculation could impair the reactivity control function of safety injection by limiting the amount of boron injection.

(continued)

LCO c. Steam Generator Pressure – Low (continued)

The Steam Generator Pressure – Low input is derived from the Steam Generator Pressure – Low RPS bistable output. This output is also used as an MSIS input.

The Allowable Value for this trip is set below the full load operating value for steam pressure so as not to interfere with normal plant operation. However, the setting is high enough to provide an MSIS (Function 4) during an excessive steam demand event. An excessive steam demand is one indicator of a potentially ruptured steam generator; thus, this EFAS input, in conjunction with the SGPD Function, prevents the feeding of a potentially ruptured steam generator.

~~LCO c. Steam Generator Pressure – Low (continued)~~

The Steam Generator Pressure – Low trip setpoint may be manually decreased as steam generator pressure is reduced. This prevents an RPS trip or MSIS actuation during controlled plant cooldown. The margin between actual ~~pressurizer~~ steam generator pressure and the trip setpoint must be maintained less than or equal to the specified value of 200 psi to ensure that a reactor trip and MSIS will occur when required. The setpoint will increase automatically to maintain the margin ≤ 200 psi as steam generator pressure is increased until the trip setpoint is reached.

APPLICABILITY In MODES 1, 2 and 3 there is sufficient energy in the primary and secondary systems to warrant automatic ESF System responses to:

- Close the main steam isolation valves to preclude a positive reactivity addition;
- Actuate emergency feedwater to preclude the loss of the steam generators as a heat sink (in the event the normal feedwater system is not available);

(continued)

BASES

ACTIONS

D.1 and D.2 (continued)

per LCO 3.0.3, as explained in Condition B. Completion Times are consistent with Condition B.

E.1 and E.2

If the Required Actions and associated Completion Times of Condition A, B, C, or D cannot be met, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 4 within 12 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

for the Safety Injection Actuation Signal, Containment Spray Actuation Signal, Containment Isolation Actuation Signal, Main Steam Isolation Signal or Emergency Feedwater Actuation Signal

INSERT 1

SURVEILLANCE REQUIREMENTS

SR 3.3.5.1

Performance of the CHANNEL CHECK once every 12 hours ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is 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. 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 by the plant staff based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the match 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 match criteria, it is an indication that the channels are OPERABLE.

The Frequency, about once every shift, is based on operating experience that demonstrates channel failure is rare. Thus,

(continued)

INSERT 1

F.1 and F.2

If the Required Actions and associated Completion Times of Condition A, B, C, or D cannot be met for the Recirculation Actuation Signal, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions in an orderly manner and without challenging plant systems.

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.5.1 (continued)

performance of the CHANNEL CHECK guarantees that undetected overt channel failure is limited to 12 hours. Since the probability of two random failures in redundant channels in any 12 hour period is low, the CHANNEL CHECK minimizes the chance of loss of protective function due to failure of redundant channels. The CHANNEL CHECK supplements less formal, but more frequent, checks of channel OPERABILITY during normal operational use of displays associated with the LCO required channels.

SR 3.3.5.2

A CHANNEL FUNCTIONAL TEST is performed every 92 days to ensure the entire channel will perform its intended function when needed.

The CHANNEL FUNCTIONAL TEST is part of an overlapping test sequence similar to that employed in the RPS. This sequence, consisting of SR 3.3.5.2, SR 3.3.6.1, and SR 3.3.6.2, tests the entire ESFAS from the bistable input through the actuation of the individual subgroup relays. These overlapping tests are described in Reference 1. SR 3.3.5.2 and SR 3.3.6.1 are normally performed together and in conjunction with ESFAS testing. SR 3.3.6.2 verifies that the subgroup relays are capable of actuating their respective ESF components when de-energized.

These tests verify that the ESFAS is capable of performing its intended function, from bistable input through the actuated components. SRs 3.3.6.1 and 3.3.6.2 are addressed in LCO 3.3.6. SR 3.3.5.2 includes bistable tests.

A test signal is superimposed on the input in one channel at a time to verify that the bistable trips within the specified tolerance around the setpoint. This is done with the affected PPS trip channel bypassed.

SR 3.3.5.3 and SR 3.3.5.4

CHANNEL CALIBRATION is a complete check of the instrument channel including the detector and the bypass removal functions. The Surveillance verifies that the channel

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.5.3 and SR 3.3.5.4 (continued)

responds to a measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drift between successive calibrations to ensure that the channel remains operational between successive surveillances. Measurement error determination, setpoint error determination, and calibration adjustment must be performed consistent with the plant specific setpoint analysis. The channel shall be left calibrated consistent with the assumptions of the current plant specific setpoint analysis.

The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power.

SR 3.3.5.5

This Surveillance ensures that the train actuation response times are within the maximum values assumed in the safety analyses.

Response time testing acceptance criteria are included in Reference 10.

ESF RESPONSE TIME tests are conducted on a STAGGERED TEST BASIS of once every 24 months. The 24 month Frequency is consistent with the typical industry refueling cycle and is based upon plant operating experience, which shows that random failures of instrumentation components causing serious response time degradation, but not channel failure, are infrequent occurrences.

SR 3.3.5.6

SR 3.3.5.6 is a CHANNEL FUNCTIONAL TEST similar to SR 3.3.5.2, except SR 3.3.5.6 is performed within 92 days prior to startup and is only applicable to bypass functions. Since the Pressurizer Pressure—Low bypass is identical for both the RPS and ESFAS, this is the same Surveillance performed for the RPS in SR 3.3.1.13.

(continued)

BACKGROUND (continued)

- Matrix Logic,
- Initiation Logic (trip paths), and
- Actuation Logic.

This LCO addresses ESFAS Logic. Bistables and measurement channels are addressed in LCO 3.3.5, "Engineered Safety Features Actuation System (ESFAS) Instrumentation."

The role of the measurement channels and bistables is described in LCO 3.3.5. The role of the ESFAS Logic is described below.

ESFAS Logic

The ESFAS Logic, consisting of Matrix, Initiation and Actuation Logic, employs a scheme that provides an ESF actuation of both trains when bistables in any two of the four channels sense the same input parameter trip. This is called a two-out-of-four trip logic.

Bistable relay contact outputs from the four channels are configured into six Matrix Logics. Each Matrix Logic checks for a coincident trip in the same parameter in two bistable channels. The matrices are designated the AB, AC, AD, BC, BD, and CD matrices, to reflect the bistable channels being monitored. Each Matrix Logic contains four normally energized matrix relays. When a coincidence is detected in the two channels being monitored by the Matrix Logic, all four matrix relays de-energize.

The matrix relay contacts are arranged into trip paths, with one relay contact from each matrix relay in each of the four trip paths. Each trip path controls two initiation relays. Each of the two initiation relays in each trip path controls a contact~~s~~ in the Actuation Logic for one train of ESF.

Each of the two channels of Actuation Logic, mounted in the Auxiliary Relay Cabinets (ARCs), is responsible for actuating one train of ESF equipment. Each ESF Function has separate Actuation Logic in each ARC.

The contacts from the Initiation Logic are configured in a selective two-out-of-four logic in the Actuation Logic, similar to the configuration employed by the RPS in the RTCBs. This logic controls ARC mounted subgroup relays,

(continued)

BASES

BACKGROUND

ESFAS Logic (continued)

channel at a time. An interlock prevents simultaneous trip channel bypassing of the same parameter in more than one channel. Trip channel bypassing is normally employed during maintenance or testing. Trip channel bypassing is addressed in LCO 3.3.5.

Manual ESFAS initiation capability is provided to permit the operator to manually actuate an ESF System when necessary, with the exception of RAS which does not have manual initiation capability. Two sets of two push buttons (located in the control room) for each ESF Function are provided, and each set actuates both trains ~~except for RAS~~. Each Manual Trip push button opens one trip path, de-energizing one set of two initiation relays, one affecting each train of ESF. Initiation relay contacts are arranged in a selective two-out-of-four configuration in the Actuation Logic. By arranging the push buttons in two sets of two, such that both push buttons in a set must be depressed, it is possible to ensure that Manual Trip will not be prevented in the event of a single random failure. Each set of two push buttons is designated a single channel in this LCO.

However, all ESFAS functions, including RAS, have

~~However,~~ RAS does not have manual pushbuttons on the Control Room panels. ~~RAS~~ manual actuation ~~is~~ available from the Manual pushbuttons on the ESFAS panels. These pushbuttons operate contacts in the Actuation Logic, so Initiation Logic is not required for a manual actuation. These pushbuttons are not credited in the Technical Specifications

APPLICABLE SAFETY ANALYSES

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.

ESFAS Functions are as follows:

1. Safety Injection Actuation Signal

   SIAS ensures acceptable consequences during large break loss of coolant accidents (LOCAs), small break

(continued)

BASES

APPLICABLE SAFETY ANALYSES

1. Safety Injection Actuation Signal (continued)

and feedwater line breaks

LOCAs, control element assembly ejection accidents, and main steam line breaks (MSLBs) inside or outside containment. To provide the required protection, either a high containment pressure or a low pressurizer pressure signal will initiate SIAS. SIAS initiates the Emergency Core Cooling Systems (ECCS) and performs several other Functions, such as initiating a containment cooling actuation, initiating control room isolation, and starting the diesel generators.

2. Containment Isolation Actuation Signal

CIAS ensures acceptable mitigating actions during large and small break LOCAs and during MSLBs or feedwater line breaks (FWLBs) inside containment. CIAS is initiated by high containment pressure.

3. Containment Cooling Actuation Signal

CCAS mitigates containment overpressurization when required by either a manual CCAS actuation or an automatic SIAS Function.

4. Recirculation Actuation Signal

At the end of the injection phase of a LOCA, the refueling water storage tank (RWST) will be nearly empty. Continued cooling must be provided by the ECCS to remove decay heat. The source of water for the ECCS pumps is automatically switched to the containment recirculation sump. Switchover from RWST to containment sump must occur before the RWST empties to prevent damage to the ECCS pumps and a loss of core cooling capability. For similar reasons, switchover must not occur before there is sufficient water in the containment sump to support pump suction. Furthermore, early switchover must not occur to ensure sufficient borated water is injected from the RWST to ensure the reactor remains shut down in the recirculation mode. An RWST Level – Low signal initiates the RAS.

(continued)

APPLICABLE SAFETY ANALYSES (continued)

5. Containment Spray Actuation Signal

CSAS actuates containment spray, preventing containment overpressurization during large break LOCAs, small break LOCAs, and MSLBs or FWLBs inside containment. CSAS is initiated by high high containment pressure and a coincident automatic SIAS. This configuration reduces the likelihood of inadvertent containment spray.

6. Main Steam Isolation Signal

MSIS ensures acceptable consequences during an MSLB either inside or outside containment or FWLB (between the steam generator and the main feedwater check valve). MSIS isolates both steam generators if either generator indicates a low pressure condition. This prevents an excessive rate of heat extraction and subsequent cooldown of the RCS during these events.

7, 8. Emergency Feedwater Actuation Signal

EFAS ~~logic~~ consists of two ~~steam generator~~ start (SG) specific signals (EFAS-1 and EFAS-2). EFAS-1 initiates emergency feed to SG #1, and EFAS-2 initiates emergency feed to SG #2.

ESFAS maintains a secondary heat sink during any event resulting in low steam generator water level.

EFAS Logic maintains a s~~team generator~~ secondary heat sink during ~~a steam generator tube rupture event and~~ an MSLB or FWLB event either inside or outside containment by selectively feeding the unaffected or least affected steam generator. Low steam generator water level initiates emergency feed to the affected steam generator, providing the generator is not identified (by the circuitry) as faulted (an MSLB or FWLB).

EFAS logic includes steam generator specific inputs from the Steam Generator Pressure – Low bistable comparator (also used in MSIS) and the SG Pressure Difference – High (SG #1 > SG #2 or SG #2 > SG #1, bistable comparators) to determine if a rupture in either generator has occurred.

Rupture is assumed if the affected generator has a low pressure condition, unless that generator is

(continued)

APPLICABLE SAFETY ANALYSES

7, 8. Emergency Feedwater Actuation Signal (continued)

significantly higher in pressure than the other generator. This latter feature allows feeding the intact steam generator even if both are below the MSIS setpoint, while preventing the ruptured generator from being fed. Not feeding a ruptured generator prevents containment overpressurization during the analyzed events.

The ESFAS satisfies Criterion 3 of the NRC Policy Statement.

LCO

The LCO requires all channel components necessary to provide an ESFAS actuation to be OPERABLE.

The requirements for each Function are listed below. The reasons for the applicable MODES for each Function are addressed under APPLICABILITY.

1. Safety Injection Actuation Signal

Automatic SIAS is required ~~to~~ for automatic initiation of ~~initiate~~ CCAS and CSAS. Automatic SIAS occurs in Pressurizer Pressure – Low or Containment Pressure – High and is explained in Bases 3.3.5.

a. Manual Trip

This LCO requires two channels of SIAS Manual Trip to be OPERABLE in MODES 1, 2, 3, and 4.

b. Matrix Logic

This LCO requires six channels of SIAS Matrix Logic to be OPERABLE in MODES 1, 2, and 3.

c. Initiation Logic

This LCO requires four channels of SIAS Initiation Logic to be OPERABLE in MODES 1, 2, 3, and 4.

(continued)

LCO
(continued)

d. Actuation Logic

This LCO requires two channels of SIAS Actuation Logic to be OPERABLE in MODES 1, 2, 3, and 4.

2. Containment Isolation Actuation Signal

For Containment Pressure — High, the SIAS and CIAS share the same ~~input~~ measurement channels, bistables, and matrices and matrix relays. The remainder of the initiation channels, the manual channels, and the Actuation Logic are separate. Since their applicability is also the same, they have identical actions.

a. Manual Trip

This LCO requires two channels of CIAS Manual Trip ~~or two channels of SIAS Manual Trip~~ to be OPERABLE in MODES 1, 2, 3, and 4.

b. Matrix Logic

This LCO requires six channels of CIAS Matrix Logic to be OPERABLE in MODES 1, 2, and 3.

c. Initiation Logic

This LCO requires four channels of CIAS Initiation Logic to be OPERABLE in MODES 1, 2, 3, and 4.

d. Actuation Logic

This LCO requires two channels of CIAS Actuation Logic to be OPERABLE in MODES 1, 2, 3, and 4.

3. Containment Cooling Actuation Signal

The CCAS Function ~~can~~ will be ~~manually~~ automatically actuated on an automatic SIAS. It can also be manually actuated using two channels of CCAS push buttons, configured similarly to all other ESFAS Manual Trips except for RAS. CCAS therefore shares the SIAS

(continued)

BASES

LCO

3. Containment Cooling Actuation Signal (continued)

~~sensor~~ measurement channels, bistables, coincidence matrices, and matrix relays. It has separate manual channels and Actuation Logic.

a. Manual Trip

This LCO requires two channels of CCAS Manual Trip ~~or SIAS Manual Trip~~ to be OPERABLE in MODES 1, 2, 3, and 4.

b. Automatic SIAS

This LCO requires four channels of Automatic SIAS input to CCAS to be OPERABLE in MODES 1, 2, and 3, as described in the following Matrix Logic and Initiation Logic sections.

c. Matrix Logic

This LCO requires six channels of SIAS Matrix Logic to be OPERABLE in MODES 1, 2, and 3.

d ~~b~~. Initiation Logic

This LCO requires four channels of CCAS Initiation Logic to be OPERABLE in MODES 1, 2, 3, and 4.

Four channels of SIAS Initiation Logic are also required in MODES 1, 2, and 3. Failure of any channel of SIAS Initiation Logic may disable the corresponding channels of CCAS Initiation Logic.

e ~~c~~. Actuation Logic

This LCO requires two channels of CCAS Actuation Logic to be OPERABLE in MODES 1, 2, 3, and 4.

4. Recirculation Actuation Signal

a. Matrix Logic

This LCO requires six channels of RAS Matrix Logic to be OPERABLE in MODES 1, 2, ~~and~~ 3~~.~~, and 4.

b. Initiation Logic

This LCO requires ~~two~~ four channels of RAS Initiation Logic to be OPERABLE in MODES 1, 2, 3, and 4.

c. Actuation Logic

This LCO requires two channels of RAS Actuation Logic to be OPERABLE in MODES 1, 2, 3, and 4.

5. Containment Spray Actuation Signal

CSAS is initiated either manually or automatically. For an automatic actuation it is necessary to have a

(continued)

BASES

LCO 5. Containment Spray Actuation Signal (continued)

Containment Pressure – High High signal, coincident with an automatic SIAS. The SIAS requirement should always be satisfied on a legitimate CSAS, since the Containment Pressure – High signal used in the SIAS will initiate before the Containment Pressure – High High input signal to CSAS. This ensures that a CSAS will not initiate unless required.

a. Manual Trip

This LCO requires two channels of CSAS Manual Trip to be OPERABLE in MODES 1, 2, and 3.

b. Automatic SIAS (Function 1)

This LCO requires four channels of Automatic SIAS input to CSAS to be OPERABLE in MODES 1, 2, and 3 as described in the following Matrix Logic and Initiation Logic sections.
The Automatic SIAS occurs on Pressurizer Pressure – Low or Containment Pressure – High and is explained above.

c. Matrix Logic

This LCO requires six channels of CSAS Matrix Logic and Six channels of SIAS Matrix Logic to be OPERABLE in MODES 1, 2, and 3. Failure of one channel in one functions matrices will not be assumed to disable the corresponding channel in the other functions matrices.

d. Initiation Logic

This LCO requires four channels of CSAS Initiation Logic and four channels of SIAS Initiation Logic to be OPERABLE in MODES 1, 2, and 3. Failure of one channel of SIAS Initiation Logic may disable the corresponding channel of CSAS Initiation Logic.

e. Actuation Logic

This LCO requires two channels of CSAS Actuation Logic to be OPERABLE in MODES 1, 2, and 3.

(continued)

APPLICABILITY (continued)

- Actuate emergency feedwater to preclude the loss of the steam generators as a heat sink (in the event the normal feedwater system is not available);
- Actuate ESF systems to prevent or limit the release of fission product radioactivity to the environment by isolating containment and limiting the containment pressure from exceeding the containment design pressure during a design basis LOCA or MSLB; and
- Actuate ESF systems to ensure sufficient borated inventory to permit adequate core cooling and reactivity control during a design basis LOCA or MSLB accident.

In MODES 4, 5, and 6, automatic actuation of these Functions is not required because adequate time is available to evaluate plant conditions and respond by manually operating the ESF components if required.

ESFAS ~~Manual Trip~~ actuation capability is required in MODE 4 for SIAS, CIAS, CCAS, and RAS even though automatic actuation is not required. for SIAS, CIAS, or CCAS Because of the large number of components actuated by these Functions, ESFAS actuation is simplified by the use of the Manual Trip push buttons for SIAS, CIAS, and CSAS Functions. The RAS function requires automatic actuation capability in MODE 4 and does not have manual trip pushbutton CSAS, MSIS, and EFAS have relatively few components, which can be actuated individually if required in MODE 4, and the systems may be disabled or reconfigured, making system level Manual Trip impossible and unnecessary.

The ESFAS logic must be OPERABLE in the same MODES as the automatic and Manual Trip. In MODE 4, only the portion of the SIAS, CIAS and CCAS Function ESFAS logic responsible for the required Manual Trip must be OPERABLE.

In MODES 5 and 6, the systems initiated by ESFAS are either reconfigured or disabled for shutdown cooling operation. Accidents in these MODES are slow to develop and would be mitigated by manual operation of individual components.

ACTIONS

When the number of inoperable channels in a trip Function exceeds those specified in any related Condition associated with the same trip Function, then the plant is outside the

(continued)

ACTIONS (continued)

safety analysis. Therefore, LCO 3.0.3 should be entered immediately, if applicable in the current MODE of operation.

A Note has been added to the ACTIONS to clarify the application of the Completion Time rules. The Conditions of this Specification may be entered independently for each Function. The Completion Time for the inoperable channel of a Function will be tracked separately for each Function, starting from the time the Condition was entered for that Function.

A.1

matrix

Condition A applies if one Matrix Logic channel is inoperable. Since matrix power supplies in a given matrix (e.g., AB, BC, etc.) are common to all ESFAS Functions, a single power supply failure may affect more than one matrix~~.~~,
but not more than one matrix per Function.
Failures of individual bistables and their relays are considered measurement channel failures. This section describes failures of the Matrix Logic not addressed in the above, such as the failure of matrix relay power supplies, or the failure of the trip channel bypass contact in the bypass condition. Loss of a single vital bus will de-energize one of the two power supplies in each of three matrices. This will result in two initiation circuits de-energizing, reducing the ESFAS Actuation Logic to a one-out-of-two logic in both trains.

This Condition has been modified by a Note stating that for the purposes of this LCO, de-energizing up to three matrix power supplies due to a single failure, such as loss of a vital instrument bus, is to be treated as a single matrix channel failure, providing the affected matrix relays de-energize as designed. Although each of the six matrices within an ESFAS Function uses separate power supplies, the matrices for the different ESFAS Functions share power supplies. Thus, failure of a matrix power supply may force entry into the Condition specified for each of the affected ESFAS Functions.

The channel must be restored to OPERABLE status within 48 hours. This provides the operator with time to take appropriate actions and still ensures that any risk involved in operating with a failed channel is acceptable. Operating

(continued)

ACTIONS

A.1 (continued)

experience has demonstrated that the probability of a random failure of a second Matrix Logic channel is low during any given 48 hour period. If the channel cannot be restored to OPERABLE status with 48 hours, Condition E or Condition F, as appropriate, is entered.

B.1

Condition B applies to one Manual Trip or Initiation Logic channel inoperable.

The channel must be restored to OPERABLE status within 48 hours. Operating experience has demonstrated that the probability of a random failure in a second channel is low during any given 48 hour period.

Failure of a single Initiation Logic channel may open one contact affecting both Actuation Logic channels. For the purposes of this Specification, the Actuation Logic is not inoperable. This prevents the need to enter LCO 3.0.3 in the event of an Initiation Logic channel failure. The Actions differ from those involving one RPS manual channel inoperable, because in the case of the RPS, opening RTCBs can be easily performed and verified. Opening an initiation relay contact is more difficult to verify, and subsequent shorting of the contact is always possible.

INSERT #3

C.1 and C.2

Condition C applies to the failure of both Initiation Logic channels affecting the same trip leg.

In this case, the Actuation Logic channels are not inoperable, since they are in one-out-of-two logic and capable of performing as required. This obviates the need to enter LCO 3.0.3 in the event of a matrix or vital bus power failure.

Both Initiation Logic channels in the same trip leg will de-energize if a matrix power supply or vital instrument bus is lost. This will open the Actuation Logic contacts,

(continued)

INSERT #3

For the EFAS function only, the contact opened must be in series with the Interposing relay. This will cause the cycling valve actuated by that relay to go to the open position and remain there, and will cause a contact to open in series with the subgroup relays. Opening only the contact in series with the subgroup relays would preserve the ability to deenergize the subgroup relays, but would leave the cycling valve unable to go to the EFAS actuated position.

With one EFAS cycling valve held open by a deenergized EFAS Interposing relay, an MSIS actuation will not be able to take that cycling valve to its MSIS actuated position (closed). Other MSIS actuated valves will prevent feeding the affected steam generator, but there will only be single valve isolation. This single valve isolation is acceptable for the short period of time allowed to restore the channel.

ACTIONS

D.1 (continued)

Failure of a single Initiation Logic channel, matrix channel power supply, or vital instrument bus may open one or both contacts in the same trip leg in both Actuation Logic channels. For the purposes of this Specification, the Actuation Logic is not inoperable. This obviates the need to enter LCO 3.0.3 in the event of a vital bus, matrix, or initiation channel failure.

Required Action D.1 is modified by a Note to indicate that one channel of Actuation Logic may be bypassed for up to 1 hour for Surveillance, provided the other channel is OPERABLE.

This allows performance of a PPS CHANNEL FUNCTIONAL TEST on an OPERABLE ESFAS train without generating an ESFAS actuation in the inoperable train.

E.1 and E.2

If the Required Actions and associated Completion Times of Conditions for MSIS, CSAS or EFAS cannot be met, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 4 within 12 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

F.1 and F.2

If the Required Actions and associated Completion Times for SIAS, CIAS, RAS, ~~CSAS,~~ or CCAS are not met, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.6.1

A CHANNEL FUNCTIONAL TEST is performed every 92 days to ensure the entire channel will perform its intended function when needed.

The CHANNEL FUNCTIONAL TEST is part of an overlapping test sequence similar to that employed in the RPS. This sequence, consisting of SR 3.3.5.2, SR 3.3.6.1, and SR 3.3.6.2, tests the entire ESFAS from the bistable input through the actuation of the individual subgroup relays. These overlapping tests are described in Reference 1. SR 3.3.5.2 and SR 3.3.6.1 are normally performed together and in conjunction with ESFAS testing. SR 3.3.6.2 verifies that the subgroup relays are capable of actuating their respective ESF components when de-energized.

These tests verify that the ESFAS is capable of performing its intended function, from bistable input through the actuated components. SR 3.3.5.2 is addressed in LCO 3.3.5. SR 3.3.6.1 includes Matrix Logic tests and trip path (Initiation Logic) tests.

Matrix Logic Tests

These tests are performed one matrix at a time. They verify that a coincidence in the two input channels for each function removes power to the matrix relays. During ~~testing,~~ holding power is applied to the matrix relay test coils, preventing the matrix relay contacts from assuming their de energized state. The Matrix Logic tests will detect any short circuits around the bistable contacts in the coincidence logic, such as may be caused by faulty bistable relay or trip channel bypass contacts.

Trip Path (Initiation Logic) Tests

These tests are similar to the Matrix Logic tests, except that test power is withheld from one matrix relay at a time, allowing the initiation circuit to de-energize, opening one contact in each Actuation Logic channel.

The initiation circuit lockout relay must be reset (except for EFAS, which lacks initiation circuit lockout relays) prior to testing the other three initiation circuits, or an ESFAS actuation may result.

(continued)

SURVEILLANCE REQUIREMENTS

Trip Path (Initiation Logic) Tests (continued)

Automatic Actuation Logic operation is verified during Initiation Logic testing by verifying that current is interrupted in each trip leg in the selective two-out-of-four actuation circuit logic whenever the initiation relay is de-energized. A Note is added to indicate that testing of Actuation Logic shall include verification of the proper operation of each initiation relay.

The Frequency of 92 days is based on the reliability analysis presented in topical report CEN-327, "RPS/ESFAS Extended Test Interval Evaluation" (Ref. 2).

SR 3.3.6.2

The Subgroup Relay Test of each Actuation Logic channel tests only the Individual subgroup relays

Individual ESFAS subgroup relays must ~~also~~ be tested, one at a time, to verify the individual ESFAS components will actuate when required. Proper operation of the individual subgroup relays is verified by de-energizing each relay in response to a test signal, ~~reenergizes in response to a reset signal, and at least~~ one connected component or pair of contacts is observed to actuate when the relay deenergizes.

energizing the relay by releasing the test signal and verifying at least

The 184 day Frequency is based on operating experience and ensures individual relay problems can be detected within this time frame. The actual justification is based on CEN-403, "Relaxation of Surveillance Test Interval for ESFAS Subgroup Relay Testing" (Ref. 3).

Some components cannot be tested at power since their actuation might lead to plant trip or equipment damage. Reference 1 lists those relays exempt from testing at power, with an explanation of the reason for each exception. Relays not tested at power must be tested in accordance with the Note to this SR.

SR 3.3.6.3

A CHANNEL FUNCTIONAL TEST is performed on the manual ESFAS actuation circuitry, de-energizing relays and providing manual actuation of the function.

SURVEILLANCE

SR 3.3.6.3 (continued)

(continued)

This test verifies that the manual trip push buttons are capable of opening contacts in the Actuation Logic as designed. The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown these components usually pass the Surveillance when performed at a Frequency of once every 24 months.

REFERENCES

1. SONGS Units 2 and 3 UFSAR, Section 7.3.
2. CEN-327, May 1986, including Supplement 1, March 1989.
3. CEN-403.

B 3.3 INSTRUMENTATION

B 3.3.7 Diesel Generator (DG) – Loss of Voltage Start (LOVS)

BASES

BACKGROUND

The DGs provide a source of emergency power when offsite power is either unavailable or insufficiently stable to allow safe unit operation. Undervoltage protection will generate a LOVS in the event a Loss of Voltage or Degraded Voltage condition occurs. There are two LOVS Functions for each 4.16 kV vital bus.

Four undervoltage relays with inverse time characteristics are provided on each 4.16 kV Class 1E instrument bus for the purpose of detecting a loss of bus voltage. Four undervoltage relays with definite time characteristics are provided for the purpose of detecting a sustained degraded voltage condition. The relays are combined in a two-out-of-four logic to generate a LOVS if the voltage is below 75% for a short time or below 90% for a long time. The LOVS initiated actions are described in "Onsite Power Systems" (Ref. 1).

Trip Setpoints and Allowable Values

The trip setpoints and Allowable Values are based on the analytical limits presented in "Accident Analysis," Reference 2. The selection of these 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, and instrument drift, Allowable Values ~~specified in Figure 3.3.7-1~~ are conservatively adjusted with respect to the analytical limits. The actual nominal trip setpoint is normally still more conservative than that required by the plant specific setpoint calculations. If the measured trip setpoint does not exceed the documented Surveillance acceptance criteria, the undervoltage relay is considered OPERABLE.

Setpoints in accordance with the Allowable Values will ensure that the consequences of accidents will be acceptable, providing the plant is operated from within the LCOs at the onset of the accident and the equipment functions as designed.

(continued)

BASES

ACTIONS (continued)

Note 1 was added to ensure review by the Onsite Review Committee is performed to discuss the desirability of maintaining the channel in the bypassed condition.

A.1 and A.2

Condition A applies if one channel is inoperable for one Function per DG bus.

If the channel cannot be restored to OPERABLE status, the affected channel should either be bypassed or tripped within 1 hour (Required Action A.1).

Placing this channel in either Condition ensures that logic is in a known configuration. In trip, the LOVS Logic is one-out-of-three. In bypass, the LOVS Logic is two-out-of-three, ~~and interlocks prevent bypass of a second channel for the affected Function~~. The 1 hour Completion Time is sufficient to perform these Required Actions.

Once Required Action A.1 has been complied with, Required Action A.2 allows prior to entering MODE 2 following the next MODE 5 entry to repair the inoperable channel. If the channel cannot be restored to OPERABLE status, the plant cannot enter MODE 2 following the next MODE 5 entry. The time allowed to repair or trip the channel is reasonable to repair the affected channel while ensuring that the risk involved in operating with the inoperable channel is acceptable. The prior to entering MODE 2 following the next MODE 5 entry Completion Time is based on adequate channel independence, which allows a two-out-of-three channel operation since no single failure will cause or prevent a reactor trip.

B.1 and B.2

Condition B applies if two channels are inoperable for one Function.

The Required Action is modified by a Note stating that LCO 3.0.4 is not applicable. The Note was added to allow the changing of MODES even though two channels are inoperable, with one channel bypassed and one tripped. In this configuration, the protection system is in a

(continued)

ACTIONS

B.1 and B.2 (continued)

one-out-of-two logic, which is adequate to ensure that no random failure will prevent protection system operation.

If the channel cannot be placed in bypass or trip within 1 hour, the Conditions and Required Actions for the associated DG made inoperable by DG – LOVS instrumentation are required to be entered. Alternatively, one affected channel is required to be bypassed and the other is tripped, in accordance with Required Action B.2. This places the Function in one-out-of-two logic. The 1 hour Completion Time is sufficient to perform the Required Actions.

One of the two inoperable channels will need to be restored to OPERABLE status prior to the next required CHANNEL FUNCTIONAL TEST because channel surveillance testing on an OPERABLE channel requires that the OPERABLE channel be placed in bypass. However, it is not ~~possible~~ allowed to bypass more than one DG – LOVS channel, and placing a second channel in trip will result in a loss of voltage diesel start signal. Therefore, if one DG – LOVS channel is in trip and a second channel is in bypass, a third inoperable channel would place the unit in LCO 3.0.3.

After one channel is restored to OPERABLE status, the provisions of Condition A still apply to the remaining inoperable channel.

C.1

Condition C applies when more than two undervoltage or Degraded Voltage channels on a single bus are inoperable.

Required Action C.1 requires all but two channels to be restored to OPERABLE status within 1 hour. With more than two channels inoperable, the logic is not capable of providing the DG – LOVS signal for valid Loss of Voltage or Degraded Voltage conditions. The 1 hour Completion Time is reasonable to evaluate and take action to correct the degraded condition in an orderly manner and takes into account the low probability of an event requiring LOVS occurring during this interval.

(continued)

BASES

LCO (continued)

b. Airborne Radiation and Containment Area Radiation

The LCO on the radiation channels requires that each channel be OPERABLE for each Actuation Logic channel, since they are not totally redundant to each other.

The trip setpoint of twice background is selected to allow detection of small deviations from normal. The absolute value of the trip setpoint in MODES 5 and 6 differs from the setpoint in MODES 1, 2, 3, and 4 so that a fuel handling accident can be detected in the lower background radiation expected in ~~these~~ MODE~~S~~. 6

~~Only~~ The Containment Area Radiation channels are credited with being OPERABLE During MODE 6. The Airborne Radiation Channels are not required during mode 6.

c. Actuation Logic

One channel of Actuation Logic is required, since the valves can be shut independently of the CPIS signal either manually from the control room or using either the SIAS or CIAS push button.

APPLICABILITY

In MODES 1, 2, 3, and 4, the minipurge valves may be open. In these MODES, it is necessary to ensure the valves will shut in the event of a primary leak in containment whenever any of the containment purge valves are open.

With the purge valves open during CORE ALTERATIONS or movement of irradiated fuel assemblies within containment, a fuel handling accident would require CPIS on high radiation in containment.

The APPLICABILITY is modified by a Note, which states that the CPIS Specification is only required when the penetration is not isolated by at least one closed and de-activated automatic valve, closed manual valve, or blind flange.

(continued)

LCO
(continued)

b. <u>Airborne Radiation and Containment Area Radiation</u>

The LCO on the radiation channels requires that ~~each~~ one channel be OPERABLE for each Actuation Logic channel. ~~since they are not totally redundant to each other.~~

The trip setpoint of twice background is selected to allow detection of small deviations from normal. The absolute value of the trip setpoint in MODES 5 and 6 differs from the setpoint in MODES 1, 2, 3, and 4 so that a fuel handling accident can be detected in the lower background radiation expected in these MODES.

c. <u>Actuation Logic</u>

One channel of Actuation Logic is required, since the valves can be shut independently of the CPIS signal either manually from the control room or using either the SIAS or CIAS push button.

APPLICABILITY

In MODES 1, 2, 3, and 4, the minipurge valves may be open. In these MODES, it is necessary to ensure the valves will shut in the event of a primary leak in containment whenever any of the containment purge valves are open.

With the purge valves open during CORE ALTERATIONS or movement of irradiated fuel assemblies within containment, a fuel handling accident would require CPIS on high radiation in containment.

The APPLICABILITY is modified by a Note, which states that the CPIS Specification is only required when the penetration is not isolated by at least one closed and de-activated automatic valve, closed manual valve, or blind flange.

(continued)

This test verifies that the trip push buttons are capable of opening contacts in the Actuation Logic as designed,

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.9.5 (continued)

de-energizing the initiation relays and providing Manual Trip of the function. The 18 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown these components usually pass the Surveillance when performed at a Frequency of once every 18 months.

REFERENCES

1. SONGS Units 2 and 3 UFSAR, Chapter 15.
2. PPS Selection of Trip Valves Document.
3. 10 CFR 50, Appendix A, GDC 19.

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add

B 3.3 INSTRUMENTATION

B 3.3.10 Fuel Handling Isolation Signal (FHIS)

BASES

BACKGROUND

This LCO encompasses FHIS actuation, which is a plant specific instrumentation channel that performs an actuation Function required for plant protection but is not otherwise included in LCO 3.3.6, "Engineered Safety Features Actuation System (ESFAS) Logic and Manual Trip," or LCO 3.3.7, "Diesel Generator (DG) – Loss of Voltage Start (LOVS)." This is a non-Nuclear Steam Supply System ESFAS Function that, because of differences in purpose, design, and operating requirements, is not included in LCO 3.3.6 and LCO 3.3.7.

The FHIS provides protection from radioactive contamination in the spent fuel pool area in the event that a spent fuel element ruptures during handling.

The FHIS will detect radioactivity from fission products in the fuel and will initiate appropriate actions so the release to the environment is limited. More detail is provided in Reference 1.

The FHIS includes two independent, redundant subsystems, including actuation trains. Each train employs a separate sensor to detect gaseous activity. Since the two sensors detect different types of activity, they are not considered redundant to each other. However, since there is a separate sensor in each train, the trains are redundant. If the bistable monitoring the sensor indicates an unsafe condition, that train will be actuated (one-out-of-two logic). The two trains actuate separate equipment.

Trip Setpoints and Allowable Values

Trip setpoints used in the bistables are based on the analytical limits (Ref. 2). The selection of these 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, and instrument drift, Allowable Values specified in LCO 3.3.10 are conservatively adjusted with respect to the analytical limits. A detailed description of the methodology used to calculate the trip

(continued)

BACKGROUND

Trip Setpoints and Allowable Values (continued)

setpoints, including their explicit uncertainties, is provided in "Plant Protection System Selection of Trip Setpoint Values" (Ref. 3). The actual nominal trip setpoint entered into the bistable is normally still more conservative than that specified by the Allowable Value to account for changes in random measurement errors detectable by a CHANNEL FUNCTIONAL TEST. One example of such a change in measurement error is drift during the surveillance interval. If the measured setpoint does not exceed the Allowable Value, the bistable is considered OPERABLE.

Setpoints in accordance with the Allowable Value will ensure the consequences of Design Basis Accidents will be acceptable, providing the plant is operated from within the LCOs at the onset of the accident and the equipment functions as designed.

APPLICABLE SAFETY ANALYSES

The FHIS is required to isolate the normal Fuel Handling Building Post Accident Cleanup (PACU) System and automatically initiate the recirculation and filtration systems in the event of the fuel handling accident in the fuel handling building, as described in Reference 2. The FHIS helps ensure acceptable consequences for the dropping of a spent fuel bundle breaching up to 60 fuel pins.

The FHIS satisfies the requirements of Criterion 3 of the NRC Policy Statement.

LCO

LCO 3.3.10 requires one channel of FHIS to be OPERABLE. The required channel consists of Actuation Logic, Manual Trip, and gaseous radiation monitor. The specific Allowable Values for the setpoints of the FHIS are listed in the SRs.

Only the Allowable Values are specified for each trip Function in the SRs. Operation with a trip setpoint less conservative than the nominal trip setpoint, but within its Allowable Value, is acceptable, provided that the difference between the nominal trip setpoint and the Allowable Value is

(continued)

BASES

LCO (continued)

equal to or greater than the drift allowance assumed for each trip in the transient and accident analyses.

The Allowable Value specified is more conservative than the analytical limit assumed in the transient and accident analysis in order to account for instrument uncertainties appropriate to the trip Function. These uncertainties are defined in the "Plant Protection System Selection of Trip Setpoint Values" (Ref. 3).

The Bases for the LCO on the FHIS are discussed below for each Function:

a. Manual Trip

The LCO on Manual Trip ensures that the FHIS Function can easily be initiated if any parameter is trending rapidly toward its setpoint. Components can be actuated independently of the FHIS. Both available channels are required to ensure a single failure will not disable automatic initiation capability.

b. Airborne Radiation

The LCO on the two Airborne Radiation channels requires that each channel be OPERABLE for the required Actuation Logic channel, since they are not redundant to each other.

c. Actuation Logic

Two channels of Actuation Logic are required to be OPERABLE to ensure no single random failure can prevent automatic actuation.

APPLICABILITY

One FHIS channel is required to be OPERABLE during movement of irradiated fuel in the fuel building. The FHIS isolates the fuel building area in the event of a fuel handling accident.

ACTIONS

An FHIS channel is inoperable when it does not satisfy the OPERABILITY criteria for the channel's function. The most

(continued)

ACTIONS
(continued)

common cause of channel inoperability is outright failure or drift of the bistable or process module sufficient to exceed the tolerance allowed by the plant specific setpoint analysis. Typically, the drift is not large and would result in a delay of actuation rather than a total loss of function. This determination is generally made during the performance of a CHANNEL FUNCTIONAL TEST when the process instrument is set up for adjustment to bring it within specification. If the trip setpoint is not consistent with the Allowable Value in LCO 3.3.10, the channel must be declared inoperable immediately and the appropriate Conditions must be entered.

In the event a channel's trip setpoint is found nonconservative with respect to the Allowable Value, or the sensor, instrument loop, signal processing electronics, or bistable is found inoperable, then all affected Functions provided by that channel are required to be declared inoperable and the LCO Condition entered for the particular protective function affected.

A.1 and A.2

Condition A applies to FHIS Manual Trip, Actuation Logic, and required gaseous radiation monitor inoperable during movement of irradiated fuel in the fuel handling building.

The Required Actions are to restore required channels to OPERABLE status, or place one OPERABLE PACU train in operation, or suspend movement of irradiated fuel in the fuel building. These Required Actions are required to be completed immediately. The Completion Time accounts for the higher likelihood of releases in the fuel building during fuel handling.

SURVEILLANCE REQUIREMENTS

SR 3.3.10.1

Performance of the CHANNEL CHECK once every 12 hours ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is 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.

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.10.1 (continued)

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. 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 by the plant staff based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the match criteria, it may be an indication that the transmitter or the signal processing equipment has drifted outside its limit.

The Frequency, about once every shift, is based on operating experience that demonstrates the rarity of channel failure. Thus, performance of the CHANNEL CHECK guarantees that undetected overt channel failure is limited to 12 hours. Since the probability of two random failures in redundant channels in any 12 hour period is low, the CHANNEL CHECK minimizes the chance of loss of protective function due to failure of redundant channels. The CHANNEL CHECK supplements less formal, but more frequent, checks of channel OPERABILITY during normal operational use of the displays associated with the LCO required channels.

SR 3.3.10.2

A CHANNEL FUNCTIONAL TEST is performed on the required fuel building radiation monitoring channel to ensure the entire channel will perform its intended function.

The setpoint shall be left set consistent with the assumptions of the current plant specific setpoint analysis.

The Frequency of 92 days is based on plant operating experience with regard to channel OPERABILITY and drift, which demonstrates that failure of more than one channel of a given Function in any 92 day Frequency is a rare event.

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.10.3

Proper operation of the individual initiation relays is verified by actuating these relays during the CHANNEL FUNCTIONAL TEST of the Actuation Logic every 18 months. This will actuate the Function, operating all associated equipment. Proper operation of the equipment actuated by each train is thus verified. The Frequency of 18 months is based on plant operating experience with regard to channel OPERABILITY and drift, which demonstrates that failure of more than one channel of a given Function during any 18 month Frequency is a rare event.

A Note to the SR indicates that this Surveillance includes verification of operation for each initiation relay.

SR 3.3.10.4

Every 18 months, a CHANNEL FUNCTIONAL TEST is performed on the FHIS Manual Trip channel.

This Surveillance verifies that the trip push buttons are capable of opening contacts in the Actuation Logic as designed, de-energizing the initiation relays and providing Manual Trip of the Function. Operating experience has shown these components usually pass the Surveillance when performed at a Frequency of once every 18 months.

SR 3.3.10.5

CHANNEL CALIBRATION is a complete check of the instrument channel including the sensor. The Surveillance verifies that the channel responds to a measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drift between successive calibrations to ensure that the channel remains operational between successive tests. Measurement error determination, setpoint error determination, and calibration adjustment must be performed consistent with the plant specific setpoint analysis. The channel shall be left calibrated consistent with the assumptions of the current plant specific setpoint analysis.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.10.5 (continued)

As found and as left channel calibration values are recorded. If the as found calibration is outside its Allowable Value, the plant specific setpoint analysis may be revised as appropriate, if the history of this setpoint and all other pertinent information indicate a need for setpoint revision. The setpoint analysis shall be revised before the next time this channel is calibrated.

The Frequency is based upon the assumption of an 24 month calibration interval for the determination of the magnitude of equipment drift in the setpoint analysis.

REFERENCES

1. SONGS Units 2 and 3 UFSAR, Chapter 9.
2. SONGS Units 2 and 3 UFSAR, Chapter 15.
3. "Plant Protection System Selection of Trip Setpoint Values."

LCO
(continued)

2, 3. Reactor Coolant System (RCS) Hot and Cold Leg Temperature

RCS Hot and Cold Leg Temperatures are Category I variables provided for verification of core cooling and long term surveillance.

Reactor outlet temperature inputs to the PAMI are provided by two fast response resistance elements and associated transmitters in each loop. ~~The channels provide indication over a range of 32°F to 700°F.~~

4. Reactor Coolant System Pressure (wide range)

RCS Pressure (wide range) is a Category I variable, provided for verification of core cooling and RCS integrity long term surveillance.

~~Wide range RCS loop pressure is measured by pressure transmitters with a span of 0 psig to 3000 psig.~~ The pressure transmitters are located inside the containment. Redundant monitoring capability is provided by two trains of instrumentation.

Operator actions to maintain a controlled cooldown, such as adjusting steam generator pressure or level, would use this indication. Furthermore, RCS pressure is one factor that may be used in decisions to terminate reactor coolant pump operation.

5. Reactor Vessel Water Level

Reactor Vessel Water Level is provided for verification and long term surveillance of core cooling.

The Reactor Vessel Water Level Monitoring System provides a direct measurement of the collapsed liquid level above the fuel alignment plate. The collapsed level represents the amount of liquid mass that is in the reactor vessel above the core.

(continued)

LCO

5. Reactor Vessel Water Level (continued)

Measurement of the collapsed water level is selected because it is a direct indication of the water inventory. The collapsed level is obtained over the same temperature and pressure range as the saturation measurements, thereby encompassing all operating and accident conditions where it must function. Also, it functions during the recovery interval. Therefore, it is designed to survive the high steam temperature that may occur during the preceding core recovery interval.

The level range extends from the top of the vessel down to the top of the fuel alignment plate. The response time is short enough to track the level during small break LOCA events. The resolution is sufficient to show the initial level drop, the key locations near the hot leg elevation, and the lowest levels just above the alignment plate. This provides the operator with adequate indication to track the progression of the accident and to detect the consequences of its mitigating actions or the functionality of automatic equipment.

A channel is eight sensors in a probe. A channel is OPERABLE if four or more sensors, one sensor in the upper head and three sensors in the lower ~~head~~ plenum are OPERABLE.

6. Containment Sump Water Level (wide range)

Containment Sump Water Level is provided for verification and long term surveillance of RCS integrity.

7. Containment Pressure (wide range)

Containment Pressure is provided for verification of RCS and containment OPERABILITY.

(continued)

BASES

LCO (continued)

11. Pressurizer Level

Pressurizer Level is used to determine whether to terminate safety injection (SI), if still in progress, or to reinitiate SI if it has been stopped. Knowledge of pressurizer water level is also used to verify the plant conditions necessary to establish natural circulation in the RCS and to verify that the plant is maintained in a safe shutdown condition.

12. Steam Generator Water Level

Steam Generator Water Level is provided to monitor operation of decay heat removal via the steam generators. The Category I indication of steam generator level is the wide range level instrumentation. Temperature compensation of this indication is performed manually by the operator. Redundant monitoring capability is provided by two trains of instrumentation.

Operator action is based on the control room indication of Steam Generator Water Level. The RCS response during a design basis small break LOCA is dependent on the break size. For a certain range of break sizes, the boiler condenser mode of heat transfer is necessary to remove decay heat. Wide range level is a Type A variable because the operator must manually raise and control the steam generator 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.

13. Condensate Storage Tank (CST) Level

CST Level is provided to ensure water supply for AFW. The CST provides the ensured, safety grade water supply for the AFW System. ~~The CST consists of two~~

(continued)

LCO 13. Condensate Storage Tank (CST) Level (continued)

~~tanks connected by a common outlet header.~~ CST Level is displayed on a control room indicator, strip chart recorder, and plant computer. In addition, a control room annunciator alarms on low level.

CST Level is considered a Type A variable because the control room meter and annunciator are considered the primary indication used by the operator. The DBAs that require AFW are the loss of electric power, steam line break (SLB), and small break LOCA. The CST is the initial source of water for the AFW System.

14, 15, 16, 17. Core Exit Temperature

Core Exit Temperature is provided for verification and long term surveillance of core cooling.

An evaluation was made of the minimum number of valid core exit thermocouples necessary for inadequate core cooling detection. The evaluation determined the complement of core exit thermocouples necessary to detect initial core recovery and trend the ensuing core heatup. The evaluations account for core nonuniformities including incore effects of the radial decay power distribution and excore effects of condensate runback in the hot legs and nonuniform inlet temperatures. Based on these evaluations, adequate or inadequate core cooling detection is ensured with two valid core exit thermocouples per quadrant.

The design of the Incore Instrumentation System includes a Type K (chromel alumel) thermocouple within each of the 56 incore instrument detector assemblies. The junction of each thermocouple is located a few inches above the fuel assembly, inside a structure that supports and shields the incore instrument

(continued)

LCO

14, 15, 16, 17. Core Exit Temperature (continued)

detector assembly string from flow forces in the outlet plenum region. These core exit thermocouples monitor the temperature of the reactor coolant as it exits the fuel assemblies.

~~The core exit thermocouples have a usable temperature range from 32°F to 2300°F, although accuracy is reduced at temperatures above 1800°F.~~

18. Auxiliary Feedwater (AFW) Flow

AFW Flow is provided to monitor operation of decay heat removal via the steam generators.

~~AFW Flow to each steam generator is determined from a differential pressure measurement calibrated to a span of 0 gpm to 800 gpm.~~ Each differential pressure transmitter provides an input to a control room indicator and the plant computer. Since the primary indication used by the operator during an accident is the control room indicator, the PAMI Specification deals specifically with this portion of the instrument channel.

AFW Flow is also used by the operator to verify that the AFW System is delivering the correct flow to each steam generator. However, the primary indication used by the operator to ensure an adequate inventory is steam generator level.

19. Containment Pressure (Narrow Range)

Containment Pressure is provided for verification of containment OPERABILITY.

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.11.2 (continued)

Agreement criteria are determined by the plant staff based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the match 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 match criteria, it is an indication that the channels are OPERABLE. If the channels are normally off scale during times when surveillance is required, the CHANNEL CHECK will only verify that they are off scale in the same direction.

Off scale low current loop channels are verified to be reading at the bottom of the range and not failed downscale.

The Frequency of 31 days is based upon plant operating experience with regard to channel OPERABILITY and drift, which demonstrates that failure of more than one channel of a given Function in any 31 day interval is a rare event. The CHANNEL CHECK supplements less formal, but more frequent, checks of channel during normal operational use of the displays associated with this LCO's required channels.

SR 3.3.11.3

A 31 day CHANNEL FUNCTIONAL TEST is required for the Containment Area Radiation Monitor only.

SR 3.3.11.4

A CHANNEL CALIBRATION is performed every ~~24~~ 18 months or approximately every refueling. CHANNEL CALIBRATION is a complete check of the instrument channel including the sensor. The Surveillance verifies the channel responds to the measured parameter within the necessary range and accuracy.

The Frequency is based upon operating experience and consistency with the typical industry refueling cycle and is justified by the assumption of an ~~24~~ 18 month calibration interval for the determination of the magnitude of equipment drift.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.11.5

A CHANNEL CALIBRATION is performed every 24 months for the Containment Area Radiation Monitor.

REFERENCES

1. SONGS Units 2 and 3 Regulatory Guide 1.97 Instrumentation Report #90065, Rev. 0, dated October 1, 1992.
2. Regulatory Guide 1.97, Revision 2.

REFERENCES (continued)

3. NUREG-0737, Supplement 1.
4. NRC Safety Evaluation Report (SER).

APPLICABLE SAFETY ANALYSES (continued)

10 CFR 20, Appendix A, GDC 19 (Ref. 1)

The Remote Shutdown System has been identified as an important contributor to the reduction of plant accident risk and, therefore, has been retained in the Technical Specifications, as indicated in the NRC Policy Statement.

LCO

The Remote Shutdown System LCO provides the requirements for the OPERABILITY of the instrumentation necessary to place and maintain the plant in MODE 3 from a location other than the control room. The instrumentation required are listed in Table 3.3.12-1 in the accompanying LCO.

Instrumentation is required for:

- Reactivity Control (initial and long term);
- Vital Auxiliaries
- RCS Inventory Control;
- RCS Pressure Control;
- Decay Heat Removal; and
- Safety support systems for the above Functions, as well as service water, component cooling water, and onsite power including the diesel generators.

A Function of a Remote Shutdown System is OPERABLE if all instrument channels needed to support the remote shutdown Functions are OPERABLE. In some cases, Table 3.3.12-1 may indicate that the required information ~~or control capability~~ is available from several alternative sources. In these cases, the Remote Shutdown System is OPERABLE as long as one channel of any of the alternative information ~~or control sources~~ for each Function is OPERABLE.

The Remote Shutdown System instrumentation ~~and control~~ circuits covered by this LCO do not need to be energized to be considered OPERABLE. This LCO is intended to ensure that

(continued)

BASES

LCO
(continued)

the instrument ~~and control~~ circuits will be OPERABLE if plant conditions require that the Remote Shutdown System be placed in operation.

APPLICABILITY

The Remote Shutdown System LCO is applicable in MODES 1, 2, and 3. This is required so that the unit can be placed and maintained in MODE 3 for an extended period of time from a location other than the control room.

This LCO is not applicable in MODE 4, 5, or 6. In these MODES, the unit is already subcritical and in the condition of reduced RCS energy. Under these conditions, considerable time is available to restore necessary instrument ~~control~~ Functions if control room instruments or control become unavailable.

ACTIONS

A Note has been included that excludes the MODE change restrictions 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 is acceptable due to the low probability of an event requiring this system.

Note 2 has been added in the ACTIONS to clarify the application of Completion Time rules. The Conditions of this Specification may be entered independently for each Function listed in Table 3.3.12-1. The Completion Time(s) of the inoperable channel(s)/train(s) of a Function will be tracked separately for each Function starting from the time the Condition was entered for that Function.

A.1

Condition A addresses the situation where one or more functions of the Remote Shutdown System are inoperable. This includes any Function listed in Table 3.3.12-1 ~~as well as the control and transfer switches~~.

The Required Action is to restore the Functions to OPERABLE status within 30 days. The Completion Time is based on

(continued)

B 3.3 INSTRUMENTATION

B 3.3.13 Source Range Monitoring Channels

BASES

BACKGROUND

The source range monitoring channels provide neutron flux power indication from < 1E-7% RTP to > 100% RTP. They also provide reactor protection when the reactor trip circuit breakers (RTCBs) are shut, in the form of a Logarithmic Power Level — High trip.

This LCO addresses MODES 3, 4, and 5 with the RTCBs open. When the RTCBs are shut, the source range monitoring channels are addressed by LCO 3.3.2, "Reactor Protective System (RPS) Instrumentation — Shutdown."

When the RTCBs are open, two of the four wide range power channels must be available to monitor neutron flux power. In this application, the RPS channels need not be OPERABLE since the reactor trip Function is not required. By monitoring neutron flux (wide range) power when the RTCBs are open, loss of SDM caused by boron dilution can be detected as an increase in flux. Alarms are also provided when power increases above the fixed bistable setpoints. For plants employing separate post accident, wide range nuclear instrumentation channels with adequate range, these can be substituted for the source range range channels. Two channels must be OPERABLE to provide single failure protection and to facilitate detection of channel failure by providing CHANNEL CHECK capability.

Insert 1

APPLICABLE SAFETY ANALYSES

The source range (startup) monitoring channels are necessary to monitor core reactivity changes. They are the primary means for detecting and triggering operator actions to respond to reactivity transients initiated from conditions in which the RPS is not required to be OPERABLE. They also trigger operator actions to anticipate RPS actuation in the event of reactivity transients starting from shutdown or low power conditions. The source range monitoring channel's LCO requirements support compliance with 10 CFR 50, Appendix A, GDC 13 (Ref. 1). Reference 2 describes the specific source range monitoring channel features that are critical to comply with the GDC.

(continued)

Insert 1

~~BACKGROUND~~

The source range (startup) monitoring channels provide neutron flux countrate level indication from 0.1 to 500,000 cps. They also provide a Boron Dilution Monitor and alarm in the Control Room to alert the operator of a boron dilution event.

This LCO addresses MODES 3, 4, and 5 with the RTCBs open. LCO 3.9.2 addresses the source range monitors during Mode 6 refueling operations.

Both source range monitoring channels must be available to monitor neutron flux level when the RTCBs are open. By monitoring source range countrate level, loss of SDM caused by a boron dilution event can be detected as an increase in neutron flux. The Boron Dilution Monitor provides an alarm when the countrate level exceeds the setpoint which is adjusted to 0.5 volt above background.

BASES

APPLICABLE SAFETY ANALYSES (continued)

The OPERABILITY of source range monitoring channels is necessary to meet the assumptions of the safety analyses and provide for the mitigation of accident and transient conditions.

The source range monitoring channels satisfy Criterion 3 of the NRC Policy Statement.

LCO

The LCO on the source range monitoring channels ensures that adequate information is available to verify core reactivity conditions while shut down.

A minimum of two source range monitoring channels are required to be OPERABLE. ~~At SONGS four channels are capable of performing this function. Therefore, multiple failures may be tolerated while the plants are still complying with LCO requirements~~.

APPLICABILITY

In MODES 3, 4, and 5, with RTCBs open or the Control Element Assembly (CEA) Drive System not capable of CEA withdrawal, source range monitoring channels must be OPERABLE to monitor core power for reactivity changes. In MODES 1 and 2, and in MODES 3, 4, and 5, with the RTCBs shut and the CEAs capable of withdrawal, the Logarithmic Power Monitoring ~~source range monitoring~~ channels are addressed as part of the RPS in LCO 3.3.1, "Reactor Protective System (RPS) Instrumentation – Operating," and LCO 3.3.2, "Reactor Protective System (RPS) Instrumentation – Shutdown."

The requirements for source range neutron flux monitoring in MODE 6 are addressed in LCO 3.9.2, "Nuclear Instrumentation." The source range nuclear instrumentation channels provide neutron flux coverage extending an additional one to two decades below the logarithmic channels for use during refueling, when neutron flux may be extremely low.

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.13.1 (continued)

verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined by the plant staff and should be based on a combination of the channel instrument uncertainties including control isolation, indication, and readability. If a channel is outside of the match criteria, it may be an indication that the transmitter or the signal processing equipment has drifted outside of its limits. If the channels are within the match criteria, it is an indication that the channels are OPERABLE.

The Frequency, about once every shift, is based on operating experience that demonstrates the rarity of channel failure. Thus, the performance of CHANNEL CHECK ensures that undetected overt channel failure is limited to 12 hours. Since the probability of two random failures in redundant channels in any 12 hour period is extremely low, CHANNEL CHECK minimizes the chance of loss of protective function due to failure of redundant channels. CHANNEL CHECK supplements less formal, but more frequent, checks of channel OPERABILITY during normal operational use of displays associated with the LCO required channels.

SR 3.3.13.2

A CHANNEL FUNCTIONAL TEST is performed every 92 days to ensure that the entire channel is capable of properly indicating neutron flux. Internal test circuitry is used to feed ~~preadjusted~~ test signals into the ~~preamplifier~~ Signal processor to verify channel alignment. It is not necessary to test the detector, because generating a meaningful test signal is difficult; the detectors are of simple construction, and any failures in the detectors will be apparent as change in channel output. This Frequency is the same as that employed for the same channels in the other applicable MODES.

(continued)

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.1 RCS Pressure, Temperature, and Flow Limits

BASES

BACKGROUND

These Bases address requirements for maintaining RCS pressure, temperature, and flow rate within limits assumed in the safety analyses. The safety analyses (Ref. 1) of normal operating conditions and anticipated operational occurrences assume initial conditions within the normal steady state envelope. The limits placed on DNB related parameters ensure that these parameters will not be less conservative than were assumed in the analyses and thereby provide assurance that the minimum departure from nucleate boiling ratio (DNBR) will meet the required criteria for each of the transients analyzed.

The LCO limits for minimum and maximum RCS pressures as measured at the pressurizer are consistent with operation within the nominal operating envelope and are bounded by those used as the initial pressures in the analyses.

The LCO limits for minimum and maximum RCS cold leg temperatures are consistent with operation at the indicated power level and are bounded by those used as the initial temperatures in the analyses.

associated   a separate input to the safety analyses that is

Since RCS flow is ~~subject to variations during plant life~~ and due to ~~potential~~ instrument ~~errors of the flow meters~~ uncertainty ~~which are used to measure RCS flow rate~~, monitoring of this parameter during plant operation will be specified by Core Operating Limits Report (COLR). The COLR limits for minimum and maximum RCS flow rates are bounded by those used as the initial flow rates in the analyses. and the associated RCS flow uncertainty

independent of all other inputs

that must be accounted for in the safety analyses,

APPLICABLE SAFETY ANALYSES

The requirements of LCO 3.4.1 represent the initial conditions for DNB limited transients analyzed in the safety analyses (Ref. 1). The safety analyses have shown that transients initiated from the limits of this LCO will meet the DNBR criterion of ≥ 1.31. This is the acceptance limit for the RCS DNB parameters. Changes to the facility that could impact these parameters must be assessed for their impact on the DNBR criterion. The transients analyzed for include loss of coolant flow events and dropped or struck

(continued)

APPLICABILITY (continued)

counterproductive. Also, since they represent transients initiated from power levels < 100% RTP, an increased DNBR margin exists to offset the temporary pressure variations. Also, a note which permits exception from RCS cold leg temperature limits when RTP ≤ 30% was included in the proposed APPLICABILITY.

Another set of limits on DNB related parameters is provided in Safety Limit (SL) 2.1.1, "Reactor Core Safety Limits." Those limits are less restrictive than the limits of this LCO, but violation of SLs merits a stricter, more severe Required Action. Should a violation of this LCO occur, the operator should check whether or not an SL may have been exceeded.

ACTIONS

A.1

Pressurizer pressure is a controllable and measurable parameter. With this parameter not within the LCO limits, action must be taken to restore the parameter.

The 2 hour Completion Time is based on plant operating experience that shows the parameter can be restored in this time period.

RCS flow rate is not a controllable parameter and is not expected to vary during steady state operation. If the flow rate is not within the limit specified in the COLR, then 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 provides sufficient time to adjust plant parameters, and to determine the cause of the off normal condition. The Completion Time 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

(continued)

50%

BASES

LCO (continued)

of requiring both SGs to be capable (> 10% wide range water level) of transferring heat from the reactor coolant at a controlled rate. Forced reactor coolant flow is the required way to transport heat, although natural circulation flow provides adequate removal. A minimum of one running RCP meets the LCO requirement for one loop in operation.

The Note permits a limited period of operation without RCPs. All RCPs may be de-energized for ≤ 1 hour per 8 hour period. This means that natural circulation has been established. When in natural circulation, a reduction in boron concentration is prohibited because an even concentration distribution throughout the RCS cannot be ensured. Core outlet temperature is to be maintained at least 10°F below the saturation temperature so that no vapor bubble may form and possibly cause a natural circulation flow obstruction.

In MODES 3, 4, and 5, it is sometimes necessary to stop all RCPs or shutdown cooling (SDC) pump forced circulation (e.g., to change operation from one SDC train to the other, to perform surveillance or startup testing, to perform the transition to and from SDC System cooling, or to avoid operation below the RCP minimum net positive suction head limit). The time period is acceptable because natural circulation is adequate for heat removal, or the reactor coolant temperature can be maintained subcooled and boron stratification affecting reactivity control is not expected.

An OPERABLE loop consists of at least one RCP providing forced flow for heat transport and an SG that is OPERABLE in accordance with the Steam Generator Tube Surveillance Program. An RCP is OPERABLE if it is capable of being powered and is able to provide forced flow if required.

APPLICABILITY

In MODE 3, the heat load is lower than at power; therefore, one RCS loop in operation is adequate for transport and heat removal. A second RCS loop is required to be OPERABLE but not in operation for redundant heat removal capability.

Operation in other MODES is covered by:

LCO 3.4.4, "RCS Loops – MODES 1 and 2";
LCO 3.4.6, "RCS Loops – MODE 4";
LCO 3.4.7, "RCS Loops – MODE 5, Loops Filled";

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.4.5.1

This SR requires verification every 12 hours that the required number of RCS loops are in operation. Verification includes flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal. The 12 hour interval has been shown by operating practice to be sufficient to regularly assess degradation and verify operation within safety analyses assumptions. In addition, control room indication and alarms will normally indicate loop status.

SR 3.4.5.2

50%

This SR requires verification every 12 hours that the secondary side water level in each SG is ≥ 10% wide range. An adequate SG water level is required in order to have a heat sink for removal of the core decay heat from the reactor coolant. The 12 hour interval has been shown by operating practice to be sufficient to regularly assess degradation and verify operation within the safety analyses assumptions.

SR 3.4.5.3

Verification that the required number of RCPs are OPERABLE ensures that the single failure criterion is met and that an additional RCS loop 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 availability to the required RCPs. The Frequency of 7 days is considered reasonable in view of other administrative controls available and has been shown to be acceptable by operating experience.

REFERENCES

1. UFSAR, Section 15.3.

BASES

ACTIONS

B.1 (continued)

reasonable, based on operating experience, to reach MODE 5 from MODE 4, with only one SDC train operating, in an orderly manner and without challenging plant systems.

C.1 and C.2

If no RCS loops or SDC trains are OPERABLE or in operation, except during conditions permitted by Note 1 in the LCO section, all operations involving reduction of RCS boron concentration must be suspended and action to restore one RCS loop or SDC train to OPERABLE status and operation must be initiated. Boron dilution requires forced circulation for proper mixing, and the margin to criticality must not be reduced in this type of operation. The immediate Completion Times reflect the importance of decay heat removal. The action to restore must continue until one loop or train is restored to operation.

SURVEILLANCE REQUIREMENTS

SR 3.4.6.1

This SR requires verification every 12 hours that one required loop or train is in operation. This ensures forced flow is providing heat removal. Verification includes flow rate, temperature, or pump status monitoring. The 12 hour Frequency has been shown by operating practice to be sufficient to regularly assess RCS loop status. In addition, control room indication and alarms will normally indicate loop status.

SR 3.4.6.2

50%

This SR requires verification every 12 hours of secondary side water level in the required SG(s) ≥ 10% (wide range). An adequate SG water level is required in order to have a heat sink for removal of the core decay heat from the reactor coolant. The 12 hour interval has been shown by operating practice to be sufficient to regularly assess degradation and verify operation within safety analyses assumptions.

(continued)

≥ 50%

LCO

The purpose of this LCO is to require at least one of the SDC trains or RCS loops be OPERABLE and in operation with an additional SDC train or RCS loop OPERABLE or secondary side water level of each SG shall be ≥ 10% wide range. One SDC train or RCS loop provides sufficient forced circulation to perform the safety functions of the reactor coolant under these conditions. The second SDC or RCS loop train is normally maintained OPERABLE as a backup to the operating train/loop to provide redundant paths for decay heat removal. However, if the standby SDC train/RCS loop is not OPERABLE, a sufficient alternate method to provide redundant paths for decay heat removal is two SGs with their secondary side water levels ≥ 10% wide range. Should the operating SDC train/RCS loop fail, the SGs could be used to remove the decay heat.

≥ 50%

Note 1 permits all RCPs and SDC pumps to be de-energized ≤ 1 hour per 8 hour period. The circumstances for stopping both SDC trains/RCS loops are to be limited to situations where pressure and temperature increases can be maintained well within the allowable pressure (pressure and temperature and low temperature overpressure protection) and 10°F subcooling limits, or an alternate heat removal path through the SG(s) is in operation.

This LCO is modified by a Note that prohibits boron dilution when forced flow is stopped because an even concentration distribution cannot be ensured. Core outlet temperature is to be maintained at least 10°F below saturation temperature, so that no vapor bubble would form and possibly cause a natural circulation flow obstruction. In this MODE, the SG(s) can be used as the backup for heat removal. To ensure their availability, the RCS loop flow path is to be maintained with subcooled liquid.

In MODE 5, it is sometimes necessary to stop all RCP or SDC forced circulation. This is permitted to change operation from one SDC train or RCS loop to the other, perform surveillance or startup testing, perform the transition to and from the SDC, or to avoid operation below the RCP minimum net positive suction head limit. The time period is acceptable because natural circulation is acceptable for decay heat removal, the reactor coolant temperature can be maintained subcooled, and boron stratification affecting reactivity control is not expected.

(continued)

BASES

LCO
(continued)

An OPERABLE RCS loop consists of at least one RCP providing forced flow for heat transport and an SG that is OPERABLE in accordance with the Steam Generator Tube Surveillance Program. An RCP is OPERABLE if it is capable of being powered and is able to provide forced flow if required.

APPLICABILITY

In MODE 5 with RCS loops filled, this LCO requires forced circulation to remove decay heat from the core and to provide proper boron mixing. One SDC train/RCS loop provides sufficient circulation for these purposes.

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 3.9.4, "Shutdown Cooling (SDC) and Coolant Circulation — High Water Level" (MODE 6); and
LCO 3.9.5, "Shutdown Cooling (SDC) and Coolant Circulation — Low Water Level" (MODE 6).

ACTIONS

A.1 and A.2

50%

If the required SDC train/RCS loop is inoperable and any SGs have secondary side water levels < 10% wide range, redundancy for heat removal is lost. Action must be initiated immediately to restore a second SDC train/RCS loop to OPERABLE status or to restore the water level in the required SGs. Either Required Action A.1 or Required Action A.2 will restore redundant decay heat removal paths. The immediate Completion Times reflect the importance of maintaining the availability of two paths for decay heat removal.

B.1 and B.2

If no SDC train/RCS loop is in operation, except as permitted in Note 1, all operations involving the reduction of RCS boron concentration must be suspended. Action to restore one SDC train/RCS loop to operation must be

(continued)

BASES

ACTIONS (continued)

initiated. Boron dilution requires forced circulation for proper mixing and the margin to criticality must not be reduced in this type of operation. The immediate Completion Times reflect the importance of maintaining operation for decay heat removal.

SURVEILLANCE REQUIREMENTS

SR 3.4.7.1

This SR requires verification every 12 hours that at least one SDC train/RCS loop is in operation. Verification includes flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing decay heat removal. The 12 hour Frequency has been shown by operating practice to be sufficient to regularly assess degradation and verify operation is within safety analyses assumptions. In addition, control room indication and alarms will normally indicate loop status.

The SDC/RCS flow is established to ensure that core outlet temperature is maintained sufficiently below saturation to allow time for swapover to the standby SDC train/RCS loop should the operating train be lost.

SR 3.4.7.2

50%

Verifying the SGs are OPERABLE by ensuring their secondary side water levels are ≥ 10% wide range ensures that redundant heat removal paths are available if the second SDC train/RCS loop is inoperable. The Surveillance is required to be performed when the LCO requirement is being met by use of the SGs. If both SDC trains are OPERABLE and one SDC train is in operation, this SR is not needed. The 12 hour Frequency has been shown by operating practice to be sufficient to regularly assess degradation and verify operation within safety analyses assumptions.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.7.3

Verification that the second SDC train/RCS loop is OPERABLE ensures that redundant paths for decay heat removal are available. The requirement also ensures that the additional train 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 the required pumps. The Surveillance is required to be performed when the LCO requirement is being met by one of two SDC trains or one of two RCS loops, e.g., both SGs have < 10% wide range water level. The Frequency of 7 days is considered reasonable in view of other administrative controls available and has been shown to be acceptable by operating experience.

< 50%

REFERENCES

1. UFSAR, Section 5.4.

BASES

APPLICABLE SAFETY ANALYSES

RCS Vent Performance (continued)

The RCS vent is passive and is not subject to active failure.

LCO

This LCO is required to ensure 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.

To limit the coolant input capability, the LCO requires at most two HPSI pumps capable of injecting into the RCS and the SITS isolated or depressurized to less than the PTLR limit. LCO 3.5.3, "ECCS – Shutdown," defines the pump OPERABILITY requirements. LCO 3.3.2, "Engineered Safety Feature Activation System (ESFAS) Instrumentation," defines SI actuation OPERABILITY for the LTOP MODE 4 small break LOCA, as discussed in the previous section.

The elements of the LCO that provide overpressure mitigation through pressure relief are:

a. The Shutdown Cooling System Relief Valve; or

b. The depressurized RCS and an RCS vent.

The SDCS is OPERABLE for LTOP when both trains of isolation valves are open, its lift setpoint is set at 406 ± 10 psig or less and testing has proven its ability to open at that setpoint. An RCS vent is OPERABLE when open with an area ≥ 5.6 square inches.

Each of these methods of overpressure prevention is capable of mitigating the limiting LTOP transient.

APPLICABILITY

This LCO is applicable in MODE 4 when the temperature of any RCS cold leg is ≤ the enable temperatures specified in the PTLR, in MODE 5, and in MODE 6 when the reactor vessel head is on. The pressurizer safety valves provide overpressure protection that meets the Reference 1 P/T limits above the

(continued)

APPLICABILITY (continued)

enable temperatures specified in the PTLR. When the reactor vessel head is off, overpressurization cannot occur.

LCO 3.4.3 provides the operational P/T limits for all MODES. LCO 3.4.10, "Pressurizer Safety Valves," requires the OPERABILITY of the pressurizer safety valves that provide overpressure protection during MODES 1, 2, and 3, and MODE 4 above the enable temperatures specified in the PTLR.

Low temperature overpressure prevention is most critical during shutdown when the RCS is water solid, and a mass or heat input transient can cause a very rapid increase in RCS pressure when little or no time allows operator action to mitigate the event.

or depressurization to less than the PTLR limit

The Applicability is modified by a Note stating that SIT isolation is only required when the SIT pressure is greater than or equal to the RCS pressure for the existing temperature, as allowed by the P/T limit curves provided in the PTLR. This Note permits the SIT discharge valve surveillance performed only under these pressure and temperature conditions.

ACTIONS

A.1

With more than two HPSI pumps capable of injecting into the RCS, overpressurization is possible.

The immediate Completion Time to initiate actions to restore restricted coolant input capability to the RCS reflects the importance of maintaining overpressure protection of the RCS.

B.1 and B.2

When the SIT pressure is greater than or equal to the maximum RCS pressure for the existing cold leg temperature allowed in the PTLR, an unisolated SIT requires isolation within 1 hour or the affected SIT(s) must be depressurized to less than the maximum RCS pressure for the existing cold leg temperature allowed in the PTLR within 12 hours.

(continued)

BASES

ACTIONS

B.1 and B.2 (continued)

By isolating the SIT(s) or depressurizing the SIT(s) below the LTOP limit stated in the PTLR, the RCS is protected against the SIT tanks pressurizing the RCS in excess of the LTOP limits.

The Completion Times is are based on operating this experience that ~~these activities~~ this activity can be accomplished in these time periods and on engineering evaluations indicating that an event requiring LTOP is not likely in the allowed times.

INSERT "A"

D C.1 and D C.2

The 24-hour Allowable Outage Time (AOT) for a single channel SDCS Relief Valve isolation valve(s) increases the availability of the LTOP system to mitigate low temperature overpressure transients especially during MODES 5 and 6 when the potential for these transients are highest (RCS temperatures between 80°F and 190°F and the RCS is water-solid). The 24-hour AOT implements the guidance provided in Generic Letter 90-06.

E D.1

or D

If the SDCS Relief Valve is inoperable, or if a Required Action and the associated Completion Time of Condition A, through Condition C, are not met, or if the LTOP System is inoperable for any reason other than Condition A through C or Condition D, the RCS must be depressurized and a vent established within 8 hours. The vent must be sized at least 5.6 square inches to ensure the flow capacity is greater than that required for the worst case mass input transient reasonable during the applicable MODES. This action protects the RCPB from a low temperature overpressure event and a possible brittle failure of the reactor vessel.

The Completion Time of 8 hours to depressurize and vent the RCS is based on the time required to place the plant in this condition and the relatively low probability of an overpressure event during this time period due to increased operator awareness of administrative control requirements.

(continued)

INSERT "A"

for the Bases 3.4.12.1, "LTOP System."

C.1

If the Required Action and associated Completion Time of Condition B is not met, the affected SIT(s) must be depressurized to less than the maximum RCS pressure for the existing cold leg temperature allowed in the PTLR within 12 hours.

By depressurizing the SIT(s) below the LTOP limit stated in the PTLR the RCS is protected against the SIT(s) pressurizing the RCS in excess of the LTOP limits.

The Completion Time is based on operating experience that this activity can be accomplished in this time period and on engineering evaluation indicating that an event requiring LTOP is not likely in the allowed time.

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BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.4.12.1.1 and SR 3.4.12.1.2, and SR 3.4.12.1.3

To minimize the potential for a low temperature overpressure event by limiting the mass input capability, not more than two HPSI pumps are verified OPERABLE with the other pump locked out with power removed and the SIT discharge isolation valves are verified closed and deactivated or SIT(s) are depressurized to less than the PTLR limit. The 12 hour interval considers operating practice to regularly assess potential degradation and to verify operation within the safety analysis.

SR 3.4.12.1.3

SR 3.4.12.1.3 requires verifying that the RCS vent is open ≥ 5.6 square inches is proven OPERABLE by verifying its open condition either:

a. Once every 12 hours for a vent valve that is unlocked open; and

b. Once every 31 days for a valve that is locked, sealed, or otherwise secured open and once every 31 days for open flanged RCS penetrations.

The passive vent arrangement must only be open to be OPERABLE. This Surveillance need only be performed if the vent is being used to satisfy the requirements of this LCO. The Frequencies consider operating experience with mispositioning of unlocked and locked vent valves, respectively.

SR 3.4.12.1.4 and SR 3.4.12.1.5

When one or both SDCS Relief Valve isolation valve(s) in one isolation valve pair becomes INOPERABLE, the other OPERABLE SDCS Relief Valve isolation valve pair is verified in a power-lock open condition every 12 hours to preclude a single failure which might cause undesired mechanical motion of one or both of the OPERABLE SDCS Relief Valve isolation valve(s) in a single isolation valve pair and result in loss of system function.

(continued)

BASES

LCO (continued)

Each of these methods of overpressure prevention is capable of mitigating the limiting LTOP transient.

APPLICABILITY

This LCO is applicable in MODE 4 when the temperature of all RCS cold legs are above the enable temperatures specified in the PTLR. When the temperature of any RCS cold leg is equal to or below the enable temperatures specified in the PTLR the Shutdown Cooling System Relief valve is used for overpressure protection or if the RCS is also depressurized, then an RCS vent to atmosphere sized 5.6 inches or greater can be used for overpressure protection. When the reactor vessel head is off, overpressurization cannot occur.

LCO 3.4.3 provides the operational P/T limits for all MODES. LCO 3.4.10, "Pressurizer Safety Valves," requires the OPERABILITY of the pressurizer safety valves that provide overpressure protection during MODES 1, 2, and 3.

Low temperature overpressure prevention is most critical during shutdown when the RCS is water solid, and a mass or heat input transient can cause a very rapid increase in RCS pressure when little or no time allows operator action to mitigate the event.

ACTIONS

A.1

With no pressurizer code safety valves OPERABLE and the SDCS Relief Valve INOPERABLE overpressurization is possible.

The 8 hours Completion Time to be in MODE 5 and vented through a greater than or equal to 5.6 inch vent reflects the importance of maintaining overpressure protection of the RCS.

(continued)

INSERT "A" for LCO 3.4.12.2 (Bases)

For LCO 3.4.12.2

INSERT "A"

B.1 and B.2

The 24-hour Allowable Outage Time (AOT) for a single channel SDCS Relief Valve isolation valve(s) increases the availability of the LTOP system to mitigate low temperature overpressure transients especially during MODES 5 and 6 when the potential for these transients are highest (RCS temperatures between 80°F and 190°F and the RCS is water-solid). The 24-hour AOT implements the guidance provided in Generic Letter 90-06

BASES

APPLICABLE SAFETY ANALYSES (continued)

this analysis is used to assess changes to the facility that could affect RCS specific activity as they relate to the acceptance limits.

The rise in pressure in the ruptured SG causes radioactively contaminated steam to discharge to the atmosphere through the atmospheric dump valves or the main steam safety valves. The atmospheric discharge stops when the turbine bypass to the condenser removes the excess energy to rapidly reduce the RCS pressure and close the valves. The unaffected SG removes core decay heat by venting steam until the cooldown ends.

The safety analysis shows the radiological consequences of an SGTR accident are within a small fraction of the Reference 1 dose guideline limits. Operation with iodine specific activity levels greater than the LCO limit is permissible, if the activity levels do not exceed the limits shown in Figure 3.4.16-1 for more than 48 hours.

The remainder of the above limit permissible iodine levels shown in Figure 3.4.16-1 are acceptable because of the low probability of an SGTR accident occurring during the established 48 hour time limit. The occurrence of an SGTR accident at these permissible levels could increase the site boundary dose levels, but still be within 10 CFR 100 dose guideline limits.

RCS [illegible]fic activity satisfies Criterion 2 of the NRC [illegible] .atement.

LCO

in the Primary Coolant

stet

of radionuclides other than iodines

The specific iodine activity is limited to 1.0 µCi/gm DOSE EQUIVALENT I-131, and the gross specific activity in the primary coolant is limited to the number of µCi/gm equal to 100 divided by E (average disintegration energy of the sum of the average beta and gamma energies of the coolant nuclides). The limit on DOSE EQUIVALENT I-131 ensures the 2 hour thyroid dose to an individual at the site boundary during the Design Basis Accident (DBA) will be a small fraction of the allowed thyroid dose. The limit on gross specific activity ensures the 2 hour whole body dose to an individual at the site boundary during the DBA will be a small fraction of the allowed whole body dose.

(continued)

BASES

ACTIONS (continued)

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 3.7.1.1

This SR verifies the OPERABILITY of the MSSVs by the verification of each MSSV lift setpoints in accordance with the inservice testing program. The ASME Code, Section XI (Ref. 4), requires that safety and relief valve tests be performed in accordance with ANSI/ASME OM-1-1987 (Ref. 5). According to Reference 5, the following tests are required for MSSVs:

a. Visual examination;

b. Seat tightness determination;

c. Setpoint pressure determination (lift setting); and

d. Compliance with owner's seat tightness criteria.

9

The ANSI/ASME Standard requires that all valves be tested each subsequent 10 year period, with a minimum of 20% of the valves tested within any 48 months. The ASME Code specifies the activities and frequencies necessary to satisfy the requirements.

This SR is modified by a Note that allows entry into and operation in MODE 3 prior to performing the SR. This is to allow testing of the MSSVs at hot conditions. The MSSVs may be either bench tested or tested in situ at hot conditions using an assist device to simulate lift pressure. If the MSSVs are not tested at hot conditions, the lift setting pressure shall be corrected to ambient conditions of the valve at operating temperature and pressure.

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

e. The MSIVs are also utilized during other events such as a feedwater line break. These events are less limiting so far as MSIV OPERABILITY is concerned.

The MSIVs satisfy Criterion 3 of the NRC Policy Statement.

LCO

This LCO requires that the MSIV in each of the two steam lines be OPERABLE. The MSIVs are considered OPERABLE when the isolation times are within limits, and they close on an isolation actuation signal.

This LCO provides assurance that the MSIVs will perform their design safety function to mitigate the consequences of accidents that could result in offsite exposures comparable to the 10CFR 100 (Ref. 4) limits.

APPLICABILITY

The MSIVs must be OPERABLE in MODE 1 and in MODES 2 and 3 except when all MSIVs are closed and deactivated when there is significant mass and energy in the RCS and steam generators. When the MSIVs are closed, they are already performing their safety function.

In MODE 4, the steam generator energy is low; therefore, the MSIVs are not required to be OPERABLE.

In MODES 5 and 6, the steam generators do not contain much energy because their temperature is below the boiling point of water; therefore, the MSIVs are not required for isolation of potential high energy secondary system pipe breaks in these MODES.

ACTIONS

be made to the MSIV with the unit hot. The 8 hour Completion Time is reasonable, considering the probability of an accident occurring during the time period that would require closure of the MSIVs.

Move this paragraph to [*](page B 3.7-11).

(continued)

ACTIONS (continued)

A.1

With one MSIV inoperable in MODE 1, time is allowed to restore the component to OPERABLE status. Some repairs can [*] The 8 hour Completion Time is greater than that normally allowed for containment isolation valves because the MSIVs are valves that isolate a closed system penetrating containment. These valves differ from other containment isolation valves in that the closed system provides an additional means for containment isolation.

B.1

If the MSIV cannot be restored to OPERABLE status within 8 hours, 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 MODE 2 within 6 hours and Condition C would be entered. The Completion Time is reasonable, based on operating experience, to reach MODE 2, and close the MSIVs in an orderly manner and without challenging unit systems.

C.1, and C.2

Condition C is modified by a Note indicating that separate Condition entry is allowed for each MSIV.

Since the MSIVs are required to be OPERABLE in MODES 2 and 3, the inoperable MSIVs may either be restored to OPERABLE status or closed. When closed, the MSIVs are already in the position required by the assumptions in the safety analysis.

The 8 hour Completion Time is consistent with that allowed in Condition A.

Inoperable MSIVs that cannot be restored to OPERABLE status within the specified Completion Time, but are closed, must be verified on a periodic basis to be closed. This is necessary to ensure that the assumptions in the safety analysis remain valid. The 7 day Completion Time is reasonable, based on engineering judgment, MSIV status indications available in the control room, and other

(continued)

ACTIONS

A.1

Required Action A.1 is modified by a Note indicating that LCO 3.0.4 does not apply.

With one required ADV inoperable, action must be taken to restore the OPERABLE status within 72 hours.

B.1

With two ADVs inoperable, action must be taken to restore one of the ADVs to OPERABLE status. As the block valve can be closed to isolate an ADV, some repairs may be possible with the unit at power. The 24 hour Completion Time is reasonable to repair inoperable ADVs, based on the availability of the Steam Bypass System and MSSVs, and the low probability of an event occurring during this period that requires the ADVs.

C.1

If backup nitrogen gas supply system capacity for each ADV is less than or equal to 8 hours, action should be taken to restore nitrogen gas supply system capacity in 72 hours. The backup nitrogen capacity is controlled to a minimum accumulator pressure of 1050 psig. This pressure represents enough backup nitrogen gas system capacity for each ADV to have up to 8 hours of pneumatic operation. This time period is consistent and conservative relative to the SONGS Units 2 and 3 emergency operating instructions.

The completion time of 72 hours is based on operating experience and on the fact that normal operating instrument air supply system is still available.

(continued)

BASES

ACTIONS

B.1 and B.2 (continued)

Operating experience shows that the likelihood of Primary Plant Makeup Storage Tank level dropping below 66% (which corresponds to an allowable CCW leakage of 18 gpm based on Figure 3.7.7.1-1) is extremely low. Also, a Probabilistic Risk Assessment (PRA) was performed to assess the increased risk of core damage from an 8 hour allowed outage time for two trains of the CCW Safety Related Makeup System. The PRA indicated that the increased risk of core damage from an 8 hour allowed outage time is less than 1x10^{-6} per year. This increase in core damage risk is considered acceptably small.

C.1 and C.2

In MODES 1, 2, 3, and 4, two CCW System critical loops provide cooling to a number of safety related systems, such as HPSI, LPSI, shutdown cooling, emergency chillers, etc. The CCW Safety Related Makeup System is a support system for the CCW System. Two CCW Safety Related Makeup flow paths are required to provide makeup to the two CCW critical loops. If one CCW Safety Related Makeup flow path can not be restored to OPERABLE status in seven days, the Unit must be placed in a MODE in which the LIMITING CONDITION FOR OPERATION does not apply.

To achieve this status, the Unit must be placed in at least HOT STANDBY within the next 6 hours, and in COLD SHUTDOWN within ~~30~~ 36 hours.

Similarly, action should be taken if the PPMU Tank level is below that required for two CCW critical loops operation and/or both CCW Safety Related Makeup flow paths are inoperable. If both the PPMU Tank level and at least one flow path are not OPERABLE within 8 hours, the Unit must then be placed in a MODE in which the LIMITING CONDITION FOR OPERATION does not apply. To achieve this status, the Unit must be placed in at least HOT STANDBY within the next 6 hours, and in COLD SHUTDOWN within 30 hours.

The allowed completion time is consistent with other Technical Specification completion time requirements to

(continued)

BASES

BACKGROUND (continued)

related equipment is always operable to handle all design basis events.

If redundant pieces of safety related equipment are located in the same room and the room has redundant emergency cooling, such as the spent fuel pool (SFP) pumps, loss of one source of emergency cooling does not render either pump inoperable. The 7 day completion time of the REQUIRED ACTION A.1 would be in effect due to the loss of one source of emergency cooling. Since TS 3.7.10 establishes allowable outage times for the ECWS, it is not necessary to declare the safety related equipment cooled by the ECWS inoperable during the allowable outage times (this assumes the normal cooling is operable).

If an ECWS train is inoperable due to an inoperable room cooler, other than a CREACUS cooler, then the associated CREACUS train is considered operable provided the ECWS surveillances are maintained current. If an ECWS train is inoperable due to an inoperable chiller or pump then the associated CREACUS train is inoperable and TS 3.7.11 applies. An inoperable room cooler does not affect the capability of the ECWS to provide chilled water to the CREACUS coolers. An inoperable chiller or chilled water pump affects the capability of the system to provide chilled water to CREACUS.

APPLICABLE SAFETY ANALYSES

The design basis of the ECW System is to remove the post accident heat load from ESF spaces following a DBA coincident with a loss of offsite power. Each train provides chilled water to the HVAC units at the design temperature and flow rate.

The maximum heat load in the ESF pump room area occurs during the recirculation phase following a loss of coolant accident. During recirculation, hot fluid from the containment sump is supplied to the high pressure safety injection and containment spray pumps. This heat load to the area atmosphere must be removed by the ECW System to ensure that these pumps remain OPERABLE.

The ECW satisfies Criterion 3 of the NRC Policy Statement.

(continued)

ACTIONS
(continued)

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

In MODE 5 or 6, or during movement of irradiated fuel assemblies, if Required Action A.1 cannot be completed within the required Completion Time, the OPERABLE CREACUS train must be immediately placed in the emergency mode of operation. This action ensures that the remaining train is OPERABLE, that no failures preventing automatic actuation will occur, and that any active failure will be readily detected.

An alternative to Required Action C.1 is to immediately suspend activities that could result in a release of radioactivity that might require isolation of the control room. This places the unit in a condition that minimizes the accident risk. This does not preclude the movement of fuel assemblies to a safe position.

D.1

If both CREACUS trains are inoperable in MODE 1, 2, 3, or 4, the CREACUS may not be capable of performing the intended function and the unit is in a condition outside the accident analyses. Therefore, LCO 3.0.3 must be entered immediately.

E.1 and E.2

When in MODES 5 or 6, or during movement of irradiated fuel assemblies with two trains inoperable, action must be taken immediately to suspend activities that could result in a release of radioactivity that might enter the control room. This places the unit in a condition that minimizes the accident risk. This does not preclude the movement of fuel to a safe position.

SURVEILLANCE
REQUIREMENTS

SR 3.7.11.1

Standby systems should be checked periodically to ensure that they function properly. Since the environment and normal operating conditions on this system are not severe, testing each train once every month provides an adequate check on this system.

(continued)

B 3.7 PLANT SYSTEMS

B 3.7.14 Fuel Handling Building Post-Accident Cleanup Filter System

BASES

BACKGROUND

The Fuel Handling Building Post-Accident Cleanup Filter System filters airborne radioactive particulates and gases from the area of the fuel pool following a fuel handling accident. The Fuel Handling Building Post-Accident Cleanup Filter System, in conjunction with other normally operating systems, also provides environmental control of temperature in the fuel pool area.

The Fuel Handling Building Post-Accident Cleanup Filter System consists of two independent, redundant trains. Each train consists of a heater, a prefilter a high efficiency particulate air (HEPA) filter, an activated charcoal adsorber section for removal of gaseous activity (principally iodines), ~~and~~ a fan. Ductwork, valves or dampers, and instrumentation also form part of the system, as well as heaters, functioning to reduce the relative humidity of the air stream. A second bank of HEPA filters follows the adsorber section to collect carbon fines and provide backup in case of failure of the main HEPA filter bank. The downstream HEPA filter is not credited in the analysis, but serves to collect charcoal fines, and to back up the upstream HEPA filter should it develop a leak. The system initiates filtered ventilation of the fuel handling building following receipt of a high radiation signal.

The Fuel Handling Building Post-Accident Cleanup Filter System is a standby system, part of which may also be operated during normal unit operations. Upon receipt of the actuating signal, the fuel handling building is isolated, and the stream of ventilation air discharges through the system filter trains. The prefilters remove any large particles in the air, to prevent excessive loading of the HEPA filters and charcoal adsorbers.

Operation of the FHB normal HVAC system with one PACFS unit operating and the other unit inoperable is permissible provided both radiation monitors RT-7823 and 7822 and their associated circuitry remain OPERABLE.

(continued)

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BASES

BACKGROUND (continued)

Distribution System. Within 77 seconds after the initiating signal is received, all automatic and permanently connected loads needed to recover the unit or maintain it in a safe condition are returned to service via the programmed time interval load sequence.

The onsite standby power source for each 4.16 kV ESF bus is a dedicated DG. DGs G002 and G003 are dedicated to ESF buses A04 and A06, respectively. A DG starts automatically on a safety injection actuation signal (SIAS) (i.e., low pressurizer pressure or high containment pressure signals) or on an ESF bus degraded voltage or undervoltage signal. After the DG has started, it will automatically tie to its respective bus after offsite power is tripped as a consequence of ESF bus undervoltage or degraded voltage, independent of or coincident with an SIAS signal. The DGs will also start and operate in the standby mode without tying to the ESF bus on an SIAS alone. Following the trip of offsite power, an undervoltage signal strips nonpermanent loads from the ESF bus. When the DG is tied to the ESF bus, loads are then sequentially connected to its respective ESF bus by the programmed time interval load sequence. The sequencing logic controls the permissive and starting signals to motor breakers to prevent overloading the DG by automatic load application.

In the event of a loss of preferred power, the ESF electrical loads are automatically connected to the DGs in sufficient time to provide for safe reactor shutdown and to mitigate the consequences of a Design Basis Accident (DBA) such as a loss of coolant accident (LOCA).

Certain required unit loads are returned to service in a predetermined sequence in order to prevent overloading the DG in the process. Within 77 seconds after the initiating signal is received, all loads needed to recover the unit or maintain it in a safe condition are returned to service.

Ratings for Train A and Train B DGs satisfy the requirements of Regulatory Guide 1.9 (Ref. 3). The continuous service rating of each DG is 4700 kW with 10% overload permissible for up to 2 hours in any 24 hour period. The ESF loads that are powered from the 4.16 kV ESF buses are listed in Reference 2.

However, for standby class of service like the San Onofre DGs the manufacturer allows specific overload values up to 116.1% of continuous duty rating based on the total hours the DG is operated per year.

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.1.2 and SR 3.8.1.7 (continued)

SR 3.8.1.7 requires that, at a 184 day Frequency, the DG starts from standby conditions and achieves required voltage and frequency within 10 seconds. The 10 second start requirement supports the assumptions of the design basis LOCA analysis in the UFSAR, Chapter 15 (Ref. 5)

The 10 second start requirement is not applicable to SR 3.8.1.2 (see Note 3) when a modified start procedure as described above is used.

Since SR 3.8.1.7 requires a 10 second start, it is more restrictive than SR 3.8.1.2 and it may be performed in lieu of SR 3.8.1.2. This is the intent of Note 1 of SR 3.8.1.2.

The normal 31 day Frequency for SR 3.8.1.2 (see Table 3.8.1-1, "Diesel Generator Test Schedule," in the accompanying LCO) ~~is consistent with Regulatory Guide 1.9 (Ref. 3). The~~ and the 184 day Frequency for SR 3.8.1.7 ~~is a reduction in cold testing consistent with Generic Letter 84-15 (Ref. 7) and~~ are consistent with Regulatory Guide 1.9 (Ref. 3). These Frequencies provide adequate assurance of DG OPERABILITY, while minimizing degradation resulting from testing.

SR 3.8.1.3

This Surveillance verifies that the DGs are capable of synchronizing with the offsite electrical system and accepting loads greater than or equal to the equivalent of the maximum expected accident loads listed in Reference 2. A minimum run time of 60 minutes is required to stabilize engine temperatures, while minimizing the time that the DG is connected to the offsite source.

Although no power factor requirements are established by this SR, the DG is normally operated at a power factor between 0.8 lagging and 1.0. The 0.8 value is the design rating of the machine, while 1.0 is an operational limitation to ensure circulating currents are minimized.

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.1.3 (continued)

The normal 31 day Frequency for this Surveillance (Table 3.8.1-1) is consistent with Regulatory Guide 1.9 (Ref. 3).

This SR is modified by four Notes. Note 1 indicates that diesel engine runs for this Surveillance may include gradual loading, as recommended by the manufacturer, so that mechanical stress and wear on the diesel engine are minimized. Note 2 states that momentary transients because of changing bus loads do not invalidate this test. Similarly, momentary power factor transients above the limit will not invalidate the test. Note 3 indicates that this Surveillance should be conducted on only one DG at a time in order to avoid common cause failures that might result from offsite circuit or grid perturbations. Note 4 stipulates a prerequisite requirement for performance of this SR. A successful DG start must precede this test to credit satisfactory performance.

SR 3.8.1.4

This SR provides verification that the level of fuel oil in the day tank is at or above the level at which fuel oil is automatically added. The level is expressed as an equivalent volume in ~~[illegible]~~ inches, and is selected to ensure adequate fuel oil for a minimum of 1 hour of DG operation at full load plus 10%.

The 31 day Frequency is adequate to assure that a sufficient supply of fuel oil is available, since low level alarms are provided and unit operators would be aware of any large uses of fuel oil during this period.

SR 3.8.1.5

Microbiological fouling is a major cause of fuel oil degradation. There are numerous microorganisms that can grow in fuel oil and cause fouling, but all must have a water environment in order to survive. Removal of water from the fuel oil day tanks once every 31 days eliminates the necessary environment for microbial survival in the da

(continue

SURVEILLANCE REQUIREMENTS

SR 3.8.1.9 (continued)

recommendations for response during load sequence intervals. The 4 seconds specified is equal to 80% of a typical 5 second load sequence interval associated with sequencing of the largest load. The voltage and frequency specified are consistent with the design range of the equipment powered by the DG. SR 3.8.1.9.a corresponds to the maximum frequency excursion, while SR 3.8.1.9.b and SR 3.8.1.9.c are steady state voltage and frequency values to which the system must recover following load rejection. The 24 month Frequency is consistent with the recommendation of Regulatory Guide 1.9 (Ref. 3).

In order to ensure that the DG is tested under load conditions that are as close to design basis conditions as possible, testing is performed using design basis kW loading and maximum kVAR loading permitted during testing. These loadings represent the inductive loading that the DG would experience to the extent practicable and is consistent with the intent of Regulatory Guide 1.9 (Ref. 3).

This SR is modified by a Note which acknowledges that credit may be taken for unplanned events that satisfy this SR.

94.5%

SR 3.8.1.10

This Surveillance demonstrates the DG capability to reject a load equal to 90% to 100% of its continuous rating without overspeed tripping or exceeding the predetermined voltage limits. The DG full load rejection may occur because of a system fault or inadvertent breaker tripping. This Surveillance ensures proper engine generator load response under the simulated test conditions. This test simulates the loss of the total connected load that the DG experiences following a full load rejection and verifies that the DG will not trip upon loss of the load. These acceptance criteria provide DG damage protection. While the DG is not expected to experience this transient during an event and continues to be available, this response ensures that the DG is not degraded for future application, including reconnection to the bus if the trip initiator can be corrected or isolated. These loads and limits are consistent with Regulatory Guide 1.9 (Ref. 3).

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.1.10 (continued)

In order to ensure that the DG is tested under load conditions that are as close to design basis conditions as possible, testing is performed using design basis kW loading and maximum kVAR loading permitted during testing. These loadings represent the inductive loading that the DG would experience to the extent practicable and is consistent with the intent of Regulatory Guide 1.9 (Ref. 3).

The 24 month Frequency is consistent with the recommendation of Regulatory Guide 1.9 (Ref. 3) and is intended to be consistent with expected fuel cycle lengths.

This SR is modified by a Note which acknowledges that credit may be taken for unplanned events that satisfy this SR.

SR 3.8.1.11

As required by Regulatory Guide 1.9 (Ref. 3), this Surveillance demonstrates the as designed operation of the standby power sources during loss of the offsite source. This test verifies all actions encountered from the loss of offsite power, including shedding of the nonessential loads and energization of the emergency buses and respective loads from the DG. It further demonstrates the capability of the DG to automatically achieve the required voltage and frequency within the specified time.

The DG auto-start time of 10 seconds is derived from requirements of the accident analysis to respond to a design basis large break LOCA. The frequency should be restored to within 2% of nominal following a load sequence step. The Surveillance should be continued for a minimum of 5 minutes in order to demonstrate that all starting transients have decayed and stability has been achieved.

The requirement to verify the connection and power supply of permanent ~~and auto-connected~~ loads is intended to satisfactorily show the relationship of these loads to the DG loading logic. In certain circumstances, many of these loads cannot actually be connected or loaded without undue hardship or potential for undesired operation.

(continued)

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.3 Diesel Fuel Oil, Lube Oil, and Starting Air

BASES

assuming the maximum load demand
is supplied by one DG.

BACKGROUND

Each diesel generator (DG) is provided with a storage tank having a fuel oil capacity sufficient to operate that diesel for a period of 7 days, while the DG is supplying maximum post loss of coolant accident load demand as discussed in the UFSAR, Section 9.5.4.2 (Ref. 1). The maximum load demand is calculated ~~using the assumption that at least two DGs are available~~. This onsite fuel oil capacity is sufficient to operate the DGs for longer than the time to replenish the onsite supply from outside sources.

Fuel oil is transferred from storage tank to day tank by either of two transfer pumps associated with each storage tank. Redundancy of pumps and piping precludes the failure of one pump, or the rupture of any pipe, valve, or tank to result in the loss of more than one DG. All outside tanks, pumps, and piping are located underground.

For proper operation of the standby DGs, it is necessary to ensure the proper quality of the fuel oil. Regulatory Guide 1.137 (Ref. 2) addresses the recommended fuel oil practices as supplemented by ANSI N195-1976 (Ref. 3). The fuel oil properties governed by these SRs are the water and sediment content, the kinematic viscosity, and impurity level.

San Onofre has a Diesel Fuel Oil (DFO) testing program which ensures proper fuel oil quality. The program includes purchasing, receipt testing of new fuel oil, and periodic analyses of the stored fuel. San Onofre is not committed to the fuel analysis portion of Regulatory Guide 1.137 (Ref. 2) or ANSI N195-1976 (Ref. 3); however, these standards were utilized as guidance in the development of the DFO testing program.

The DG lubrication system is designed to provide sufficient lubrication to permit proper operation of its associated DG under all loading conditions. The system is required to circulate the lube oil to the diesel engine working surfaces and to remove excess heat generated by friction during operation. Each engine oil sump contains an inventory capable of supporting a minimum of 7 days of operation. The onsite storage in addition to the engine oil sump is sufficient to ensure 7 days of continuous operation. This supply is sufficient supply to allow the operator to replenish lube oil from outside sources.

Each DG has an air start system with adequate capacity for five successive start attempts on the DG without recharging the air start receiver(s).

(continued)

BASES

APPLICABILITY (continued)

air are required to be within limits when the associated DG is required to be OPERABLE.

ACTIONS

A.1

In this Condition, the 7 day fuel oil supply (89 % level) for a DG is not available. However, the Condition is restricted to fuel oil level reductions that maintain at least a 6 day supply (76 % level). These circumstances may be caused by events such as full load operation required after an inadvertent start while at minimum required level; or feed and bleed operations, which may be necessitated by increasing particulate levels or any number of other oil quality degradations. This restriction allows sufficient time for obtaining the requisite replacement volume and performing the analyses required prior to addition of fuel oil to the tank. A period of 48 hours is considered sufficient to complete restoration of the required level prior to declaring the DG inoperable. This period is acceptable based on the remaining capacity (> 6 days), the fact that procedures will be initiated to obtain replenishment, and the low probability of an event during this brief period.

¶

The analyses for the fuel oil are based upon the requirements in gallons. The percentage figures are provided because the fuel oil level indicators in the control room are marked in percentages not in gallons.

B.1

With lube oil inventory ~~< 413 gal for the 20 cylinder engine and < 370 gal for the 16 cylinder engine~~ less than the TSmin marking in the dipstick, sufficient lubricating oil to support 7 days of continuous DG operation at full load conditions may not be available. However, the Condition is restricted to lube oil volume reductions that maintain at least a 6 day supply (greater than or equal to the TSinop marking in the dipstick). This restriction allows sufficient time to obtain the requisite replacement volume. A period of 48 hours is considered sufficient to complete restoration of the required volume prior to declaring the DG inoperable. This period is acceptable based on the remaining capacity (> 6 days), the low rate of usage, the fact that procedures will be initiated to obtain replenishment, and the low probability of an event during this brief period.

(continued)

BASES

ACTIONS (continued)

INSERT "B"

D ~~C~~.1

This Condition is entered as a result of a failure to meet the acceptance criterion of SR 3.8.3.3. Normally, trending of particulate levels allows sufficient time to correct high particulate levels prior to reaching the limit of acceptability. Poor sample procedures (bottom sampling), contaminated sampling equipment, and errors in laboratory analysis can produce failures that do not follow a trend. Since the presence of particulates does not mean failure of the fuel oil to burn properly in the diesel engine, and particulate concentration is unlikely to change significantly between Surveillance Frequency intervals, and proper engine performance has been recently demonstrated (within 31 days), it is prudent to allow a brief period prior to declaring the associated DG inoperable. The 7 day Completion Time allows for further evaluation, resampling, and re-analysis of the DG fuel oil.

E ~~D~~.1

With the new fuel oil properties defined in the Bases for SR 3.8.3.3 not within the required limits, a period of 30 days is allowed for restoring the stored fuel oil properties. This period provides sufficient time to test the stored fuel oil to determine that the new fuel oil, when mixed with previously stored fuel oil, remains acceptable, or restore the stored fuel oil properties. This restoration may involve feed and bleed procedures, filtering, or combinations of these procedures. Even if a DG start and load was required during this time interval and the fuel oil properties were outside limits, there is a high likelihood that the DG would still be capable of performing its intended function.

F ~~E~~.1

With starting air receiver pressure < 175 psig, sufficient capacity for five successive DG start attempts does not exist. However, as long as the receiver pressure is ≥ 136 psig, there is adequate capacity for at least one start attempt, and the DG can be considered OPERABLE while the air receiver pressure is restored to the required limit. A period of 48 hours is considered sufficient to complete

(continued)

INSERT "B"

C.1

In this Condition, the 7 day fuel oil supply (72% level) for a DG during Mode 5 or 6 is not available. However, the Condition is restricted to fuel oil level reductions that maintain at least a 6 day supply (63% level). These circumstances may be caused by events such as full load operation required after an inadvertent start while at minimum required level; or feed and bleed operations, which may be necessitated by increasing particulate levels or any number of other oil quality degradations. This restriction allows sufficient time for obtaining the requisite replacement volume and performing the analyses required prior to addition of fuel oil to the tank. A period of 48 hours is considered sufficient to complete restoration of the required level prior to declaring the DG inoperable. This period is acceptable based on the remaining capacity (> 6 days), the fact that procedures will be initiated to obtain replenishment, and the low probability of an event during this brief period.

BASES

ACTIONS

~~E~~F.1 (continued)

restoration to the required pressure prior to declaring the DG inoperable. This period is acceptable based on the remaining air start capacity, the fact that most DG starts are accomplished on the first attempt, and the low probability of an event during this brief period.

~~F~~G.1

With a Required Action and associated Completion Time not met, or one or more DGs with diesel fuel oil or lube oil not within limits for reasons other than addressed by Conditions A through ~~E~~ F, the associated DG may be incapable of performing its intended function and must be immediately declared inoperable.

SURVEILLANCE REQUIREMENTS

SR 3.8.3.1

This SR provides verification that there is an adequate inventory of fuel oil (≥89% in Mode 1, 2, 3, or 4 and ≥72% in Mode 5 or 6) in the storage tanks to support each DG's operation for 7 days at full load. The 7 day period is sufficient time to place the unit in a safe shutdown condition and to bring in replenishment fuel from an offsite location.

The 31 day Frequency is adequate to ensure that a sufficient supply of fuel oil is available, since low level alarms are provided and unit operators would be aware of any large uses of fuel oil during this period.

SR 3.8.3.2

This Surveillance ensures that sufficient lube oil inventory is available to support at least 7 days of full load operation for each DG. The TS$_{min}$ (413 gal for the 20 cylinder engine and 370 gal for the 16 cylinder engine) requirements are based on the DG manufacturer consumption values for the run time of the DG. Implicit in this SR is the requirement to verify the capability to transfer the lube oil from its storage location to the DG, when the DG lube oil sump does not hold adequate inventory for 7 days of full load

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.3.2 (continued)

operation without the level reaching the manufacturer recommended minimum level.

A 31 day Frequency is adequate to ensure that a sufficient lube oil supply is onsite, since DG starts and run time are closely monitored by the unit staff.

SR 3.8.3.3

The tests listed below are a means of determining whether new fuel oil is of the appropriate grade and has not been contaminated with substances that would have an immediate, detrimental impact on diesel engine combustion. If results from these tests are within acceptable limits, the fuel oil may be added to the storage tanks without concern for contaminating the entire volume of fuel oil in the storage tanks. These tests are to be conducted prior to adding the new fuel to the storage tank(s), but in no case is the time between receipt of new fuel and conducting the tests to exceed 31 days. The tests, limits, and applicable ASTM Standards are as follows:

a. Sample the new fuel oil in accordance with ASTM D4057-81 (Ref. 6);

b. Verify in accordance with the tests specified in ASTM D975-81 (Ref. 6) that the sample has a kinematic viscosity at 40°C of ≥ 1.9 centistokes and ≤ 4.1 centistokes, a water and sediment content of ≤ 0.05% by volume, and a flash point of ≥ 125°F; and

c. Verify in accordance with ASTM D287-82 that the sample has an API gravity at 60°F of ≥27° and ≤39°.

¶ Failure to meet any of the above limits is cause for rejecting the new fuel oil, but does not represent a failure to meet the LCO concern since the fuel oil is not added to the storage tanks.

Within 31 days following the initial new fuel oil delivery, the fuel oil is analyzed to establish that the other properties specified in Table 1 of ASTM D975-81 (Ref. 6) are met when tested in accordance with ASTM D975-81, except that the analysis for 1) sulfur may be performed in accordance with ASTM D1266, D1552, D2622, D3120, or D4294 and 2) a calculated cetane index may be determined in accordance with ASTM D976.

The 31 day period is acceptable because the fuel oil properties of interest, even if they were not within stated limits, would not have an immediate effect on DG operation. This Surveillance ensures the availability of high quality fuel oil for the DGs.

Fuel oil degradation during long term storage ~~shows up as~~ may be indicated by an increase in particulate, due mostly to oxidation. The

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.3.3 (continued)

presence of particulate does not mean the fuel oil will not burn properly in a diesel engine. The particulate can cause fouling of filters and fuel oil injection equipment, however, which can cause engine failure.

At least once per 92 days total Particulate Contamination of stored fuel ~~Particulate concentrations~~ should be determined in accordance with ASTM D2276-83, Method A (Ref. 6). This method involves a gravimetric determination of total particulate concentration in the fuel oil and has a limit of ≤10 mg/L. It is acceptable to obtain a field sample for subsequent laboratory testing in lieu of field testing.

The Frequency of this test takes into consideration fuel oil degradation trends that indicate that particulate concentration is unlikely to change significantly between Frequency intervals.

SR 3.8.3.4

This Surveillance ensures that, without the aid of the refill compressor, sufficient air start capacity for each DG is available. The system design requirements provide for a minimum of five engine start cycles without recharging. The start cycle ~~is defined by the DG vendor, but usually is measured in terms of time (seconds of cranking) or engine cranking speed~~ air usage has been determined by actual testing. The pressure specified in this SR is intended to reflect the lowest value at which the five starts can be accomplished.

The 31 day Frequency takes into account the capacity, capability, redundancy, and diversity of the AC sources and other indications available in the control room, including alarms, to alert the operator to below normal air start pressure.

SR 3.8.3.5

Microbiological fouling is a major cause of fuel oil degradation. There are numerous microorganisms that can grow in fuel oil and cause fouling, but all must have a water environment in order to survive. Removal of water from the fuel storage tanks once every 31 days eliminates

(continu-

BASES

REFERENCES (continued)

6. ASTM Standards: D4057-81; D975-81; D2276-83.

7. ASME, Boiler and Pressure Vessel Code, Section XI.

D1266- ; D1552- ;
D2622- ; D4294 ;
D976- ;

BASES

LCO (continued)

An OPERABLE DC electrical power subsystem requires the required battery and associated charger to be operating and connected to the associated DC bus.

APPLICABILITY

The DC electrical power sources are required to be OPERABLE in MODES 1, 2, 3, and 4 to ensure safe unit operation and to ensure that:

a. Acceptable fuel design limits and reactor coolant pressure boundary limits are not exceeded as a result of AOOs or abnormal transients; and

b. Adequate core cooling is provided, and containment integrity and other vital functions are maintained in the event of a postulated DBA.

The DC electrical power requirements for MODES 5 and 6 are addressed in the Bases for LCO 3.8.5, "DC Sources — Shutdown."

ACTIONS

A.1 and B.1

Condition A or B represents one train with a loss of ability to completely respond to an event, and a potential loss of ability to remain energized during normal operation. It is therefore, imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for complete loss of DC power to the affected train. The 2 hour limit for Condition A is consistent with the allowed time for an inoperable DC distribution system train.

This 2 hour limit is appropriate for 125 VDC Trains A and B because these trains supply the majority of the required safety related loads. The 72 hour limit for Condition B is consistent with the allowed time for Trains C and D as determined from a San Onofre Units 2 and 3 probabilistic risk assessment (PRA).

If one of the required DC electrical power subsystems is inoperable (e.g., inoperable battery, inoperable battery charger, or inoperable battery charger and associated inoperable battery), the remaining DC electrical power subsystem has the capacity to support a safe shutdown and t mitigate an accident condition. Since a subsequent worst case single failure would, however, result in the loss of two of the remaining 125 VDC electrical power subsystems with attendant loss of ESF functions, continued power operation should not exceed 2 hours for Trains A or B and 72 hours for Trains C or D. The 2 hour Completion Time for Train A or B is based on Regulatory Guide 1.93 (Ref. 8) and reflec

(continue

A.1 and B.1

BASES

ACTIONS

~~A.1~~ (continued)

The 72 hour Completion Time is based on a PRA which determined that the resulting increase in risk of core damage due to unavailability of Trains C or D is significantly low. The resulting increase in risk of core damage from a year long outage of Train C or D is calculated to be approximately 1.9E-6 per year. A single 72 hour outage of Train C or Train D represents a 0.05% (1.6E-8) increase in the total core damage from internal events as calculated in the San Onofre Units 2 and 3 Individual Plant Examination (IPE). Both the 2 hour and 72 hour Completion Times reflect a reasonable time to assess unit status as a function of the inoperable DC electrical power subsystem and, if the DC electrical power subsystem is not restored to OPERABLE status, to prepare to effect an orderly and safe unit shutdown.

C C
~~B~~.1 and ~~B~~.2

If the inoperable DC electrical power subsystem cannot be restored to OPERABLE status within the required Completion Time, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems. The Completion Time to bring the unit to MODE 5 is consistent with the time required in Regulatory Guide 1.93 (Ref. 8).

D~~E~~.1

Condition ~~E~~ D represents one train with a loss of ability to completely respond to a long term event, and a potential loss of ability to remain energized during normal operation. Since eventual failure of the battery to maintain the required battery cell parameters is highly probable, it is imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for complete loss of DC power to the affected train. The additional time provided by the Completion Time is consistent with the battery's capability to maintain its short term capability to respond to a design basis event. A note is added to take exception to the allowance of LCO 3.0.4 to enter Modes or other specified conditions in the Applicability. Even though Condition ~~C~~ D Required Actions do not require a plant shutdown or require exiting the Modes or other specified conditions in the Applicability, the condition of the DC system is not such that extended operation is expected. Therefore, the note requires restoration of the inoperable battery charger to OPERABLE status prior to increasing power. This exception is not intended to preclude the allowance of LCO 3.0.4 to always enter Modes or other

(continue

BASES

ACTIONS

D~~C~~.1 (continued)

specified conditions in the Applicability as a result of a plant shutdown.

E~~D~~.1

If the battery cell parameters cannot be maintained within Category A limits, the short term capability of the battery is also degraded and the battery must be declared inoperable.

SURVEILLANCE REQUIREMENTS

SR 3.8.4.1

Verifying battery terminal voltage while on float charge for the batteries helps to ensure the effectiveness of the charging system and the ability of the batteries to perform their intended function. Float charge is the condition in which the charger is supplying the continuous charge required to overcome the internal losses of a battery (or battery cell) and maintain the battery (or a battery cell) in a fully charged state. The voltage requirements are based on the nominal design voltage of the battery and are consistent with the initial voltages assumed in the battery sizing calculations. The 7 day Frequency is consistent with manufacturer recommendations and IEEE-450 (Ref. 9).

SR 3.8.4.2

Visual inspection to detect corrosion of the battery cells and connections, or measurement of the resistance of each intercell, interrack, intertier, and terminal connection, provides an indication of physical damage or abnormal deterioration that could potentially degrade battery performance.

The limits established for this SR must be no more than 20% above the resistance as measured during installation or not above the ceiling value established by the manufacturer.

The Surveillance Frequency for these inspections, which can detect conditions that can cause power losses due to resistance heating, is 92 days. This Frequency is

(continued)

BASES

60

SURVEILLANCE REQUIREMENTS

SR 3.8.4.7 (continued)

This SR is modified by two Notes. Note 1 allows the once per 72 months performance of SR 3.8.4.8 in lieu of SR 3.8.4.7. This substitution is acceptable because SR 3.8.4.8 represents a more severe test of battery capacity than does SR 3.8.4.7. Note 2 acknowledges that credit may be taken for unplanned events that satisfy this SR.

SR 3.8.4.8

A battery performance test is a test of constant current capacity of a battery, normally done in the "as found" condition, after having been in service, to detect any change in the capacity determined by the acceptance test. The test is intended to determine overall battery degradation due to age and usage.

The acceptance criteria for this Surveillance are consistent with IEEE-450 (Ref. 9) and IEEE-485 (Ref. 5). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements.

60

The Surveillance Frequency for this test is 72 months, or every 12 months if the battery shows degradation or has reached 85% of its expected life. Degradation is indicated, according to IEEE-450 (Ref. 9), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is below 90% of the manufacturer's rating. ~~The 72 month surveillance frequency is intended to ensure the surveillance will occur on a refueling cycle outage based on the expected 24 month refueling cycle.~~

This SR is modified by a Note which acknowledges that credit may be taken for unplanned events that satisfy this SR.

REFERENCES

1. 10 CFR.50, Appendix A, GDC 17.
2. Regulatory Guide 1.6, March 10, 1971.

(continue

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

The Category A limit specified for specific gravity for each pilot cell is ≥ 1.200 (0.015 below the manufacturer fully charged nominal specific gravity or a battery charging current that had stabilized at a low value). This value is characteristic of a charged cell with adequate capacity. According to IEEE-450 (Ref. 3), the specific gravity readings are based on a temperature of 77°F (25°C).

The specific gravity readings are corrected for actual electrolyte temperature and level. For each 3°F (1.67°C) above 77°F (25°C), 1 point (0.001) is added to the reading; 1 point is subtracted for each 3°F below 77°F. The specific gravity of the electrolyte in a cell increases with a loss of water due to electrolysis or evaporation. Footnote b to Table 3.8.6-1 requires the above mentioned correction for electrolyte level and temperature, with the exception that level correction is not required when battery charging current is < 2 amps on float charge. This current provides, in general, an indication of overall battery condition.

Because of specific gravity gradients that are produced during the recharging process, delays of several days may occur while waiting for the specific gravity to stabilize. A stabilized charging current at the charging voltage is an acceptable alternative to specific gravity measurement for determining the state of charge of the designated pilot cell. This phenomenon is discussed in IEEE-450 (Ref. 3). Footnote c to Table 3.8.6-1 allows the float charge current to be used as an alternate to specific gravity for up to 7 days following a battery equalizing recharge.

Category B defines the normal parameter limits for each connected cell. The term "connected cell" excludes any battery cell that may be jumpered out.

The Category B limits specified for electrolyte level and float voltage are the same as those specified for Category A and have been discussed above. The Category B limit specified for specific gravity for each connected cell is ≥ 1.195 (0.020 below the manufacturer fully charged, nominal specific gravity) with the average of all connected cells > 1.205 (0.010 below the manufacturer fully charged, nominal specific gravity). These values are based on

≥

(continued)

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.7 Inverters – Operating

BASES

125

BACKGROUND

The inverters are the preferred source of power for the AC vital buses because of the stability and reliability they achieve in being powered from the 120 VDC battery source. The function of the inverter is to convert DC electrical power to AC electrical power, thus providing an uninterruptible power source for the instrumentation and controls for the Reactor Protective System (RPS) and the Engineered Safety Feature Actuation System (ESFAS). Specific details on inverters and their operating characteristics are found in the UFSAR, Chapter 8 (Ref. 1).

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the UFSAR, Chapter 6 (Ref. 2) and Chapter 15 (Ref. 3), assume Engineered Safety Feature systems are OPERABLE. The DC to AC inverters are designed to provide the required capacity, capability, redundancy, and reliability to ensure the availability of necessary power to the RPS and ESFAS instrumentation and controls so that the fuel, Reactor Coolant System, and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for Section 3.2, Power Distribution Limits; Section 3.4, Reactor Coolant System (RCS); and Section 3.6, Containment Systems.

The OPERABILITY of the inverters is consistent with the initial assumptions of the accident analyses and is based on meeting the design basis of the unit. This includes maintaining required AC vital buses OPERABLE during accident conditions in the event of:

a. An assumed loss of all offsite AC electrical power or all onsite AC electrical power; and

b. A worst case single failure.

Inverters are a part of the distribution system and, as such, satisfy Criterion 3 of the NRC Policy Statement.

(continued)

BASES (continued)

LCO

The inverters ensure the availability of AC electrical power for the systems instrumentation required to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated DBA.

Maintaining the required inverters OPERABLE ensures that the redundancy incorporated into the design of the RPS and ESFAS instrumentation and controls is maintained. The four battery powered inverters (one per train) are required to be OPERABLE to ensure an uninterruptible supply of AC electrical power to the AC vital buses even if the 4.16 kV safety buses are de-energized.

OPERABLE inverters require the associated AC vital bus to be powered by the inverter, which has the correct DC voltage (105-140 V) applied from a battery to the inverter input, and inverter output AC voltage within tolerances.

This LCO is modified by a Note that allows ~~one~~ Train A or Train B inverter to be disconnected from its battery for ≤ 24 hours, if the associated vital bus is powered from a Class 1E constant voltage transformer during the period and all other inverters are operable. This allows an equalizing charge to be placed on one battery. If the inverter(s) were not disconnected, the resulting voltage condition might damage the inverter(s). These provisions minimize the loss of equipment that would occur in the event of a loss of offsite power. The 24 hour time period for the allowance minimizes the time during which a loss of offsite power could result in the loss of equipment energized from the affected AC vital bus while taking into consideration the time required to perform an equalizing charge on the battery bank. When utilizing the allowance, if one or more of the provisions is not met (e.g., 24 hour or 72 hour time period exceeded), LCO 3.0.3 must be entered immediately.

The same Note allows either Train C or Train D inverter to be disconnected from its battery for ≤72 hours as long as all other inverters are operable.

The intent of this Note is to limit the number of inverters that may be disconnected. Only those inverters associated with the single battery undergoing an equalizing charge may be disconnected. All other inverters must be aligned to their associated batteries, regardless of the number of inverters or unit design.

(continued)

BASES (continued)

APPLICABILITY

The inverters are required to be OPERABLE in MODES 1, 2, 3, and 4 to ensure that:

a. Acceptable fuel design limits and reactor coolant pressure boundary limits are not exceeded as a result of AOOs or abnormal transients; and

b. Adequate core cooling is provided, and containment OPERABILITY and other vital functions are maintained in the event of a postulated DBA.

Inverter requirements for MODES 5 and 6 are covered in the Bases for LCO 3.8.8, "Inverters – Shutdown."

ACTIONS

A.1 and A.2

Required Action A.1 is modified by a Note, which states to enter the applicable conditions and Required Actions of LCO 3.8.9, "Distribution Systems – Operating," when Condition A is entered with ~~one~~ either Train A or Train B AC vital bus de-energized. This ensures the vital bus is returned to OPERABLE status within 2 hours.

Required Action A.2 allows 24 hours to fix the inoperable Train A or Train B inverter and return it to service. The 24 hour limit is based upon engineering judgment, taking into consideration the time required to repair an inverter and the additional risk to which the unit is exposed because of the inverter inoperability. This has to be balanced against the risk of an immediate shutdown, along with the potential challenges to safety systems such a shutdown might entail. When the AC vital bus is powered from its constant voltage source, it is relying upon interruptible AC electrical power sources (offsite and onsite). The uninterruptible, battery backed inverter source to the AC vital buses is the preferred source for powering instrumentation trip setpoint devices.

INSERT "D"

C ~~B~~.1 and ~~B~~.2 C

If the inoperable devices or components cannot be restored to OPERABLE status within the required Completion Time, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought t

(continue

INSERT "D"

B.1

Required Action B.1 is modified by a Note, which states to enter the applicable conditions and Required Actions of LCO 3.8.9, "Distribution Systems-Operating," when Condition B is entered with either Train C or Train D AC vital bus de-energized. This ensures the vital bus is returned to OPERABLE status within 72 hours. The 72 hour limit is based on the results of a probabilistic risk assessment which determined that the resulting increase in risk of core damage due to the unavailability of Train C or D is significantly low. The resulting increase in risk of core damage from a year long outage of Train C or D is calculated to be approximately 1.9E-6 per year. A single 72 hour outage of Train C or D represents a 0.05% (1.6E-8) increase in the total core damage from internal events as calculated in the San Onofre Units 2 and 3 Individual Plant Examination.

BASES

ACTIONS

C ~~B~~.1 and C ~~B~~.2 (continued)

at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

SURVEILLANCE REQUIREMENTS

SR 3.8.7.1

This Surveillance verifies that the inverters are functioning properly with all required circuit breakers closed and AC vital buses energized from the inverter. The verification of proper voltage output ensures that the required power is readily available for the instrumentation of the RPS and ESFAS connected to the AC vital buses. The 7 day Frequency takes into account the redundant capability of the inverters and other indications available in the control room that alert the operator to inverter malfunctions.

REFERENCES

1. UFSAR, Chapter 8.
2. UFSAR, Chapter 6.
3. UFSAR, Chapter 15.

BASES

ACTIONS

A.1 (continued)

train by stabilizing the unit, and on restoring power to the affected train. The 8 hour time limit before requiring a unit shutdown in this condition is acceptable because of:

a. The potential for decreased safety if the unit operator's attention is diverted from the evaluations and actions necessary to restore power to the affected train, to the actions associated with taking the unit to shutdown within this time limit; and

b. The potential for an event in conjunction with a single failure of a redundant component in the train with AC power.

B.1

With ~~one~~ either Train A or Train B AC vital bus inoperable, the remaining OPERABLE AC vital buses are capable of supporting the minimum safety functions necessary to shut down the unit and maintain it in the safe shutdown condition. Overall reliability is reduced, however, since an additional single failure could result in the minimum required ESF functions not being supported. Therefore, the required AC vital bus must be restored to OPERABLE status within 2 hours.

Condition B represents ~~one~~ either Train A or Train B AC vital bus without power; potentially both the DC source and the associated AC source are nonfunctioning. In this situation, the unit is significantly more vulnerable to a complete loss of all noninterruptible power. It is, therefore, imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for loss of power to the remaining vital buses, and restoring power to the affected vital bus.

This 2 hour limit is more conservative than Completion Times allowed for the vast majority of components that are without adequate vital AC power.

The 2 hour Completion Time takes into account the importance to safety of restoring the AC vital bus to OPERABLE status, the redundant capability afforded by the other OPERABLE vital buses, and the low probability of a DBA occurring during this period.

(continue

BASES

ACTIONS (continued)

IP

INSERT "G"

D ~~C~~.1

Train A or Train B

With the DC bus in one train inoperable, the remaining DC electrical power distribution subsystems are capable of supporting the minimum safety functions necessary to shut down the reactor and maintain it in a safe shutdown condition, assuming no single failure. The overall reliability is reduced, however, because a single failure in the remaining DC electrical power distribution subsystem could result in the minimum required ESF functions not being supported. Therefore, the required DC bus must be restored to OPERABLE status within 2 hours.

Condition ~~C~~ D represents ~~one train~~ Train A or Train B without adequate DC power; potentially both with the battery significantly degraded and the associated charger nonfunctioning. In this situation, the unit is significantly more vulnerable to a complete loss of all DC power. It is, therefore, imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for loss of power to the remaining trains and restoring power to the affected train.

IP

INSERT "H"

This 2 hour limit is more conservative than Completion Times allowed for the vast majority of components which would be without power.

The 2 hour Completion Time for Train A or Train B DC buses is consistent with Regulatory Guide 1.93 (Ref. 3).

F ~~D~~.1 and ~~D~~.2 F

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

(continued)

INSERT "G"

C.1

With either Train C or Train D AC vital bus inoperable, the remaining OPERABLE AC vital buses are capable of supporting the minimum safety functions necessary to shut down the unit and maintain it in the safe shutdown condition. Overall reliability is reduced, however, since an additional single failure could result in the minimum required ESF functions not being supported. Therefore, the required AC vital bus must be restored to OPERABLE status within 72 hours.

Condition C represents either one of the Train C or Train D AC vital bus without power; potentially both the DC source and the associated AC source are nonfunctioning. In this situation, the unit is significantly more vulnerable to a complete loss of all noninterruptible power. It is, therefore, imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for loss of power to the remaining vital buses, and restoring power to the affected vital bus.

The 72 hour Completion Time is based on the results of a probabilistic risk assesment which determined the low significance of the risks involved due to the unavailability of Train C or Train D AC vital bus when compared to Train A or B AC vital bus unavailability. This completion time also takes into account the importance to safety of restoring the AC vital bus to OPERABLE status, the redundant capability afforded by the other OPERABLE vital buses, and the low probability of a DBA occurring during this period.

INSERT "H"

E.1

With either Train C or Train D DC bus inoperable, the remaining DC electrical power distribution subsystems are capable of supporting the minimum safety functions necessary to shut down the reactor and maintain it in a safe shutdown condition, assuming no single failure. The overall reliability is reduced, however, because a single failure in the remaining DC electrical power distribution subsystem could result in the minimum required ESF functions not being supported. Therefore, the required DC bus must be restored to OPERABLE status within 72 hours.

Condition D represents Train C or Train D without adequate DC power; potentially both with the battery significantly degraded and the associated charger nonfunctioning. In this situation, the unit is significantly more vulnerable to a complete loss of all DC power. It is, therefore, imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for loss of power to the remaining trains and restoring power to the affected train.

The 72 hour Completion Time for Train C or Train D DC bus is consistent with the results of a probabilistic risk assesment which determined the low significance of the risk involved due to the unavailability of Train C or Train D AC vital bus when compared to Train A or B AC vital bus unavailability. This completion time also takes into account the importance to safety of restoring the AC vital bus to OPERABLE status, the redundant capability afforded by the other OPERABLE vital buses, and the low probability of a DBA occurring during this period.

LCO (continued)

COLR ensures a core k_{eff} of ≤ 0.95 is maintained during fuel handling operations. Violation of the LCO could lead to an inadvertent criticality during MODE 6.

APPLICABILITY

This LCO is applicable in MODE 6 to ensure that the fuel in the reactor vessel will remain subcritical. The required boron concentration ensures a k_{eff} ≤ 0.95. Above MODE 6, LCO 3.1.1, "SHUTDOWN MARGIN (SDM) – T_{avg} > 200°F," and LCO 3.1.2, "SHUTDOWN MARGIN – T_{avg} ≤ 200°F," ensure that an adequate amount of negative reactivity is available to shut down the reactor and to maintain it subcritical.

ACTIONS

A.1 and A.2

Continuation of CORE ALTERATIONS or positive reactivity additions (including actions to reduce boron concentration) is contingent upon maintaining the unit in compliance with the LCO. If the boron concentration of any coolant volume in the RCS, or the refueling canal is less than its limit, all operations involving CORE ALTERATIONS or positive reactivity additions must be suspended immediately.

INSERT

Temperature fluctuations need not be considered when suspending positive reactivity additions

Small temperature fluctuations associated with maintaining the plant status are permissible provided they remain within limits established by Station Technical for the plant conditions.

Suspension of CORE ALTERATIONS and positive reactivity additions shall not preclude moving a component to a safe position.

A.3

In addition to immediately suspending CORE ALTERATIONS or positive reactivity additions, boration to restore the concentration must be initiated immediately.

In determining the required combination of boration flow rate and concentration, there is no unique design basis event that must be satisfied. The only requirement is to restore the boron concentration to its required value as

(continued)

BASES (continued)

APPLICABILITY

In MODE 6, the SRMs must be OPERABLE to determine changes in core reactivity. There is no other direct means available to check core reactivity levels.

In MODES 3, 4, and 5, the installed source range detectors and circuitry are required to be OPERABLE by LCO 3.3.13, "Source Range Monitors."

ACTIONS

A.1 and A.2

With only one SRM OPERABLE, redundancy has been lost. Since these instruments are the only direct means of monitoring core reactivity conditions, CORE ALTERATIONS and positive reactivity additions must be suspended immediately. Performance of Required Action A.1 shall not preclude completion of movement of a component to a safe position.

INSERT

Temperature fluctuations need not be considered when suspending positive reactivity additions

Small temperature fluctuations associated with maintaining the plant status are permissible provided they remain within limits established by Station Technical for the plant conditions.

B.1

With no SRM OPERABLE, actions to restore a monitor to OPERABLE status shall be initiated immediately. Once initiated, actions shall be continued until an SRM is restored to OPERABLE status.

B.2

With no SRM OPERABLE, there is no direct means of detecting changes in core reactivity. However, since CORE ALTERATIONS and positive reactivity additions are not to be made, the core reactivity condition is stabilized until the SRMs are OPERABLE. This stabilized condition is determined by performing SR 3.9.1.1 to verify that the required boron concentration exists.

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SR 3.9.3.2

requirements. These surveillances performed during MODE 6 will ensure that the valves are capable of closing after postulated fuel handling accident to limit a release of fission product radioactivity from the containment.

REFERENCE

1. UFSAR, Section 15.7.3.4.

(continued)