PACKAGE 3.3

INSTRUMENTATION

PART E

MARKUP OF NUREG-1431
IMPROVED STANDARD TECHNICAL SPECIFICATIONS AND BASES

List of Pages

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
UNITS 1 AND 2

Improved Technical Specifications
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3.3 INSTRUMENTATION

3.3.1 Reactor Trip System (RTS) Instrumentation

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

APPLICABILITY: According to Table 3.3.1-1.

ACTIONS

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

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one or more required channels or trains inoperable.	A.1 Enter the Condition referenced in Table 3.3.1-1 for the channel(s) or train(s).	Immediately TA3.3-151

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. One Manual Reactor Trip channel inoperable.	B.1 Restore channel to OPERABLE status.	48 hours
	OR	
	B.2~~.1~~ Be in MODE 3.	54 hours TA3.3-151
	~~AND~~	
	~~B.2.2 Open reactor trip breakers (RTBs).~~	~~55 hours~~

(continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. One channel or train inoperable.	C.1 Restore channel or train to OPERABLE status.	48 hours
	OR	
	C.2.1 Initiate action to fully insert all rods~~Open RTBs~~.	489 hours TA3.3-151
	AND	
	C.2.2 Place the Rod Control System in a condition incapable of rod withdrawal.	49 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. One Power Range Neutron Flux–High channel inoperable.	------------NOTES------------ 1. The inoperable channel may be bypassed for up to 4 hours for surveillance testing and setpoint adjustment of other channels. 2. An additional power range instrumentation channel may be made inoperable for low power PHYSICS TESTS. -----------------------------	CL3.3-152
	D.1.1 Place channel in trip.	6 hours
	<u>AND</u>	
	~~D.1.2 Reduce THERMAL POWER to ≤ 75% RTP.~~	~~12 hours~~
	~~<u>OR</u>~~	
	~~D.2.1 Place channel in trip.~~	~~6 hours~~
	~~<u>AND</u>~~	
		(continued)

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
D. (continued)	D.1.2	----------NOTE------- Only required to be performed when THERMAL POWER is > 85% RTP and the Power Range Neutron Flux input to QPTR is inoperable. ---------------------	PA3.3-153 CL3.3-152
	~~D.2.2~~	Perform SR 3.2.4.2.	Once per 12 hours
	OR		
	D.2~~3~~	Be in MODE 3.	12 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. One channel inoperable.	------------NOTES------------ 1. The inoperable channel may be bypassed for up to 4 hours for surveillance testing of other channels. 2. An additional power range instrumentation channel may be made inoperable for low power PHYSICS TESTS. ----------------------------	CL3.3-152
	E.1 Place channel in trip.	6 hours
	OR	
	E.2 Be in MODE 3.	12 hours
F. ~~THERMAL POWER > P-6 and < P-10,~~ Oone Intermediate Range Neutron Flux channel inoperable.	F.1 Reduce THERMAL POWER to < P-6.	TA3.3-151 TP3.3-154
	OR	
	F.2 Increase THERMAL POWER to > P-10.	24 hours 24 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
G. ~~THERMAL POWER > P-6 and < P-10,~~ Ttwo Intermediate Range Neutron Flux channels inoperable.	G.1 -------NOTE------- Limited plant cooldown or boron dilution is allowed provided the change is accounted for in the calculated SDM. -------------------- Suspend operations involving positive reactivity additions.	TA3.3-151 TA3.3-159 Immediately
	AND	
	G.2 Reduce THERMAL POWER to < P-6.	2 hours
~~H. THERMAL POWER < P-6, one or two Intermediate Range Neutron Flux channels inoperable.~~	~~H.1 Restore channel(s) to OPERABLE status.~~	TA3.3-151 ~~Prior to increasing THERMAL POWER to > P-6~~

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
H~~I~~. One Source Range Neutron Flux channel inoperable.	H~~I~~.1 -----NOTE----- Limited plant cooldown or boron dilution is allowed provided the change is accounted for in the calculated SDM. ------------------- Suspend operations involving positive reactivity additions.	TA3.3-159 Immediately
I~~J~~. Two Source Range Neutron Flux channels inoperable.	I~~J~~.1 Open Reactor Trip Breakers (RTBs).	Immediately TA3.3-151
J~~K~~. One Source Range Neutron Flux channel inoperable.	J~~K~~.1 Restore channel to OPERABLE status. OR J~~K~~.2.1 Initiate action to fully insert all rods~~Open RTBs~~. AND J.2.2 Place the Rod Control System in a condition incapable of rod withdrawal.	48 hours 489 hours TA3.3-151 49 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
		(continued)
~~L. Required Source Range Neutron Flux channel[(s)] inoperable.~~	~~L.1 Suspend operations involving positive reactivity additions.~~	~~Immediately~~ TA3.3-151
	~~AND~~	
	~~L.2 Close unborated water source isolation valves.~~	~~1 hour~~
	~~AND~~	
	~~L.3 Perform SR 3.1.1.1.~~	~~1 hour~~ ~~AND~~ ~~Once per 12 hours thereafter~~

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
KM. One channel inoperable.	------------NOTE------------ The inoperable channel may be bypassed for up to 4 hours for surveillance testing of other channels. ----------------------------	
	KM.1 Place channel in trip.	6 hours
	OR	CL3.3-158
	KM.2 Reduce THERMAL POWER to < P-7 and P-8.	12 hours

(continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
LN. One or both ~~Reactor Coolant Flow — Low (Single Loop)~~ channel(s) inoperable on one bus.	------------NOTE------------ One~~The~~ inoperable channel may be bypassed for up to 4 hours for surveillance testing of other channels. ----------------------------	TA3.3-155 CL3.3-156
	LN.1 Place channel(s) in trip.	6 hours
	OR	CL3.3-158
	LN.2 Reduce THERMAL POWER to < P-7 and P-8.	12~~0~~ hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
M~~O~~. One Reactor Coolant Pump Breaker Position channel inoperable.	~~------------NOTE------------~~ ~~The inoperable channel may be bypassed for up to 4 hours for surveillance testing of other channels.~~ ----------------------------	CL3.3-157
	M~~O~~.1 Restore channel to OPERABLE status.	48~~6~~ hours
	OR	
	M~~O~~.2 Reduce THERMAL POWER to < P-7 and P-8.	CL3.3-158 54~~10~~ hours

(continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
N~~P~~. One Turbine Trip channel inoperable.	------------NOTE------------ The inoperable channel may be bypassed for up to 4 hours for surveillance testing of other channel(s). ----------------------------	
	N~~P~~.1 Place channel in trip.	6 hours
	OR	
	N~~P~~.2 Reduce THERMAL POWER to < ~~[~~P-9~~]~~.	12~~0~~ hours CL3.3-169

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
OQ. One train inoperable.	------------NOTE------------- One train may be bypassed for up to 8[4] hours for surveillance testing provided the other train is OPERABLE. -----------------------------	CL3.3-161
	OQ.1 Restore train to OPERABLE status.	6 hours
	OR	
	OQ.2 Be in MODE 3.	12 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
PR. One RTB train inoperable.	------------NOTE~~S~~------------ 1. One train may be bypassed for up to 4~~2~~ hours for surveillance testing, provided the other train is OPERABLE.	CL3.3-162
	2. One RTB may be bypassed for up to 4~~2~~ hours for maintenance on undervoltage or shunt trip mechanisms, provided the other train is OPERABLE. ----------------------------	CL3.3-163
	PR.1 Restore RTB~~train~~ to OPERABLE status.	1 hour
	<u>OR</u>	
	PR.2 Be in MODE 3.	7 hours
Q~~S~~. One or more channels inoperable.	Q~~S~~.1 Verify interlock is in required state for existing unit conditions.	1 hour TA3.3-151
	<u>OR</u>	
	Q~~S~~.2 Be in MODE 3.	7 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~R~~T. One ~~or more~~ channel~~s~~ inoperable.	~~R~~T.1 Verify interlock is in required state for existing unit conditions. OR ~~R~~T.2 Be in MODE 2.	1 hour TA3.3-151 7 hours
~~S~~U. One trip mechanism inoperable for one RTB.	~~S~~U.1 Restore inoperable trip mechanism to OPERABLE status. OR ~~S~~U.2~~.1~~ Be in MODE 3. ~~AND~~ ~~U.2.2 Open RTB.~~	48 hours 54 hours TA3.3-151 ~~55 hours~~
~~V. Two RTS trains inoperable.~~	~~V.1 Enter LCO 3.0.3.~~	TA3.3-151 ~~Immediately~~

SURVEILLANCE REQUIREMENTS

-----NOTE-----
Refer to Table 3.3.1-1 to determine which SRs apply for each RTS Function.

SURVEILLANCE		FREQUENCY
SR 3.3.1.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.1.2	-----NOTES----- 1. Adjust NIS channel if absolute difference is > 2%. 2. Not required to be performed until [12] hours after THERMAL POWER is ≥ 15% RTP. --- Compare results of calorimetric heat balance calculation to Nuclear Instrumentation System (NIS) channel output.	24 hours

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.3	-------------------NOTES------------------ 1. Adjust NIS channel if absolute difference is ≥ 3%. 2. ~~Only~~~~Not~~ required to be performed with ~~until [24] hours after~~ THERMAL POWER ~~is~~ ≥ ~~[~~15~~]~~% RTP. --- Compare results of the incore detector measurements to NIS AFD.	PA3.3-168 Prior to exceeding 75% RTP after each refueling AND 31 effective full power days (EFPD)

(continued)

SR 3.3.1.4	-------------------NOTES------------------ 1. This Surveillance must be performed on the reactor trip bypass breaker when ~~prior to~~ placing the bypass breaker in service. 2. Verification of setpoints not required. --- Perform TADOT.	PA3.3-160 31 days on a STAGGERED TEST BASIS

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.5	Perform ACTUATION LOGIC TEST.	31 days on a STAGGERED TEST BASIS
SR 3.3.1.6	-------------------NOTE------------------- Not required to be performed until ~~[~~24~~]~~ hours after THERMAL POWER is ≥ 75~~50~~% RTP. -- Calibrate excore channels to agree with incore detector measurements.	CL3.3-164 ~~[~~92~~]~~ EFPD
SR 3.3.1.7	~~-------------------NOTE-------------------~~ ~~Not required to be performed for source range instrumentation prior to entering MODE 3 from MODE 2 until 4 hours after entry into MODE 3.~~ ~~--~~ Perform COT.	CL3.3-165 ~~[~~92~~]~~ days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.8	-------------------NOTE------------------- This Surveillance shall include verification that interlocks P-6 and P-10 are in their required state for existing unit conditions. -- Perform COT.	-----NOTE----- Only required when not performed within previous [92] days --------------- Prior to reactor startup CL3.3-166 AND Four hours after reducing power below P-10 for power and intermediate instrumentation AND Four hours after reducing power below P-6 for source range instrumentation AND Eve PA3.3-171 ry 92 days thereafter when the unit is in MODES 3, 4 and 5

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
		(continued)
SR 3.3.1.9	-------------------NOTE------------------- Verification of setpoint is not required. -- Perform TADOT.	[92] days
SR 3.3.1.10	-------------------NOTE------------------- This Surveillance shall include verification that the time constants are adjusted to the prescribed values. -- Perform CHANNEL CALIBRATION.	X3.3-172 24[18] months
SR 3.3.1.11	-------------------NOTE------------------- 1. Neutron detectors are excluded from CHANNEL CALIBRATION. 2. This Surveillance shall include verification that the time constants are adjusted to the prescribed values. -- Perform CHANNEL CALIBRATION.	PA3.3-173 X3.3-172 24[18] months

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.3.1.12	-------------------NOTE------------------- 1. This Surveillance shall include verification of Reactor Coolant System resistance temperature detector bypass loop flow rate. 2. This Surveillance shall include verification that the time constants are adjusted to the prescribed values. -- Perform CHANNEL CALIBRATION.	PA3.3-173 X3.3-172 24~~[18]~~ months
SR 3.3.1.13	Perform COT.	X3.3-172 24~~18~~ months
SR 3.3.1.14	-------------------NOTE------------------- Verification of setpoint is not required. -- Perform TADOT.	X3.3-172 24~~[18]~~ months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.15	------------------NOTE------------------ Verification of setpoint is not required. -- Perform TADOT.	~~-----NOTE-----~~ ~~Only required when not performed within previous 31 days~~ ------------------ TA3.3-175 Prior to exceeding the P-9 interlock whenever the unit has been shutdown in excess of 2 days, if not performed within the previous 31 days ~~reactor startup~~
SR 3.3.1.16	~~------------------NOTE------------------~~ ~~Neutron detectors are excluded from response time testing.~~ -- Verify RTS RESPONSE TIME is within limits.	CL3.3-178 X3.3-172 24~~[18]~~ months on a STAGGERED TEST BASIS

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

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	TA3.3-176 ~~TRIP SETPOINT(a)~~
1. Manual Reactor Trip	1,2	2	B	SR 3.3.1.14	NA	~~NA~~
	3(~~a~~b), 4(~~a~~b), 5(~~a~~b)	2	C	SR 3.3.1.14	NA	~~NA~~
2. Power Range Neutron Flux						
a. High	1,2	4	D	SR 3.3.1.1 SR 3.3.1.2 SR 3.3.1.7 SR 3.3.1.11 SR 3.3.1.16	≤ 110~~[111.2]~~ % RTP	X3.3-177 ~~≤ [109]% RTP~~
b. Low	1(~~b~~c),2	4	E	SR 3.3.1.1 SR 3.3.1.8 SR 3.3.1.11 SR 3.3.1.16	≤ 40~~[27.2]~~% RTP	CL3.3-181 ~~≤ [25]% RTP~~
3. Power Range Neutron Flux Rate						
a. High Positive Rate	1,2	4	E	SR 3.3.1.7 SR 3.3.1.11 SR 3.3.1.16 CL3.3-182	X3.3-177 ≤ 6~~[6.8]~~% RTP with time constant ≥ ~~[~~2~~]~~ sec	~~≤ [5]% RTP with time constant ≥ [2] sec~~
b. High Negative Rate	1,2	4	E	SR 3.3.1.7 SR 3.3.1.11 SR 3.3.1.16	X3.3-177 ≤ 8~~[6.8]~~% RTP with time constant ≥ ~~[~~2~~]~~ sec	~~≤ [5]% RTP with time constant ≥ [2] sec~~
4. Intermediate Range Neutron Flux	1(~~b~~c), 2(~~c~~d)	2	F,G	SR 3.3.1.1 SR 3.3.1.8 SR 3.3.1.11	CL3.3-184 ≤ 40~~[31]~~% RTP	~~≤ [25]% RTP~~
	~~2(e)~~	~~2~~	~~H~~	~~SR 3.3.1.1~~ ~~SR 3.3.1.8~~ ~~SR 3.3.1.11~~	~~≤ [31]% RTP~~	TA3.3-151 ~~≤ [25]% RTP~~

(continued)

~~(a) Reviewer's Note: Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.~~ TA3.3-176

(~~a~~b) With ~~Reactor Trip Breakers (RTBs) closed and~~ Rod Control System capable of rod withdrawal or one or more rods not fully inserted. TA3.3-151

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

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

~~(e) Below the P-6 (Intermediate Range Neutron Flux) interlocks.~~ TA3.3-151

Table 3.3.1-1 (page 2 of 8)
Reactor Trip System Instrumentation

	FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	TA3.3-176 TRIP SETPOINT(a)
						CL3.3-185	
5.	Source Range Neutron Flux	2(de)	2	H, I, J	SR 3.3.1.1 SR 3.3.1.8 SR 3.3.1.11 SR 3.3.1.16	≤ 1.0E6 [1.4 E5] cps	≤ [1.0 E5] cps
		3(ab), 4(ab), 5(ab)	2	I, J, K	SR 3.3.1.1 CL3.3-188 SR 3.3.1.87 SR 3.3.1.11 SR 3.3.1.16	≤ 1.0E6 [1.4 E5] cps	≤ [1.0 E5] cps
							TA3.3-151
		3(f), 4(f), 5(f)	[1]	L	SR 3.3.1.1 SR 3.3.1.11	N/A	N/A
6.	Overtemperature ΔT	1,2	[4]	E	SR 3.3.1.1 SR 3.3.1.3 SR 3.3.1.6 SR 3.3.1.7 SR 3.3.1.12 SR 3.3.1.16	Refer to Note 1 (Page 3.3.1-212)	Refer to Note 1 (Page 3.3-21)
7.	Overpower ΔT	1,2	[4]	E	SR 3.3.1.1 CL3.3-164 SR 3.3.1.3 SR 3.3.1.6 SR 3.3.1.7 SR 3.3.1.12 SR 3.3.1.16	Refer to Note 2 (Page 3.3.1-223)	Refer to Note 2 (Page 3.3-22)

(continued)

(a) Reviewer's Note: Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit. TA3.3-176

(ab) With RTBs closed and Rod Control System capable of rod withdrawal or one or more rods not fully inserted. TA3.3-151

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

(f) With the RTBs open. In this condition, source range Function does not provide reactor trip but does provide [input to the Boron Dilution Protection System (LCO 3.3.9), and] indication. TA3.3-151

Table 3.3.1-1 (page 3 of 8)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	TA3.3-176 ~~TRIP SETPOINT(a)~~
8. Pressurizer Pressure						
a. Low	1(~~e~~g)	~~[4]~~	~~K~~M	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 CL3.3-186	X3.3-177 ≥ 1760~~[1886]~~ psig	~~≥ [1900] psig~~
b. High	1,2	CL3.3-191 3~~[4]~~	E	~~SR 3.3.1.16~~ SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 CL3.3-186 ~~SR 3.3.1.16~~	X3.3-177 ≤ 2400~~[2396]~~ psig	~~≤ [2385] psig~~
9. Pressurizer Water Level - High	1(~~e~~g)	3	~~K~~M	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10	CL3.3-192 ≤ 90~~[93.8]~~%	~~≤ [92]%~~
10. Reactor Coolant Flow - Low						
~~a. Single Loop~~	1(~~f~~h)	3 per loop	~~K~~N	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 CL3.3-186 ~~SR 3.3.1.16~~	X3.3-177 ≥ 91~~[89.2]~~%	~~≥ [90]%~~
~~b. Two Loops~~	~~1(i)~~	~~3 per loop~~	M	~~SR 3.3.1.1~~ ~~SR 3.3.1.7~~ ~~SR 3.3.1.10~~ ~~SR 3.3.1.16~~	TA3.3-155 ~~≥ [89.2]%~~	~~≥ [90]%~~

(continued)

~~(a) Reviewer's Note: Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.~~ TA3.3-176

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

(~~f~~h) Above the P-8 (Power Range Neutron Flux) or P-7 (Low Power Reactor Trips Block) interlocks. CL3.3-189

~~(i) Above the P-7 (Low Power Reactor Trips Block) interlock and below the P-8 (Power Range Neutron Flux) interlock.~~ TA3.3-155

Table 3.3.1-1 (page 4 of 8)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	TA3.3-176 TRIP SETPOINT(a)
11. Loss of Reactor Coolant Pump (RCP) Breaker Position CL3.3-195						
a. RCP Breaker OpenSingle Loop	1(fh)	1 per RCP	MO	SR 3.3.1.14	NA	NA
b. Underfrequency Buses 11 and 12 (21 and 22) Two Loops(g) CL3.3-196	1(fi)	2 per bus1 per RCP	CL3.3-156 LM	SR 3.3.1.9 SR 3.3.1.10 SR 3.3.1.14	CL3.3-197 ≥ 58.2 HzNA	NA
12. Undervoltage on Buses 11 and 12 (21 and 22) RCPs CL3.3-201	1(eg)	CL3.3-202 2[3] per bus	CL3.3-156 LM	SR 3.3.1.9 SR 3.3.1.10 CL3.3-186 SR 3.3.1.16	X3.3-177 ≥ 76% bus voltage[4760] V	≥ [4830] V
13. Underfrequency RCPs CL3.3-195	1(g)	[3] per bus	M	SR 3.3.1.9 SR 3.3.1.10 SR 3.3.1.16	≥ [57.1] Hz	≥ [57.5] Hz
134. Steam Generator (SG) Water Level - Low Low	1,2	[34 per SG]	E	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 CL3.3-186 SR 3.3.1.16	CL3.3-203 ≥ 5[30.4]%	≥ [32.3]%
15. SG Water Level - Low	1,2	2 per SG	E	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 SR 3.3.1.16	CL3.3-204 ≥ [30.4]%	≥ [32.3]%
Coincident with Steam Flow/Feedwater Flow Mismatch	1,2	2 per SG	E	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 SR 3.3.1.16	≤ [42.5]% full steam flow at RTP	≤ [40]% full steam flow at RTP

(continued)

(a) Reviewer's Note: Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit. TA3.3-176

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

(fh) Above the P-8 (Power Range Neutron Flux) or P-7 (Low Power Reactor Trips Block) interlocks. CL3.3-189

(g) Not a direct reactor trip; underfrequency will trip the RCP breakers open. CL3.3-198

~~(i) Above the P-7 (Low Power Reactor Trips Block) interlock and below the P-8 (Power Range Neutron Flux) interlock.~~ CL3.3-196

Table 3.3.1-1 (page 5 of 8)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	[TA3.3-176] ~~TRIP SETPOINT~~(a)
146. Turbine Trip						
a. Low [PA3.3-205] Autostop ~~Fluid~~ Oil Pressure	1(hj)	3	NP	SR 3.3.1.10 SR 3.3.1.15	[CL3.3-206] ≥ 45 ~~[750]~~ psig	~~≥ [800] psig~~
b. Turbine Stop Valve Closure	1(hj)	24	[CL3.3-167] NP	[CL3.3-207] ~~SR 3.3.1.10~~ SR 3.3.1.15	NA ~~≥ [1]% open~~	~~≥ [1]% open~~
157. Safety Injection (SI) Input from Engineered Safety Feature Actuation System (ESFAS)	1,2	2 trains	OQ	SR 3.3.1.14	NA	~~NA~~
168. Reactor Trip System Interlocks						
a. Intermediate Range Neutron Flux, P-6	2(de)	2	QS	SR 3.3.1.11 SR 3.3.1.13	[CL3.3-211] ≥ 1.0E-10 ~~[6E-11]~~ amp	~~≥ [1E-10] amp~~
b. Low Power Reactor Trips Block, P-7						
1. Power Range Neutron Flux	1	~~41 per train~~	RT	SR 3.3.1.11 SR 3.3.1.13	≤ 12% RTP ~~NA~~	~~NA~~ [CL3.3-212]
2. Turbine Impulse Pressure	1	2	R	SR 3.3.1.10 SR 3.3.1.13	[X3.3-177] ≤ 12% Full Load	
c. Power Range Neutron Flux, P-8	1	4	RT	SR 3.3.1.11 SR 3.3.1.13	[X3.3-177] ≤ 11 ~~[50.2]~~% RTP	~~≤ [48]% RTP~~
d. Power Range Neutron Flux, P-9	1	4	RT	SR 3.3.1.11 SR 3.3.1.13	[X3.3-177] ≤ 12 ~~[52.2]~~% RTP	~~≤ [50]% RTP~~
e. Power Range Neutron Flux, P-10	1,2	4	QS	SR 3.3.1.11 SR 3.3.1.13	≥ 9 ~~[7.8]~~% RTP ~~and ≤ [12.2]% RTP~~	~~≥ [10]% RTP~~
~~f. Turbine Impulse Pressure, P-13~~	~~1~~	~~2~~	~~T~~	~~[SR 3.3.1.1]~~ ~~SR 3.3.1.10~~ ~~SR 3.3.1.13~~	~~≤ [12.2]% turbine power~~	[CL3.3-213] ~~≤ [10]% turbine power~~

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	TA3.3-176 ~~TRIP SETPOINT~~~~(a)~~

(continued)

~~(a) Reviewer's Note: Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.~~ TA3.3-176

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

(h~~j~~) Above the P-9 (Power Range Neutron Flux) interlock.

Table 3.3.1-1 (page 6 of 8)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	TA3.3-176 ~~TRIP SETPOINT~~~~(a)~~
179. Reactor Trip Breakers(jk) (RTBs)	1,2	2 trains	PR	SR 3.3.1.4	NA	~~NA~~
	3(ab), 4(ab), 5(ab)	2 trains	C	SR 3.3.1.4	NA	~~NA~~
1820. Reactor Trip Breaker Undervoltage and Shunt Trip Mechanisms (j)	1,2	1 each per RTB	SU	SR 3.3.1.4	NA	~~NA~~
	3(ab), 4(ab), 5(ab)	1 each per RTB	C	SR 3.3.1.4	NA	~~NA~~
1921. Automatic Trip Logic	1,2	2 trains	OQ	SR 3.3.1.5	NA	~~NA~~
	3(ab), 4(ab), 5(ab)	2 trains	C	SR 3.3.1.5	NA	~~NA~~

~~(a) Reviewer's Note: Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.~~ TA3.3-176

(ab) With ~~RTBs closed and~~ Rod Control System capable of rod withdrawal or one or more rods not fully inserted. TA3.3-151

(jk) Including any reactor trip bypass breakers that are racked in and closed for bypassing an RTB.

(j) Only applies to breakers OPERABLE and closed. PA3.3-208

Table 3.3.1-1 (page 7 of 8)
Reactor Trip System Instrumentation

Note 1: Overtemperature ΔT

The Overtemperature ΔT Function Allowable Value is defined by ~~shall not exceed~~ the following Trip Setpoint ~~by more than [3.8]% of ΔT span~~.
~~Delete NUREG-1431 equation:~~

$$\Delta T \frac{(1+\tau_1 s)}{(1+\tau_2 s)}\left(\frac{1}{1+\tau_3 s}\right) \le \Delta T_o \left\{K_1 - K_2 \frac{(1+\tau_4 s)}{(1+\tau_5 s)}\left[T\frac{1}{(1+\tau_6 s)} - T'\right] + K_3(P-P') - f_1(\Delta I)\right\}$$

~~Insert CTS equation:~~

$$\Delta T \le \Delta T_o\left\{K_1 - K_2(T-T')\left[\frac{(1+\tau_1 s)}{(1+\tau_2 s)}\right] + K_3(P-P') - f(\Delta I)\right\}$$

CL3.3-214

Where: ΔT is measured Reactor Coolant System (RCS) ΔT, °F.
ΔT_0 is the indicated ΔT at RTP, °F.
s is the Laplace transform operator, sec^{-1}.
T is the measured RCS average temperature, °F.
T' is the nominal T_{avg} at RTP, ≤ 567.3~~[588]~~°F.

P is the measured pressurizer pressure, psig
P' is the nominal RCS operating pressure, ≤ ~~[~~2235~~]~~ psig

CL3.3-215

K_1 ≤ 1.11~~[1.09]~~ K_2 ≥ ~~[~~0.009~~138]~~/°F K_3 = ~~[~~0.00056~~671]~~/psig
τ_1 ≥ 30~~[8]~~ sec τ_2 ≤ 4~~[3]~~ sec ~~τ_3 ≤ [2] sec~~
~~τ_4 ≥ [33] sec τ_5 ≤ [4] sec τ_6 ≤ [2] sec~~

CL3.3-214

f(ΔI) = 0.0150~~1.26~~{1235 + (q_t - q_b)}when q_t - q_b ≤ - 12~~[35]~~% RTP
0% of RTP when -12~~[35]~~% RTP < q_t - q_b ≤ 9~~[7]~~% RTP
0.0250~~-1.05~~{(q_t - q_b) - 9~~7~~}when q_t - q_b > 9~~[7]~~% RTP

CL3.3-214

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

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

Note 2: Overpower ΔT

The Overpower ΔT Function Allowable Value is defined by ~~shall not exceed~~ the following Trip Setpoint ~~by more than [3]% of ΔT span~~.

~~Delete NUREG-1431 equation:~~

$$\frac{(1+\tau_1 s)}{(1+\tau_2 s)}\left(\frac{1}{1+\tau_3 s}\right) \le \Delta T_0 \left\{K_4 - K_5 \frac{\tau_7 s}{1+\tau_7 s}\left(\frac{1}{1+\tau_6 s}\right) T - K_6\left[T\frac{1}{1+\tau_6 s} - T''\right] - f_2(\Delta I\right.$$

~~Insert CTS equation:~~

$$\Delta T \le \Delta T_0 \left\{K_4 - K_5 \frac{\tau_3 s\, T}{1+\tau_3 s} - K_6(T - T') - f(\Delta I)\right\}$$ CL3.3-214

Where: ΔT is measured RCS ΔT, °F.
ΔT_0 is the indicated ΔT at RTP, °F.
s is the Laplace transform operator, sec^{-1}.
T is the measured RCS average temperature, °F. CL3.3-215
T' is the nominal T_{avg} at RTP, ≤ 567.3 ~~[588]~~ °F.

K_4 ≤ ~~[~~1.109~~]~~
K_5 ≥ ~~[~~0.0275~~]~~/°F for increasing T_{avg} ; ~~[~~0~~]~~/°F for decreasing T_{avg}
K_6 ≥ ~~[~~0.00128~~]~~/°F when T > T' ; ~~[~~0~~]~~/°F when T ≤ T'
~~τ_1 ≥ [8] sec~~ ~~τ_2 ≤ [3] sec~~ τ_3 ≤ 10 ~~[2]~~ sec
~~τ_6 ≤ [2] sec~~ ~~τ_7 ≥ [10] sec~~

CL3.3-214

f(ΔI) = As defined in Note 1 ~~0% RTP for all ΔI.~~

3.3 INSTRUMENTATION

3.3.2 Engineered Safety Feature Actuation System (ESFAS) Instrumentation

LCO 3.3.2 The ESFAS instrumentation for each Function in Table 3.3.2-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.2-1.

ACTIONS

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

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One or more Functions with one or more required channels or trains inoperable.	A.1	Enter the Condition referenced in Table 3.3.2-1 for the channel(s) or train(s).	Immediately

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. One channel or train inoperable.	B.1	Restore channel or train to OPERABLE status.	48 hours
	<u>OR</u>		
	B.2.1	Be in MODE 3.	54 hours
	<u>AND</u>		
	B.2.2	Be in MODE 5.	84 hours
C. One train inoperable.	~~C.1~~	--------NOTE--------- One train may be bypassed for up to 8~~[4]~~ hours for surveillance testing provided the other train is OPERABLE. ---------------------	PA3.3-153 CL3.3-221
	C.1	Restore train to OPERABLE status.	6 hours
	<u>OR</u>		
	C.2.1	Be in MODE 3.	12 hours
	<u>AND</u>		
	C.2.2	Be in MODE 5.	42 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
D. One channel inoperable.	~~D.1~~	--------NOTE--------- The inoperable channel may be bypassed for up to ~~[4]~~ hours for surveillance testing of other channels. -------------------	PA3.3-153
	D.1	Place channel in trip.	6 hours
	OR		
	D.2.1	Be in MODE 3.	12 hours
	AND		
	D.2.2	Be in MODE 4.	18 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
E. Two One Containment Pressure channels inoperable.	~~E.1~~	--------NOTE--------- The tripped ~~One additional~~ channel may be bypassed for up to [4] hours for surveillance testing. ---------------------	PA3.3-153 CL3.3-222
	E.1.1	Verify one channel tripped per Required Action D.1.	Immediately
	AND		
	E.1.2	Place the other channel in bypass.	6 hours
	OR		
	E.2.1	Be in MODE 3.	12 hours
	AND		
	E.2.2	Be in MODE 4.	18 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~F. One channel or train inoperable.~~	~~F.1 Restore channel or train to OPERABLE status.~~	CL3.3-223 ~~48 hours~~
	~~OR~~	
	~~F.2.1 Be in MODE 3.~~	~~54 hours~~
	~~AND~~	
	~~F.2.2 Be in MODE 4.~~	~~60 hours~~

(continued)

F~~G~~. One train inoperable.	~~G.1~~ --------NOTE--------- One train may be bypassed for up to 8~~[4]~~ hours for surveillance testing provided the other train is OPERABLE. ---------------------	PA3.3-153 CL3.3-224
	F.1 Restore train to OPERABLE status.	6 hours
	OR	
	F~~G~~.2.1 Be in MODE 3.	12 hours
	AND	
	F~~G~~.2.2 Be in MODE 4.	18 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~H. One train inoperable.~~	~~H.1~~ ---------NOTE--------- ~~One train may be bypassed for up to [4] hours for surveillance testing provided the other train is OPERABLE.~~ ------------------------	CL3.3-225
	~~Restore train to OPERABLE status.~~	~~6 hours~~
	~~OR~~	
	~~H.2 Be in MODE 3.~~	~~12 hours~~

(continued)

G~~I~~. One channel inoperable.	~~I.1~~ ---------NOTE--------- The inoperable channel may be bypassed for up to ~~[4]~~ hours for surveillance testing of other channels. ---------------------	PA3.3-153
	G.1 Place channel in trip.	6 hours
	OR	
	G~~I~~.2 Be in MODE 3.	12 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
H~~J~~. One or both~~Main Feedwater Pumps trip~~ channel(s) inoperable on one bus.	---------NOTE--------- One inoperable channel may be bypassed for up to 4 hours for surveillance testing of other channels. ------------------------------ H~~J~~.1 Place channel(s) in trip~~Restore channel to OPERABLE status~~.	CL3.3-226 6~~48~~ hours
	OR	
	H~~J~~.2 Be in MODE 3.	12~~54~~ hours
I~~K~~. One channel or train inoperable.	I~~K~~.1 ~~---------NOTE---------~~ ~~One additional channel may be bypassed for up to [4] hours for surveillance testing.~~ ------------------------------ Enter applicable Condition(s) and Required Action(s) of Specification 3.7.5 for the associated Auxiliary Feedwater (AFW) train.~~Place channel in bypass.~~	CL3.3-227 Immediately ~~6 hours~~
	~~OR~~	

(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~K. (continued)~~	~~K.2.1 Be in MODE 3.~~ ~~AND~~ ~~K.2.2 Be in MODE 5.~~	~~12 hours~~ ~~42 hours~~
~~L. One channel inoperable.~~	~~L.1 Verify interlock is in required state for existing unit condition.~~ ~~OR~~ ~~L.2.1 Be in MODE 3.~~ ~~AND~~ ~~L.2.2 Be in MODE 4.~~	CL3.3-231 ~~1 hour~~ ~~7 hours~~ ~~13 hours~~

SURVEILLANCE REQUIREMENTS

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

SURVEILLANCE		FREQUENCY
SR 3.3.2.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.2.2	Perform ACTUATION LOGIC TEST.	31 days on a STAGGERED TEST BASIS
~~SR 3.3.2.3~~	~~-----NOTE-----~~ ~~The continuity check may be excluded.~~ ~~-----~~ ~~Perform ACTUATION LOGIC TEST.~~	CL3.3-232 ~~31 days on a STAGGERED TEST BASIS~~
~~SR 3.3.2.4~~	~~Perform MASTER RELAY TEST.~~	CL3.3-233 ~~31 days on a STAGGERED TEST BASIS~~
SR 3.3.2.~~8~~5	Perform COT.	92 days

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
~~SR 3.3.2.6~~	~~Perform SLAVE RELAY TEST.~~	CL3.3-233 ~~[92] days~~ (continued)
~~SR 3.3.2.7~~	~~-------------------NOTE-------------------~~ ~~Verification of relay setpoints not required.~~ ~~--~~ ~~Perform TADOT.~~	CL3.3-234 ~~[92] days~~
SR 3.3.2.4~~8~~	-------------------NOTE------------------- Verification of setpoint not required ~~for manual initiation functions~~. -- Perform TADOT.	CL3.3-235 X3.3-172 24~~[18]~~ months
SR 3.3.2.5	-------------------NOTE------------------- Verification of setpoint not required. -- Perform TADOT.	CL3.3-236 24 months on a STAGGERED TEST BASIS

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.2.69	-------------------NOTE------------------- This Surveillance shall include verification that the time constants are adjusted to the prescribed values. -- Perform CHANNEL CALIBRATION.	X3.3-172 24[18] months
SR 3.3.2.10	-------------------NOTE------------------- Not required to be performed for the turbine driven AFW pump until [24] hours after SG pressure is ≥ [1000] psig. -- Verify ESFAS RESPONSE TIMES are within limit.	CL3.3-237 [18] months on a STAGGERED TEST BASIS

(continued)

SR 3.3.2.11	-------------------NOTE------------------- Verification of setpoint not required. -- Perform TADOT.	CL3.3-231 Once per reactor trip breaker cycle

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

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	[TA3.3-176] ~~TRIP SETPOINT~~ ~~(a)~~
1. Safety Injection						
a. Manual Initiation	1,2,3,4	2	B	[CL3.3-236] SR 3.3.2.~~5~~8	NA	~~NA~~
b. Automatic Actuation Relay Logic ~~and Actuation Relays~~ [CL3.3-238]	1,2,3,4	2 trains	C	SR 3.3.2.2 [CL3.3-233] ~~SR 3.3.2.4~~ ~~SR 3.3.2.6~~	NA	~~NA~~
c. High Containment Pressure ~~High 1~~ [PA3.3-241]	1,2,3	3	D	SR 3.3.2.1 SR 3.3.2.~~3~~5 SR 3.3.2.~~6~~9 [CL3.3-237] ~~SR 3.3.2.10~~	≤ 4.0 ~~[3.86]~~ psig	~~≤ [3.6] psig~~
d. Pressurizer Low Pressure ~~Low~~ [PA3.3-241]	1,2,3(ab)	~~[3]~~	D	SR 3.3.2.1 SR 3.3.2.~~3~~5 SR 3.3.2.~~6~~9 [CL3.3-237] ~~SR 3.3.2.10~~	[X3.3-177] ≥ 1760 ~~[1839]~~ psig	~~≥ [1850] psig~~
e. Steam Line Low Pressure						
~~(1) Low~~	1,2, 3~~(ab)~~	3 per steam line	D	SR 3.3.2.1 SR 3.3.2.~~3~~5 SR 3.3.2.~~6~~9 [CL3.3-237] ~~SR 3.3.2.10~~	[CL3.3-242] ≥ 500 ~~[635]~~(bc) psig	~~≥ [675](c) psig~~
~~(2) High Differential Pressure Between Steam Lines~~	~~1,2,3~~	~~3 per steam line~~	~~D~~	~~[SR 3.3.2.1]~~ ~~SR 3.3.2.5~~ ~~SR 3.3.2.9~~ ~~SR 3.3.2.10~~	[CL3.3-244] ~~≤ [106] psig~~	~~≤ [97] psig~~
~~f. High Steam Flow in Two Steam Lines~~	~~1,2,3(d)~~	~~2 per steam line~~	~~D~~	~~SR 3.3.2.1~~ ~~SR 3.3.2.5~~ ~~SR 3.3.2.9~~ ~~SR 3.3.2.10~~	[CL3.3-244] ~~(e)~~	~~(f)~~

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	TA3.3-176 TRIP SETPOINT[a]
Coincident with T_{avg} – Low Low	1,2,3[d]	1 per loop	D	SR 3.3.2.1 SR 3.3.2.5 SR 3.3.2.9 SR 3.3.2.10	≥ [550.6]°F	≥ [553]°F

(continued)

TA3.3-176

(a) Reviewer's Note: Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.

(ab) Above the P-11 (Pressurizer Pressure) interlock ≥ 2000 psig. CL3.3-245

(bc) Time constants used in the lead/lag controller are $t_1 \geq$ 12 [50] seconds and $t_2 \leq$ 2 [5] seconds. CL3.3-242

(d) Above the P-12 (T_{avg} – Low Low) interlock.

(e) Less than or equal to a function defined as ΔP corresponding to [44]% full steam flow below [20]% load, and ΔP increasing linearly from [44]% full steam flow at [20]% load to [114]% full steam flow at [100]% load, and ΔP corresponding to [114]% full steam flow above 100% load. CL3.3-244

(f) Less than or equal to a function defined as ΔP corresponding to [40]% full steam flow between [0]% and [20]% load and then a ΔP increasing linearly from [40]% steam flow at [20]% load to [110]% full steam flow at [100]% load.

Table 3.3.2-1 (page 2 of 8)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	TA3.3-176 TRIP SETPOINT(a)
1. Safety Injection (continued)						
g. High Steam Flow in Two Steam Lines	1,2,3(d)	2 per steam line	D	SR 3.3.2.1 SR 3.3.2.5 SR 3.3.2.9 SR 3.3.2.10	CL3.3-244 (e)	(f)
Coincident with Steam Line Pressure - Low	1,2,3(d)	1 per steam line	D	SR 3.3.2.1 SR 3.3.2.5 SR 3.3.2.9 SR 3.3.2.10	≥ [635](c) psig	≥ [675] psig
2. Containment Spray						
a. Manual Initiation	1,2,3,4	CL3.3-246 2 per train, 2 trains	B	SR 3.3.2.48	NA	NA
b. Automatic Actuation Relay Logic and Actuation Relays CL3.3-238	1,2,3,4	2 trains	C	SR 3.3.2.2 CL3.3-233 SR 3.3.2.4 SR 3.3.2.6	NA	NA
c. High-High Containment Pressure						
High - 3 (High High)	1,2,3	4	E	SR 3.3.2.1 SR 3.3.2.5 SR 3.3.2.9 SR 3.3.2.10	CL3.3-247 ≤ [12.31] psig	≤ [12.05] psig
High - 3 (Two Loop Plants)	1,2,3	[3] sets of [2]	D E CL3.3-222	SR 3.3.2.1 SR 3.3.2.35 SR 3.3.2.69 CL3.3-237 SR 3.3.2.10	≤ 23[12.31] psig	≤ [12.05] psig

(continued)

(a) Reviewer's Note: Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit. TA3.3-176

(c) Time constants used in the lead/lag controller are $t_1 \geq [50]$ seconds and $t_2 \leq [5]$ seconds. Not used on this page

(d) Above the P-12 (T_{avg} - Low Low) interlock.

(e) Less than or equal to a function defined as ΔP corresponding to [44]% full steam flow below [20]% load, and ΔP increasing linearly from [44]% full steam flow at [20]% load to [114]% full steam flow at [100]% load, and ΔP corresponding to [114]% full steam flow above 100% load. CL3.3-244

(f) Less than or equal to a function defined as ΔP corresponding to [40]% full steam flow between [0]% and [20]%

~~load and then a ΔP increasing linearly from [40]% steam flow at [20]% load to [110]% full steam flow at [100]% load.~~

Table 3.3.2-1 (page 3 of 8)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	TA3.3-176 ~~TRIP SETPOINT~~~~(a)~~
3. Containment Isolation						
~~a. Phase A Isolation~~						
a. ~~(1)~~ Manual Initiation	1,2,3,4	2	B	SR 3.3.2.48	NA	~~NA~~
b. ~~(2)~~ Automatic Actuation Relay Logic ~~and Actuation Relays~~ CL3.3-238	1,2,3,4	2 trains	C	SR 3.3.2.2 CL3.3-233 ~~SR 3.3.2.4~~ ~~SR 3.3.2.6~~	NA	~~NA~~
c. ~~(3)~~ Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements.					
~~b. Phase B Isolation~~						
~~(1) Manual Initiation~~	~~1,2,3,4~~	~~2 per train, 2 trains~~	~~B~~	~~SR 3.3.2.8~~	CL3.3-252 ~~NA~~	~~NA~~
~~(2) Automatic Actuation Logic and Actuation Relays~~	~~1,2,3,4~~	~~2 trains~~	~~C~~	~~SR 3.3.2.2~~ ~~SR 3.3.2.4~~ ~~SR 3.3.2.6~~	~~NA~~	~~NA~~
~~(3) Containment Pressure~~						
~~High 3 (High High)~~	~~1,2,3~~	~~[4]~~	~~E~~	~~SR 3.3.2.1~~ ~~SR 3.3.2.5~~ ~~SR 3.3.2.9~~ ~~SR 3.3.2.10~~	~~≤ [12.31] psig~~	~~≤ [12.05] psig~~
4. Steam Line Isolation						CL3.3-223
~~a. Manual Initiation~~	~~1,2(i), 3(i)~~	~~2~~	~~F~~	~~SR 3.3.2.8~~	~~NA~~	~~NA~~

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	TA3.3-176 ~~TRIP SETPOINT~~ ~~(a)~~
ab. Automatic Actuation Relay Logic ~~and Actuation Relays~~ CL3.3-238	1,2 (ci), 3 (ci)	2 trains	FG	SR 3.3.2.2 CL3.3-233 ~~SR 3.3.2.4~~ ~~SR 3.3.2.6~~	NA	~~NA~~

(continued)

~~(a) Reviewer's Note: Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.~~ TA3.3-176

(ci) Except when both ~~all~~ Main Steam Isolation Valves (MSIVs) are closed ~~and [de-activated]~~. CL3.3-254

Table 3.3.2-1 (page 4 of 8)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	TA3.3-176 ~~TRIP SETPOINT(a)~~
4. Steam Line Isolation (continued)						
~~b~~c. ~~High~~ — CL3.3-241 High Containment Pressure — ~~High 2~~	1,2(~~c~~i), 3(~~c~~i)	CL3.3-253 3~~[4]~~	D	SR 3.3.2.1 SR 3.3.2.~~3~~5 SR 3.3.2.~~6~~9 CL3.3-237 ~~SR 3.3.2.10~~	≤ 17~~[6.61]~~ psig	~~≤ [6.35] psig~~
~~d. Steam Line Pressure~~					CL3.3-255	
~~(1) Low~~	~~1,2(i), 3(b)(i)~~	~~3 per steam line~~	~~D~~	~~SR 3.3.2.1~~ ~~SR 3.3.2.5~~ ~~SR 3.3.2.9~~ ~~SR 3.3.2.10~~	~~≥ [635](c) psig~~	~~≥ [675](c) psig~~
~~(2) Negative Rate — High~~	~~3(g)(i)~~	~~3 per steam line~~	~~D~~	~~SR 3.3.2.1~~ ~~SR 3.3.2.5~~ ~~SR 3.3.2.9~~ ~~SR 3.3.2.10~~	~~≤ [121.6](h) psi/sec~~	~~≤ [110](h) psi/sec~~
~~e. High Steam Flow in Two Steam Lines~~	~~1,2(i), 3(i)~~	~~2 per steam line~~	~~D~~	~~SR 3.3.2.1~~ ~~SR 3.3.2.5~~ ~~SR 3.3.2.9~~ ~~SR 3.3.2.10~~	~~(e)~~	~~(f)~~
~~Coincident with T_{avg} — Low Low~~	~~1,2(i), 3(d)(i)~~	~~1 per loop~~	~~D~~	~~SR 3.3.2.1~~ ~~SR 3.3.2.5~~ ~~SR 3.3.2.9~~ ~~SR 3.3.2.10~~	~~≥ [550.6]°F~~	~~≥ [553]°F~~

(continued)

~~(a) Reviewer's Note: Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.~~ TA3.3-176
(~~a~~b) ~~Above the P-11 (~~Pressurizer Pressure~~) interlock~~ ≥ 2000 psig.
(~~b~~c) Time constants used in the lead/lag controller are $t_1 \geq [50]$ seconds and $t_2 \leq [5]$ seconds. Not used this page
~~(d) Above the P-12 (T_{avg} — Low Low) interlock.~~
~~(e) Less than or equal to a function defined as ΔP corresponding to [44]% full steam flow below [20]% load, ΔP increasing linearly from [44]% full steam flow at [20]% load to [114]% full steam flow at [100]% load, and ΔP corresponding to [114]% full steam flow above 100% load.~~ CL3.3-244
~~(f) Less than or equal to a function defined as ΔP corresponding to [40]% full steam flow between [0]% and [20]% load and then a ΔP increasing linearly from [40]% steam flow at [20]% load to [110]% full steam flow at [100]% load.~~
~~(g) Below the P-11 (Pressurizer Pressure) interlock.~~
~~(h) Time constant utilized in the rate/lag controller is ≤ [50] seconds.~~
(~~c~~i) Except when both~~all~~ MSIVs are closed ~~and [de-activated]~~. CL3.3-254

Table 3.3.2-1 (page 5 of 8)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	TA3.3-176 ~~TRIP SETPOINT(a)~~
4. Steam Line Isolation (continued)						
~~f. High Steam Flow in Two Steam Lines~~	~~1,2(i), 3(i)~~	~~2 per steam line~~	~~D~~	~~SR 3.3.2.1~~ ~~SR 3.3.2.5~~ ~~SR 3.3.2.9~~ ~~SR 3.3.2.10~~	~~(e)~~	~~(f)~~
~~Coincident with Steam Line Pressure — Low~~	~~1,2,(i)~~ ~~3(i)~~	~~1 per steam line~~	~~D~~	~~SR 3.3.2.1~~ ~~SR 3.3.2.5~~ ~~SR 3.3.2.9~~ ~~SR 3.3.2.10~~	~~≥ [635](c) psig~~	~~≥ [675](c) psig~~
e~~g~~. Low-Low T_{avg} ~~High Steam Flow~~ X3.3-239	CL3.3-256 1,2(c~~i~~), 3(c~~i~~)(d)	4 ~~2 per~~ steam CL3.3-253 ~~line~~	D	SR 3.3.2.1 SR 3.3.2.3~~5~~ SR 3.3.2.6~~9~~ CL3.3-237 ~~SR 3.3.2.10~~	X3.3-177 ≥ 542 °F ~~≤ [25]% of full steam flow at no load steam pressure~~	~~≤ [ ] full steam flow at no load steam pressure~~
Coincident with Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements.					
~~and~~						
~~Coincident with T~~avg ~~— Low Low~~ X3.3-239	~~1,2(i), 3(d)(i)~~	~~[2] per loop~~	~~D~~	~~SR 3.3.2.1~~ ~~SR 3.3.2.5~~ ~~SR 3.3.2.9~~ ~~SR 3.3.2.10~~	~~≥ [550.6]°F~~	~~≥ [553]°F~~
f~~h~~. High High Steam Flow	1,2(c~~i~~), 3(c~~i~~)	2 per steam line	D	SR 3.3.2.1 SR 3.3.2.3~~5~~ SR 3.3.2.6~~9~~ CL3.3-237 ~~SR 3.3.2.10~~	CL3.3-242 ≤ 4.5E6 lb/hr at 735 psig ~~[130]% of full steam flow at full load steam pressure~~	~~≤ [ ] of full steam flow at full load steam pressure~~
Coincident with Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements.					

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	TA3.3-176 TRIP SETPOINT(a)

(continued)

(a) Reviewer's Note: Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit. TA3.3-176
(ci) Except when bothall MSIVs are closed and [de-activated]. CL3.3-254
(dd) Reactor Coolant System (RCS) T_{avg} ≥ Above 520°F the P-12 (T_{avg} Low Low) interlock. CL3.3-256

Table 3.3.2-1 (page 6 of 8)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	TA3.3-176 TRIP SETPOINT(a)
5. Turbine Trip and Feedwater Isolation CL3.3-257						
a. Automatic Actuation Relay Logic and Actuation Relays CL3.3-238	1,2(e j), [3](e j)	2 trains	CL3.3-225 F H [G]	SR 3.3.2.2 CL3.3-233 SR 3.3.2.4 SR 3.3.2.6	NA	NA
b. High-High Steam Generator (SG) Water Level - High High (P-14) CL3.3-241	1,2(e j), CL3.3-258 [3](j)	[3] per SG	CL3.3-225 G I [D]	SR 3.3.2.1 SR 3.3.2.35 SR 3.3.2.69 CL3.3-237 SR 3.3.2.10	X3.3-261 ≤ 90[84.2] %	≤ [82.4]%
c. Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements.					
6. Auxiliary Feedwater						
a. Automatic Actuation Logic and Actuation Relays (Solid State Protection System)	1,2,3	2 trains	G	SR 3.3.2.2 SR 3.3.2.4 SR 3.3.2.6	CL3.3-262 NA	NA
ab. Automatic Actuation Relay Logic and Actuation Relays (Balance of Plant ESFAS) CL3.3-238	1,2,3	2 trains	CL3.3-227 I G	CL3.3-232 SR 3.3.2.23	NA	NA
bc. Low-Low SG Water Level - Low Low CL3.3-241	1,2,3	[3] per SG	D	SR 3.3.2.1 SR 3.3.2.35 SR 3.3.2.69 CL3.3-237 SR 3.3.2.10	CL3.3-203 ≥ 5[30.4]%	≥ [32.2]%

(continued)

TA3.3-176

(a) Reviewer's Note: Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.

(ef) Except when all MFIVs, Main Feedwater Regulation Valves (MFRVs), [and MFRV associated bypass valves] are closed and in manual [de-activated] [or isolated by a closed non-automatic manual valve]. CL3.3-273

Table 3.3.2-1 (page 7 of 8)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	TA3.3-176 TRIP SETPOINT[a]
6. Auxiliary Feedwater (continued)						
Ed. Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements.					
e. Loss of Offsite Power	1,2,3	[3] per bus	F	SR 3.3.2.7 SR 3.3.2.9 SR 3.3.2.10	CL3.3-263 ≥ [2912] V with ≤ 0.8 sec time delay	≥ [2975] V with ≤ 0.8 sec time delay
df. Undervoltage CL3.3-241 on Buses 11 and 12 (21 and 22) Reactor Coolant Pump(f)	1,2	CL3.3-202 2 [3] per bus	CL3.3-226 H I	CL3.3-237 SR 3.3.2.47 SR 3.3.2.69 SR 3.3.2.10	X3.3-177 ≥ 76 [69]% bus voltage	≥ [70]% bus voltage
Eg. Trip of CL3.3-241 both all Main Feedwater Pumps	1,2(g)	[2] per pump	CL3.3-227 I J	SR 3.3.2.48 CL3.3-265 SR 3.3.2.9 SR 3.3.2.10	CL3.3-265 NA ≥ [ ] psig	≥ [ ] psig
h. Auxiliary Feedwater Pump Suction Transfer on Suction Pressure - Low	1,2,3	[2]	F	SR 3.3.2.1 SR 3.3.2.7 SR 3.3.2.9	CL3.3-266 ≥ [20.53] [psia]	≥ [ ] [psia]
7. Automatic Switchover to Containment Sump						
a. Automatic Actuation Logic and Actuation Relays	1,2,3,4	2 trains	C	SR 3.3.2.2 SR 3.3.2.4 SR 3.3.2.6	CL3.3-267 NA	NA
b. Refueling Water Storage Tank (RWST) Level - Low Low	1,2,3,4	4	K	SR 3.3.2.1 SR 3.3.2.5 SR 3.3.2.9 SR 3.3.2.10	≥ [15]% and ≤ [ ]%	≥ [ ] and ≤ [ ]
Coincident with Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements.					

(continued)

~~(a) Reviewer's Note: Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.~~ TA3.3-176

(f) Start of Turbine Driven Pump only. CL3.3-271

(g) This Function may be bypassed during alignment and operation of the AFW System for SG level control. CL3.3-272

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

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	TA3.3-176 TRIP SETPOINT(a)
7. Automatic Switchover to Containment Sump (continued)					CL3.3-267	
c. RWST Level — Low Low	1,2,3,4	4	K	SR 3.3.2.1 SR 3.3.2.5 SR 3.3.2.9 SR 3.3.2.10	≥ [15]%	≥ [18]%
Coincident with Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements.					
and						
Coincident with Containment Sump Level — High	1,2,3,4	4	K	SR 3.3.2.1 SR 3.3.2.5 SR 3.3.2.9 SR 3.3.2.10	≥ [30] in. above el. [703] ft	≥ [ ] in. above el. [ ] ft
8. ESFAS Interlocks					CL3.3-231	
a. Reactor Trip, P-4	1,2,3	1 per train, 2 trains	F	SR 3.3.2.11	NA	NA
b. Pressurizer Pressure, P-11	1,2,3	3	L	SR 3.3.2.1 SR 3.3.2.5 SR 3.3.2.9	≤ [1996] psig	≤ [ ] psig
c. T_{avg} — Low Low, P-12	1,2,3	[1] per loop	L	SR 3.3.2.1 SR 3.3.2.5 SR 3.3.2.9	≥ [550.6]°F	≥ [553]°F

(a) Reviewer's Note: Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit. TA3.3-176

3.3 INSTRUMENTATION

3.3.3 EventPost Accident Monitoring (EPAM) Instrumentation CL3.3-281

LCO 3.3.3 The EPAM instrumentation for each Function in Table 3.3.3-1 shall be OPERABLE.

APPLICABILITY: MODES 1, and 2, and 3. CL3.3-282

ACTIONS

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

1. LCO 3.0.4 is not applicable.
2. Separate Condition entry is allowed for each Function. CL3.3-283
3. Required Core Exit Thermocouple (CET) Channels shall be OPERABLE prior to MODE 2 following each refueling outage.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. ----------NOTE---------- Not applicable to CETs. ------------------------ One or more Functions with one required channel inoperable.	A.1 Restore required channel to OPERABLE status.	30 days CL3.3-283

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME	
B. One or more required CETs channel(s) inoperable. AND At least 4 CETs OPERABLE in the center region of the core. AND At least one CET OPERABLE in each quadrant of the outside core region.	B.1 Restore required CET channel(s) to OPERABLE status.	30 days	CL3.3-283
CB. Required Action and associated Completion Time of Condition A or B not met.	CB.1 Submit a report to the NRC. ~~Initiate action in accordance with Specification 5.6.8~~.	14 days ~~Immediately~~	CL3.3-284
DC. -------NOTE------- Not applicable to hydrogen monitor or CET channels. --------------------- One or more Functions with two required channels inoperable.	DC.1 Restore one channel to OPERABLE status.	7 days	CL3.3-283

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
ED. Two hydrogen monitor channels inoperable.	E D.1 Restore one hydrogen monitor channel to OPERABLE status.	72 hours
F. Three or more required CET channels inoperable in one or more quadrants. AND Less than four CET channels OPERABLE in the center region of the core.	F.1 Restore required inoperable channels to OPERABLE status.	7 days
G. Three or more required CET channels inoperable in one or more quadrants. AND Less than one CET channel OPERABLE in each quadrant of the outside core region.	G.1 Restore required inoperable channels to OPERABLE status.	7 days

CL3.3-283

CL3.3-283

ACTIONS (continued)

CONDITION		REQUIRED ACTION		COMPLETION TIME
HE.	Required Action and associated Completion Time of Condition C or D, E, F or G not met.	HE.1	Enter the Condition referenced in Table 3.3.3-1 for the channel.	Immediately
IF.	As required by Required Action HE.1 and referenced in Table 3.3.3-1.	IF.1 AND F.2	Be in MODE 3. Be in MODE 4.	6 hours 12 hours
JG.	As required by Required Action HE.1 and referenced in Table 3.3.3-1.	JG.1	Submit a report to the NRC. Initiate action in accordance with Specification 5.6.8.	14 days Immediately

CL3.3-285

CL3.3-284

SURVEILLANCE REQUIREMENTS

------------------------------------NOTE------------------------------------
SR 3.3.3.1 and SR 3.3.3.2 apply to each EPAM instrumentation Function in Table 3.3.3-1, except Item 9. SR 3.3.3.3 applies only to Item 9. PA3.3-287

SURVEILLANCE		FREQUENCY
SR 3.3.3.1	Perform CHANNEL CHECK for each required instrumentation channel that is normally energized.	31 days
SR 3.3.3.2	-------------------NOTE------------------- Neutron detectors are excluded from CHANNEL CALIBRATION. -- Perform CHANNEL CALIBRATION.	24 [18] months
SR 3.3.3.3	-------------------NOTE------------------- Verification of setpoint is not required. -- Perform TADOT.	24 months

X3.3-172

PA3.3-287

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

CL3.3-281

FUNCTION	REQUIRED CHANNELS	CL3.3-283 CONDITION REFERENCED FROM REQUIRED ACTION HE.1
1. Power Range Neutron Flux (Logarithmic Scale) CL3.3-292	2	IF
2. Source Range Neutron Flux (Logarithmic Scale) CL3.3-292	2	IF
	CL3.3-293	
3. Reactor Coolant System (RCS) Hot Leg Temperature	2 per loop	IF
4. RCS Cold Leg Temperature	2 per loop	IF
5. RCS Pressure (Wide Range)	2	IF
6. Reactor Vessel Water Level	2	JG
7. Containment Sump Water Level (Wide Range)	2	IF
8. Containment Pressure (Wide Range)	2	IF
		TA3.3-294 CL3.3-295
9. Penetration Flow Path Automatic Containment Isolation Valve Position	2 per penetration flow path(a)(b)	IF
10. Containment Area Radiation (High Range)	2	JG
11. Hydrogen Monitors	2	IF
12. Pressurizer Level	2	IF
13. Steam Generator Water Level (Wide Range)	2 per steam generator	IF
14. Condensate Storage Tank Level	2	IF
15. Core Exit Temperature — Quadrant [1]	4 per quadrant 2(c)	IF CL3.3-283
		CL3.3-296
16. Refueling Water Storage Tank Level Core Exit Temperature — Quadrant [2]	2(c)	IF
17. Core Exit Temperature — Quadrant [3]	2(c)	F
18. Core Exit Temperature — Quadrant [4]	2(c)	F
		CL3.3-296
19. Auxiliary Feedwater Flow	2	F

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

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

(c) A channel consists of one ~~two~~ core exit thermocouples (CETs). CL3.3-283

~~Reviewer's Note: Table 3.3.3-1 shall be amended for each unit as necessary to list:~~ PA3.3-297

~~(1) All Regulatory Guide 1.97, Type A instruments, and~~

~~(2) All Regulatory Guide 1.97, Category I, non-Type A instruments in accordance with the unit's Regulatory Guide 1.97, Safety Evaluation Report.~~

CL3.3-353

3.3 INSTRUMENTATION

3.3.4 Remote Shutdown System

LCO 3.3.4 The Remote Shutdown System Functions in Table 3.3.4-1 shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

NOTES

1. LCO 3.0.4 is not applicable.

2. Separate Condition entry is allowed for each Function.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more required Functions inoperable.	A.1 Restore required Function to OPERABLE status.	30 days
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

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
[SR 3.3.4.1	Perform CHANNEL CHECK for each required instrumentation channel that is normally energized.	31 days]
SR 3.3.4.2	Verify each required control circuit and transfer switch is capable of performing the intended function.	[18] months
SR 3.3.4.3	-------------------NOTE------------------- Neutron detectors are excluded from CHANNEL CALIBRATION. --- Perform CHANNEL CALIBRATION for each required instrumentation channel.	[18] months
[SR 3.3.4.4	Perform TADOT of the reactor trip breaker open/closed indication.	18 months]

Table 3.3.4-1 (page 1 of 1)
Remote Shutdown System Instrumentation and Controls

NOTE
Reviewer's Note: This table is for illustration purposes only. It does not attempt to encompass every Function used at every unit, but does contain the types of Functions commonly found.

FUNCTION/INSTRUMENT OR CONTROL PARAMETER	REQUIRED NUMBER OF FUNCTIONS
1. Reactivity Control	
a. Source Range Neutron Flux	[1]
b. Reactor Trip Breaker Position	[1 per trip breaker]
c. Manual Reactor Trip	[2]
2. Reactor Coolant System (RCS) Pressure Control	
a. Pressurizer Pressure or RCS Wide Range Pressure	[1]
b. Pressurizer Power Operated Relief Valve (PORV) Control and Block Valve Control	[1, controls must be for PORV & block valves on same line]
3. Decay Heat Removal via Steam Generators (SGs)	
a. RCS Hot Leg Temperature	[1 per loop]
b. RCS Cold Leg Temperature	[1 per loop]
c. AFW Controls Condensate Storage Tank Level	[1]
d. SG Pressure	[1 per SG]
e. SG Level or AFW Flow	[1 per SG]
4. RCS Inventory Control	
a. Pressurizer Level	[1]
b. Charging Pump Controls	[1]

3.3 INSTRUMENTATION

PA3.3-311

3.3.45 4 kV Safeguards Bus VoltageLoss of Power (LOP) Diesel Generator (DG) Start Instrumentation

LCO 3.3.45 The following 4 kV safeguards bus voltage instrumentation Functions shall be OPERABLE:

a. TwoThree channels per bus of the underloss of voltage Function; and

CL3.3-313

b. Twothree channels per bus of the degraded voltage Function shall be OPERABLE; and

X3.3-312

c. Two trains of automatic load sequencers.

APPLICABILITY: MODES 1, 2, 3, and 4,
When associated Diesel Generator (DG) is required to be OPERABLE by LCO 3.8.2, "AC Sources – Shutdown."

ACTIONS

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

CONDITION	REQUIRED ACTION	COMPLETION TIME	
A. One or more Functions a or b or both with one channel per bus inoperable.	A.1 ---------NOTE--------- The inoperable channel may be bypassed for up to 4 hours for surveillance testing of other channels. ------------------------- Place channel in bypasstrip.	6 hours	CL3.3-315
B. One or more Functions with two or more channels per bus inoperable.	B.1 Restore all but one channel to OPERABLE status.	1 hour	CL3.3-316

(continued)

BC. ------NOTE------ Only applicable in MODE 1, 2, 3, or 4. ------------------- Required Action and associated Completion Time of Condition A not met. OR Function a or b or both with two channels per bus inoperable.	BC.1 Enter applicable Condition(s) and Required Action(s) for the associated DG made inoperable by LOP DG start instrumentation. Perform SR 3.3.4.1 for OPERABLE automatic load sequencer.	Immediately 6 hours AND Once per 24 hours thereafter	CL3.3-317

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. (continued) OR One required automatic load sequencer inoperable.	AND		
	B.2	Establish offsite paths block loading capability for associated 4 kV safeguards bus.	8 hours
	AND		
	B.3	Verify operability of offsite paths for associated 4kV safeguards bus.	8 hours AND Once per 8 hours thereafter
	AND		
	B.4	Restore automatic load sequencer to OPERABLE status.	7 days
C. Required Action and associated Completion Time of Condition B not met.	C.1	Be in MODE 3.	6 hours
	AND		
	C.2	Be in MODE 5.	36 hours

X3.3-312

X3.3-312

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. ---------NOTE--------- Only applicable in MODES 5 or 6. ------------------------ Required Action and associated Completion Time of Condition A not met. OR Function a or b or both with two channels per bus inoperable. OR One required automatic load sequencer inoperable.	D.1 Enter applicable LCO 3.8.2 Condition(s) and Required Action(s) for the associated DG.	Immediately X3.3-312

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
~~SR 3.3.5.1 Perform CHANNEL CHECK.~~	CL3.3-321 ~~12 hours~~
SR 3.3.45.12 Perform CTADOT.	CL3.3-322 [31 days]

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
		(continued)
SR 3.3.45.23	Perform CHANNEL CALIBRATION with [setpoint Allowable Value] [Trip Setpoint and Allowable Value] as follows: a. Under Loss of voltage Allowable Value ≥ 3016[2912] V and ≤ 3224 V with an undervoltage time delay of 4[0.8] ± 1.5[ ] seconds. b. Loss of voltage Trip Setpoint ≥ [2975] V with a time delay of [0.8] ± [ ] second. Degraded voltage Allowable Value ≥ 3944[3683] V and ≤ 4002 V with a degraded voltage time delay of 8[20] ± 0.5[ ] seconds and degraded voltage DG start time delay of 60 ± 3 seconds. Degraded voltage Trip Setpoint ≥ [3746] V with a time delay of [20] ± [ ] seconds.	24 [18] months

X3.3-172

CL3.3-323

3.3 INSTRUMENTATION

3.3.56 Containment Ventilation Purge and Exhaust Isolation Instrumentation

CL3.3-331

LCO 3.3.56 The Containment Ventilation Purge and Exhaust Isolation instrumentation for each Function in Table 3.3.56-1 shall be OPERABLE.

CL3.3-331

APPLICABILITY: According to Table 3.3.5-1MODES 1, 2, 3, and 4, During CORE ALTERATIONS, During movement of irradiated fuel assemblies within containment.

TA3.3-332

ACTIONS

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

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One radiation monitoring train channel inoperable.	A.1 Place and maintain containment inservice (low flow) purge valves in closed position Restore the affected channel to OPERABLE status.	4 hours

CL3.3-333

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. ---------NOTE--------- Only applicable in MODE 1, 2, 3, or 4. --------------------- One or more Functions (except radiation monitors) with one or more manual or automatic actuation trains inoperable. <u>OR</u> Two ~~or more~~ radiation monitoring trains ~~channels~~ inoperable. <u>OR</u> Required Action and associated Completion Time of Condition A not met.	B.1	Place and maintain containment inservice (low flow) purge valves in closed position.	Immediately CL3.3-333
	<u>OR</u>		
	B.2	Enter applicable Conditions and Required Actions of LCO 3.6.3, "Containment Isolation Valves," for containment inservice (low flow) purge ~~and exhaust isolation~~ valves made inoperable by isolation instrumentation.	Imme diately CL3.3-331

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. ---------NOTE--------- Only applicable during CORE ALTERATIONS or movement of irradiated fuel assemblies within containment. ---------------------	C.1 Place and maintain containment inservice (low flow) purge ~~and exhaust~~ valves in closed position.	Immediately CL3.3-331
	OR	
One or more Functions (except radiation monitors) with one or more manual or automatic actuation trains inoperable. OR Two ~~or more~~ radiation monitoring trains ~~channels~~ inoperable. OR Required Action and associated Completion Time for Condition A not met.	C.2 Enter applicable Conditions and Required Actions of LCO 3.9.4, "Containment Penetrations," for containment inservice (low flow) purge ~~and exhaust isolation~~ valves made inoperable by isolation instrumentation.	Immediately CL3.3-333

SURVEILLANCE REQUIREMENTS

-----------------------------------NOTE-----------------------------------
Refer to Table 3.3.56-1 to determine which SRs apply for each Containment Ventilation ~~Purge and Exhaust~~ Isolation Function. CL3.3-331

SURVEILLANCE		FREQUENCY
SR 3.3.56.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.56.2	Perform ACTUATION LOGIC TEST.	31 days on a STAGGERED TEST BASIS
~~SR 3.3.6.3~~	~~Perform MASTER RELAY TEST.~~	~~31 days on a STAGGERED TEST BASIS~~ CL3.3-233
SR 3.3.56.34	Perform COT.	3192 days CL3.3-335
~~SR 3.3.6.5~~	~~Perform SLAVE RELAY TEST.~~	~~[92] days~~ CL3.3-233
SR 3.3.56.46	--------------------NOTE-------------------- Verification of setpoint is not required. -- Perform TADOT.	24~~[18]~~ months X3.3-172

SURVEILLANCE	FREQUENCY
SR 3.3.56.57 Perform CHANNEL CALIBRATION.	24 ~~[18]~~ months X3.3-172

Table 3.3.56-1 (page 1 of 1)
Containment Ventilation Purge and Exhaust Isolation Instrumentation

FUNCTION	TA3.3-332 APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE TRIP SETPOINT TA3.3-176
1. Manual Initiation	1(a), 2(a), 3(a), 4(a), (b)	2	SR 3.3.54 6.6	NA
2. Automatic CL3.3-337 Actuation Relay Logic and Actuation Relays	1(a), 2(a), 3(a), 4(a), (b)	2 trains	SR 3.3.56.2 CL3.3-233 SR 3.3.6.3 SR 3.3.6.5	NA
3. High Radiation in Exhaust Air Containment Radiation	1(a), 2(a), 3(a), 4(a), (b)	CL3.3-333 2 trains	SR 3.3.5.1 SR 3.3.5.3 SR 3.3.5.5	(c) CL3.3-341
a. Gaseous		[1]	SR 3.3.6.1 SR 3.3.6.4 SR 3.3.6.7	≤ [2 x background]
b. Particulate		[1]	SR 3.3.6.1 SR 3.3.6.4 SR 3.3.6.7	≤ [2 x background]
c. Iodine		[1]	SR 3.3.6.1 SR 3.3.6.4 SR 3.3.6.7	≤ [2 x background]
d. Area Radiation		[1]	SR 3.3.6.1 SR 3.3.6.4 SR 3.3.6.7	≤ [2 x background]
4. Manual Containment Isolation — Phase A	1(a), 2(a), 3(a), 4(a)	Refer to LCO 3.3.2, "ESFAS Instrumentation," Function 3.a., for all initiation functions and requirements.		TA3.3-332 CL3.3-342
5. Safety Injection	1(a), 2(a), 3(a), 4(a)	Refer to LCO 3.3.2, "ESFAS Instrumentation," Function 1, for initiation functions and requirements.		CL3.3-343

6.	Manual Containment Spray	1(a), 2(a), 3(a), 4(a)	Refer to LCO 3.3.2, "ESFAS Instrumentation," Function 2, for initiation functions and requirements.	CL3.3-343

(a) When the Containment Inservice Purge System is not isolated. CL3.3-344

(b) During CORE ALTERATIONS and movement of irradiated fuel assemblies within containment when the Containment Inservice Purge System is not isolated.

(c) ≤ count rate corresponding to 500 mrem/year whole body and 3000 mrem/year skin due to noble gases at the site boundary. CL3.3-341

CL3.3-352

3.3 INSTRUMENTATION

3.3.7 Control Room Emergency Filtration System (CREFS) Actuation Instrumentation

LCO 3.3.7 The CREFS actuation instrumentation for each Function in Table 3.3.7-1 shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, 4, [5, and 6,]
During movement of irradiated fuel assemblies,
[During CORE ALTERATIONS].

ACTIONS

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

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one channel or train inoperable.	A.1 -----NOTE----- Place in toxic gas protection mode if automatic transfer to toxic gas protection mode is inoperable. ---------- Place one CREFS train in emergency [radiation protection] mode.	7 days

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. One or more Functions with two channels or two trains inoperable.	NOTE Place in the toxic gas protection mode if automatic transfer to toxic gas protection mode is inoperable.		
	B.1.1	Place one CREFS train in emergency [radiation protection] mode.	Immediately
	AND		
	B.1.2	Enter applicable Conditions and Required Actions for one CREFS train made inoperable by inoperable CREFS actuation instrumentation.	Immediately
	OR		
	B.2	Place both trains in emergency [radiation protection] mode.	Immediately

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time for Condition A or B not met in MODE 1, 2, 3, or 4.	C.1 Be in MODE 3. AND C.2 Be in MODE 5.	6 hours 36 hours

(continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. Required Action and associated Completion Time for Condition A or B not met during movement of irradiated fuel assemblies [or during CORE ALTERATIONS].	[D.1 Suspend CORE ALTERATIONS. AND] D.[2] Suspend movement of irradiated fuel assemblies.	[Immediately] Immediately
[E. Required Action and associated Completion Time for Condition A or B not met in MODE 5 or 6.	E.1 Initiate action to restore one CREFS train to OPERABLE status.	Immediately]

SURVEILLANCE REQUIREMENTS

NOTE

Refer to Table 3.3.7-1 to determine which SRs apply for each CREFS Actuation Function.

SURVEILLANCE	FREQUENCY
SR 3.3.7.1 Perform CHANNEL CHECK.	12 hours
SR 3.3.7.2 Perform COT.	92 days

(continued)

SR 3.3.7.3 Perform ACTUATION LOGIC TEST.	31 days on a STAGGERED TEST BASIS
SR 3.3.7.4 Perform MASTER RELAY TEST.	31 days on a STAGGERED TEST BASIS
SR 3.3.7.5 Perform SLAVE RELAY TEST.	[92] days
SR 3.3.6.47.6 ---NOTE--- Verification of setpoint is not required. ------ Perform TADOT.	[18] months
SR 3.3.7.7 Perform CHANNEL CALIBRATION.	[18] months

Table 3.3.7-1 (page 1 of 1)
CREFS Actuation Instrumentation

FUNCTION	REQUIRED CHANNELS	SURVEILLANCE REQUIREMENTS	TRIP SETPOINT
1. Manual Initiation	[2 trains	SR 3.3.7.6	NA
2. Automatic Actuation Logic and Actuation Relays	[2 trains	SR 3.3.7.3 SR 3.3.7.4 SR 3.3.7.5	NA
3. Control Room Radiation:			
a. Control Room Atmosphere	[2]	SR 3.3.7.1 SR 3.3.7.2 SR 3.3.7.7	≤ [2] mR/hr
b. Control Room Air Intakes	[2]	SR 3.3.7.1 SR 3.3.7.2 SR 3.3.7.7	≤ [2] mR/hr
4. Safety Injection	Refer to LCO 3.3.2, "ESFAS Instrumentation," Function 1, for all initiation functions and requirements.		

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3.3 INSTRUMENTATION

3.3.8 Fuel Building Air Cleanup System (FBACS) Actuation Instrumentation

LCO 3.3.8 The FBACS actuation instrumentation for each Function in Table 3.3.8-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.8-1.

ACTIONS

NOTE

Separate Condition entry is allowed for each Function.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one channel or train inoperable.	A.1 Place one FBACS train in operation.	7 days

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. One or more Functions with two channels or two trains inoperable.	B.1.1 Place one FBACS train in operation. AND B.1.2 Enter applicable Conditions and Required Actions of LCO 3.7.13, "Fuel Building Air Cleanup System (FBACS)," for one train made inoperable by inoperable actuation instrumentation. OR	Immediately Immediately (continued)
B. (continued)	B.2 Place both trains in emergency [radiation protection] mode.	Immediately
C. Required Action and associated Completion Time for Condition A or B not met during movement of irradiated fuel assemblies in the fuel building.	C.1 Suspend movement of irradiated fuel assemblies in the fuel building.	Immediately

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. Required Action and associated Completion Time for Condition A or B not met in MODE 1, 2, 3, or 4.	D.1 Be in MODE 3. AND D.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

NOTE

Refer to Table 3.3.8-1 to determine which SRs apply for each FBACS Actuation Function.

SURVEILLANCE	FREQUENCY
SR 3.3.8.1 Perform CHANNEL CHECK.	12 hours
SR 3.3.8.2 Perform COT.	92 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
SR 3.3.8.3 Perform ACTUATION LOGIC TEST.	31 days on a STAGGERED TEST BASIS
SR 3.3.8.4 -------------------NOTE------------------- Verification of setpoint is not required. -- Perform TADOT.	[18] months
SR 3.3.8.5 Perform CHANNEL CALIBRATION.	[18] months

Table 3.3.8-1 (page 1 of 1)
FBACS Actuation Instrumentation

FUNCTION	APPLICABLE MODES OR SPECIFIED CONDITIONS	REQUIRED CHANNELS	SURVEILLANCE REQUIREMENTS	TRIP SETPOINT
1. Manual Initiation	[1,2,3,4] (a)	2 2	SR 3.3.8.4 SR 3.3.8.4	NA NA
[2. Automatic Actuation Logic and Actuation Relays	1,2,3,4 (a)	2 trains -	SR 3.3.8.3	NA]
3. Fuel Building Radiation				
a. Gaseous	[1,2,3,4] (a)	[2]	SR 3.3.8.1 SR 3.3.8.2 SR 3.3.8.5	≤ [2] mR/hr
b. Particulate	[1,2,3,4] (a)	[2]	SR 3.3.8.1 SR 3.3.8.2 SR 3.3.8.5	≤ [2] mR/hr

(a) During movement of irradiated fuel assemblies in the fuel building.

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3.3 INSTRUMENTATION

3.3.9 Boron Dilution Protection System (BDPS)

LCO 3.3.9 Two trains of the BDPS shall be OPERABLE.

APPLICABILITY: MODES [2,] 3, 4, and 5.

NOTE

The boron dilution flux doubling signal may be blocked in MODES 2 and 3 during reactor startup.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One train inoperable.	A.1 Restore train to OPERABLE status.	72 hours

ACTIONS CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Two trains inoperable. OR Required Action and associated Completion Time of Condition A not met.	B.1 Suspend operations involving positive reactivity additions. AND B.2.1 Restore one train to OPERABLE status. OR B.2.2.1 Close unborated water source isolation valves. AND	Immediately 1 hour 1 hour (continued)
B. (continued)	B.2.2.2 Perform SR 3.1.1.1.	1 hour AND Once per 12 hours thereafter

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.3.9.1 Perform COT.	[92] days

SURVEILLANCE	FREQUENCY
SR 3.3.9.2 Perform CHANNEL CALIBRATION.	[18] months

B 3.3 INSTRUMENTATION

B 3.3.1 Reactor Trip System (RTS) Instrumentation

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BACKGROUND

AEC GDC Criterion 14, "Core Protection Systems" (Ref. 1), requires that core protection systems, together with associated equipment, shall be designed to prevent or suppress conditions that could result in exceeding acceptable fuel damage limits. The RTS initiates a unit shutdown, based on the values of selected unit parameters, to protect against violating the core fuel design limits and Reactor Coolant System (RCS) pressure boundary during anticipated operational occurrences (AOOs) and to assist the Engineered Safety Features (ESF) Systems in mitigating accidents. PA3.3-357

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

~~The LSSS, defined in this specification as the [Trip Setpoints], in conjunction with the LCOs, establish the threshold for protective system action to prevent exceeding acceptable limits during Design Basis Accidents (DBAs).~~ TA3.3-176 Technical specifications are required by 10CFR50.36 to contain LSSS defined by the regulation as "... settings for automatic protective devices ... so chosen that automatic protective action will correct the abnormal situation before a safety limit (SL) is exceeded." The analytical limit is the limit of the process variable at which a safety action is initiated, as established by the safety analysis, to ensure that a SL is not exceeded. Any automatic protection action that occurs on reaching the analytical limit

(continued)

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therefore ensures that the SL is not exceeded. However, in practice, the actual settings for automatic protective devices must be chosen to be more conservative than the analytical limit to account for instrument loop uncertainties related to the setting at which the automatic protective action would actually occur. TA3.3-176

The trip setpoint is a predetermined setting for a protective device chosen to ensure automatic actuation prior to the process variable reaching the analytical limit and thus ensuring that the SL would not be exceeded. As such, the trip setpoint accounts for uncertainties in setting the device (e.g., calibration), uncertainties in how the device might actually perform (e.g., repeatability), changes in the point of action of the device over time (e.g., drift during surveillance intervals), and any other factors which may influence its actual performance (e.g., harsh accident environments). In this manner, the trip setpoint plays an important role in ensuring that SLs are not exceeded. As such, the trip setpoint meets the definition of an LSSS (Ref. 2) and could be used to meet the requirement that they be contained in the technical specifications. TA3.3-176

Technical specifications contain values related to the OPERABILITY of equipment required for safe operation of the facility. OPERABLE is defined in technical specifications as "... being capable of performing its safety function(s)." For automatic protective devices, the required safety function is to ensure that a SL is not exceeded and therefore the LSSS as defined by 10CFR50.36 is the same as the OPERABILITY limit for these devices. However, use of the trip setpoint to define OPERABILITY in technical specifications and its corresponding designation as the LSSS required by 10CFR50.36 would be an overly restrictive requirement if it were applied as an OPERABILITY limit for the "as found" value of a protective device setting during a surveillance. This would result in technical specification TA3.3-176

(continued)

BASES

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compliance problems, as well as reports and corrective actions required by the rule which are necessary to ensure safety. For example, an automatic protective device with a setting that has been found to be different from the trip setpoint due to some drift of the setting may still be OPERABLE since drift is to be expected. This expected drift would have been specifically accounted for in the setpoint methodology for calculating the trip setpoint and thus the automatic protective action would still have ensured that the SL would not be exceeded with the "as found" setting of the protective device. Therefore, the device would still be OPERABLE since it would have performed its safety function and the only corrective action required would be to reset the device to the trip setpoint to account for further drift during the next surveillance interval. TA3.3-176

Use of the trip setpoint to define "as found" OPERABILITY and its designation as the LSSS under the expected circumstances described above would result in actions required by both the rule and technical specifications that are clearly not warranted. However, there is also some point beyond which the device would have not been able to perform its function due, for example, to greater than expected drift. This value needs to be specified in the technical specifications in order to define OPERABILITY of the devices and is designated as the the Allowable Value which, as stated above, is the same as the LSSS. TA3.3-176

The Allowable Value specified in Table 3.3.1-1 serves as the LSSS such that a channel is OPERABLE if the actual setting is found not to exceed the Allowable Value during the CHANNEL OPERATIONAL TEST (COT). As such, the Allowable Value differs from the trip setpoint by an amount primarily equal to the expected instrument loop uncertainties, such as drift, during the surveillance interval. In this manner, the actual setting of the device will still meet the LSSS definition and ensure that a safety limit is not exceeded at TA3.3-176

(continued)

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any given point of time as long as the device has not drifted beyond that expected during the surveillance interval. If the actual setting of the device is found to have exceeded the Allowable Value the device would be considered inoperable from a technical specification perspective. This requires corrective action including those actions required by 10CFR50.36 when automatic protective devices do not function as required. Note that although the channel is "OPERABLE" under these circumstances, the trip setpoint should be left adjusted to a value within the established trip setpoint calibration tolerance band, in accordance with uncertainty assumptions stated in the referenced setpoint methodology (as-left criteria), and confirmed to be operating within the statistical allowances of the uncertainty terms assigned. TA3.3-176

During AOOs, which are those events expected to occur one or more times during the unit life, the acceptable limits (Ref. 8) are: PA3.3-350

1. The dDeparture from nNucleate bBoiling rRatio (DNBR) shall be maintained ~~above the Safety Limit (SL) value~~ to prevent departure from nucleate boiling (DNB);

2. Fuel centerline melt shall not occur; and

3. The RCS pressure SL of 27~~35~~50 psiga shall not be exceeded.

Operation within the SLs of Specification 2.0, "Safety Limits (SLs)," also maintains the above values and assures that offsite dose will be within the ~~10 CFR 50 and~~ 10 CFR 100 criteria during AOOs. PA3.3-358

Accidents are events that are analyzed even though they are not expected to occur during the unit life. ~~The~~One acceptable limit during accidents is that offsite dose shall

(continued)

BASES PA3.3-356

BACKGROUND (continued)

be maintained within an acceptable fraction of 10 CFR 100 limits. Different accident categories are allowed a different fraction of these limits, based on probability of occurrence. Meeting the acceptable dose limit for an accident category is considered having acceptable consequences for that event.

The RTS instrumentation is segmented into four distinct but interconnected portionsmodules as describedillustrated in Figure [ ], Fthe USAR, Chapter [7] (Ref. 41), and as identified below: PA3.3-360

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

2. Signal Process Control and Protection System, including AnalogReactor Protection Analog System, and Nuclear Instrumentation System (NIS), field contacts, andarranged in protection channel sets: provides signal conditioning, bistable setpoint comparison, process algorithm actuation, compatiblebistable electrical signal output to protection system relay logicdevices, and control board/control room/ miscellaneous indications; PA3.3-360

3. Solid StateReactor Protection Relay Logic System (SSPS), including channelized input, and logic, and output bays: initiates proper unit shutdown and/or ESF actuation in accordance with the defined logic, which is based on the bistable outputs from the signal process control andanalog protection system and NIS; and CL3.3-359

4. Reactor trip switchgear, including reactor trip breakers (RTBs) and bypass breakers: provides the means to interrupt power to the control rod drive

(continued)

BASES

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mechanisms (CRDMs) and allows the rod cluster control assemblies (RCCAs), or "rods," to fall into the core and shut down the reactor. The bypass breakers allow testing of the RTBs at power.

Field Transmitters or Sensors

To meet the design demands for redundancy and reliability, more than one, and often as many as four, field transmitters or sensors are used to measure unit parameters. To account for the calibration tolerances and instrument drift, which are assumed to occur between calibrations, statistical allowances are provided in the tTrip sSetpoint and Allowable

BACKGROUND Field Transmitters or Sensors (continued)

TA3.3-176

Values. The OPERABILITY of each transmitter or sensor is determined by eithercan be evaluated when its "as found" calibration data are compared against its documented acceptance criteriaevaluated during the CHANNEL CALIBRATION or by qualitative assessment of field transmitter or sensor as related to the channel behavior observed during performance of the CHANNEL CHECK.

Signal Process Control and Protection SystemReactor Protection Analog and NI Systems

PA3.3-360

Generally, two tothree or four channels of process control equipmentinstrumentation are used for the signal processing of unit parameters measured by the field instruments. The process control equipmentinstrument channels provides signal conditioning, comparable output signals for instruments located on the main control board, and comparison of measured input signals with setpoints that are based onestablished by safety analyses. These setpoints are

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defined in FSAR, Chapter [7] (Ref. 1), Chapter [6] (Ref. 2), and Chapter [15] (Ref. 3). If the measured value of a unit parameter exceeds the predetermined setpoint, an output from a bistable actuates logic input relaysis forwarded to the SSPS for decision evaluation. Channel separation is described in Reference 4maintained up to and through the input bays. However, not all unit parameters require four channels of sensor measurement and signal processing. Some unit parameters provide input only to the SSPS, while others provide input to the SSPS, theprotection logic, main control board indication, and the plantunit computer, and In addition, some provide input to one or more control systems. CL3.3-359

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

Generally, Iif a parameter is used for input to the protection logicSSPS and a control function, four channels with a two-out-of-four logic are sufficient to provide the required reliability and redundancy. Tthe circuit must be able to withstand both an input failure to the control system, which may then require the protection function actuation, and a single failure in the other channels providing the protection function actuation. Again, a single failure will neither cause nor PA3.3-361

BACKGROUND Signal Process Control and Protection System (continued)

prevent the protection function actuation. These requirements are described in IEEE-279-1971 (Ref. 4). Where necessary to provide the required reliability and PA3.3-361

(continued)

BASES PA3.3-356

redundancy, four channels with a two-out-of-four logic, or median signal selection and signal validation are provided. The actual number of channels required for each unit parameter is specified in Reference 4~~1~~. Again, a single failure will neither cause nor prevent the protection function actuation.

~~Two logic channels are required to ensure no single random failure of a logic channel will disable the RTS. The logic channels are designed such that testing required while the reactor is at power may be accomplished without causing trip. Provisions to allow removing logic channels from service during maintenance are unnecessary because of the logic system's designed reliability~~. CL3.3-362

~~Trip Setpoints and~~ Allowable Values and RTS Setpoints TA3.3-176

~~The Trip Setpoints are the nominal values at which the bistables are set. Any bistable is considered to be properly adjusted when the "as left" value is within the band for CHANNEL CALIBRATION accuracy (i.e., ± rack calibration + comparator setting accuracy).~~

The t~~T~~rip s~~S~~etpoints used in the bistables are based on the analytical limits from~~stated in~~ Reference 8~~1~~. The selection of these t~~T~~rip s~~S~~etpoints is such that adequate protection is provided when all sensor and processing time delays are taken into account. To allow for calibration tolerances, instrumentation uncertainties, instrument drift, and severe environment errors for those RTS channels that must function in harsh environments as defined by 10 CFR 50.49~~(Ref. 5)~~, the ~~Trip Setpoints and~~ Allowable Values specified in Table 3.3.1-1 in the accompanying LCO are conservative~~ly adjusted~~ with respect to the analytical limits. A detailed description of the methodology used to calculate the Allowable Values and t~~T~~rip s~~S~~etpoints, including their

(continued)

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explicit uncertainties, is provided in the "RTS/ESFASplant specific s-Setpoint mMethodology sStudy (Ref. 56)-, which incorporates all of the known uncertainties applicable to each channel. The magnitudes of these uncertainties are factored into the determination of each trip setpoint and corresponding Allowable Value. The actual nominal Ttrip Ssetpoint entered into the bistable is more conservative than that specified by the Allowable Value (LSSS) to account for changes in random measurement errors detectable by athe COT. 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. TA3.3-176

The trip setpoint is the value at which the bistable is set and is the expected value to be achieved during calibration. The trip setpoint value ensures the LSSS and the safety analysis limits are met for the surveillance interval selected when a channel is adjusted based on stated channel uncertainties. Any bistable is considered to be properly adjusted when the "as-left" setpoint value is within the band for CHANNEL CALIBRATION uncertainty allowance (i.e., ± rack calibration + bistable setting uncertainties). TA3.3-176

BACKGROUND

Trip Setpoints and Allowable Values and RTS Setpoints (continued)

Trip sSetpoints consistentin accordance with the requirements of the Allowable Value ensure that SLs and DNBR limits are not violated during AOOs (and that the consequences of DBAs will be acceptable, providing the unit is operated from within the LCOs at the onset of the AOO or DBA and the equipment functions as designed). Note that in the accompanying LCO 3.3.1, the Trip Setpoints of Table 3.3.1-1 are the LSSS. TA3.3-176 PA3.3-350

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Each required instrument channel of the process control equipment can be tested on line to verify that the signal or setpoint accuracy is within the specified allowance requirements of Reference 52. Once a designated channel is taken out of service for testing, a simulated signal is injected in place of the field instrument signal. The process equipmentinstrumentation for the channel in test is then tested, verified, and calibrated. SRs for the channels are specified in the SRs section. PA3.3-360

The Trip Setpoints and Allowable Values listed in Table 3.3.1-1 are based on the methodology described in Reference 6, which incorporates all of the known uncertainties applicable for each channel. The magnitudes of these uncertainties are factored into the determination of each Trip Setpoint. All field sensors and signal processing equipment for these channels are assumed to operate within the allowances of these uncertainty magnitudes. TA3.3-176

ReactorSolid State Protection Relay Logic System CL3.3-359

The relay logicSSPS equipment is usesd for the decision logic processing of outputs from the analog and NIsignal processing equipment bistables. To meet the redundancy requirements, two trains of relay logicSSPS, each performing the same functions, are provided. If one train is taken out of service for maintenance or test purposes, the second train will provide reactor trip and/or ESF actuation for the unit. If both trains are taken out of service or placed in test, a reactor trip will result. Each train is packaged in its own set of cabinets for physical and electrical separation to satisfy separation and independence requirements. The system has been designed to provide a reactor trip in the event of a loss of power, directing the unit to a safe shutdown condition. PA3.3-363

(continued)

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BACKGROUND Solid State Protection System (continued) CL3.3-359

The SSPS performs the decision logic for actuating a reactor trip or ESF actuation, generates the electrical output signal that will initiate the required trip or actuation, and provides the status, permissive, and annunciator output signals to the main control room of the unit.

The bistable outputs from the signal processing equipment are sensed by the SSPS equipment and combined into logic matrices that represent combinations indicative of various unit upset and accident transients. If a required logic matrix combination is completed, the system will initiate a reactor trip or send actuation signals via master and slave relays to those components whose aggregate Function best serves to alleviate the condition and restore the unit to a safe condition. Examples are given in the Applicable Safety Analyses, LCO, and Applicability sections of this Bases. CL3.3-359 PA3.3-363

Reactor Trip Switchgear

The RTBs are in the electrical power supply line from the control rod drive motor generator set power supply to the CRDMs. Opening of the RTBs interrupts power to the CRDMs, which allows the shutdown rods and control rods to fall into the core by gravity. Each RTB is equipped with a bypass breaker to allow testing of the RTB while the unit is at power. During normal operation the output from the relay logicSSPS is a contactvoltage signal that energizes the undervoltage coils in the RTBs, and bypass breakers, if in use. When the required logic matrix combination is completed, the relay logicSSPS output contacts openvoltage signal is removed, the undervoltage coils are de-energized, the breaker trip lever is actuated by the de-energized undervoltage coil, and the RTBs and bypass breakers are CL3.3-359

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BASES PA3.3-356

tripped open. This allows the shutdown rods and control rods to fall into the core. In addition to the de-energization of the undervoltage coils, each breaker is also equipped with a shunt trip device that is energized to trip the breaker open upon receipt of a reactor trip signal from the relay logicSSPS. Either the undervoltage coil or the shunt trip mechanism is sufficient by itself to open the RTBs, thus providing a diverse trip mechanism.

The decision logic matrix Functions are described in the functional diagrams included in Reference 42. In addition to

BACKGROUND Reactor Trip Switchgear (continued)

the reactor trip or ESF, Reference 4these diagrams also identifiesdescribe the various "permissive interlocks" that are associated with unit conditions. Each train has a built in testing devicefeatures that can allowautomatically testing of the decision logic matrix Functions and the actuation devices while the unit is at power. When any one train is taken out of service for testing, the other train is capable of providing unit monitoring and protection until the testing has been completed. The testing device is semiautomatic to minimize testing time. CL3.3-364

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

The RTS functions to maintain the SLs and DNBR limits during all AOOs as identified in Reference 3 and mitigates the consequences of DBAs in all MODES in which the RTBs are closed.Rod Control System is capable of rod withdrawal or one or more rods not fully inserted. PA3.3-350 TA3.3-151

Each of the analyzed accidents and transients can be detected by one or more RTS Functions. The accident analysis described in Reference 3 takes credit for most RTS trip Functions. RTS trip Functions not specifically credited in the accidentsafety analysis are qualitatively

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~~APPLICABLE SAFETY ANALYSES~~, ~~LCO, and APPLICABILITY (continued)~~

credited in the safety analysis and the NRC staff approved licensing basis for the unit. These RTS trip Functions may provide protection for conditions that do not require dynamic transient analysis~~ to demonstrate Function performance~~. They may also serve as backups to RTS trip Functions that were credited in the accident analysis.

The LCO requires all instrumentation performing an RTS Function, listed in Table 3.3.1-1 in the accompanying LCO, to be OPERABLE. A channel is OPERABLE with an actual setpoint value outside its calibration tolerance provided the actual setpoint "as found" value does not exceed its associated Allowable Value and provided the setpoint "as left" value is adjusted to a value within the "as left" calibration tolerance band. Failure of any instrument renders the affected channel(s) inoperable and reduces the reliability of the affected Functions. TA3.3-176

The LCO generally requires OPERABILITY of two, three, or four~~ or three~~ channels in each instrumentation Function, two channels of Manual Reactor Trip~~ in each logic Function,~~ and two trains in each Automatic Trip Logic Function. Four OPERABLE instrumentation channels in a two-out-of-four configuration are required when ~~one~~ RTS channels are~~is~~ also used as ~~a~~ control system inputs and there is a~~. This configuration accounts for the~~ possibility of the shared channel failing in such a manner that it creates a transient that requires RTS action. In this case, the RTS will still provide protection, even with random failure of one of the other three protection channels. Three ~~operable~~OPERABLE instrumentation channels in a two-out-of-three configuration are generally required when there is no potential for control system and protection system interaction that could simultaneously create a need for RTS trip and disable one RTS channel. The two-out-of-three and two-out-of-four configurations allow one channel to be tripped during PA3.3-361 TA3.3-151

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maintenance or testing without causing a reactor trip. Specific exceptions to the above general philosophy exist and are discussed below.

Reactor Trip System Functions

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

1. Manual Reactor Trip

The Manual Reactor Trip ensures that the control room operator can initiate a reactor trip at any time by using either of two reactor trip switches in the control room. A Manual Reactor Trip accomplishes the same results as any one of the automatic trip Functions. It is used by the reactor operator to shut down the reactor whenever any parameter is rapidly trending toward its ~~T~~trip ~~S~~setpoint.

The LCO requires two Manual Reactor Trip channels to be OPERABLE. Each channel is controlled by a manual reactor trip switch. Each channel activates the reactor trip breakers in both trains. Two independent channels are required to be OPERABLE so that no single random failure will disable the Manual Reactor Trip Function.

In MODE 1 or 2, ~~m~~Manual ~~initiation of a r~~Reactor ~~t~~Trip must be OPERABLE. These are the MODES in which the shutdown rods and/or control rods are partially or fully withdrawn from the core. In MODE 3, 4, or 5, the ~~m~~Manual Reactor Trip ~~initiation~~ Function must also be OPERABLE if ~~the~~one or more shutdown rods or control rods are withdrawn or the Rod Control ~~Rod Drive (CRD)~~ System is capable of withdrawing the TA3.3-151

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shutdown rods or ~~the~~ control rods. In this condition, inadvertent control rod withdrawal is

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

1. Manual Reactor Trip (continued)

possible. In MODE 3, 4, or 5, ~~m~~Manual Reactor Trip ~~initiation of a reactor trip~~ does not have to be OPERABLE if the Rod Control~~CRD~~ System is not capable of withdrawing the shutdown rods or control rods and if all rods are fully inserted. If the rods cannot be withdrawn from the core, or all of the rods are inserted there is no need to be able to trip the reactor~~because all of the rods are inserted~~. In MODE 6, ~~neither the shutdown rods nor the control rods are permitted to be withdrawn and~~ the CRDMs are disconnected from the control rods and shutdown rods. Therefore, the ~~m~~Manual Reactor Trip~~initiation~~ Function is not required. TA3.3-151 PA3.3-365

2. Power Range Neutron Flux

The NIS power range detectors are located external to the reactor vessel and measure neutrons leaking from the core. The NIS power range detectors provide input to the ~~Rod~~reactor ~~C~~control ~~S~~system~~ and the Steam Generator (SG) Water Level Control System~~. Therefore, the actuation logic must be able to withstand an input failure to the control system, which may then require the protection function actuation, and a single failure in the other channels providing the protection function actuation. Note that this Function also provides a signal to prevent automatic and manual rod withdrawal prior to initiating a reactor trip. Limiting further rod CL3.3-366

(continued)

PA3.3-356

BASES

withdrawal may terminate the transient and eliminate the need to trip the reactor.

a. Power Range Neutron Flux – High

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

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

In MODE 1 or 2, when a positive reactivity excursion could occur, the Power Range Neutron Flux – High trip must be OPERABLE. This Function

~~APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY~~ ~~a. Power Range Neutron Flux – High (continued)~~

will terminate the reactivity excursion and shut down the reactor prior to reaching a power level that could damage the fuel. In MODE 3, 4, 5, or 6, the NIS power range channels~~detectors~~ cannot indicate~~detect~~ neutron levels in this range. In these MODES, the Power Range Neutron Flux – High does not have to be OPERABLE because the reactor is shut down and reactivity excursions into the power range are extremely unlikely. Other RTS Functions and administrative controls provide protection against reactivity additions when in MODE 3, 4, 5, or 6. PA3.3-375

b. Power Range Neutron Flux – Low

The LCO requirement for the Power Range Neutron Flux–Low trip Function ensures that protection is

(continued)

BASES PA3.3-356

provided against a positive reactivity excursion from low power or subcritical conditions.

The LCO requires all four of the Power Range Neutron Flux–Low channels to be OPERABLE.

In MODE 1, below the Power Range Neutron Flux (P-10 setpoint), and in MODE 2, the Power Range Neutron Flux–Low trip must be OPERABLE. This Function may be manually blocked by the operator when two out of four power range channels are greater than the approximately 10% RTP (P-10 setpoint). This Function is automatically unblocked when three out of four power range channels are below the P-10 setpoint. Above the P-10 setpoint, positive reactivity additions are mitigated by the Power Range Neutron Flux–High trip Function. PA3.3-376

In MODE 3, 4, 5, or 6, the Power Range Neutron Flux–Low trip Function does not have to be OPERABLE because the reactor is shut down and the NIS power range channels detectors cannot detect indicate neutron levels in this range. Other RTS trip Functions and administrative controls provide protection PA3.3-375

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY — b. Power Range Neutron Flux – Low (continued)

against positive reactivity additions or power excursions in MODE 3, 4, 5, or 6.

3. Power Range Neutron Flux Rate

The Power Range Neutron Flux Rate trips use the same channels as discussed for Function 2 above.

(continued)

BASES PA3.3-356

a. Power Range Neutron Flux-High Positive Rate

The Power Range Neutron Flux-High Positive Rate trip Function ensures that protection is provided against rapid increases in neutron flux that are characteristic of an RCCA rod drive ~~rod~~ housing rupture and the accompanying ejection of the RCCA and uncontrolled RCCA withdrawal at power. This Function compliments the Power Range Neutron Flux-High and Low Setpoint trip Functions to ensure that the criteria are met for a rod ejection from the power range. CL3.3-381

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

In MODE 1 or 2, when there is a potential to add a large amount of positive reactivity from a rod ejection accident ~~(REA)~~ or uncontrolled RCCA withdrawal at power, the Power Range Neutron Flux-High Positive Rate trip must be OPERABLE. In MODE 3, 4, 5, or 6, the Power Range Neutron Flux-High Positive Rate trip Function does not have to be OPERABLE because other RTS trip Functions and administrative controls will provide protection against positive reactivity additions. ~~Also, since only the shutdown banks may be withdrawn in MODE 3, 4, or 5, the remaining complement of control bank worth ensures a sufficient degree of SDM in the event of an REA.~~ In MODE 6, no rods are withdrawn and the SDM is increased during refueling operations. The reactor vessel head is also removed or the closure bolts are detensioned preventing any pressure buildup. In addition, the NIS power CL3.3-381 PA3.3-382

(continued)

BASES PA3.3-356

range channelsdetectors cannot indicatedetect neutron levels present in this mode. PA3.3-375

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

b. Power Range Neutron Flux-High Negative Rate

The Power Range Neutron Flux-High Negative Rate trip Function ensures that protection is provided for multiple rod drop accidentsevents. At high power levels, a multiple rod drop accidentevent could cause local flux peaking that would result in an unconservative local DNBR. DNBR is defined as the ratio of the heat flux required to cause a DNB at a particular location in the core to the local heat flux. The DNBR is indicative of the margin to DNB. No credit is taken for the Ooperation of this Function is not required for certain single rod drop events. Safety analysis results show that for those rod drop accidents in which the local DNBRs will be greater than the limit for those dropped rods that do not actuate this function. PA3.3-367 CL3.3-381

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

In MODE 1 or 2, when there is potential for a multiple rod drop accidentevent to occur, the Power Range Neutron Flux-High Negative Rate trip must be OPERABLE. In MODE 3, 4, 5, or 6, the Power Range Neutron Flux-High Negative Rate trip Function does not have to be OPERABLE because the core is not critical and DNB is not a concern. Also, since only the shutdown banks may be withdrawn in MODE 3, 4, or 5, the remaining complement of control bank worth ensures a sufficient degree of SDM in the event of an REA. In MODE 6, no rods are withdrawn and the required CL3.3-381 PA3.3-367 PA3.3-382

(continued)

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PA3.3-356

SDM is increased during refueling operations. In addition, the NIS power range channels~~detectors~~ cannot indicate~~detect~~ neutron levels present in this MODE. PA3.3-375

4. Intermediate Range Neutron Flux

The Intermediate Range Neutron Flux trip Function ~~ensures that protection is provided against an uncontrolled RCCA bank rod withdrawal accident from a subcritical condition during startup. This trip Function~~ provides redundant protection to the Power Range Neutron Flux-Low Setpoint trip Function. The NIS intermediate range detectors are located external to the reactor vessel and measure neutrons leaking from the core. The NIS intermediate range detectors CL3.3-381

~~APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY~~

~~4. Intermediate Range Neutron Flux (continued)~~

do not provide any input to control systems. Note that this Function also provides a signal to prevent automatic and manual rod withdrawal prior to initiating a reactor trip. Limiting further rod withdrawal may terminate the transient and eliminate the need to trip the reactor.

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

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

(continued)

BASES

PA3.3-356

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

TA3.3-151 PA3.3-367 CL3.3-381 PA3.3-375

5. Source Range Neutron Flux

The LCO requirement for the Source Range Neutron Flux trip Function ensures that protection is provided against a positive reactivity excursion~~an uncontrolled RCCA bank rod withdrawal accident~~ from a subcritical condition~~ during startup~~. This trip Function provides redundant protection to

PA3.3-383

~~APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY~~ ~~5. Source Range Neutron Flux (continued)~~

the Power Range Neutron Flux–Low ~~Setpoint and Intermediate Range Neutron Flux~~ trip Function~~s. In MODES 3, 4, and 5, administrative controls also~~

TA3.3-151

(continued)

BASES

PA3.3-356

~~prevent the uncontrolled withdrawal of rods.~~ The NIS source range detectors are located external to the reactor vessel and measure neutrons leaking from the core. The NIS source range detectors do not provide any inputs to control systems. The source range trip is the only RTS automatic protection function required in MODES 3, 4, and 5 when rods are capable of withdrawal or one or more rods are not fully inserted. Therefore, the functional capability at the specified ~~T~~trip ~~S~~setpoint is assumed to be available. TA3.3-151

~~The LCO requires two channels of Source Range Neutron Flux to be OPERABLE. Two OPERABLE channels are sufficient to ensure no single random failure will disable this trip Function. The LCO also requires one channel of the Source Range Neutron Flux to be OPERABLE in MODE 3, 4, or 5 with RTBs open. In this case, the source range Function is to provide control room indication and input to the Boron Dilution Protection System (BDPS). The outputs of the Function to RTS logic are not required OPERABLE when the RTBs are open.~~ TA3.3-151

The Source Range Neutron Flux Function provides protection for control rod withdrawal from subcritical, boron dilution and control rod ejection events. ~~The Function also provides visual neutron flux indication in the control room.~~ TA3.3-151

In MODE 2 when below the P-6 setpoint ~~during a reactor startup,~~ and in MODES 3, 4, and 5 when there is a potential for an uncontrolled RCCA bank rod withdrawal event the Source Range Neutron Flux trip must be OPERABLE. Two OPERABLE channels are sufficient to ensure no single random failure will disable this trip Function. Above the P-6 setpoint, the Intermediate Range Neutron Flux trip and the Power TA3.3-151

(continued)

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PA3.3-356

Range Neutron Flux–Low Setpoint trip will provide core protection for reactivity accidentsevents. Above the P-6 setpoint, the NIS source range detectors are de-energized and inoperable. PA3.3-367

In MODES 3, 4, orand 5 with all rods fully inserted and the Rod Control System not capable of rod withdrawal, and in MODE 6, the outputs from the Function to RTS logic are not required to be OPERABLEthe reactor shut down, the Source Range Neutron Flux trip Function must also be OPERABLE. If the CRD System is capable of rod withdrawal, the Source Range Neutron Flux trip must be TA3.3-151

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

5. Source Range Neutron Flux (continued)

OPERABLE to provide core protection against a rod withdrawal accident. If the CRD System is not capable of rod withdrawal, the source range detectors are not required to trip the reactor. However, their monitoring Function must be OPERABLE The requirements for the NIS source range detectors to monitor core neutron levels and provide indication of reactivity changes that may occur as a result of events like a boron dilution are addressed in LCO 3.9.3, "Nuclear Instrumentation," for MODE 6. These inputs are provided to the BDPS. The requirements for the NIS source range detectors in MODE 6 are addressed in LCO 3.9.3, "Nuclear Instrumentation." TA3.3-151 CL3.3-368

6. Overtemperature ΔT

The Overtemperature ΔT trip Function is provided to ensure that the design limit DNBR is met. This trip Function also limits the range over which the Overpower ΔT trip Function must provide protection. The inputs to the Overtemperature ΔT trip include all CL3.3-371

(continued)

BASES

PA3.3-356

pressurizer pressure, coolant temperature, axial power distribution, and reactor power as indicated by loop ΔT assuming full reactor coolant flow. Protection from violating the DNBR limit is assured for those transients that are slow with respect to delays from the core to the measurement system. ~~The Function monitors both variation in power and flow since a decrease in flow has the same effect on ΔT as a power increase.~~ The Overtemperature ΔT trip Function uses each loop's ΔT as a measure of reactor power and is compared with a setpoint that is automatically varied with the following parameters: PA3.3-426

- reactor coolant average temperature – the ~~T~~trip ~~S~~setpoint is varied to correct for changes in coolant density and specific heat capacity with changes in coolant temperature;

- pressurizer pressure – the ~~T~~trip ~~S~~setpoint is varied to correct for changes in system pressure; and

- axial power distribution – f(ΔI), the ~~T~~trip ~~S~~setpoint is varied to account for imbalances in the axial power distribution as detected by the

~~APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY~~

~~6. Overtemperature ΔT (continued)~~

NIS upper and lower power range channels ~~detectors~~. If axial peaks are greater than the design limit, as indicated by the difference between the upper and lower NIS power range channels~~detectors~~, the ~~T~~trip ~~S~~setpoint is reduced in accordance with Note 1 of Table 3.3.1-1. PA3.3-375

(continued)

BASES

PA3.3-356

Dynamic compensation is included for system piping delays from the core to the temperature measurement system.

The Overtemperature ΔT trip Function is calculated for each ~~loop~~channel as described in Note 1 of Table 3.3.1-1. A ~~t~~Trip occurs if Overtemperature ΔT is indicated in two ~~loops~~channels. Since~~At some units,~~ the pressure and temperature signals are used for other control functions, ~~. For those units,~~ the actuation logic must be able to withstand an input failure to the control system, which may then require the protection function actuation, and a single failure in the other channels providing the protection function actuation. Note that this Function also provides a signal to generate a turbine runback prior to reaching the t~~T~~rip s~~S~~etpoint. A turbine runback will reduce turbine power and reactor power. A reduction in power will normally alleviate the Overtemperature ΔT condition and may prevent a reactor trip.

The LCO requires all four channels of the Overtemperature ΔT trip Function to be OPERABLE~~ for two and four loop units (the LCO requires all three channels on the Overtemperature ΔT trip Function to be OPERABLE for three loop units)~~. Note that the Overtemperature ΔT Function receives input from channels shared with other RTS Functions. Failures that affect multiple Functions require entry into the Conditions applicable to all affected Functions. PA3.3-369

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

(continued)

BASES — PA3.3-356

~~APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)~~

7. Overpower ΔT

The Overpower ΔT trip Function ensures that protection is provided to ensure the integrity of the fuel (i.e., no fuel pellet melting and less than 1% cladding strain) under all possible overpower conditions. CL3.3-371 This trip Function also ~~limits the required range of the Overtemperature ΔT trip Function and~~ provides a backup to the Power Range Neutron Flux – High Setpoint trip. The Overpower ΔT trip Function ensures that the allowable heat generation rate (kW/ft) of the fuel is not exceeded. It uses the ΔT of each loop as a measure of reactor power with a setpoint that is automatically varied with the following parameters:

- reactor coolant average temperature – the ~~T~~trip ~~S~~setpoint is varied to correct for changes in coolant density and specific heat capacity with changes in coolant temperature;~~ and~~

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

- axial power distribution – f(ΔI), the trip setpoint is varied to account for imbalances in the axial power distribution as detected by the NIS upper and lower power range detectors. If axial peaks are greater than the design limit, as indicated by the difference between the upper and lower NIS power range detectors, the trip setpoint is reduced in accordance with Note 2 of Table 3.3.1-1. CL3.3-214

(continued)

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BASES

The Overpower ΔT trip Function is calculated for each ~~loop~~channel as per Note 2 of Table 3.3.1-1. ~~A~~ ~~T~~trip occurs if Overpower ΔT is indicated in two channels~~loops~~. ~~At some units,~~ Since the temperature signals are used for other control functions, ~~. At those units,~~ the actuation logic must be able to withstand an input failure to the control system, which may then require the protection function actuation and a single failure in the remaining channels providing the protection function actuation. Note that this Function also provides a signal to generate a turbine runback prior to reaching the Allowable Value. A turbine runback will reduce turbine power and reactor power. A reduction in power will normally alleviate the Overpower ΔT condition and may prevent a reactor trip.

The LCO requires four channels ~~for two and four loop units (three channels for three loop units)~~ of the Overpower ΔT trip Function to be OPERABLE. Note that the Overpower ΔT trip Function receives input from

PA3.3-369

~~APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY~~

~~7. Overpower ΔT (continued)~~

channels shared with other RTS Functions. Failures that affect multiple Functions require entry into the Conditions applicable to all affected Functions.

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

(continued)

BASES

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8. Pressurizer Pressure

The same sensors provide input to the Pressurizer Pressure—High and —Low trips and the Overtemperature ΔT trip. ~~At some units, the Pressurizer Pressure channels are also used to provide input to the Pressurizer Pressure Control System. For those units, the actuation logic must be able to withstand an input failure to the control system, which may then require the protection function actuation, and a single failure in the other channels providing the protection function actuation.~~ CL3.3-370

a. Pressurizer Pressure—Low

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

The LCO requires four channels ~~for two and four loop units (three channels for three loop units)~~ PA3.3-369 of Pressurizer Pressure—Low to be OPERABLE. Since the pressurizer pressure channels are also used to provide input to the pressurizer pressure control system, the actuation logic must be able to withstand an input failure to the control system, which may then require the protection function actuation, and a single failure in the other channels providing the protection function actuation. CL3.3-370

In MODE 1, when DNB is a major concern, the Pressurizer Pressure—Low trip must be OPERABLE. This trip Function is automatically enabled on increasing power by the P-7 interlock (NIS power range ~~P-10~~ or turbine impulse pressure ~~greater than approximately 10% of full power equivalent~~ PA3.3-376

(continued)

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

a. Pressurizer Pressure – Low (continued) CL3.3-212

~~(P-13)~~). On decreasing power, this trip Function is automatically blocked below P-7. Below the P-7 setpoint, ~~no conceivable power distributions can occur that would cause DNB concerns~~the AOOs meet their DNB criteria without requiring this trip function. PA3.3-379

b. Pressurizer Pressure – High

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

The LCO requires three~~four~~ channels ~~for two and four loop units (three channels for three loop units)~~ of the Pressurizer Pressure – High to be OPERABLE. Although the pressurizer pressure channels are also input to pressure control, an input failure to the control system can not cause a transient that would require actuation of this protection function. Three OPERABLE channels are sufficient to ensure no single random failure will disable this trip Function. CL3.3-370

The Pressurizer Pressure – High ~~LSSS~~Allowable Value is selected to be below the pressurizer safety valve actuation pressure and above the power operated relief valve (PORV) setting. This setting minimizes challenges to safety valves while avoiding unnecessary reactor trip for those TA3.3-176

(continued)

BASES

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pressure increases that can be controlled by the PORVs.

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

~~APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY~~ (continued)

9. Pressurizer Water Level – High

The Pressurizer Water Level – High trip Function provides a backup signal for the Pressurizer Pressure – High trip and also provides protection against water relief through the pressurizer safety valves. These valves are designed to pass steam in order to achieve their design energy removal rate. A reactor trip is actuated prior to the pressurizer becoming water solid. The LCO requires three channels of Pressurizer Water Level – High to be OPERABLE. The pressurizer level channels are used as input to the Pressurizer Level Control System. A fourth channel is not required to address control/protection interaction concerns. The level channels do not actuate the safety valves, and the high pressure reactor trip is set below the safety valve setting. Therefore, with the slow rate of charging available, pressure overshoot due to level channel failure cannot cause

(continued)

BASES PA3.3-356

the safety valve to lift before the reactor high pressure trip.

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

10. Reactor Coolant Flow - Low

~~a. Reactor Coolant Flow - Low (Single Loop)~~ TA3.3-155

The Reactor Coolant Flow - Low ~~(Single Loop)~~ trip Function ensures that protection is provided against violating the DNBR limit due to low flow in one or more RCS loops, while avoiding reactor trips due to normal variations in loop flow. Above the P-8 setpoint, ~~which is approximately 48% RTP,~~ a loss of flow in ~~any~~either RCS loop will actuate a reactor trip. Above the P-7 setpoint, a loss of flow in both RCS loops will actuate a reactor trip. Each RCS loop has three flow detectors to monitor flow. The flow signals are not used for any control system input. PA3.3-376 CL3.3-373

~~APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY~~

~~a. Reactor Coolant Flow - Low (Single Loop) (continued)~~

The LCO requires three Reactor Coolant Flow - Low channels per loop to be OPERABLE in MODE 1 above P-7 or P-8. TA3.3-155

(continued)

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In MODE 1 above the P-7 or P-8 setpoints, a loss of flow in onean RCS loop could result in DNB conditions in the core. In MODE 1 below the P-8 setpoint, a loss of flow in two or more loops is required to actuate a reactor trip (Function 10.b) because of the lower power level and the greater margin to the design limit DNBR. TA3.3-155

b. Reactor Coolant Flow - Low (Two Loops) TA3.3-155

The Reactor Coolant Flow - Low (Two Loops) trip Function ensures that protection is provided against violating the DNBR limit due to low flow in two or more RCS loops while avoiding reactor trips due to normal variations in loop flow.

Above the P-7 setpoint and below the P-8 setpoint, a loss of flow in two or more loops will initiate a reactor trip. Each loop has three flow detectors to monitor flow. The flow signals are not used for any control system input.

The LCO requires three Reactor Coolant Flow - Low channels per loop to be OPERABLE.

In MODE 1 above the P-7 setpoint and below the P-8 setpoint, the Reactor Coolant Flow - Low (Two Loops) trip must be OPERABLE. Below the P-7 and P-8 setpoints, all reactor trips on low flow are automatically blocked since there is insufficient heat production to generate DNB conditionsno conceivable power distributions could occur that would cause a DNB concern at this low power level. Above the P-7 setpoint, the reactor trip on low flow in two or more RCS loops is automatically enabled. Above the P-8 CL3.3-373

(continued)

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setpoint, a loss of flow in any one loop will actuate a reactor trip because of the higher power level and the reduced margin to the design limit DNBR.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

11. Loss of Reactor Coolant Pump (RCP) Breaker Position

CL3.3-195

BothLoss of RCP Breaker Position trip Functions operates together on two sets of auxiliary contacts, with one set on each RCP breaker. Thesеis Functions anticipates the Reactor Coolant Flow-Low trips to avoid RCS heatup that would occur before the low flow trip actuates.

a. Reactor Coolant Pump Breaker OpenPosition (Single Loop)

CL3.3-196

The RCP Breaker OpenPosition (Single Loop) trip Function ensures thatprovides protection is provided against violating the DNBR limit due to a loss of flow in one or both RCS loop(s). The position of each RCP breaker is monitored. If one RCP breaker is open above the P-8 setpoint, a reactor trip is initiated. If both RCP breakers are open above the P-7 setpoint, a reactor trip is initiated. This trip Function will generate a reactor trip before the Reactor Coolant Flow-Low (Single Loop) Ttrip Ssetpoint is reached.

The LCO requires one RCP Breaker OpenPosition channel per RCP to be OPERABLE. One OPERABLE channel is sufficient for this trip Function because the RCS Flow-Low trip alone provides sufficient protection of unit SLsthe DNBR limit for loss of flow events. The RCP Breaker OpenPosition trip serves only to anticipate the

CL3.3-374

(continued)

BASES PA3.3-356

low flow trip, minimizing the thermal transient associated with loss of a pump.

This Function measures only the discrete position (open or closed) of the RCP breaker, using a position switches. Therefore, the Function has no adjustable trip setpoint with which to associate an Allowable ValueLSSS. TA3.3-176

In MODE 1 above the P-7 or P-8 setpoints, when a loss of flow in either or bothany RCS loop(s) could result in DNB conditions in the core, the RCP Breaker OpenPosition (Single Loop) trip must be OPERABLE. In MODE 1 below the P-8 setpoint, a loss of flow in two or more loops is required to actuate a reactor trip because of the lower power level and the greater margin to the design limit DNBR. CL3.3-189 CL3.3-196

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

b. Reactor Coolant Pump Breaker Position (Two Loops) CL3.3-196

The RCP Breaker Position (Two Loops) trip Function ensures that protection is provided against violating the DNBR limit due to a loss of flow in two or more RCS loops. The position of each RCP breaker is monitored. Above the P-7 setpoint and below the P-8 setpoint, a loss of flow in two or more loops will initiate a reactor trip. This trip Function will generate a reactor trip before the Reactor Coolant Flow - Low (Two Loops) Trip Setpoint is reached.

The LCO requires one RCP Breaker Position channel per RCP to be OPERABLE. One OPERABLE channel is sufficient for this Function because the RCS

(continued)

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Flow - Low trip alone provides sufficient protection of unit SLs for loss of flow events. The RCP Breaker Position trip serves only to anticipate the low flow trip, minimizing the thermal transient associated with loss of an RCP.

This Function measures only the discrete position (open or closed) of the RCP breaker, using a position switch. Therefore, the Function has no adjustable trip setpoint with which to associate an LSSS.

In MODE 1 above the P-7 setpoint and below the P-8 setpoint, the RCP Breaker Position (Two Loops) trip must be OPERABLE. Below the P-7 and P-8 setpoints, all RCP Breaker Open reactor trips on loss of flow are automatically blocked since no conceivable power distributions could occur that would cause a DNB concern the AOOs meet their DNB criteria without requiring this trip function at this low power level. Above the P-7 or P-8 setpoints, the RCP Breaker Open reactor trips are on loss of flow in two RCS loops is automatically enabled. Above the P-8 setpoint, a loss of flow in any one loop will actuate a reactor trip because of the higher power level and the reduced margin to the design limit DNBR. CL3.3-196 PA3.3-379

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

12. Undervoltage on Buses 11 and 12 (21 and 22) Reactor Coolant Pumps CL3.3-201

The Undervoltage on Buses 11 and 12 (21 and 22) RCPs reactor trip Function ensures that provides protection is provided against violating the DNBR

(continued)

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(continued)

limit due to a loss of flow in two or moreboth RCS loops. The voltage to each RCP is monitored. Above the P-7 setpoint, a loss of voltage detected on bothtwo or more RCP buses will initiate a reactor trip. This trip Function will generate a reactor trip before the Reactor Coolant Flow-Low (Two Loops) Ttrip Ssetpoint is reached. Time delays are incorporated into the Uundervoltage RCPs channels to prevent reactor trips due to momentary electrical power transients.

The LCO requires threetwo Uundervoltage RCPs channels (one per phase) per bus to be OPERABLE.

In MODE 1 above the P-7 setpoint, the Uundervoltage RCP trip must be OPERABLE. Below the P-7 setpoint, all reactor trips on loss of flowundervoltage are automatically blocked since no conceivable power distributions could occur that would cause a DNB concernthe AOO's meet their DNB criteria without requiring this trip function at this low power level. Above the P-7 setpoint, the reactor trip on loss of flowundervoltage in bothtwo or more RCS loops is automatically enabled. This Function uses the same relays as the ESFAS Function 6.df, "Undervoltage on Buses 11 and 12 (21 and 22)Reactor Coolant Pump (RCP)" start of the turbine driven auxiliary feedwater (AFW) pumps.

PA3.3-379

11.b13.
Underfrequency Buses 11 and 12 (21 and 22)Reactor Coolant Pumps

CL3.3-195

The Underfrequency RCPsBuses 11 and 12 (21 and 22) breakerreactor trip Function ensures thatprovides protection is provided against violating the DNBR limit due to a loss of flow in bothtwo or more RCS

(continued)

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loops from a major network frequency disturbance. An underfrequency condition will slow down the pumps, thereby reducing their coastdown time following a pump trip. The proper coastdown time is required so that reactor heat can be removed immediately after reactor trip. The frequency of each RCP bus is monitored. ~~Above the P-7 setpoint, a~~A loss of frequency detected on both~~two or more~~ RCP buses will initiate a ~~reactor~~ trip of both RCP breakers. This trip ~~Function~~ will generate a reactor trip before the Reactor Coolant Flow-Low ~~(Two Loops) T~~trip ~~S~~setpoint is reached. Time delays are incorporated into the Underfrequency Buses 11 and 12 (21 and 22) ~~RCPs~~ channels to prevent RCP breaker~~reactor~~ trips due to momentary electrical power transients. CL3.3-195

~~APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY~~

~~13. Underfrequency Reactor Coolant Pumps (continued)~~

The LCO requires two~~three~~ ~~U~~underfrequency ~~RCPs~~ channels per bus to be OPERABLE.

In MODE 1 above the P-7 or P-8 setpoints, the Underfrequency Buses 11 and 12 (21 and 22) ~~RCPs~~ trip Function must be OPERABLE. Below the P-7 and P-8 setpoints, ~~all~~ reactor trips on RCP breaker open~~loss of flow~~ are automatically blocked since ~~no conceivable power distributions could occur that would cause a DNB concern~~the AOO's meet their DNB criteria without requiring this trip function at this low power level. Above the P-7 or P-8 setpoints, the reactor trips on ~~loss of flow in two or more RCS loops is~~RCP breaker open are automatically enabled. CL3.3-195 PA3.3-379

(continued)

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1314. Steam Generator (SG) Water Level – Low Low

The SG Water Level – Low Low trip Function ensures that protection is provided against a loss of heat sink and actuates the Auxiliary Feedwater (AFW) System prior to uncovering the SG tubes. The SGs are the heat sink for the reactor. In order to act as a heat sink, the SGs must contain a minimum amount of water. A narrow range low low level in eitherany SG is indicatesive of a potential loss of heat sink for the reactor. The level transmitters provide input to the SG Level Control System. Therefore, the actuation logic must be able to withstand an input failure to the control system, which may then require the protection function actuation, and a single failure in the other channels providing the protection function actuation. This Function also performs the ESFAS function of starting the AFW pumps on low low SG level. CL3.3-377

The LCO requires threefour channels of SG Water Level – Low Low per SG to be OPERABLE. for four loop units in which these channels are shared between protection and control. In two, three, and four loop units where three SG Water Levels are dedicated to the RTS, The level channels provide input to the SG level control system. However, median signal selection ensures that the failure of a single channel will not result in a low level which may require the protection function actuation. Therefore, only three channels per SG are required to be OPERABLE. CL3.3-377

In MODE 1 or 2, when the reactor requires a heat sink, the SG Water Level – Low Low trip must be OPERABLE. The normal source of water for the SGs is the Main Feedwater (MFW) System (not safety related). Generally Tthe MFW System is only in operation in CL3.3-378

(continued)

BASES PA3.3-356

MODE 1 or 2. The AFW System is the safety related backup source of water to

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

14. Steam Generator Water Level - Low Low (continued)

ensure that the SGs remain the heat sink for the reactor. During normal startups and shutdowns, the AFW System provides feedwater to maintain SG level. In MODE 3, 4, 5, or 6, the SG Water Level - Low Low Function does not have to be OPERABLE because the MFW System is not in operation and the reactor is not operating or even critical. Decay heat removal is accomplished by the AFW System in MODE 3 and or by the Residual Heat Removal (RHR) System in MODE 3, 4, 5, or 6. CL3.3-378 CL3.3-386

15. Steam Generator Water Level - Low, Coincident With Steam Flow/Feedwater Flow Mismatch

CL3.3-204

SG Water Level - Low, in conjunction with the Steam Flow/Feedwater Flow Mismatch, ensures that protection is provided against a loss of heat sink and actuates the AFW System prior to uncovering the SG tubes. In addition to a decreasing water level in the SG, the difference between feedwater flow and steam flow is evaluated to determine if feedwater flow is significantly less than steam flow. With less feedwater flow than steam flow, SG level will decrease at a rate dependent upon the magnitude of the difference in flow rates. There are two SG level channels and two Steam Flow/Feedwater Flow Mismatch channels per SG. One narrow range level channel sensing a low level coincident with one Steam Flow/Feedwater Flow Mismatch channel sensing flow mismatch (steam flow greater than feed flow) will actuate a reactor trip.

(continued)

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The LCO requires two channels of SG Water Level – Low coincident with Steam Flow/Feedwater Flow Mismatch.

In MODE 1 or 2, when the reactor requires a heat sink, the SG Water Level – Low coincident with Steam Flow/Feedwater Flow Mismatch trip must be OPERABLE. The normal source of water for the SGs is the MFW System (not safety related). The MFW System is only in operation in MODE 1 or 2. The AFW System is the safety related backup source of water to ensure that the SGs remain the heat sink for the reactor. During normal startups and shutdowns, the AFW System provides feedwater to maintain SG level. In MODE 3, 4, 5,

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

15. Steam Generator Water Level – Low, Coincident With Steam Flow/Feedwater Flow Mismatch (continued)

or 6, the SG Water Level – Low coincident with Steam Flow/Feedwater Flow Mismatch Function does not have to be OPERABLE because the MFW System is not in operation and the reactor is not operating or even critical. Decay heat removal is accomplished by the AFW System in MODE 3 and by the RHR System in MODE 4, 5, or 6. The MFW System is in operation only in MODE 1 or 2 and, therefore, this trip Function need only be OPERABLE in these MODES.

1416. Turbine Trip

a. Turbine Trip – Low AutostopFluid Oil Pressure

PA3.3-205

The Turbine Trip – Low AutostopFluid Oil Pressure trip Function anticipates the loss of heat removal capabilities of the secondary system following a turbine trip. This trip Function acts to minimize the pressure/temperature transient on the reactor. Any turbine trip from a power level below the P-9

(continued)

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setpoint, approximately 50% power, will not actuate a reactor trip. Three pressure switches monitor the autostopcontrol oil pressure in the tTurbine eElectrohydraulic cControl sSystem. A low pressure condition sensed by two-out-of-three pressure switches will actuate a reactor trip. These pressure switches do not provide any input to the control system. The unit is designed to withstand a complete loss of load and not sustain core damage or challenge the RCS pressure limitations. Core protection is provided by the Pressurizer Pressure – High trip Function and RCS integrity is ensured by the pressurizer safety valves. PA3.3-376

The LCO requires three channels of Turbine Trip – Low AutostopFluid Oil Pressure to be OPERABLE in MODE 1 above P-9.

Below the P-9 setpoint, a turbine trip does not actuate a reactor tripheat removal can be accommodated by the steam dump system. In MODE 2, 3, 4, 5, or 6, there is no potential for a turbine trip. CL3.3-388

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

a. Turbine Trip – Low Fluid Oil Pressure (continued)

and the Turbine Trip – Low AutostopFluid Oil Pressure trip Function does not need to be OPERABLE.

b. Turbine Trip – Turbine Stop Valve Closure

The Turbine Trip – Turbine Stop Valve Closure trip Function anticipates the loss of heat removal

(continued)

BASES PA3.3-356

capabilities of the secondary system following a turbine trip from a power level belowabove the P-9 setpoint, approximately 50% power. This action will not actuate a reactor trip. The trip Function anticipates the loss of secondary heat removal capability that occurs when the stop valves close. Tripping the reactor in anticipation of loss of secondary heat removal acts to minimize the pressure and temperature transient on the reactor. This trip Function will not and is not required to operate in the presence of a single channel failure. The unit is designed to withstand a complete loss of load and not sustain core damage or challenge the RCS pressure limitations. Core protection is provided by the Pressurizer Pressure – High trip Function, and RCS integrity is ensured by the pressurizer safety valves. This trip Function is diverse to the Turbine Trip – Low AutostopFluid Oil Pressure trip Function. Each turbine stop valve is equipped with one limit switch channel that inputs to the RTS relay logic. If all fourthe limit switches indicate that boththe stop valves are all closed, a reactor trip is initiated. PA3.3-376 CL3.3-167

The LSSS for this Function is set to assure channel trip occurs when the associated stop valve is completely closed. CL3.3-207

The LCO requires twofour Turbine Trip – Turbine Stop Valve Closure channels, one per valve, to be OPERABLE in MODE 1 above P-9. All fourBoth channels to a train of relay logic must trip to cause reactor trip. CL3.3-167

Below the P-9 setpoint, a load rejectionheat removal can be accommodated by the sSteam dDump CL3.3-388

(continued)

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§System. In MODE 2, 3, 4, 5, or 6, there is no potential for

~~APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY~~ ~~b. Turbine Trip - Turbine Stop Valve Closure (continued)~~

a load rejection, and the Turbine Trip - Stop Valve Closure trip Function does not need to be OPERABLE.

§15~~17~~. Safety Injection §(SI)§ Input from Engineered Safety Feature Actuation System

The SI Input from ESFAS ensures that if a reactor trip has not already been generated by the RTS, the ESFAS automatic actuation relay logic will initiate a reactor trip upon any signal that initiates SI. This is not a condition of acceptability for the LOCA. However, other transients and accidents take credit for varying levels of ESF performance and rely upon rod insertion, except for the most reactive rod that is assumed to be fully withdrawn, to ensure reactor shutdown. Therefore, a reactor trip is initiated every time an SI signal is present. CL3.3-238

~~Trip Setpoint and~~ Allowable Values are not applicable to this Function. The SI Input is provided by relay§ in the ESFAS. Therefore, there is no measurement signal with which to associate an ~~LSSS~~ Allowable Value. TA3.3-176

The LCO requires two trains of SI Input from ESFAS to be OPERABLE in MODE 1 or 2.

A reactor trip is initiated every time an SI signal is present. Therefore, this trip Function must be OPERABLE in MODE 1 or 2, when the reactor is critical,

(continued)

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and must be shut down in the event of an accident. In MODE 3, 4, 5, or 6, the reactor is not critical, and this trip Function does not need to be OPERABLE.

1618. Reactor Trip System Interlocks

Reactor protection interlocks are provided to ensure reactor trips are in the correct configuration for the current unit status. They back up operator actions to ensure protection system Functions are not bypassed during unit conditions under which the safety analysis assumes the Functions are not bypassed.– ~~Therefore, the interlock Functions do not need to be OPERABLE~~ PA3.3-389

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1618. Reactor Trip System Interlocks (continued)

~~when the associated reactor trip functions are outside the applicable MODES.~~ Each interlock Function consists of the following circuitry: CL3.3-380

- The bistables that provide the applicable process parameter input;
- Logic input relays and contact matrix; and
- Permissive (P) relays that provide the interlock to the appropriate trip logic.

These interlock Functions are:

a. Intermediate Range Neutron Flux, P-6

The Intermediate Range Neutron Flux, P-6 interlock is actuated when any NIS intermediate range channel goes approximately one decade above the minimum channel reading. If both channels

(continued)

BASES PA3.3-356

drop below the setpoint, the permissive will automatically be defeated. The LCO requirement for the P-6 interlock ensures that the following Functions are performed:

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

- on decreasing power, the P-6 interlock automatically energizes the NIS source range detectors and enables the NIS Source Range Neutron Flux reactor trip.; and

- ~~on increasing power, the P-6 interlock provides a backup block signal to the source range flux doubling circuit. Normally, this Function is manually blocked by the control room operator during the reactor startup.~~ CL3.3-393

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

Above the P-6 interlock setpoint, the NIS Source Range Neutron Flux reactor trip will be blocked, and this Function will no longer be necessary.

~~APPLICABLE a. Intermediate Range Neutron Flux, P-6 (continued)~~

(continued)

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

b. Low Power Reactor Trips Block, P-7

The Low Power Reactor Trips Block, P-7 interlock is actuated by input from either the Power Range Neutron Flux, P-10, or the Turbine Impulse Pressure, P-13 interlock. The LCO requirement for the P-7 interlock ensures that the following Functions are performed: CL3.3-212

(1) on increasing power, the P-7 interlock automatically enables reactor trips on the following Functions:

- Pressurizer Pressure – Low;
- Pressurizer Water Level – High;
- Reactor Coolant Flow – Low (Two both lLoops);
- RCPs Breaker Open (Twoboth lLoops); and
- Undervoltage Buses 11 and 12 (21 and 22) RCPs; and CL3.3-201
- Underfrequency RCPs. CL3.3-195

These reactor trips are only required when operating above the P-7 setpoint (approximately 10% power). The reactor trips provide protection against violating the DNBR limit. Below the P-7 setpoint, PA3.3-376

(continued)

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the RCS is capable of providing sufficient natural circulation without any RCP running.

(2) on decreasing power, the P-7 interlock automatically blocks reactor trips on the following Functions:

- Pressurizer Pressure – Low;

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b. Low Power Reactor Trips Block, P-7 (continued)

- Pressurizer Water Level – High;
- Reactor Coolant Flow – Low (~~Two~~ both ~~L~~loops);
- RCP Breaker Position (~~Two~~ both ~~L~~loops); and
- Undervoltage Buses 11 and 12 (21 and 22) ~~RCPs; and~~ — CL3.3-201
- ~~Underfrequency RCPs.~~ — CL3.3-195

~~Trip Setpoint and Allowable Value are not applicable to the P-7 interlock because it is a logic Function and thus has no parameter with which to associate an LSSS.~~ — CL3.3-212

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

(continued)

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The ~~low power~~associated trips are blocked below the P-7 setpoint and unblocked above the P-7 setpoint. In MODE 2, 3, 4, 5, or 6, this Function does not have to be OPERABLE because the interlock performs its Function when power level drops below the P-7 setpoint~~10% power~~, which is in MODE 1. PA3.3-376

1. Power Range Neutron Flux, P-7 CL3.3-212

Power Range Neutron Flux, P-7 is actuated by two-out-of-four NIS power range channels. The LCO requirement for this Function ensures that this input to the P-7 interlock is available.

The LCO requires four channels of Power Range Neutron Flux, P-7 to be OPERABLE in MODE 1.

OPERABILITY in MODE 1 ensures the Function is available to perform its increasing power Functions.

2. Turbine Impulse Pressure, P-7 CL3.3-212

The Turbine Impulse Pressure, P-7 is actuated by one-out-of-two pressure channels. The LCO requirement for this Function ensures that this input to the P-7 interlock is available.

The LCO requires two channels of Turbine Impulse Pressure, P-7 to be OPERABLE in MODE 1. The interlock Function is not

(continued)

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required OPERABLE in MODE 2, 3, 4, 5, or 6 because the turbine generator is not operating.

[illegible]

c. Power Range Neutron Flux, P-8

The Power Range Neutron Flux, P-8 interlock is actuated ~~at approximately 48% power as determined~~ by two-out-of-four NIS power range channels~~detectors~~. The P-8 interlock automatically enables the Reactor Coolant Flow—Low (s~~S~~ingle l~~L~~oop) and RCP Breaker ~~Position~~open (s~~S~~ingle l~~L~~oop) reactor trips on low flow in one or more RCS loops on increasing power. The LCO requirement for this trip Function ensures that protection is provided against a loss of flow in any RCS loop that could result in DNB conditions in the core when greater than the P-8 setpoint~~approximately 48% power~~. On decreasing PA3.3-376 PA3.3-375

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

c. Power Range Neutron Flux, P-8 (continued)

power, the reactor trip on low flow in any loop is automatically blocked.

The LCO requires four channels of Power Range Neutron Flux, P-8 interlock to be OPERABLE in MODE 1.

In MODE 1, a loss of flow in one RCS loop could result in DNB conditions, so the Power Range Neutron Flux, P-8 interlock must be OPERABLE. In MODE 2, 3, 4, 5, or 6, this Function does not

(continued)

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have to be OPERABLE because the core is not producing sufficient power to be concerned about DNB conditions.

d. Power Range Neutron Flux, P-9

The Power Range Neutron Flux, P-9 interlock is actuated ~~at approximately 50% power as determined~~ by two-out-of-four NIS power range channels~~detectors~~. The LCO requirement for this Function ensures that the Turbine Trip – Low Autostop~~Fluid~~ Oil Pressure and Turbine Trip – Turbine Stop Valve Closure reactor trips are enabled above the P-9 setpoint. Above the P-9 setpoint, a turbine trip could~~will~~ cause a load rejection beyond the capacity of the s~~S~~team d~~D~~ump and Rod Control Systems. A reactor trip is automatically initiated on a turbine trip when it is above the P-9 setpoint, to minimize the transient on the reactor. PA3.3-376 PA3.3-375

The LCO requires four channels of Power Range Neutron Flux, P-9 interlock to be OPERABLE in MODE 1.

In MODE 1, a turbine trip could cause a load rejection beyond the capacity of the s~~S~~team d~~D~~ump and Rod Control Systems, so the Power Range Neutron Flux interlock must be OPERABLE. In MODE 2, 3, 4, 5, or 6, this Function does not have to be OPERABLE because the reactor is not at a power level sufficient to have a load rejection beyond the capacity of the s~~S~~team d~~D~~ump s~~S~~ystem.

(continued)

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

e. Power Range Neutron Flux, P-10

The Power Range Neutron Flux, P-10 interlock is actuated ~~at approximately 10% power, as determined~~ by two-out-of-four NIS power range channels~~detectors~~. If power level falls below the setpoint~~10% RTP~~ on 3 of 4 channels, the nuclear instrument trips will be automatically unblocked. The LCO requirement for the P-10 interlock ensures that the following Functions are performed: PA3.3-376 PA3.3-375

- on increasing power, the P-10 interlock allows the operator to manually block the Intermediate Range Neutron Flux reactor trip. Note that blocking the reactor trip also blocks the signal to prevent automatic and manual rod withdrawal;
- on increasing power, the P-10 interlock allows the operator to manually block the Power Range Neutron Flux—Low reactor trip;
- on increasing power, the P-10 interlock automatically provides a backup signal to block the Source Range Neutron Flux reactor trip, and also to de-energize the NIS source range detectors;
- ~~the P-10 interlock provides one of the two inputs to the P-7 interlock;~~ and CL3.3-212
- on decreasing power, the P-10 interlock automatically enables the Power Range Neutron Flux—Low reactor trip and the Intermediate Range Neutron Flux reactor trip (and rod stop).

(continued)

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The LCO requires four channels of Power Range Neutron Flux, P-10 interlock to be OPERABLE in MODE 1 or 2. OPERABILITY in MODE 1 ensures the Function is available to perform its decreasing power Functions in the event of a reactor shutdown. This Function must be OPERABLE in MODE 2 to ensure that core protection is provided during a

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

e. Power Range Neutron Flux, P-10 (continued)

startup or shutdown by the Power Range Neutron Flux – Low and Intermediate Range Neutron Flux reactor trips. In MODE 3, 4, 5, or 6, this Function does not have to be OPERABLE because the reactor is not at power and the Source Range Neutron Flux reactor trip provides core protection.

f. Turbine Impulse Pressure, P-13

CL3.3-213

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

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

The Turbine Impulse Chamber Pressure, P-13 interlock must be OPERABLE when the turbine generator is operating. The interlock Function

(continued)

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is not required OPERABLE in MODE 2, 3, 4, 5, or 6 because the turbine generator is not operating.

17~~19.~~ Reactor Trip Breakers

~~This trip Function applies to the RTBs exclusive of individual trip mechanisms.~~ The LCO requires two OPERABLE trains of trip breakers. A trip breaker train consists of all trip breakers associated with a single RTS logic train that are racked in, closed, and capable of supplying power to the ~~CRD~~Rod Control System. Thus, the train may consist of the main breaker, bypass breaker, or main breaker and bypass breaker, depending upon the system configuration. Two OPERABLE trains ensure no single random failure can disable the RTS trip capability. The OPERABILITY requirement for the individual trip mechanisms is provided in the Function 18 below. PA3.3-391 TA3.3-151

~~APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY~~

~~19. Reactor Trip Breakers (continued)~~

Th~~i~~ese trip Function~~s~~ must be OPERABLE in MODE 1 or 2. This ensures it is available when the reactor is critical. In MODE 3, 4, or 5, th~~i~~ese RTS trip Function~~s~~ must be OPERABLE when the ~~RTBs or associated bypass breakers are closed, and the CRD~~Rod Control System is capable of rod withdrawal or one or more rods are not fully inserted. TA3.3-151

18~~20~~. Reactor Trip Breaker Undervoltage and Shunt Trip Mechanisms

The LCO requires both the Undervoltage and Shunt Trip Mechanisms to be OPERABLE for each RTB that is in service. The trip mechanisms are not required to be OPERABLE for trip breakers that are open, racked out, TA3.3-151

(continued)

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incapable of supplying power to the Rod ControlCRD System, or declared inoperable under Function 1719 above. OPERABILITY of both trip mechanisms on each breaker ensures that no single trip mechanism failure will prevent opening any breaker on a valid signal.

These trip Functions must be OPERABLE in MODE 1 or 2. This ensures they are available when the reactor is critical. In MODE 3, 4, or 5, these RTS trip Functions must be OPERABLE when the ~~RTBs and associated bypass breakers are closed, and the CRD~~Rod Control System is capable of rod withdrawal or one or more rods are not fully inserted. TA3.3-151

1921. Automatic Trip Logic

The LCO requirement for the RTBs (Functions 1719 and 1820) and Automatic Trip Logic (Function 1921) ensures that means are provided to interrupt the power to allow the rods to fall into the reactor core. Each RTB is equipped with an undervoltage coil and a shunt trip coil to trip the breaker open when needed. Each RTB is equipped with a bypass breaker to allow testing of the trip breaker while the unit is at power. The reactor trip signals generated by the RTS Automatic Trip Logic cause the RTBs and associated bypass breakers to open and shut down the reactor.

The LCO requires two trains of RTS Automatic Trip Logic to be OPERABLE. Having two OPERABLE trains ~~channels~~ ensures that random failure of a single logic train~~channel~~ will not prevent reactor trip.

APPLICABLE SAFETY ANALYSES LCO, and

1921. Automatic Trip Logic (continued)

Thiese trip Functions must be OPERABLE in MODE 1 or 2.

(continued)

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APPLICABILITY

This ensures it is available when the reactor is critical. In MODE 3, 4, or 5, thiese RTS trip Function~~s~~ must be OPERABLE when the ~~RTBs and associated bypass breakers are closed, and the CRD~~Rod Control System is capable of rod withdrawal or one or more rods not fully inserted. TA3.3-151

The RTS instrumentation satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii)~~the NRC Policy Statement~~.

ACTIONS

A Note has been added to the ACTIONS to clarify the application of Completion Time rules. The Conditions of this Specification may be entered independently for each Function listed in Table 3.3.1-1.

In the event a channel's t~~T~~rip s~~S~~etpoint is found nonconservative with respect to the Allowable Value, or the transmitter, instrument loop, ~~signal processing electronics,~~ or bistable is found inoperable, then all affected Functions provided by that channel must be declared inoperable and the LCO Condition(s) entered for the protection Function(s) affected. When the Required Channels in Table 3.3.1-1 are specified (eg., on a per steamline, per loop, per SG, etc., basis), then the Condition may be entered separately for each steamline, loop, SG, etc., as applicable. PA3.3-384 PA3.3-385

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

(continued)

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~~Reviewer's Note: Certain LCO Completion Times are based on approved topical reports. In order for a licensee to use these times, the licensee must justify the Completion Times as required by the staff Safety Evaluation Report (SER) for the topical report.~~

A.1

Condition A applies to all RTS protection Functions. Condition A addresses the situation where one or more required channels or trains for one or more Functions are inoperable

TA3.3-151

~~ACTIONS A.1 (continued)~~

at the same time. The Required Action is to refer to Table 3.3.1-1 and to take the Required Actions for the protection functions affected. The Completion Times are those from the referenced Conditions and Required Actions.

B.1~~, B.2.1,~~ and B.2.~~2~~

TA3.3-151

Condition B applies to the Manual Reactor Trip in MODE 1 or 2. This action addresses the train orientation of the ~~SSPS~~Reactor Protection Relay Logic for this Function. With one channel inoperable, the inoperable channel must be restored to OPERABLE status within 48 hours. In this Condition, the remaining OPERABLE channel is adequate to perform the safety function.

CL3.3-359

The Completion Time of 48 hours is reasonable considering that there are two automatic actuation trains and another manual initiation channel OPERABLE, and the low probability of an event occurring during this interval.

(continued)

BASES PA3.3-356

If the Manual Reactor Trip Functionchannel cannot be restored to OPERABLE status within the allowed 48 hour Completion Time, the unit must be brought to a MODE in which the requirement does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 6 additional hours (54 hours total time) followed by opening the RTBs within 1 additional hour (55 hours total time). The 6 additional hours to reach MODE 3 and the 1 hour to open the RTBs areis reasonable, based on operating experience, to reach MODE 3 and open the RTBs from full power operation in an orderly manner and without challenging unit systems. With the RTBs open and the unit in MODE 3, this trip Function is no longer required to be OPERABLE. Action C would apply to any inoperable Manual Reactor Trip Function if the Rod Control System is capable of rod withdrawal or one or more rods are not fully inserted. TA3.3-151

C.1 and C.2.1 and C.2.2

Condition C applies to the following reactor trip Functions in MODE 3, 4, or 5 with the RTBs closed and the Rod ControlCRD System capable of rod withdrawal or one or more rods not fully inserted: TA3.3-151

ACTIONS C.1 and C.2 (continued)

- Manual Reactor Trip;
- RTBs;
- RTB Undervoltage and Shunt Trip Mechanisms; and
- Automatic Trip Logic.

(continued)

BASES

PA3.3-356

This action addresses the train orientation of the SSPSRTS for these Functions. With one channel or train inoperable, the inoperable channel or train must be restored to OPERABLE status within 48 hours. If the affected Function(s) cannot be restored to OPERABLE status within the allowed 48 hour Completion Time, the unit must be placed in a MODE in which the requirement does not apply. To achieve this status, the RTBs must be opened within the next hour. action must be initiated within the same 48 hours to ensure that all rods are fully inserted and the Rod Control System must be placed in a condition incapable of rod withdrawal within the next hour. The additional hour provides sufficient time to accomplish the action in an orderly manner. With rods fully inserted and the Rod Control System incapable of rod withdrawal, the RTBs open, these Functions are no longer required. CL3.3-359 TA3.3-151

The Completion Time is reasonable considering that in this Condition, the remaining OPERABLE train is adequate to perform the safety function, and given the low probability of an event occurring during this interval.

D.1.1, D.1.2, D.2.1, D.2.2, and D.32

Condition D applies to the Power Range Neutron Flux—High Function.

The NIS power range detectors provide input to the reactor controlCRD Ssystem and the SG Water Level Control System and, therefore, have a two-out-of-four trip logic. A known inoperable channel must be placed in the tripped condition. This results in a partial trip condition requiring only one-out-of-three logic for actuation. The 6 hours allowed to place the inoperable channel in the tripped condition is justified in WCAP-10271-P-A (Ref. 67). CL3.3-366

(continued)

BASES PA3.3-356

In addition to placing the inoperable channel in the tripped condition, ~~THERMAL POWER must be reduced to ≤ 75% RTP within 12 hours. Reducing the power level prevents operation of the core with radial power distributions beyond the design~~ CL3.3-152

~~ACTIONS D.1.1, D.1.2, D.2.1, D.2.2, and D.3 (continued)~~

~~limits. With one of the NIS power range detectors inoperable, 1/4 of the radial power distribution monitoring capability is lost.~~

~~As an alternative to the above actions, the inoperable channel can be placed in the tripped condition within 6 hours and~~monitor the QPTR ~~monitored~~ once every 12 hours as per SR 3.2.4.2, QPTR verification. Calculating QPTR every 12 hours compensates for the lost monitoring capability due to the inoperable NIS power range channel and allows continued unit operation at power levels ~~≥~~≧ 85~~75~~% RTP. The ~~6 hour Completion Time and the~~ 12 hour Frequency ~~are~~is consistent with LCO 3.2.4, "QUADRANT POWER TILT RATIO (QPTR)." CL3.3-152

As an alternative to the above Actions, the plant must be placed in a MODE where this Function is no longer required OPERABLE. Twelve hours are allowed to place the plant in MODE 3. This is a reasonable time, based on operating experience, to reach MODE 3 from full power in an orderly manner and without challenging plant systems. If Required Actions cannot be completed within their allowed Completion Times, LCO 3.0.3 must be entered.

The Required Actions have been modified by ~~a~~two Notes. ~~that~~ Note 1 allows placing the inoperable channel in the bypass condition for up to 4 hours while performing routine surveillance testing of other channels. ~~The~~This Note also allows placing the inoperable channel in the bypass CL3.3-152

(continued)

BASES

PA3.3-356

condition to allow setpoint adjustments of other channels when required to reduce the setpoint in accordance with other Technical Specifications. The 4 hour time limit is justified in Reference 76. Note 2 allows an additional power range instrument channel to be made inoperable only during low power PHYSICS TESTS.

Required Action D.2.2D.1.2 has been modified by a Note which only requires SR 3.2.4.2 to be performed if THERMAL POWER is ≥ 85% RTP and the Power Range Neutron Flux input to QPTR becomes inoperable. Failure of a component in the Power Range Neutron Flux Channel which renders the High Flux Trip Function inoperable may not affect the capability to monitor QPTR. As such, determining QPTR using theis movable incore detectors once per 12 hours may not be necessary. CL3.3-152

ACTIONS (continued)

E.1 and E.2

Condition E applies to the following reactor trip Functions:

- Power Range Neutron Flux – Low;
- ~~Overtemperature ΔT;~~
- ~~Overpower ΔT;~~
- Power Range Neutron Flux – High Positive Rate;
- Power Range Neutron Flux – High Negative Rate;
- Overtemperature ΔT;
- Overpower ΔT;
- Pressurizer Pressure – High; and

(continued)

BASES PA3.3-356

- SG Water Level – Low Low; ~~and~~
- ~~SG Water Level – Low coincident with Steam Flow/ Feedwater Flow Mismatch.~~ CL3.3-204

A known inoperable channel must be placed in the tripped condition within 6 hours. Placing the channel in the tripped condition results in a partial trip condition requiring only one-out-of-two logic for actuation of the two-out-of-three trips and one-out-of-three logic for actuation of the two-out-of-four trips. The 6 hours allowed to place the inoperable channel in the tripped condition is justified in Reference ~~7~~6.

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

The Required Actions have been modified by ~~a~~two Notes. Note 1~~that~~ allows placing the inoperable channel in the bypassed condition for up to 4 hours while performing routine surveillance testing of the other channels. The 4 hour time limit is justified in Reference ~~7~~6. Note 2 allows an additional power range instrument channel to be made inoperable only for low power PHYSICS TESTS. CL3.3-152

ACTIONS (continued)

F.1 and F.2

Condition F applies to the Intermediate Range Neutron Flux trip when ~~THERMAL POWER is above the P-6 setpoint and below the P-10 setpoint and~~ one channel is inoperable. TA3.3-151 PA3.3-375

(continued)

BASES PA3.3-356

Above the P-6 setpoint and below the P-10 setpoint, the NIS intermediate range ~~detector~~channel performs the monitoring Functions. If THERMAL POWER is greater than the P-6 setpoint but less than the P-10 setpoint, 24 hours is allowed to reduce THERMAL POWER below the P-6 setpoint or increase ~~to~~ THERMAL POWER above the P-10 setpoint. TP3.3-154 The provisions of LCO 3.0.4 allows entry into a MODE or other specified condition in the Applicability as directed by the Required Actions. Therefore, a MODE change is permitted with one channel inoperable whenever Required Action F.2 is used. X3.3-387 The NIS Intermediate Range Neutron Flux channels must be OPERABLE when the power level is above the capability of the source range, P-6, and below the capability of the power range, P-10. If THERMAL POWER is greater than the P-10 setpoint, the NIS power range channels ~~detectors~~ perform the monitoring and protection functions and the intermediate range is not required. The Completion Times allow for a slow and controlled power adjustment above P-10 or below P-6 and take into account the redundant capability afforded by the redundant OPERABLE channel, and the low probability of its failure during this period. This action does not require the inoperable channel to be tripped because the Function uses one-out-of-two logic. Tripping one channel would trip the reactor. Thus, the Required Actions specified in this Condition are only applicable when channel failure does not result in reactor trip.

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

Condition G applies to two inoperable Intermediate Range Neutron Flux trip channels ~~in MODE 2 when THERMAL POWER is above the P-6 setpoint and below the P-10 setpoint~~. TA3.3-151 Required Actions specified in this Condition are only applicable when channel failures do not result in reactor trip. Above the P-6 setpoint and below the P-10 setpoint, the NIS intermediate range channel~~detector~~ performs the PA3.3-375

(continued)

BASES

PA3.3-356

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

ACTIONS G.1 and G.2 (continued)

level. The Completion Time of 2 hours will allow a slow and controlled power reduction to less than the P-6 setpoint and takes into account the low probability of occurrence of an event during this period that may require the protection afforded by the NIS Intermediate Range Neutron Flux trip.

Required Action G.1 is modified by a Note to indicate that normal plant control operations that individually add limited reactivity (e.g., temperature or boron fluctuations associated with RCS inventory management or temperature control) are not precluded by this Action, provided they are accounted for in the calculated SDM. TA3.3-151

H.1

Condition H applies to the Intermediate Range Neutron Flux trip when THERMAL POWER is below the P-6 setpoint and one or two channels are inoperable. Below the P-6 setpoint, the NIS source range performs the monitoring and protection functions. The inoperable NIS intermediate range channel(s) must be returned to OPERABLE status prior to increasing power above the P-6 setpoint. The NIS intermediate range channels must be OPERABLE when the power level is above the capability of the source range, P-6, and below the capability of the power range, P-10. TA3.3-151

(continued)

PA3.3-356

BASES

~~I~~H.1

TA3.3-151

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

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

Required Action H.1 is modified by a Note to indicate that normal plant control operations that individually add limited reactivity (e.g., temperature or boron fluctuations associated with RCS inventory management or temperature control) are not precluded by this Action, provided they are accounted for in the calculated SDM. TA3.3-151

~~J~~I.1

TA3.3-151

Condition ~~J~~I applies to two inoperable Source Range Neutron Flux trip channels when in MODE 2, below the P-6 setpoint, ~~and performing a reactor startup,~~ or in MODE 3, 4, or 5 with the ~~RTBs closed and the CRD~~Rod Control System capable of rod withdrawal or one or more rods not fully inserted. With the unit in this Condition, below P-6, the

~~ACTIONS~~ ~~J.1 (continued)~~

NIS source range performs the monitoring and protection functions. With both source range channels inoperable, the RTBs must be opened immediately. With the RTBs open, TA3.3-151

(continued)

BASES

PA3.3-356

the core is in a more stable condition~~and the unit enters Condition L~~.

~~K~~J.1 and ~~K~~J.2

TA3.3-151

Condition ~~K~~J applies to one inoperable source range channel in MODE 3, 4, or 5 with the ~~RTBs closed and the CRD~~Rod Control System capable of rod withdrawal or one or more rods not fully inserted. With the unit in this Condition, below P-6, the NIS source range performs the monitoring and protection functions. With one of the source range channels inoperable, 48 hours is allowed to restore it to an OPERABLE status. If the channel cannot be returned to an OPERABLE status, action must be initiated within the same 48 hours to ensure that all rods are fully inserted, and the Rod Control System must be placed in a condition incapable of rod withdrawal within the next hour.~~1 additional hour is allowed to open the RTBs. Once the RTBs are open, the core is in a more stable condition and the unit enters Condition L.~~ The allowance of 48 hours to restore the channel to OPERABLE status, and the additional hour ~~to open the RTBs,~~ are justified in Reference ~~7~~6.

~~L.1, L.2, and L.3~~

TA3.3-151

~~Condition L applies when the required number of OPERABLE Source Range Neutron Flux channels is not met in MODE 3, 4, or 5 with the RTBs open. With the unit in this Condition, the NIS source range performs the monitoring and protection functions. With less than the required number of source range channels OPERABLE, operations involving positive reactivity additions shall be suspended immediately. This will preclude any power escalation. In addition to suspension of positive reactivity additions, all valves that could add unborated water to the RCS must be closed within~~

(continued)

BASES

PA3.3-356

~~1 hour as specified in LCO 3.9.2. The isolation of unborated water sources will preclude a boron dilution accident.~~

~~Also, the SDM must be verified within 1 hour and once every 12 hours thereafter as per SR 3.1.1.1, SDM verification. With no source range channels OPERABLE, core protection is severely reduced. Verifying the SDM within 1 hour allows~~

~~ACTIONS L.1, L.2, and L.3 (continued)~~

~~sufficient time to perform the calculations and determine that the SDM requirements are met. The SDM must also be verified once per 12 hours thereafter to ensure that the core reactivity has not changed. Required Action L.1 precludes any positive reactivity additions; therefore, core reactivity should not be increasing, and a 12 hour Frequency is adequate. The Completion Times of within 1 hour and once per 12 hours are based on operating experience in performing the Required Actions and the knowledge that unit conditions will change slowly.~~

MK.1 and MK.2

TA3.3-151

Condition MK applies to the following reactor trip Functions:

- Pressurizer Pressure – Low;
- Pressurizer Water Level – High;
- Reactor Coolant Flow – Low (single loop); and TA3.3-155
- Reactor Coolant Flow – Low (~~Two~~both ~~L~~loops)~~;~~
- ~~RCP Breaker Position (Two Loops);~~ CL3.3-157

(continued)

BASES PA3.3-356

~~• Undervoltage RCPs; and~~ CL3.3-156

~~• Underfrequency RCPs~~.

With one channel inoperable, the inoperable channel must be placed in the tripped condition within 6 hours. Placing the channel in the tripped condition results in a partial trip condition requiring only one additional channel to initiate a reactor trip above the P-7 or ~~setpoint and below the~~ P-8 setpoints. These Functions do not have to be OPERABLE below the P-7 and P-8 setpoints because there are no loss of flow trips below these ~~P-7~~ setpoints. There is insufficient heat production to generate DNB conditions below these setpoints. The 6 hours allowed to place the channel in the tripped condition is justified in Reference ~~7~~6. An additional 6 hours is allowed to reduce THERMAL POWER to below P-7 and P-8 if the inoperable channel cannot be restored to OPERABLE status or placed in trip within the specified Completion Time. TA3.3-155 CL3.3-373

Allowance of this time interval takes into consideration the redundant capability provided by the remaining redundant

~~ACTIONS M.1 and M.2 (continued)~~

OPERABLE channels, and the low probability of occurrence of an event during this period that may require the protection afforded by the Functions associated with Condition K~~M~~.

The Required Actions have been modified by a Note that allows placing the inoperable channel in the bypassed condition for up to 4 hours while performing routine surveillance testing of the other channels. The 4 hour time limit is justified in Reference ~~7~~6.

(continued)

BASES

PA3.3-356

NL.1 and NL.2

TA3.3-151

Condition LN applies to the Loss of Reactor Coolant Pump Underfrequency Buses 11 and 12 (21 and 22) and Undervoltage on Buses 11 and 12 (21 and 22)Reactor Coolant Flow - Low (Single Loop) reactor trip Function. With one or both channels inoperable on one bus, the inoperable channel(s) must be placed in trip within 6 hours. If the channel(s) cannot be restored to OPERABLE status or the channel(s) placed in trip within the 6 hours, then THERMAL POWER must be reduced below the P-7 and P-8 setpoints within the next 46 hours. This places the unit in a MODE where the LCO is no longer applicable. Theise trip Functions does not have to be OPERABLE below the P-7 and P-8 setpoints because other RTS trip Functions provide core protection below the P-8 setpoint. the AOO's meet their DNB criteria without requiring these trip functions at this low power level. The 6 hours allowed to restore the channel(s) to OPERABLE status or place in trip and the 46 additional hours allowed to reduce THERMAL POWER to below the P-7 and P-8 setpoints are justified in Reference 76.

CL3.3-156

TA3.3-155

CL3.3-373

PA3.3-379

The Required Actions have been modified by a Note that allows placing theone inoperable channel in the bypassed condition for up to 4 hours while performing routine surveillance testing of the other channels. The 4 hour time limit is justified in Reference 76.

OM.1 and OM.2

TA3.3-151

Condition OM applies to the RCP Breaker Position (Single Loop) reactor trip Function. There is one breaker position device per RCP breaker. With one channel inoperable, the inoperable channel must be restored to OPERABLE status within 648 hours. The Completion Time of 48 hours is reasonable considering that there are two automatic

CL3.3-157

(continued)

BASES

PA3.3-356

actuation trains, other breaker position channels, other flow related trip Functions and the low probability of an event occurring during this interval.

If the channel cannot be restored to OPERABLE status within the 648 hours, then THERMAL POWER must be reduced below the P-7 and P-8 setpoints within the next 46 hours. CL3.3-157 CL3.3-158

ACTIONS O.1 and O.2 (continued)

This places the unit in a MODE where the LCO is no longer applicable. This Function does not have to be OPERABLE below the P-7 and P-8 setpoints because the AOO's meet their DNB criteria without requiring this trip function at this low power level other RTS Functions provide core protection below the P-8 setpoint. The 6 hours allowed to restore the channel to OPERABLE status and the 4 additional hours allowed to reduce THERMAL POWER to below the P-8 setpoint are justified in Reference 7. The Required Actions have been modified by a Note that allows placing the inoperable channel in the bypassed condition for up to 4 hours while performing routine surveillance testing of the other channels. The 4 hour time limit is justified in Reference 7. PA3.3-379 CL3.3-373

PN.1 and PN.2

TA3.3-151

Condition PN applies to Turbine Trip on Low AutostopFluid Oil Pressure or on Turbine Stop Valve Closure. With one channel inoperable, the inoperable channel must be placed in the trip condition within 6 hours. If placed in the tripped condition, this results in a partial trip condition requiring only one additional channel to initiate a reactor trip. If the channel cannot be restored to OPERABLE status or placed in the trip condition, then power must be CL3.3-169

(continued)

BASES PA3.3-356

reduced below the P-9 setpoint within the next 64 hours. The 6 hours allowed to place the inoperable channel in the tripped condition and the 64 hours allowed for reducing power are justified in Reference 76.

The Required Actions have been modified by a Note that allows placing the inoperable channel in the bypassed condition for up to 4 hours while performing routine surveillance testing of the other channel(s). The 4 hour time limit is justified in Reference 76.

θO.1 and θO.2 TA3.3-151

Condition θO applies to the SI Input from ESFAS reactor trip and the RTS Automatic Trip Logic in MODES 1 and 2. These actions address the train orientation of the RTS for these Functions. With one train inoperable, 6 hours are allowed to restore the train to OPERABLE status (Required Action θO.1) or the unit must be placed in MODE 3 within the

~~ACTIONS~~ ~~O.1 and O.2 (continued)~~

next 6 hours. The Completion Time of 6 hours (Required Action θO.1) is reasonable considering that in this Condition, the remaining OPERABLE train is adequate to perform the safety function and given the low probability of an event during this interval. The Completion Time of an additional 6 hours (Required Action θO.2) is reasonable, based on operating experience, to reach MODE 3 from full power in an orderly manner and without challenging unit systems.

The Required Actions have been modified by a Note that allows bypassing one train up to [4]8 hours for surveillance testing, provided the other train is OPERABLE. A train is normally bypassed by placing the bypass breaker in service CL3.3-161 PA3.3-394

(continued)

BASES PA3.3-356

and opening the associated RTB. The RTB remains OPERABLE under these conditions so that entry into Condition P is not required while performing testing allowed by this Note.

RP.1 and RP.2

Condition RP applies to the RTBs in MODES 1 and 2. These actions address the train orientation of the RTS for the RTBs. With one RTB train inoperable, 1 hour is allowed to restore the RTBtrain to OPERABLE status or the unit must be placed in MODE 3 within the next 6 hours. The Completion Time of an additional 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power in an orderly manner and without challenging unit systems. The 1 hour and 76 hour Completion Times are equal to the time allowed by LCO 3.0.3 for shutdown actions in the event of a complete loss of RTS Function. Placing the unit in MODE 3 removes the requirement for this particular Function. results in Action C entry while RTB(s) are inoperable. TA3.3-151 TA3.3-151

The Required Actions have been modified by two Notes. Note 1 allows one channeltrain to be bypassed for up to 24 hours for surveillance testing, provided the other channeltrain is OPERABLE. Note 2 allows one RTB to be bypassed for up to 42 hours for maintenance on undervoltage or shunt trip mechanisms if the other RTB train is OPERABLE. The 2 hour time limit is justified in Reference 7. CL3.3-162 CL3.3-163

SQ.1 and SQ.2 TA3.3-151

Condition SQ applies to the P-6 and P-10 interlocks. With one or more channel(s) inoperable for one-out-of-two or two-out-of-four coincidence logic, the associated interlock must be verified to be in its required state for the existing unit condition

(continued)

PA3.3-356

BASES

~~ACTIONS~~ ~~S.1 and S.2 (continued)~~

within 1 hour or the unit must be placed in MODE 3 within the next 6 hours. Verifying the interlock status ~~manually accomplishes~~ensures the interlock's Function. The Completion Time of 1 hour is based on operating experience and the minimum amount of time allowed for manual operator actions. The Completion Time of an additional 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power in an orderly manner and without challenging unit systems. The 1 hour and 7~~6~~ hour Completion Times are equal to the time allowed by LCO 3.0.3 for shutdown actions in the event of a complete loss of RTS Function.

~~T~~R.1 and ~~T~~R.2

TA3.3-151

Condition ~~T~~R applies to the P-7, P-8, and P-9~~, and P-13~~ interlocks. With one or more channel(s) inoperable for one-out-of-two or two-out-of-four coincidence logic, the associated interlock must be verified to be in its required state for the existing unit condition within 1 hour or the unit must be placed in MODE 2 within the next 6 hours. These actions are conservative for the case where power level is being raised. Verifying the interlock status ~~manually accomplishes~~ensures the interlock's Function. The Completion Time of 1 hour is based on operating experience and the minimum amount of time allowed for manual operator actions. The Completion Time of an additional 6 hours is reasonable, based on operating experience, to reach MODE 2 from full power in an orderly manner and without challenging unit systems.

CL3.3-213

(continued)

BASES

PA3.3-356

US.1, U.2.1, and S.2U.2.2

TA3.3-151

Condition US applies to the RTB Undervoltage and Shunt Trip Mechanisms, or diverse trip features, in MODES 1 and 2. With one of the diverse trip features inoperable, it must be restored to an OPERABLE status within 48 hours or the unit must be placed in a MODE where the requirement does not apply. This is accomplished by placing the unit in MODE 3 within the next 6 hours (54 hours total time) followed by opening the RTBs in 1 additional hour (55 hours total time). The Completion Time of an additional 6 hours is a reasonable time, based on operating experience, to reach MODE 3 from full power in an orderly manner and without challenging unit systems.

ACTIONS U.1, U.2.1, and U.2.2 (continued)

With the RTBs open and the unit in MODE 3, Action C would apply to any inoperable RTB Trip mechanism this trip Function is no longer required to be OPERABLE. The affected RTB shall not be bypassed while one of the diverse features is inoperable except for the time required to perform maintenance to one of the diverse features. The allowable time for performing maintenance of the diverse features is 42 hours, per for the reasons stated under Condition PR.

TA3.3-151

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

V.1

TA3.3-151

(continued)

BASES

PA3.3-356

~~With two RTS trains inoperable, no automatic capability is available to shut down the reactor, and immediate plant shutdown in accordance with LCO 3.0.3 is required.~~

SURVEILLANCE REQUIREMENTS

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

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

Note that each channel of reactor~~process~~ protection analog system supplies both trains of the RTS. When testing Channel I, Train A and Train B must be examined. Similarly, Train A and Train B must be examined when testing Channel II, Channel III, and Channel IV (if applicable). The CHANNEL CALIBRATION and COTs are performed in a manner that is consistent with the assumptions used in analytically calculating the required channel accuracies.

[~~Reviewer's Note: Certain Frequencies are based on approval topical reports. In order for a licensee to use these times, the licensee must justify the Frequencies as required by the staff SER for the topical report.~~]

~~SURVEILLANCE REQUIREMENTS (continued)~~

SR 3.3.1.1

Performance of the CHANNEL CHECK once every 12 hours ensures that gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two instrument channels could be an indication

(continued)

PA3.3-356

of excessive instrument drift in one of the channels or of something even more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

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

The Frequency is based on operating experience that demonstrates channel failure is rare. The CHANNEL CHECK supplements less formal, but more frequent, checks of channels during normal operational use of the displays associated with the LCO required channels.

SR 3.3.1.2

SR 3.3.1.2 compares the calorimetric heat balance calculation to the NIS channel output every 24 hours. If the calorimetric exceeds the NIS channel output by > 2% RTP, the NIS is not declared inoperable, but must be adjusted. If the NIS channel output cannot be properly adjusted, the channel is declared inoperable.

Two Notes modify SR 3.3.1.2. The first Note indicates that the NIS channel output shall be adjusted consistent with the calorimetric results if the absolute difference between the NIS channel output and the calorimetric is > 2% RTP. The second Note clarifies that this Surveillance is required only if reactor power is ≥ 15% RTP and that 12 hours is

(continued)

BASES PA3.3-356

SURVEILLANCE REQUIREMENTS

SR 3.3.1.2 (continued)

allowed for performing the first Surveillance after reaching 15% RTP. At lower power levels, calorimetric data are inaccurate.

The Frequency of every 24 hours is adequate. It is based on unit operating experience, considering instrument reliability and operating history data for instrument drift. Together these factors demonstrate the change in the absolute difference between NIS and heat balance calculated powers rarely exceeds 2% in any 24 hour period.

In addition, control room operators periodically monitor redundant indications and alarms to detect deviations in channel outputs.

SR 3.3.1.3

SR 3.3.1.3 compares the incore system to the NIS channel output prior to exceeding 75% RTP after each refueling and every 31 Effective Full Power Days (EFPD). If the absolute difference is ≥ 3%, the NIS channel is still OPERABLE, but must be readjusted. PA3.3-168

If the NIS channel cannot be properly readjusted, the channel is declared inoperable. This Surveillance is performed to verify the f(ΔI) input to the overtemperature and overpower ΔT Functions. CL3.3-214

Two Notes modify SR 3.3.1.3. Note 1 indicates that the excore NIS channel shall be adjusted if the absolute difference between the incore and excore AFD is ≥ 3%. Note 2 clarifies that the Surveillance is required only if reactor power is ≥ [15%] RTP ~~and that 24 hours is allowed~~

(continued)

BASES

PA3.3-356

~~for performing the first Surveillance after reaching [15%] RTP~~.

PA3.3-168

The Frequency of once prior to exceeding 75% RTP following each refueling outage considers that the core, and therefore the neutron leakage characteristics, has been changed during a refueling outage such that the previous comparison is no longer valid. The Frequency also recognizes the importance of obtaining accurate excore NIS detector initial response data at high power level prior to NIS channel adjustment. An initial performance at ≤ 75% RTP provides a verification prior to attaining full power. The Frequency of every 31 EFPD is adequate. It is based on unit operating experience, considering instrument reliability and operating history data for instrument drift. Also, the slow changes in neutron flux during the fuel cycle can be detected during this interval.

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.4

SR 3.3.1.4 is the performance of a TADOT every 31 days on a STAGGERED TEST BASIS. This test shall verify OPERABILITY by actuation of the end devices. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable TADOT of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications and non-Technical Specification tests at least once per refueling interval with applicable extensions.

TA3.3-395

The RTB test shall include separate verification of the undervoltage and shunt trip mechanisms.~~ Independent~~ V~~v~~erification of ~~RTB undervoltage and~~the shunt trip Function is not required for the bypass breakers. No capability is

CL3.3-396

(continued)

BASES

PA3.3-356

provided for performing such a test~~at power. The independent test for bypass breakers is included in SR 3.3.1.14. The bypass breaker test shall include a local shunt trip~~. When performing this SR, manually trip the UV trip attachment remotely (i.e., from the protection system racks). ~~A~~ Note 1 has been added to indicate that this test must be performed on the bypass breaker when~~prior to~~ placing it in service. PA3.3-160

The Frequency of every 31 days on a STAGGERED TEST BASIS is adequate. It is based on industry operating experience, considering instrument reliability and operating history data.

Note 2 excludes verification of setpoints from the TADOT. The Functions affected have no setpoints associated with them. PA3.3-160

SR 3.3.1.5

SR 3.3.1.5 is the performance of an ACTUATION LOGIC TEST. The ~~SSPS~~RTS relay logic is tested every 31 days on a STAGGERED TEST BASIS~~, using the semiautomatic tester~~. The train being tested is placed in the bypass condition, thus preventing inadvertent actuation. ~~Through the semiautomatic tester, a~~All ~~possible~~ logic combinations, with~~and without~~ applicable permissives, are tested for each protection function required for the current plant MODE. The Frequency of every 31 days on a STAGGERED TEST BASIS is adequate. It is based on industry operating experience, considering instrument reliability and operating history data. CL3.3-359 CL3.3-364

(continued)

BASES PA3.3-356

SR 3.3.1.6

SR 3.3.1.6 is a calibration of the excore channels to the incore channels. If the measurements do not agree, the excore channels are not declared inoperable but must be calibrated to agree with the incore detector measurements. If the excore channels cannot be adjusted, the channels are declared inoperable. This Surveillance is performed to verify the f(ΔI) input to the overtemperature and overpower ΔT Functions. CL3.3-214

~~SURVEILLANCE REQUIREMENTS~~ ~~SR 3.3.1.6 (continued)~~

A Note modifies SR 3.3.1.6. The Note states that this Surveillance is required only if reactor power is > 7550% RTP and that [24] hours is allowed for performing the first surveillance after reaching 7550% RTP. CL3.3-164

The Frequency of 92 EFPD is adequate. It is based on industry operating experience, considering instrument reliability and operating history data for instrument drift.

SR 3.3.1.7

SR 3.3.1.7 is the performance of a COT every [92] days. A COT is performed on each required channel to ensure the entire channel will perform the intended Function. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable CHANNEL OPERATIONAL TEST of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications and non-Technical Specification tests at least once per refueling interval with applicable extensions. Setpoints TA3.3-395

(continued)

BASES PA3.3-356

must be within the Allowable Values specified in Table 3.3.1-1.

The difference between the current "as found" values and the previous test "as left" values must be consistent with the drift allowance used in the setpoint methodology. The setpoint shall be left set consistent with the assumptions of the current unit specific setpoint methodology.

The "as found" and "as left" values must also be recorded and reviewed for consistency with the assumptions of Reference 75.

~~SR 3.3.1.7 is modified by a Note that provides a 4 hour delay in the requirement to perform this Surveillance for source range instrumentation when entering MODE 3 from MODE 2. This Note allows a normal shutdown to proceed without a delay for testing in MODE 2 and for a short time in MODE 3 until the RTBs are open and SR 3.3.1.7 is no longer required to be performed. If the unit is to be in MODE 3 with the RTBs closed for > 4 hours this Surveillance must be performed prior to 4 hours after entry into MODE 3.~~ CL3.3-165

The Frequency of [92] days is justified in Reference 76.

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.8

SR 3.3.1.8 is the performance of a COT as described in SR 3.3.1.7, except it is modified by a Note that this test shall include verification that the P-6 and P-10 interlocks are in their required state for the existing unit condition. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. Verification that P-6 and P-10 are in their required state for existing plant conditions can also be accomplished by observation of the permissive annunciator window. This clarifies TA3.3-395 CL3.3-166

(continued)

BASES

PA3.3-356

What is an acceptable CHANNEL OPERATIONAL TEST of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications and non-Technical Specification tests at least once per refueling interval with applicable extensions. The Frequency is modified by a Note that allows this surveillance to be satisfied if it has been performed within [92] days of the Frequencies prior to reactor startup ~~and four hours after reducing power below P-10 and P-6~~. The Frequency of "prior to reactor startup" ensures this surveillance is performed prior to critical operations and applies to the source, intermediate and power range low instrument channels. ~~The Frequency of "4 hours after reducing power below P-10" (applicable to intermediate and power range low channels) and "4 hours after reducing power below P-6" (applicable to source range channels) allows a normal shutdown to be completed and the unit removed from the MODE of Applicability for this surveillance without a delay to perform the testing required by this surveillance.~~ The Frequency of every 92 days ~~thereafter~~ applies if the plant remains in the MODE of Applicability after the initial performances of prior to reactor startup ~~and four hours after reducing power below P-10 or P-6. The MODE of Applicability for this surveillance is < P-10 for the power range low and intermediate range channels and < P-6 for the source range channels.~~ Once the unit is in MODE 3, this surveillance is no longer required for the power range low and intermediate range channels. ~~If power is to be maintained < P-10 or < P-6 for more than 4 hours, then the testing required by this surveillance must be performed prior to the expiration of the 4 hour limit. Four hours is a reasonable time to complete the required testing or place the unit in a MODE where this surveillance is no longer required.~~ This test ensures that the NIS source, intermediate, and power range low channels are OPERABLE prior to taking the reactor critical and after reducing

(continued)

BASES PA3.3-356

power into the applicable MODE (< P-10 or < P-6) for periods > 4 hours.

SR 3.3.1.9

SR 3.3.1.9 is the performance of a TADOT and is performed every [92] days, as justified in Reference 76. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable TADOT of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications and non-Technical Specification tests at least once per refueling interval with applicable extensions. TA3.3-395

SURVEILLANCE REQUIREMENTS SR 3.3.1.9 (continued)

The SR is modified by a Note that excludes verification of setpoints from the TADOT. Since this SR applies to RCP undervoltage and underfrequency relays, setpoint verification requires elaborate bench calibration and is accomplished during the CHANNEL CALIBRATION. PA3.3-397

SR 3.3.1.10

A CHANNEL CALIBRATION is performed every 24[18] months, or approximately at every refueling. CHANNEL CALIBRATION is a complete check of the instrument loop, including the sensor where applicable (e.g., the undervoltage and underfrequency relays do not have separate sensors). The test verifies that the channel responds to a measured parameter within the necessary range and accuracy. X3.3-172 PA3.3-397

(continued)

BASES

PA3.3-356

CHANNEL CALIBRATIONS must be performed consistent with the assumptions of the unit specific setpoint methodology. The difference between the current "as found" values and the previous test "as left" values must be consistent with the drift allowance used in the setpoint methodology.

The Frequency of ~~18~~24 months is based on the assumption of a~~n~~ ~~18~~24 month calibration interval in the determination of the magnitude of equipment drift in the setpoint methodology. X3.3-172

SR 3.3.1.10 is modified by a Note stating that this test shall include verification that the time constants are adjusted to the prescribed values where applicable.

SR 3.3.1.11

SR 3.3.1.11 is the performance of a CHANNEL CALIBRATION, as described in SR 3.3.1.10, every ~~[18]~~24 months. This SR is modified by ~~a~~two Notes. Note 1 states~~ing~~ that neutron detectors are excluded from the CHANNEL CALIBRATION. Note 2 requires the Surveillance to include verification that the time constants, where applicable, are adjusted to the prescribed values. ~~The CHANNEL CALIBRATION for the power range neutron detectors consists of a normalization of the detectors based on a power calorimetric and flux map performed above 15% RTP. The CHANNEL CALIBRATION for the source range and intermediate range neutron detectors consists of obtaining the detector~~

X3.3-172

PA3.3-173

CL3.3-398

~~SURVEILLANCE REQUIREMENTS~~ ~~SR 3.3.1.11 (continued)~~

~~plateau or preamp discriminator curves, evaluating those curves, and comparing the curves to the manufacturer's data.~~

(continued)

BASES

PA3.3-356

This Surveillance is not required for the NIS power range detectors for entry into MODE 2 or 1, and is not required for the NIS intermediate range detectors for entry into MODE 2, because the unit must be in at least MODE 2 to perform the test for the intermediate range detectors and MODE 1 for the power range detectors. The 24[18] month Frequency is based on the assumption of a 24 month calibration interval in the determination of the magnitude of equipment drift in the setpoint methodology. 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 on the [18]month Frequency. X3.3-172

SR 3.3.1.12

SR 3.3.1.12 is the performance of a CHANNEL CALIBRATION, as described in SR 3.3.1.10, every [18]24 months. This SR is modified by atwo Notes. Note 1 statesing that this test shall include verification of the RCS resistance temperature detector (RTD) bypass loop flow rate. Note 2 requires the Surveillance to include verification that the time constants, where applicable, are adjusted to the prescribed values. X3.3-172 PA3.3-173

This test will verify the rate lag compensation for flow from the core to the RTDs.

The Frequency is justified by the assumption of an 1824 month calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis. X3.3-172

SR 3.3.1.13

(continued)

BASES PA3.3-356

SR 3.3.1.13 is the performance of a COT of RTS interlocks every ~~[18]~~24 months. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable CHANNEL OPERATIONAL TEST of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications and non-Technical Specification tests at least once per refueling interval with applicable extensions. X3.3-172 TA3.3-395

The Frequency is based on the known reliability of the interlocks and the multichannel redundancy available, and has been shown to be acceptable through operating experience.

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.14

SR 3.3.1.14 is the performance of a TADOT of the Manual Reactor Trip, RCP Breaker Position, and the SI Input from ESFAS. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable TADOT of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications and non-Technical Specification tests at least once per refueling interval with applicable extensions. TA3.3-395 This TADOT is performed every ~~[18]~~24 months. X3.3-172 The test shall independently verify the OPERABILITY of the undervoltage and shunt trip mechanisms for the Manual Reactor Trip Function for the Reactor Trip Breakers ~~and Reactor Trip Bypass Breakers~~. CL3.3-396 The Reactor Trip Bypass Breaker test shall include testing of the ~~automatic~~ undervoltage trip.

(continued)

BASES PA3.3-356

The Frequency is based on the known reliability of the Functions and the multichannel redundancy available, and has been shown to be acceptable through operating experience.

The SR is modified by a Note that excludes verification of setpoints from the TADOT. The Functions affected have no setpoints associated with them.

SR 3.3.1.15

SR 3.3.1.15 is the performance of a TADOT of Turbine Trip Functions. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable TADOT of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications and non-Technical Specification tests at least once per refueling interval with applicable extensions. This ~~TADOT is as described in SR 3.3.1.4, except that this~~ test is performed prior to exceeding P-9 interlock whenever the unit has been shutdown in excess of 2 days~~prior to reactor startup~~. ~~A Note states that t~~This Surveillance is~~-not~~ required~~-if it has been,~~ if not performed within the previous 31 days. A Note states that vVerification of the Trip Setpoint does not have to be performed for this Surveillance. Performance of this test will ensure that the turbine trip Function is OPERABLE prior to ~~taking the reactor critical. This test cannot be performed with the reactor at power and must therefore be performed prior to reactor startup~~exceeding the P-9 interlock. TA3.3-395 PA3.3-399 TA3.3-175

SR 3.3.1.16

(continued)

BASES

PA3.3-356

SR 3.3.1.16 verifies that the individual channel/train actuation response times are less than or equal to the maximum values assumed in the accident analysis. Response time testing acceptance criteria are included in ~~Technical Requirements Manual, Section 15 (Ref. 8)~~appropriate plant procedures. Individual component response times are typically not modeled in the analyses. CL3.3-390

~~SURVEILLANCE REQUIREMENTS~~ ~~SR 3.3.1.16 (continued)~~

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

~~For channels that include dynamic transfer Functions (e.g., lag, lead/lag, rate/lag, etc.), the response time test may be performed with the transfer Function set to one, with the resulting measured response time compared to the appropriate FSAR response time. Alternately, the r~~Response time test ~~can be~~is performed with the time constants set to their nominal value, provided the required response time is analytically calculated assuming the time constants are set at their nominal values. The response time may be measured by a series of overlapping tests such that the entire response time is measured. CL3.3-390

As appropriate, each channel's response must be verified every ~~[18]~~24 months on a STAGGERED TEST BASIS. Testing of the final actuation devices is included in the testing. Response times cannot be determined during unit operation because equipment operation is required to measure response times. Experience has shown that these components usually pass this surveillance when performed at the 24~~18~~ month X3.3-172

(continued)

BASES PA3.3-356

Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

~~SR 3.3.1.16 is modified by a Note stating that neutron detectors are excluded from RTS RESPONSE TIME testing. This Note is necessary because of the difficulty in generating an appropriate detector input signal. Excluding the detectors is acceptable because the principles of detector operation ensure a virtually instantaneous response.~~ CL3.3-178

REFERENCES

1. AEC "General Design Criteria for Nuclear Power Plant Construction Permits," Criterion 14, issued for comment July 10, 1967, as referenced in USAR Section 1.2 ~~FSAR, Chapter [7]~~. PA3.3-357

2. Regulatory Guide 1.105, Revision 3, "Setpoints for Safety-Related Instrumentation." TA3.3-176

3. UFSAR, Section 14~~Chapter [6]~~. CL3.3-392

~~4~~3. UFSAR, Section 7~~Chapter [15]~~.

5~~4~~. "Engineering Manual Section 3.3.4.1 Engineering Design Standard for Instrument Setpoint/Uncertainty Calculations" ~~IEEE-279-1971.~~

~~REFERENCES (continued)~~

~~5. 10 CFR 50.49.~~

~~6. RTS/ESFAS Setpoint Methodology Study.~~

~~7.~~ WCAP-10271-P-A, Supplement 2, Rev. 1, June 1990.

~~8. Technical Requirements Manual, Section 15, "Response Times."~~

B 3.3 INSTRUMENTATION

B 3.3.2 Engineered Safety Feature Actuation System (ESFAS) Instrumentation

PA3.3-356

BASES

BACKGROUND

AEC GDC Criterion 15, "Engineered Safety Features Protection Systems" (Ref. 1), requires that protection systems shall be provided for sensing accident situations and initiating the operation of necessary engineered safety features. ~~The ESFAS initiates necessary safety systems, based on the values of selected unit parameters, to protect against violating core design limits and the Reactor Coolant System (RCS) pressure boundary, and to mitigate accidents.~~ PA3.3-357

Accidents are events that are analyzed even though they are not expected to occur during the unit life. One acceptable limit during accidents is that offsite dose shall be maintained within an acceptable fraction of 10 CFR 100 limits. Different accident categories are allowed a different fraction of these limits, based on probability of occurrence. Meeting the acceptable dose limit for an accident category is considered having acceptable consequences for that event. PA3.3-357

The ESFAS instrumentation is segmented into ~~three distinct but~~ interconnected portions~~modules~~ as described in the USAR (Ref. 2), and as identified below: PA3.3-360

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

2. Signal processing equipment including Reactor~~analog~~ ~~P~~protection Analog ~~S~~system, ~~field contacts, and~~arranged in protection channel sets: provide signal conditioning, bistable setpoint comparison,

(continued)

BASES PA3.3-356

process algorithm actuation, compatiblebistable electrical signal output to engineered safety features (ESF) relayprotection system logicdevices, and control board/control room/miscellaneous indications; and PA3.3-360 PA3.3-363

3. Solid State ProtectionESF relay logic sSystem (SSPS) including channelized input, and logic, and output bays: initiates the proper unit shutdown or engineered safety feature (ESF) actuation in accordance with the defined logic and based on the bistable outputs from the signal process control andanalog protection system. CL3.3-359 PA3.3-363

The Allowable Value in conjunction with the trip setpoint and LCO establishes the threshold for ESFAS action to prevent exceeding acceptable limits such that the consequences of Design Basis Accidents (DBA's) will be acceptable. The Allowable Value is considered a limiting value such that a channel is OPERABLE if the setpoint is found not to exceed the Allowable Value during the CHANNEL OPERATIONAL TEST (COT). Note that, although a channel is "OPERABLE" under these circumstances, the ESFAS setpoint must be left adjusted to within the established calibration tolerance band of the ESFAS setpoint in accordance with the uncertainty assumptions stated in the referenced setpoint methodology, (as-left criteria) and confirmed to be operating within the statistical allowances of the uncertainty terms assigned. TA3.3-176

Field Transmitters or Sensors

To meet the design demands for redundancy and reliability, for the ESFAS Functions more than one, and often as many as four, generally two or three field transmitters or sensors are used to measure unit parameters. In many cases, CL3.3-401

(continued)

 PA3.3-356

field transmitters or sensors that input to the ESFAS are shared with the Reactor Trip System (RTS). In some cases, the same channels also provide control system inputs. To account for calibration tolerances and instrument drift, which are assumed to occur between calibrations, statistical allowances are provided in the Trip Setpoint and Allowable

BACKGROUND Field Transmitters or Sensors (continued) TA3.3-176

Values. The OPERABILITY of each transmitter or sensor can be evaluated when its "as found" calibration data are compared against its documented acceptance criteria. is determined by either "as found" calibration data evaluated during the CHANNEL CALIBRATION or by qualitative assessment of field transmitter or sensor, as related to channel behavior observed during performance of the CHANNEL CHECK.

Signal Processing EquipmentReactor Protection Analog System

Generally, for ESFAS Functions, two or three or four channels of instrumentationprocess control equipment are used for the signal processing of unit parameters measured by the field instruments. The instrument channelsprocess control equipment provides signal conditioning, comparable output signals for instruments located on the main control board, and comparison of measured input signals with setpoints that are based on established by safety analyses. These setpoints are defined in FSAR, Chapter [6] (Ref. 1), Chapter [7] (Ref. 2), and Chapter [15] (Ref. 3). If the measured value of a unit parameter exceeds the predetermined setpoint, an output from a bistable is forwarded to the SSPS for decision evaluation actuates logic input relays. Channel separation is described in Reference 2maintained up to and through the input bays. However, not all unit parameters require four channels of sensor measurement and signal processing. Some unit parameters provide input only to the SSPS, while others provide input

CL3.3-401 PA3.3-360 CL3.3-372 CL3.3-359 CL3.3-401

(continued)

BASES

PA3.3-356

to the SSPS, the main control board, the unit computer, and one or more control systems.

Generally, if a parameter is used only for input to the protection circuits, three channels with a two-out-of-three logic are sufficient to provide the required reliability and redundancy. If one channel fails in a direction that would not result in a partial Function trip, the Function will is still operateOPERABLE with a two-out-of-two logic. If one channel fails such that a partial Function trip occurs, a trip will not occur and the Function will is still operateOPERABLE with a one-out-of- two logic. Therefore, a single failure will neither cause nor prevent the protection function actuation. The actual number of channels required for each unit parameter is specified in Reference 2. CL3.3-401

Generally, if a parameter is used for input to the SSPS and a control function, four channels with a two-out-of-four logic are sufficient to provide the required reliability and redundancy. The circuit must be able to withstand both an input failure to the control system, which may then require the protection function actuation, and a single failure in the other channels providing the protection function CL3.3-401

BACKGROUND Signal Processing Equipment (continued)

actuation. Again, a single failure will neither cause nor prevent the protection function actuation.

These requirements are described in IEEE-279-1971 (Ref. 4). The actual number of channels required for each unit parameter is specified in Reference 2.

(continued)

BASES PA3.3-356

~~Trip Setpoints and~~ Allowable Values and ESFAS Setpoints TA3.3-176

~~The Trip Setpoints are the nominal values at which the bistables are set. Any bistable is considered to be properly adjusted when the "as left" value is within the band for CHANNEL CALIBRATION accuracy.~~

The t~~T~~rip s~~S~~etpoints used in the bistables are based on the analytical limits ~~stated in~~from Reference 3~~2~~. The selection of these t~~T~~rip s~~S~~etpoints is such that adequate protection is provided when all sensor and processing time delays are taken into account. To allow for calibration tolerances, instrumentation uncertainties, instrument drift, and severe environment errors for those ESFAS channels that must function in harsh environments as defined by 10 CFR 50.49~~ (Ref. 5)~~, the ~~Trip Setpoints and~~ Allowable Values specified in Table 3.3.2-1 in the accompanying LCO are conservative~~ly adjusted~~ with respect to the analytical limits. A detailed description of the methodology used to calculate the Allowable Value and ESFAS~~Trip~~ s~~S~~etpoints, including their explicit uncertainties, is provided in the ~~"RTS/ESFAS~~plant specific s~~S~~etpoint m~~M~~ethodology s~~S~~tudy~~"~~ (Ref. 4~~6~~) which incorporates all the known uncertainties applicable to each channel. The magnitudes of these uncertainties are factored into the determination of each ESFAS setpoint and corresponding Allowable Value. The ~~actual~~ nominal ~~Trip~~ESFAS s~~S~~etpoint entered into the bistable is more conservative than that specified by the Allowable Value to account for ~~changes in random~~ measurement errors detectable by a COT. 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 ESFAS Function~~bistable~~ is considered OPERABLE. TA3.3-176

The ESFAS setpoints are the values at which the bistables are set and is the expected value to be achieved during calibration. The ESFAS setpoint value ensures the safety TA3.3-176

(continued)

BASES PA3.3-356

analysis limits are met for the surveillance interval selected when a channel is adjusted based on stated channel uncertainties. Any bistable is considered to be properly adjusted when the "as-left" setpoint value is within the band for CHANNEL CALIBRATION uncertainty allowance (i.e. calibration tolerance uncertainties).

Setpoints adjusted consistent with the requirements of ~~in accordance with~~ the Allowable Value ensure that the consequences of ~~Design Basis Accidents (~~DBAs~~)~~ will be acceptable, providing the unit is operated from within the LCOs at the onset of the DBA and the equipment functions as designed. TA3.3-176

BACKGROUND ~~Trip Setpoints and Allowable Values (continued)~~

Each channel can be tested on line to verify that the signal processing equipment and setpoint accuracy is within the specified allowance requirements of Reference 4~~2~~. Once a designated channel is taken out of service for testing, a simulated signal is injected in place of the field instrument signal. The process equipment for the channel in test is then tested, verified, and calibrated. SRs for the channels are specified in the SR section.

~~The Trip Setpoints and Allowable Values listed in Table 3.3.2-1 are based on the methodology described in Reference 6, which incorporates all of the known uncertainties applicable for each channel. The magnitudes of these uncertainties are factored into the determination of each Trip Setpoint. All field sensors and signal processing equipment for these channels are assumed to operate within the allowances of these uncertainty magnitudes.~~ TA3.3-176

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BASES

PA3.3-356

Solid State ProtectionESF Relay Logic System

CL3.3-359

The SSPSrelay logic equipment is usesd for the decision logic processing of outputs from the signal processing equipmentanalog bistables. To meet the redundancy requirements, two trains of SSPSrelay logic, each performing the same functions, are provided. If one train is taken out of service for maintenance or test purposes, the second train will provide ESF actuation for the unit. If both trains are taken out of service or placed in test, a reactor trip will result. Each train is packaged in its own set of cabinets for physical and electrical separation to satisfy separation and independence requirements. PA3.3-363

The ESF relay logic systemSSPS performs the decision logic for most ESF equipment actuation; generates the electrical output signals that initiate the required actuation; and provides the status, permissive, and annunciator output signals to the main control room of the unit. CL3.3-359

The relay logic consists of input, master and slave relays. The bistable outputs from the signal processing equipment are sensed by the SSPS equipment and combined via the input relays into logic matrices that represent combinations indicative of various CL3.3-233

BACKGROUND Solid State Protection System (continued)

transients. If a required logic matrix combination is completed, the appropriate system will send actuation signals via master and slave relays are energized. The master and slave relays cause actuation ofto those components whose aggregate Function best serves to alleviate the condition and restore the unit to a safe condition. Examples are given in the Applicable Safety Analyses, LCO, and Applicability sections of this Bases.

(continued)

BASES

PA3.3-356

Each SSPS relay logic train has a built in testing device that can automatically features that allow testing the decision logic matrix and master relay functions and the actuation devices while the unit is at power. When any one train is taken out of service for testing, the other train is capable of providing unit monitoring and protection until the testing has been completed. The testing device is semiautomatic to minimize testing time. CL3.3-364

The actuation of ESF components is accomplished through master and slave relays. The SSPS energizes the master relays appropriate for the condition of the unit. Each master relay then energizes one or more slave relays, which then cause actuation of the end devices. The master and slave relays are routinely tested to ensure operation. The test of the master relays energizes the relay, which then operates the contacts and applies a low voltage to the associated slave relays. The low voltage is not sufficient to actuate the slave relays but only demonstrates signal path continuity. The SLAVE RELAY TEST actuates the devices if their operation will not interfere with continued unit operation. For the latter case, actual component operation is prevented by the SLAVE RELAY TEST circuit, and slave relay contact operation is verified by a continuity check of the circuit containing the slave relay. CL3.3-233

Reviewer's Note: No one unit ESFAS incorporates all of the Functions listed in Table 3.3.2-1. In some cases (e.g., Containment Pressure - High 3, Function 2.c), the table reflects several different implementations of the same Function. Typically, only one of these implementations are used at any specific unit.

(continued)

PA3.3-356

BASES (continued)

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY

Each of the analyzed accidents can be detected by one or more ESFAS Functions. One of the ESFAS Functions is the primary actuation signal for that accident. An ESFAS Function may be the primary actuation signal for more than one type of accident. An ESFAS Function may also be a secondary, or backup, actuation signal for one or more other accidents. For example, Pressurizer Low Pressure - Low is a primary actuation signal for small loss of coolant accidents (LOCAs) and a backup actuation signal for steam line breaks (SLBs) insideoutside containment. Functions such as manual initiation, not specifically credited in the accident safety analysis, are qualitatively credited in the safety analysis and the NRC staff approved licensing basis for the unit. These Functions may provide protection for conditions that do not require dynamic transient analysis to demonstrate Function performance. These Functions may also serve as backups to Functions that were credited in the accident analysis (Ref. 3).

The LCO requires all instrumentation performing an ESFAS Function to be OPERABLE. A channel is OPERABLE with a trip setpoint outside its calibration tolerance band provided the trip setpoint "as-found" value does not exceed its associated Allowable Value and provided the trip setpoint "as-left" value is adjusted to within the calibration tolerance band. Failure of any instrument renders the affected channel(s) inoperable and reduces the reliability of the affected Functions. TA3.3-176

The LCO generally requires OPERABILITY of two four or three channels in each instrumentation function and two channels in each logic and manual initiation function. The two-out-of-three and the two-out-of-four configurations allows one channel to be tripped during maintenance or testing without causing an ESFAS initiation. Two logic or manual initiation channels are required to ensure no single random failure disables the ESFAS. CL3.3-401

(continued)

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The required channels of ESFAS instrumentation provide unit protection in the event of any of the analyzed accidents. ESFAS protection functions are as follows:

1. Safety Injection

Safety Injection (SI) provides two primary functions:

1. Primary side water addition to ensure maintenance or recovery of reactor vessel water level (coverage of the active fuel for heat removal, clad integrity, and for limiting peak clad temperature to < 2200°F); and

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

1. Safety Injection (continued)

2. Boration to ensure recovery and maintenance of SDM ~~(k_{eff} < 1.0)~~.

These functions are necessary to mitigate the effects of a LOCA or SLB ~~high energy line breaks (HELBs)~~ both inside and outside of containment. The SI signal is also used to initiate other fFunctions such as:

- ~~Phase A~~ Containment Isolation; CL3.3-252
- Containment Ventilation~~Purge~~ Isolation;
- Reactor Trip;
- ~~Turbine Trip;~~ CL3.3-257
- Feedwater Isolation;
- ~~Start of motor driven~~ Aauxiliary Ffeedwater (AFW)~~ pumps~~; and CL3.3-402

(continued)

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- Control room ventilation isolation; and.
- Enabling automatic switchover of Emergency Core Cooling Systems (ECCS) suction to containment sump. CL3.3-267

These other functions ensure:

- Isolation of nonessential systems through containment penetrations;
- Trip of the turbine and reactor to limit power generation; CL3.3-257
- Isolation of main feedwater (MFW) to limit containment pressurization secondary side mass losses; CL3.3-405
- Start of AFW to ensure secondary side cooling capability;
- Isolation of the control room to ensure habitability; and.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

1. Safety Injection (continued)

- Enabling ECCS suction from the refueling water storage tank (RWST) switchover on low low RWST level to ensure continued cooling via use of the containment sump. CL3.3-267

a. Safety Injection - Manual Initiation

The LCO requires twoone channels per train to be OPERABLE. The operator can initiate SI at any time by using either of two switches in the control room. This action will cause actuation

(continued)

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of all components in the same manner as any of the automatic actuation signals.

The LCO for the Manual Initiation Function ensures the proper amount of redundancy is maintained in the manual ESFAS actuation circuitry to ensure the operator has manual ESFAS initiation capability.

Each channel consists of one ~~push button~~switch and the interconnecting wiring to the actuation logic cabinet. Each switch~~push button~~ actuates both trains. This configuration does not allow testing at power. The Applicability of the SI Manual Initiation Function is discussed with the Automatic Actuation Relay Logic Function below.

b. Safety Injection – Automatic Actuation Relay Logic ~~and Actuation Relays~~ CL3.3-238

This LCO requires two trains to be OPERABLE. The SI ~~a~~Actuation logic consists of all circuitry housed within the ESF relay logic cabinets for the SI actuation subsystems~~s~~, including the initiating relay contacts responsible for actuating the ESF equipment. PA3.3-403

Manual and automatic initiation of SI must be OPERABLE in MODES 1, 2, and 3. In these MODES, there is sufficient energy in the primary and secondary systems to warrant automatic initiation of ESF systems. Manual Initiation is also required in MODE 4 even though automatic actuation is not required. In this MODE, adequate time is available to manually actuate required components in the event of a DBA, but

(continued)

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

b. Safety Injection – Automatic Actuation Relay Logic and Actuation Relays (continued)

because of the large number of components actuated on a SI, actuation is simplified by the use of the manual actuation switchespush buttons. Automatic actuation relay logic and actuation relays must be OPERABLE in MODE 4 to support system level manual initiation.

These Functions are not required to be OPERABLE in MODES 5 and 6 because there is adequate time for the operator to evaluate unit conditions and respond by manually starting individual systems, pumps, and other equipment to mitigate the consequences of an abnormal condition or accident. Unit pressure and temperature are very low and many ESF components are administratively locked out or otherwise prevented from actuating to prevent inadvertent overpressurization of unit systems.

c. Safety Injection – High Containment Pressure – High 1

This signal provides protection against the following accidents:

- SLB inside containment; and
- LOCA; and
- Feed line break inside containment.

CL3.3-410

CL3.3-401

Containment Pressure – High 1 provides no input to any control functions. Thus, Tthree OPERABLE

(continued)

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channels are sufficient to satisfy protective requirements with a two-out-of-three logic. The transmitters (d/p cells) and electronics are located outside of containment with the sensing line (high pressure side of the transmitter) located inside containment. CL3.3-404

Thus, the high pressure Function will not experience any adverse environmental conditions and the Trip Setpoint Allowable Value reflects only steady state instrument uncertainties. TA3.3-176

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

c. Safety Injection - Containment Pressure - High 1 (continued)

High Containment Pressure - High 1 must be OPERABLE in MODES 1, 2, and 3 when there is sufficient energy in the primary and secondary systems to warrant automatic initiation of ESF systems pressurize the containment following a pipe break. In MODES 4, 5, and 6, plant conditions are such that the probability of an event requiring Emergency Core Cooling System (ECCS) injection is extremely low. In MODE 4, adequate time is available to manually actuate required components in the event of a DBA there is insufficient energy in the primary or secondary systems to pressurize the containment. CL3.3-406

d. Safety Injection - Pressurizer Low Pressure - Low

This signal provides protection against the following accidents:

- Inadvertent opening of a steam generator (SG) relief or safety valve;

(continued)

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- SLB;
- Rupture of a control rod drive mechanism housingA spectrum of rod cluster control assembly ejection accidents (rod ejection); CL3.3-407
- Inadvertent opening of a pressurizer relief or safety valve;
- LOCAs; and
- SG Tube Rupture.

At some units pPressurizer pressure provides both control and protection functions: input to the pPressurizer pPressure cControl sSystem, reactor trip, and SI. However, two independent Power Operated Relief Valve (PORV) open signals must be present before a PORV can open. Therefore, a single pressure channel failing high will not fail a PORV open and trigger a depressurization eventthe actuation logic must be able to withstand both an input failure to control system, which may then require SIthe protection function actuation, and a single failure in the other channels providing the protection function actuation. Thus, threefour OPERABLE channels are sufficientrequired to satisfy the protective requirements with a two-out-of-fourthree logic. For units that have dedicated protection and control channels, only three protection channels are necessary to satisfy the protective requirements. CL3.3-408

(continued)

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

d. Safety Injection - Pressurizer Pressure - Low (continued)

The transmitters are located inside containment, with the taps in the vapor space region of the pressurizer, and thus possibly experiencing adverse environmental conditions (LOCA, SLB inside containment, rod ejection). Therefore, the Trip SetpointAllowable Value reflects the inclusion of both steady state and adverse environmental instrument uncertainties. TA3.3-176

This Function must be OPERABLE in MODES 1, 2, and 3 (above P-11with pressurizer pressure ≥ 2000 psig) to mitigate the consequences of an HELB inside containment. This signal may be manually blocked by the operator when pressurizer pressure is ≤ 2000 psigbelow the P-11 setpoint. Automatic SI actuation below this pressure setpoint is then performed by the High Containment Pressure - High 1 signal. CL3.3-245 CL3.3-409

This Function is not required to be OPERABLE in MODE 3 when pressurizer pressure is ≤ 2000 psig below the P-11 setpoint. Other ESF functions are used to detect accident conditions and actuate the ESF systems in this MODE. In MODES 4, 5, and 6, this Function is not needed for accident detection and mitigation. CL3.3-245

e. Safety Injection - Steam Line Low Pressure

(1) Steam Line Pressure - Low

CL3.3-244

Steam Line Low Pressure - Low provides protection against the following accidents:

(continued)

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- SLB;
- Feed line break; and
- Inadvertent opening of ~~an SG relief or~~ an SG safety valve. CL3.3-411

Steam lLine pPressure transmitters - ~~Low~~ provides ~~no~~ input to ~~any~~ control functions, but the control function cannot initiate events that the Function acts to mitigate. Thus, three OPERABLE channels on each steam line are sufficient to satisfy the protective CL3.3-401

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

~~(1) Steam Line Pressure - Low (continued)~~

requirements with a two-out-of-three logic on each steam line.

With the transmitters typically located in the vicinity of the main steam lines ~~inside the steam tunnels~~, it is possible for them to experience adverse environmental conditions during a secondary side break. Therefore, the Allowable Value ~~Trip Setpoint~~ reflects both steady state and adverse environmental instrument uncertainties. TA3.3-176

This Function is anticipatory in nature and has a typical lead/lag ratio of 12/~~250/5~~. CL3.3-242

Steam Line Low Pressure - ~~Low~~ must be OPERABLE in MODES 1, 2, and 3 ~~(above P-11~~ with pressurizer pressure ≥ 2000 psig.~~)~~ when a secondary side break or stuck open safety valve could result in the rapid CL3.3-245 CL3.3-411

(continued)

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depressurization of the steam lines. This signal may be manually blocked by the operator below the P-11 setpointwhen pressurizer pressure is ≤ 2000 psig. Below P-11When pressurizer pressure is ≤ 2000 psig, feed line break is not a concern. Inside containment SLB will be terminated by automatic SI actuation via Containment Pressure - High 1, and outside containment SLB will be terminated by the Steam Line Pressure - Negative Rate - High signal for steam line isolation. This Function is not required to be OPERABLE in MODE 4, 5, or 6 because there is insufficient energy in the secondary side of the unit to cause an accident. CL3.3-255

(2) Steam Line Pressure - High Differential Pressure Between Steam Lines CL3.3-244

Steam Line Pressure - High Differential Pressure Between Steam Lines provides protection against the following accidents:

- SLB;
- Feed line break; and

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

(2) Steam Line Pressure - High Differential Pressure Between Steam Lines (continued)

- Inadvertent opening of an SG relief or an SG safety valve.

Steam Line Pressure - High Differential Pressure Between Steam Lines provides no input to any control functions. Thus,

(continued)

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three OPERABLE channels on each steam line are sufficient to satisfy the requirements, with a two-out-of-three logic on each steam line.

With the transmitters typically located inside the steam tunnels, it is possible for them to experience adverse environmental conditions during an SLB event. Therefore, the Trip Setpoint reflects both steady state and adverse environmental instrument uncertainties. Steam line high differential pressure must be OPERABLE in MODES 1, 2, and 3 when a secondary side break or stuck open valve could result in the rapid depressurization of the steam line(s). This Function is not required to be OPERABLE in MODE 4, 5, or 6 because there is not sufficient energy in the secondary side of the unit to cause an accident.

CL3.3-244

f, g. Safety Injection - High Steam Flow in Two Steam Lines Coincident With T_{avg} - Low Low or Coincident With Steam Line Pressure - Low

These Functions (1.f and 1.g) provide protection against the following accidents:

- SLB; and
- the inadvertent opening of an SG relief or an SG safety valve.

Two steam line flow channels per steam line are required OPERABLE for these Functions. The steam line flow channels are combined in a one-out-of-

(continued)

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

f. g. Safety Injection - High Steam Flow in Two Steam Lines Coincident With T_{avg} - Low Low or Coincident With Steam Line Pressure - Low (continued)

two logic to indicate high steam flow in one steam line. The steam flow transmitters provide control inputs, but the control function cannot cause the events that the Function must protect against. Therefore, two channels are sufficient to satisfy redundancy requirements. The one-out-of-two configuration allows online testing because trip of one high steam flow channel is not sufficient to cause initiation. High steam flow in two steam lines is acceptable in the case of a single steam line fault due to the fact that the remaining intact steam lines will pick up the full turbine load. The increased steam flow in the remaining intact lines will actuate the required second high steam flow trip. Additional protection is provided by Function 1.e.(2), High Differential Pressure Between Steam Lines.

One channel of T_{avg} per loop and one channel of low steam line pressure per steam line are required OPERABLE. For each parameter, the channels for all loops or steam lines are combined in a logic such that two channels tripped will cause a trip for the parameter. For example, for three loop units, the low steam line pressure channels are combined in two-out-of-three logic. Thus, the Function trips on one-out-of-two high flow in any two-out-of-three steam lines if there is one-out-of-one low low T_{avg} trip in any two-out-of-three RCS loops, or if there is a one-out-of-one low pressure trip in any two-out-of-three steam lines. Since the

(continued)

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accidents that this event protects against cause both low steam line pressure and low-low T_{avg}. provision of one channel per loop or steam line ensures no single random failure can disable both of these Functions. The steam line pressure channels provide no control inputs. The T_{avg} channels provide control inputs, but the control function cannot initiate events that the Function acts to mitigate.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

f. g. Safety Injection - High Steam Flow in Two Steam Lines Coincident With T_{avg} - Low Low or Coincident With Steam Line Pressure - Low (continued)

CL3.3-244

The Allowable Value for high steam flow is a linear function that varies with power level. The function is a ΔP corresponding to 44% of full steam flow between 0% and 20% load to 114% of full steam flow at 100% load. The nominal trip setpoint is similarly calculated.

With the transmitters typically located inside the containment (T_{avg}) or inside the steam tunnels (High Steam Flow), it is possible for them to experience adverse steady state environmental conditions during an SLB event. Therefore, the Trip Setpoint reflects both steady state and adverse environmental instrument uncertainties. The Steam Line Pressure - Low signal was discussed previously under Function 1.e.(1).

This Function must be OPERABLE in MODES 1, 2, and 3 (above P-12) when a secondary side break or stuck open valve could result in the rapid depressurization of the steam line(s). This signal may be manually blocked by the operator when below the P-12 setpoint. Above P-12, this

(continued)

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Function is automatically unblocked. This Function is not required OPERABLE below P-12 because the reactor is not critical, so feed line break is not a concern. SLB may be addressed by Containment Pressure High 1 (inside containment) or by High Steam Flow in Two Steam Lines coincident with Steam Line Pressure - Low, for Steam Line Isolation, followed by High Differential Pressure Between Two Steam Lines, for SI. This Function is not required to be OPERABLE in MODE 4, 5, or 6 because there is insufficient energy in the secondary side of the unit to cause an accident.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

2. Containment Spray

Containment Spray (CS) provides three primary functions:

1. Lowers containment pressure and temperature after an HELB LOCA or SLB in containment;

2. Reduces the amount of radioactive iodine in the containment atmosphere; and

3. Adjusts the pH of the water in the containment recirculation sump after a large break LOCA.

These functions are necessary to:

- Ensure the pressure boundary integrity of the containment structure;

- Limit the release of radioactive iodine to the environment in the event of a failure of the containment structure; and

(continued)

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- Minimize corrosion of the components and systems inside containment following a LOCA.

The CS~~containment spray~~ actuation signal starts the CS ~~containment spray~~ pumps and aligns the discharge of the pumps to the CS~~containment spray~~ nozzle headers in the upper levels of containment. Water is initially drawn from the RWST by the CS~~containment spray~~ pumps and mixed with a sodium hydroxide solution from the spray additive tank.~~When the RWST reaches the low low level, the spray pump suctions are shifted to the containment sump if continued containment spray is required.~~ Containment spray is actuated manually or by High High Containment Pressure – ~~High 3 or Containment Pressure – High High~~. CL3.3-412

a. Containment Spray – Manual Initiation

CL3.3-246

The LCO requires two channels to be OPERABLE. The operator can initiate CS~~containment spray~~ at any time from the control room by simultaneously turning two CS~~containment spray~~ actuation switches~~in the same train~~. Because an inadvertent actuation of CS~~containment spray~~ could have such serious consequences, two switches must be turned

~~APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY~~ ~~a. Containment Spray – Manual Initiation (continued)~~

simultaneously to initiate~~containment spray. There are two sets of two switches each in the control room. Simultaneously turning the two switches in either set will actuate containment spray in~~ both trains of CS~~in the same manner as the automatic actuation signal~~. The inoperability of either switch may fail both trains of manual initiation.

(continued)

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Each channel consists of one switch and the interconnecting wiring to the actuation logic cabinets. The Applicability of the CS Manual Initiation Function is discussed with the Automatic Actuation Relay Logic Function below~~Two Manual Initiation switches in each train are required to be OPERABLE to ensure no single failure disables the Manual Initiation Function~~. Note that mManual iInitiation of CS~~containment spray~~ also actuates ~~Phase B~~ containment ventilation isolation. PA3.3-403

b. Containment Spray – Automatic Actuation Relay Logic~~and Actuation Relays~~

The CS~~Automatic~~ actuation logic~~and actuation relays~~ consists of all circuitry housed within the ESF relay logic cabinets for the CS actuation subsystem ~~the same features and operate~~ in the same manner as described for ESFAS Function 1.b. PA3.3-403

Manual and automatic initiation of CS~~containment spray~~ must be OPERABLE in MODES 1, 2, and 3 when there is a potential for an accident to occur, and sufficient energy in the primary or secondary systems to pose a threat to containment integrity due to overpressure conditions. Manual initiation is also required in MODE 4, even though automatic actuation is not required. In this MODE, adequate time is available to manually actuate required components in the event of a DBA~~. However, because of the large number of components actuated on a containment spray, actuation is simplified~~ by the use of the manual actuation ~~push buttons~~switches. Automatic actuation relay logic~~and actuation relays~~ must CL3.3-413 CL3.3-238

(continued)

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be OPERABLE in MODE 4 to support system level manual initiation. In MODES 5 and 6, there is insufficient energy in the primary and secondary systems to result in containment overpressure. In MODES 5 and 6, there is also adequate time for the operators to evaluate unit conditions and respond, to mitigate the consequences of abnormal conditions by manually starting individual components.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

c. Containment Spray - High-High Containment Pressure

This signal provides protection against a LOCA or an SLB inside containment. The transmitters ~~(d/p cells)~~ and electronics are located outside of containment with the sensing lines ~~(high pressure side of the transmitter)~~ located inside containment. ~~The transmitters and electronics are located outside of containment.~~ Thus, they will not experience any adverse environmental conditions and the Allowable Value ~~Trip Setpoint~~ reflects only steady state instrument uncertainties. CL3.3-404 TA3.3-176

This is one of the only Functions that requires the bistable output to energize to perform its required action. It is not desirable to have a loss of power actuate CS ~~containment spray~~, since the consequences of an inadvertent actuation of CS ~~containment spray~~ could be serious. ~~Note that this Function also has the inoperable channel placed in bypass rather than trip to decrease the probability of an inadvertent actuation.~~ CL3.3-222

~~Two different logic configurations are typically used. Three and four loop units use four channels in a two-out-of-four logic~~ CL3.3-247

(continued)

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configuration. This configuration may be called the Containment Pressure - High 3 Setpoint for three and four loop units, and Containment Pressure - High High Setpoint for other units. Some two-loop units High High Containment Pressure uses three sets of two channels, each set combined in a one-out-of-two configuration, with these outputs combined so that two-out-of-three sets tripped initiates CScontainment spray. This configuration is called Containment Pressure - High 3 Setpoint. Since containment pressure is not used for control, both of theseThis arrangements exceeds the minimum redundancy requirements. Additional redundancy is warranted because this Function is energize to trip. High High Containment Pressure - [High 3] [High High] must be OPERABLE in MODES 1, 2, and 3 when there is sufficient energy in the primary and secondary sides to pressurize the containment following a pipe break. In MODES 4, 5, and 6, there is insufficient energy in the primary and secondary CL3.3-222 CL3.3-401

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

c. Containment Spray - Containment Pressure (continued)

sides to overpressurize the containment and reach the Containment Pressure - High 3 (High High) setpoints. CL3.3-414

3. Containment Isolation

Containment Isolation (CI) provides isolation of the containment atmosphere, and all process systems that penetrate containment, from the environment. This Function is necessary to prevent or limit the release of radioactivity to the environment in the event of a large break LOCA. CL3.3-416

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There are two separate Containment Isolation CI signals, Phase A and Phase B. Phase A isolation isolates all automatically isolable process lines, except component cooling water (CCW), instrument air and main steam lines, which require a steam line isolation signal at a relatively low containment pressure indicative of primary or secondary system leaks. For these types of events, forced circulation cooling using the reactor coolant pumps (RCPs) and SGs is the preferred (but not required) method of decay heat removal. Since CCW is required to support RCP operation, not isolating CCW on the low pressure Phase A signal enhances unit safety by allowing operators to use forced RCS circulation to cool the unit. Isolating CCW on the low pressure signal may force the use of feed and bleed cooling, which could prove more difficult to control. CL3.3-252 CL3.3-416

Phase A containment isolation is actuated automatically by SI, or manually via the automatic actuation logic. All process lines penetrating containment, with the exception of CCW, are isolated. CCW is not isolated at this time to permit continued operation of the RCPs with cooling water flow to the thermal barrier heat exchangers and air or oil coolers. All process lines not equipped with remote operated isolation valves are manually closed, or otherwise isolated, prior to reaching MODE 4. CL3.3-252

Manual Phase A Containment Isolation is accomplished by either of two switches in the control room. Either switch actuates both trains. Note that manual

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

3. Containment Isolation (continued)

actuation of Phase A Containment Isolation also actuates Containment Purge and Exhaust Isolation.

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The Phase B signal isolates CCW. This occurs at a relatively high containment pressure that is indicative of a large break LOCA or an SLB. For these events, forced circulation using the RCPs is no longer desirable. Isolating the CCW at the higher pressure does not pose a challenge to the containment boundary because the CCW System is a closed loop inside containment. Although some system components do not meet all of the ASME Code requirements applied to the containment itself, the system is continuously pressurized to a pressure greater than the Phase B setpoint. Thus, routine operation demonstrates the integrity of the system pressure boundary for pressures exceeding the Phase B setpoint. Furthermore, because system pressure exceeds the Phase B setpoint, any system leakage prior to initiation of Phase B isolation would be into containment. Therefore, the combination of CCW System design and Phase B isolation ensures the CCW System is not a potential path for radioactive release from containment.

Phase B containment isolation is actuated by Containment Pressure - High 3 or Containment Pressure - High High, or manually, via the automatic actuation logic, as previously discussed. For containment pressure to reach a value high enough to actuate Containment Pressure - High 3 or Containment Pressure - High High, a large break LOCA or SLB must have occurred and containment spray must have been actuated. RCP operation will no longer be required and CCW to the RCPs is, therefore, no longer necessary. The RCPs can be operated with seal injection flow alone and without CCW flow to the thermal barrier heat exchanger.

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~~Manual Phase B Containment Isolation is accomplished by the same switches that actuate Containment Spray. When the two switches in either set are turned simultaneously, Phase B Containment Isolation and Containment Spray will be actuated in both trains.~~

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

a. Containment Isolation - ~~Phase A Manual Isolation~~ CL3.3-252

~~(1)~~ ~~Phase A Isolation~~ - ~~Manual~~ Initiation

Manual CI~~Phase A Containment Isolation~~ is actuated by either of two switches in the control room. Either switch actuates both trains. Note that manual initiation of CI ~~Phase A Containment Isolation~~ also actuates Containment Ventilation~~Purge~~ Isolation.

The LCO requires two channels to be OPERABLE. Each channel consists of one switch and the interconnecting wiring to the actuation logic cabinets. The Applicability of the CI Manual Initiation Function is discussed with the Automatic Actuation Relay Logic Function below. PA3.3-403

b. ~~(2)~~ ~~Phase A~~ Containment Isolation - Automatic Actuation Relay Logic ~~and Actuation Relays~~ CL3.3-252 CL3.3-238

~~Automatic~~The CI aActuation lLogic ~~and Actuation Relays~~ consists of all circuitry housed within the ESF relay logic cabinets for the CI actuation subsystem~~the same features and operate~~ in the same manner as described for ESFAS Function 1.b. PA3.3-403

Manual and automatic initiation of CI~~Phase A Containment Isolation~~ must be OPERABLE in MODES 1, 2, and 3, when there is a potential for

(continued)

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an accident to occur. Manual initiation is also required in MODE 4 even though automatic actuation is not required. In this MODE, adequate time is available to manually actuate required components in the event of a DBA, but because of the large number of components actuated on a CIPhase A Containment Isolation, actuation is simplified by the use of the manual actuation switchespush buttons. Automatic actuation relay logic and actuation relays must be OPERABLE in MODE 4 to support system level manual initiation. In MODES 5 and 6, there is insufficient energy in the primary or secondary systems in the event of a line break to pressurize the containment to require CIPhase A Containment Isolation. There also is adequate time for the operator to evaluate unit conditions and manually actuate individual isolation valves in response to abnormal or accident conditions.

c. (3) Phase A Containment Isolation - Safety Injection CL3.3-252

Phase A Containment Isolation is also initiated by all Functions that initiate SI via the SI signal. The CIPhase A Containment Isolation

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

(3) Phase A Isolation - Safety Injection (continued)

requirements for these Functions are the same as the requirements for their SI function. Therefore, the requirements are not repeated in Table 3.3.2-1. Instead, Function 1, SI, is referenced for all initiating Functions and requirements.

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b. Containment Isolation - Phase B Isolation

CL3.3-252

Phase B Containment Isolation is accomplished by Manual Initiation, Automatic Actuation Logic and Actuation Relays, and by Containment Pressure channels (the same channels that actuate Containment Spray, Function 2). The Containment Pressure trip of Phase B Containment Isolation is energized to trip in order to minimize the potential of spurious trips that may damage the RCPs.

(1) Phase B Isolation - Manual Initiation

(2) Phase B Isolation - Automatic Actuation Logic and Actuation Relays

Manual and automatic initiation of Phase B containment isolation must be OPERABLE in MODES 1, 2, and 3, when there is a potential for an accident to occur. Manual initiation is also required in MODE 4 even though automatic actuation is not required. In this MODE, adequate time is available to manually actuate required components in the event of a DBA. However, because of the large number of components actuated on a Phase B containment isolation, actuation is simplified by the use of the manual actuation push buttons. Automatic actuation logic and actuation relays must be OPERABLE in MODE 4 to support system level manual initiation. In MODES 5 and 6, there is insufficient energy in the primary or secondary systems to pressurize the containment to require Phase B containment

(continued)

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

(1) Phase B Isolation - Manual Initiation

(2) Phase B Isolation - Automatic Actuation Logic and Actuation Relays (continued)

isolation. There also is adequate time for the operator to evaluate unit conditions and manually actuate individual isolation valves in response to abnormal or accident conditions.

(3) Phase B Isolation - Containment Pressure

The basis for containment pressure MODE applicability is as discussed for ESFAS Function 2.c above.

4. Steam Line Isolation

Isolation of the main steam lines provides protection in the event of an SLB inside or outside containment. Rapid isolation of the steam lines will limit the steam break accident to the blowdown from one SG, at most. For an SLB upstream of the main steam isolation valves (MSIVs), inside or outside of containment, closure of the non-return check valves or the MSIVs limits the accident to the blowdown from only the affected SG. For an SLB downstream of the MSIVs, closure of the MSIVs terminates the accident as soon as the steam lines depressurize. For units that do not have steam line check valves, Steam Line Isolation also mitigates the effects of a feed line break and ensures a source of steam for the turbine driven AFW pump during a feed line break. PA3.3-417

(continued)

BASES PA3.3-356

a. ~~Steam Line Isolation – Manual Initiation~~ CL3.3-223

~~Manual initiation of Steam Line Isolation can be accomplished from the control room. There are two switches in the control room and either switch can initiate action to immediately close all MSIVs. The LCO requires twochannels to be OPERABLE.~~

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

ab. Steam Line Isolation – Automatic Actuation Relay Logic ~~and Actuation Relays~~ CL3.3-238

The steam line isolation~~Automatic~~ actuation logic ~~and actuation relays~~ consists of all circuitry housed within the ESF relay logic cabinets for the steam line isolation subsystem~~the same features and operate~~ in the same manner as described for ESFAS Function 1.b. PA3.3-403

Manual and automatic initiation of steam line isolation must be OPERABLE in MODES 1, 2, and 3 when there is sufficient energy in the RCS and SGs to have an SLB~~or other accident~~. This could result in the release of significant quantities of energy and cause a cooldown of the primary system. The Steam Line Isolation Function is required in MODES 2 and 3 unless both~~all~~ MSIVs are closed~~and [de-activated]~~. In MODES 4, 5, and 6, there is insufficient energy in the RCS and SGs to experience an SLB~~or other accident~~ releasing significant quantities of energy. CL3.3-418 CL3.3-254

bc. Steam Line Isolation – High High Containment Pressure – ~~High 2~~

(continued)

BASES PA3.3-356

This Function actuates closure of the MSIVs in the event of a LOCA or an SLB inside containment to maintain at least one unfaulted SG as a heat sink for the reactor, and to limit the mass and energy release to containment. Three OPERABLE channels are sufficient to satisfy protective requirements with two-out-of-three logic. The transmitters (d/p cells) and electronics are located outside containment with the sensing line (high pressure side of the transmitter) located inside containment. Containment Pressure - High 2 provides no input to any control functions. Thus, three OPERABLE channels are sufficient to satisfy protective requirements with two-out-of-three logic. However, for enhanced reliability, this Function was designed with four channels and a two-out-of-four logic. The transmitters and electronics are located outside of containment. Thus, they will not experience any adverse environmental conditions, and the Allowable Value Trip Setpoint reflects only steady state instrument uncertainties. CL3.3-418 CL3.3-253 CL3.3-404 TA3.3-176

High High Containment Pressure - High 2 must be OPERABLE in MODES 1, 2, and 3, when there is sufficient energy in the primary and secondary side to pressurize the containment following a pipe

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

c. Steam Line Isolation - Containment Pressure - High 2 (continued)

break. This would cause a significant increase in the containment pressure, thus allowing detection and closure of the MSIVs. The Steam Line Isolation Function remains OPERABLE in MODES 2 and 3 unless both all MSIVs are closed and [de-activated]. In MODES 4, 5, and 6, there CL3.3-254

(continued)

BASES

PA3.3-356

is not enough energy in the primary and secondary sides to overpressurize ~~the~~ containment ~~to the Containment Pressure - High 2 setpoint~~. CL3.3-414

~~d. Steam Line Isolation - Steam Line Pressure~~ CL3.3-255

~~(1) Steam Line Pressure - Low~~

~~Steam Line Pressure - Low provides closure of the MSIVs in the event of an SLB to maintain at least one unfaulted SG as a heat sink for the reactor, and to limit the mass and energy release to containment. This Function provides closure of the MSIVs in the event of a feed line break to ensure a supply of steam for the turbine driven AFW pump. Steam Line Pressure - Low was discussed previously under SI Function 1.e.1.~~

~~Steam Line Pressure - Low Function must be OPERABLE in MODES 1, 2, and 3 (above P-11), with any main steam valve open, when a secondary side break or stuck open valve could result in the rapid depressurization of the steam lines. This signal may be manually blocked by the operator below the P-11 setpoint. Below P-11, an inside containment SLB will be terminated by automatic actuation via Containment Pressure - High 2. Stuck valve transients and outside containment SLBs will be terminated by the Steam Line Pressure - Negative Rate - High signal for Steam Line Isolation below P-11 when SI has been manually blocked. The Steam Line Isolation Function is required in MODES 2~~

(continued)

PA3.3-356

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

(1) Steam Line Pressure - Low (continued)

and 3 unless all MSIVs are closed and [de-activated]. This Function is not required to be OPERABLE in MODES 4, 5, and 6 because there is insufficient energy in the secondary side of the unit to have an accident.

(2) Steam Line Pressure - Negative Rate - High

Steam Line Pressure - Negative Rate - High provides closure of the MSIVs for an SLB when less than the P-11 setpoint, to maintain at least one unfaulted SG as a heat sink for the reactor, and to limit the mass and energy release to containment. When the operator manually blocks the Steam Line Pressure - Low main steam isolation signal when less than the P-11 setpoint, the Steam Line Pressure - Negative Rate - High signal is automatically enabled. Steam Line Pressure - Negative Rate - High provides no input to any control functions. Thus, three OPERABLE channels are sufficient to satisfy requirements with a two-out-of-three logic on each steam line.

Steam Line Pressure - Negative Rate - High must be OPERABLE in MODE 3 when less than the P-11 setpoint, when a secondary side break or stuck open valve could result in the rapid depressurization of the steam line(s). In MODES 1 and 2, and in MODE 3, when above the P-11 setpoint, this signal is automatically disabled and the Steam Line Pressure - Low signal is automatically

(continued)

BASES

PA3.3-356

enabled. The Steam Line Isolation Function is required to be OPERABLE in MODES 2 and 3 unless all MSIVs are closed and [de-activated]. In MODES 4, 5, and 6, there is insufficient energy in the primary and secondary sides to have an SLB or other accident that would result in a release of significant enough quantities of energy to cause a cooldown of the RCS.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

(2) Steam Line Pressure - Negative Rate - High (continued)

While the transmitters may experience elevated ambient temperatures due to an SLB, the trip function is based on rate of change, not the absolute accuracy of the indicated steam pressure. Therefore, the Trip Setpoint reflects only steady state instrument uncertainties.

e, f. Steam Line Isolation - High Steam Flow in Two Steam Lines Coincident with T_{avg} - Low Low or Coincident With Steam Line Pressure - Low (Three and Four Loop Units) CL3.3-255

These Functions (4.e and 4.f) provide closure of the MSIVs during an SLB or inadvertent opening of an SG relief or a safety valve, to maintain at least one unfaulted SG as a heat sink for the reactor and to limit the mass and energy release to containment.

These Functions were discussed previously as Functions 1.f. and 1.g.

(continued)

BASES PA3.3-356

These Functions must be OPERABLE in MODES 1 and 2, and in MODE 3, when a secondary side break or stuck open valve could result in the rapid depressurization of the steam lines unless all MSIVs are closed and [de-activated]. These Functions are not required to be OPERABLE in MODES 4, 5, and 6 because there is insufficient energy in the secondary side of the unit to have an accident.

Cg. Steam Line Isolation - High Steam Flow Coincident With Safety Injection and Low Low T_{avg} Coincident With SI T_{avg} - Low Low (Two Loop Units)

This Function provides closure of the MSIVs during an SLB or inadvertent opening of an SG relief or safety valve to maintain at least one unfaulted SG as a heat sink for the reactor, and to limit the mass and energy release to containment. CL3.3-419 CL3.3-418

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

g. Steam Line Isolation - High Steam Flow Coincident With Safety Injection and Coincident With T_{avg} - Low Low (Two Loop Units) (continued)

Two steam line flow channels per steam line are required OPERABLE for this Function. These are combined in a one-out-of-two logic to indicate high steam flow in one steam line. The steam flow transmitters provide control inputs, but the control function cannot cause the events that the function must protect against. Therefore, two channels are sufficient to satisfy redundancy requirements. The one-out-of-two configuration allows online testing because trip of one high steam flow channel is not sufficient to cause initiation. X3.3-239

(continued)

BASES

PA3.3-356

X3.3-239

The High Steam Flow Allowable Value is a ΔP corresponding to 25% of full steam flow at no load steam pressure. The Trip Setpoint is similarly calculated.

With the transmitters (d/p cells) typically located inside the steam tunnels, it is possible for them to experience adverse environmental conditions during an SLB event. Therefore, the Trip Setpointsreflect both steady state and adverse environmental instrument uncertainties.

The main steam line isolates only if the high steam flow signal occurs coincident with an SI signal is present with a and low low RCS average temperature. The Main Steam Line Isolation Function requirements for the SI Functions are the same as the requirements for their SI function. Therefore, the requirements are not repeated in Table 3.3.2-1. Instead, Function 1, SI, is referenced for all initiating functions and requirements.

Two channels of T_{avg} per loop are required to be OPERABLE. The T_{avg} channels are combined in a logic such that two channels tripped cause a trip for the parameter. The accidents that this Function protects against cause reduction of T_{avg} in the entire primary system. Therefore, the provision of two OPERABLE channels per loop in a

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

g. Steam Line Isolation - High Steam Flow Coincident With Safety Injection and Coincident With T_{avg} - Low Low (Two Loop Units) (continued)

two-out-of-four configuration ensures no single random failure disables the Low Low T_{avg} - Low Low Function. The T_{avg} channels provide control

(continued)

BASES PA3.3-356

inputs, but the control function cannot initiate events that the Function acts to mitigate. Therefore, additional channels are not required to address control protection interaction issues.

With the T_{avg} resistance temperature detectors (RTDs) located inside the containment, it is possible for them to experience adverse environmental conditions during an SLB event. Therefore, the Allowable ValueTrip Setpoint reflects both steady state and adverse environmental instrumental uncertainties. TA3.3-176

This Function must be OPERABLE in MODES 1 and 2, and in MODE 3, when T_{avg} is above 520°Fthe P-12 setpoint, when a secondary side break or stuck open valve could result in rapid depressurization of the steam lines. Below P-12 this Function is not required to be OPERABLE because the High High Steam Flow coincident with SI Function provides the required protection. The Steam Line Isolation Function is required to be OPERABLE in MODES 2 and 3 unless bothall MSIVs are closed and [de-activated]. This Function is not required to be OPERABLE in MODES 4, 5, and 6 because there is insufficient energy in the secondary side of the unit to have an accident. CL3.3-256 CL3.3-420 CL3.3-254

dh. Steam Line Isolation - High High Steam Flow Coincident With Safety Injection (Two Loop Units)

This Function provides closure of the MSIVs during a SLBsteam line break (or inadvertent opening of a relief or safety valve) to maintain at least one unfaulted SG as a heat sink for the reactor, and to limit the mass and energy release to containment. CL3.3-419 CL3.3-418

(continued)

PA3.3-356

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

~~h. Steam Line Isolation~~ - ~~High High Steam Flow Coincident With Safety Injection (Two Loop Units) (continued)~~

Two steam line flow channels per steam line are required to be OPERABLE for this Function. These are combined in a one-out-of-two logic to indicate high steam flow in one steam line. The steam flow transmitters provide control inputs, but the control function cannot cause the events that the Function must protect against. Therefore, two channels are sufficient to satisfy redundancy requirements.

The Allowable Value for High ~~H~~high ~~S~~steam ~~F~~flow is a ΔP~~,~~ corresponding to ≤ 4.5E6 lb/hr ~~130% of full steam flow~~ at 735 psig ~~full steam pressure.~~ ~~The Trip Setpoint is similarly calculated.~~ CL3.3-242 TA3.3-176

With the transmitters ~~typically~~ located inside containment ~~the steam tunnels~~, it is possible for them to experience adverse environmental conditions during an SLB event. Therefore, the ~~Trip Setpoint~~ Allowable Value reflects both steady state and adverse environmental instrument uncertainties. TA3.3-176

The main steam lines isolate ~~only~~ if the High ~~H~~high ~~S~~steam ~~F~~flow signal occurs coincident with an SI signal. The Main Steam Line Isolation Function requirements for the SI Functions are the same as the requirements for their SI function. Therefore, the requirements are not repeated in Table 3.3.2-1. Instead, Function 1, SI, is referenced for all initiating functions and requirements.

(continued)

BASES

PA3.3-356

This Function must be OPERABLE in MODES 1, 2, and 3 when a secondary side break~~ or stuck open valve~~ could result in rapid depressurization of the steam lines unless both~~all~~ MSIVs are closed ~~and [de-activated]~~. This Function is not required to be OPERABLE in MODES 4, 5, and 6 because there is insufficient energy in the secondary side of the unit to have an accident. CL3.3-419 CL3.3-254

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

5. ~~Turbine Trip and~~ Feedwater Isolation

The primary function~~s~~ of the~~ Turbine Trip and~~ Feedwater Isolation signal~~s are to prevent damage to the turbine due to water in the steam lines, and~~ is to limit containment pressurization during an SLB~~stop the excessive flow of feedwater into the SGs~~. ~~These~~This Function~~s are necessary to~~ also mitigates the effects of a high water level in the SGs, which could result in carryover of water into the steam lines and excessive cooldown of the primary system. The SG high water level is due to excessive feedwater flows. CL3.3-257 CL3.3-405

The Function ~~is actuated when the level in any SG exceeds the high high setpoint, and~~ performs the following~~ functions~~:

- Trips the main turbine;
- Trips the main feedwater (MFW) pumps;
- ~~Initiates feedwater isolation;~~ and
- Shuts the MFW regulating valves (MFRVs) and the MFRV bypass ~~feedwater regulating~~ valves.

(continued)

PA3.3-356

BASES

This Function is actuated by High High SG Water Level - ~~High High~~, or by an SI signal. ~~The RTS also initiates a turbine trip signal whenever a reactor trip (P-4) is generated~~. In the event of SI, the unit is taken off line ~~and the turbine generator must be tripped~~. The MFW System is also taken out of operation and the AFW System is automatically started. The SI signal was discussed previously. CL3.3-257

a. ~~Turbine Trip and~~ Feedwater Isolation - Automatic Actuation Relay Logic ~~and Actuation Relays~~ CL3.3-257 CL3.3-238

The feedwater isolation ~~Automatic A~~actuation Logic ~~and Actuation Relays~~ consists of all circuitry housed within the ESF relay logic cabinets for the feedwater isolation subsystem ~~the same features and operate~~ in the same manner as described for ESFAS Function 1.b. PA3.3-403

This Function must be OPERABLE in MODES 1, 2, and 3, except when all MFRV's and associated bypass valves are closed and in manual or isolated by a closed non-automatic valve, when a secondary side break could result in significant containment pressurization. This Function is not required to be OPERABLE in MODES 4, 5, and 6 because there is insufficient energy in the secondary side of the unit to cause an accident. CL3.3-423 CL3.3-405

b. ~~Turbine Trip and~~ Feedwater Isolation - High High Steam Generator Water Level - ~~High High (P-14)~~ CL3.3-257

This signal provides protection against excessive feedwater flow. The ~~ESFAS~~ SG water level

~~APPLICABLE SAFETY ANALYSES,~~ ~~b. Turbine Trip and Feedwater Isolation - Steam Generator Water Level - High High (P-14)~~

(continued)

BASES PA3.3-356

LCO, and APPLICABILITY (continued)

instruments provide input to the FeedwaterSG Water Level Control System. Therefore, the actuation logic must be able to withstand both an input failure to the control system (which may then require the protection function actuation) and a single failure in the other channels providing the protection function actuation. Median signal selection is used in the Feedwater Control System. Thus, threefour OPERABLE channels are sufficientrequired to satisfy the requirements with a two-out-of-fourthree logic. For units that have dedicated protection and control channels, o nly three protection channels are necessary to satisfy the protective requirements. For other units that have only three channels, a median signal selector is provided or justification is provided in NUREG-1218 (Ref. 7). CL3.3-377

The transmitters (d/p cells) are located inside containment. However, the events that this Function protects against cannot cause a severe environment in containment. Therefore, the Trip SetpointAllowable Value reflects only steady state instrument uncertainties. TA3.3-176

This Function must be OPERABLE in MODES 1 and 2 except when all MFRV's and associated bypass valves are closed and in manual or isolated by a closed non-automatic valve. In MODES 3, 4, 5, and 6, the MFW System and the turbine generator are normally not in service and this Function is not required to be OPERABLE. CL3.3-423

(continued)

BASES PA3.3-356

c. ~~Turbine Trip and~~ Feedwater Isolation – Safety Injection CL3.3-257

~~Turbine Trip and~~ Feedwater Isolation is also initiated by all Functions that initiate SI via the SI signal. The Feedwater Isolation Function requirements for these Functions are the same as the requirements for their SI function. Therefore, the requirements are not repeated in Table 3.3.2-1. Instead Function 1, SI, is referenced for all initiating functions and requirements.

~~Turbine Trip and Feedwater Isolation Functions must be OPERABLE in MODES 1 and 2 [and 3] except when all MFIVs, MFRVs, [and associated bypass valves] are closed and [de-activated] [or isolated by a closed manual valve] when the MFW System is in operation and the turbine generator may be in operation. In MODES [3,] 4, 5, and 6, the MFW System and the turbine~~ CL3.3-423

~~APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY~~

~~c. Turbine Trip and Feedwater Isolation~~ – Safety Injection ~~(continued)~~

~~generator are not in service and this Function is not required to be OPERABLE.~~

6. Auxiliary Feedwater

The AFW System is designed to provide a secondary side heat sink for the reactor in the event that the MFW System is not available. The system has a ~~two~~ motor driven pump~~s~~ and a turbine driven pump, making it available during normal unit operation, during a loss of AC power, a loss of MFW, and during a Feedwater System pipe break. The normal source of water for the AFW System is the condensate storage tank (CST) CL3.3-402

(continued)

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PA3.3-356

(~~normally~~ not safety related). ~~A~~Upon low level in the CST, the operators can manually ~~will automatically~~ realign the pump suctions to the Cooling~~Essential Service~~ Water (CL~~ESW~~) System (safety related). The AFW System is aligned so that upon a pump start, flow is initiated to the ~~respective~~ SGs immediately. CL3.3-266

~~a. Auxiliary Feedwater – Automatic Actuation Logic and Actuation Relays (Solid State Protection System)~~ CL3.3-262

~~Automatic actuation logic and actuation relays consist of the same features and operate in the same manner as described for ESFAS Function 1.b.~~

a~~b~~. Auxiliary Feedwater – Automatic Actuation Relay Logic ~~and Actuation Relays (Balance of Plant ESFAS)~~ CL3.3-238

The auxiliary feedwater~~Automatic~~ actuation logic ~~and actuation relays~~ consists of all circuitry housed within the reactor protection relay logic cabinets for the auxiliary feedwater actuation subsystem ~~the same features and operate in the same manner as described for ESFAS Function 1.b~~. CL3.3-402 PA3.3-403

b~~c~~. Auxiliary Feedwater – Low Low Steam Generator Water Level – ~~Low Low~~

Low Low SG Water Level – ~~Low Low~~ provides protection against a loss of heat sink. A feed line break, inside or outside of containment, or a loss of MFW, would result in a loss of SG water level. The SG ~~w~~Water l~~Level~~ – ~~Low Low~~ instruments provide~~s~~ input to the Feedwater~~SG~~

(continued)

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BASES

~~APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY~~

~~c.~~ ~~Auxiliary Feedwater - Steam Generator Water Level - Low Low (continued)~~

~~Level~~ Control System. Therefore, the actuation logic must be able to withstand both an input failure to the control system, which may then require a protection function actuation, and a single failure in the other channels providing the protection function actuation. Median signal selection is used in the Feedwater Control System. Thus, three~~four~~ OPERABLE channels per SG are sufficient~~required~~ to satisfy the requirements with a two-out-of-~~four~~three logic. ~~For units that have dedicated protection and control channels, only three protection channels are necessary to satisfy the protective requirements. For other units that have only three channels, a median signal selector is provided or justification is provided in Reference 7.~~ CL3.3-377

With the transmitters (d/p cells) located inside containment and thus possibly experiencing adverse environmental conditions (feed line break), the Allowable Value~~Trip Setpoint~~ reflects the inclusion of both steady state and adverse environmental instrument uncertainties. TA3.3-176

c~~d~~. Auxiliary Feedwater - Safety Injection

An SI signal starts the motor driven and turbine driven AFW pumps. The AFW initiation functions are the same as the requirements for their SI function. Therefore, the requirements are not repeated in Table 3.3.2-1. Instead, Function 1, SI, is referenced for all initiating functions and requirements.

(continued)

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PA3.3-356

e. Auxiliary Feedwater - Loss of Offsite Power

CL3.3-263

A loss of offsite power to the service buses will be accompanied by a loss of reactor coolant pumping power and the subsequent need for some method of decay heat removal. The loss of offsite power is detected by a voltage drop on each service bus. Loss of power to either service bus will start the turbine driven AFW pumps to ensure that at least one SG contains enough water to serve as the heat sink for

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

e. Auxiliary Feedwater - Loss of Offsite Power (continued)

reactor decay heat and sensible heat removal following the reactor trip.

Functions 6.a through 6.ec must be OPERABLE in MODES 1, 2, and 3 to ensure that the SGs remain the heat sink for the reactor. Low Low SG Water Level - Low Low in any operating SG will cause the motor driven AFW pumps to start. The system is aligned so that upon a start of the pump, water immediately begins to flow to the SGs. SG Water Level - Low Low in any two operating SGs will cause the turbine driven pumps to start. These Functions do not have to be OPERABLE in MODES 5 and 6 because there is not enough heat being generated in the reactor to require the SGs as a heat sink. In MODE 4, AFW actuation does not need to be OPERABLE because either AFW or residual heat removal (RHR) will already be in operation to remove decay heat or sufficient time is available to manually place either system in operation. CL3.3-402

(continued)

BASES PA3.3-356

df. Auxiliary Feedwater - Undervoltage on Buses 11 and 12 (21 and 22) Reactor Coolant Pump

A loss of power on the buses that provide power to the MFW pumpsRCPs provides indication of a pending loss of MFWRCP forced flow in the RCS. The uUndervoltage RCP Function senses the voltage Updownstream of each MFW pumpRCP breaker. A loss of power, or an open RCP breaker, on for bothtwo or more RCPs, MFW pumps will start the turbine driven AFW pump to ensure that at least one SG contains enough water to serve as the heat sink for reactor decay heat and sensible heat removal following the reactor trip. CL3.3-402

eg. Auxiliary Feedwater - Trip of AllBoth Main Feedwater Pumps

A tTrip of allboth MFW pumps is an indication of a loss of MFW and the subsequent need for some method of decay heat and sensible heat removal to bring the reactor back to no load temperature and pressure. A turbine driven MFW pump is equipped with two pressure switches on the control air/oil CL3.3-402

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

g. Auxiliary Feedwater-Trip of All Main Feedwater Pumps (continued)

line for the speed control system. A low pressure signal from either of these pressure switches indicates a trip of that pump. Motor driven MFW pumps are equipped with a breaker position sensing device. An open supply breaker indicates that the pump is not running. Two

(continued)

BASES PA3.3-356

OPERABLE channels per pump satisfy redundancy requirements with one-out-of-two taken twice logic. A trip of bothall MFW pumps starts the motor driven and turbine driven AFW pumps to ensure that at least one SG is available with water to act as the heat sink for the reactor.

Functions 6.fd and 6.ge must be OPERABLE in MODES 1 and 2. This ensures that at least one SG is provided with water to serve as the heat sink to remove reactor decay heat and sensible heat in the event of an accident. In MODES 3, 4, and 5, the RCPs and MFW pumps may be normally shut down, and thus neither the pump trip isor bus undervoltage are indicative of a condition requiring automatic AFW initiation. Also, in MODE 2 the AFW system may be used for SG level control. The MFW trip is bypassed by placing the AFW pump CS in shutdown auto when AFW is aligned for this purpose. Low low SG level provides protection during this operation. CL3.3-402 CL3.3-272

h. Auxiliary Feedwater – Pump Suction Transfer on Suction Pressure – Low CL3.3-266

A low pressure signal in the AFW pump suction line protects the AFW pumps against a loss of the normal supply of water for the pumps, the CST. Two pressure switches are located on the AFW pump suction line from the CST. A low pressure signal sensed by any one of the switches will cause the emergency supply of water for both pumps to be aligned, or cause the AFW pumps to stop until the emergency source of water is aligned. ESW (safety grade) is then lined up to supply the AFW pumps to ensure an adequate supply of water for the AFW System to maintain at least one of the

(continued)

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PA3.3-356

SGs as the heat sink for reactor decay heat and sensible heat removal.

Since the detectors are located in an area not affected by HELBs or high radiation, they will not experience any adverse environmental

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

h. Auxiliary Feedwater - Pump Suction Transfer on Suction Pressure - Low (continued)

conditions and the Trip Setpoint reflects only steady state instrument uncertainties.

This Function must be OPERABLE in MODES 1, 2, and 3 to ensure a safety grade supply of water for the AFW System to maintain the SGs as the heat sink for the reactor. This Function does not have to be OPERABLE in MODES 5 and 6 because there is not enough heat being generated in the reactor to require the SGs as a heat sink. In MODE 4, AFW automatic suction transfer does not need to be OPERABLE because RHR will already be in operation, or sufficient time is available to place RHR in operation, to remove decay heat.

7. Automatic Switchover to Containment Sump

CL3.3-267

At the end of the injection phase of a LOCA, the 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. The low head residual heat removal (RHR) pumps and containment spray pumps draw the water from the containment recirculation sump, the RHR pumps pump the water through the RHR heat exchanger, inject the water back into the RCS, and supply the cooled water to the other

(continued)

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~~ECCS pumps. Switchover from the RWST to the containment sump must occur before the RWST empties to prevent damage to the RHR 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 ESF pump suction. Furthermore, early switchover must not occur to ensure that sufficient borated water is injected from the RWST. This ensures the reactor remains shut down in the recirculation mode.~~

~~APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)~~

~~a. Automatic Switchover to Containment Sump - Automatic Actuation Logic and Actuation Relays~~

~~Automatic actuation logic and actuation relays consist of the same features and operate in the same manner as described for ESFAS Function 1.b.~~

~~b, c. Automatic Switchover to Containment Sump - Refueling Water Storage Tank (RWST) Level - Low Low Coincident With Safety Injection and Coincident With Containment Sump Level - High~~

~~During the injection phase of a LOCA, the RWST is the source of water for all ECCS pumps. A low low level in the RWST coincident with an SI signal provides protection against a loss of water for the ECCS pumps and indicates the end of the injection phase of the LOCA. The RWST is equipped with four level transmitters. These transmitters provide no control functions. Therefore, a two-out-of-four logic is adequate to initiate the protection function actuation. Although only three channels would be sufficient, a fourth channel has been added for increased reliability.~~

(continued)

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The RWST - Low Low Allowable Value/Trip Setpoint has both upper and lower limits. The lower limit is selected to ensure switchover occurs before the RWST empties, to prevent ECCS pump damage. The upper limit is selected to ensure enough borated water is injected to ensure the reactor remains shut down. The high limit also ensures adequate water inventory in the containment sump to provide ECCS pump suction.

The transmitters are located in an area not affected by HELBs or post accident high radiation. Thus, they will not experience any adverse environmental conditions and the Trip Setpoint reflects only steady state instrument uncertainties.

Automatic switchover occurs only if the RWST low low level signal is coincident with SI. This prevents accidental switchover during normal

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

b, c. Automatic Switchover to Containment Sump - Refueling Water Storage Tank (RWST) Level - Low Low Coincident With Safety Injection and Coincident With Containment Sump Level - High (continued)

operation. Accidental switchover could damage ECCS pumps if they are attempting to take suction from an empty sump. The automatic switchover Function requirements for the SI Functions are the same as the requirements for their SI function. Therefore, the requirements are not repeated in Table 3.3.2-1. Instead, Function 1, SI, is referenced for all initiating Functions and requirements.

(continued)

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BASES

Reviewer's Note: In some units, additional protection from spurious switchover is provided by requiring a Containment Sump Level - High signal as well as RWST Level - Low Low and SI. This ensures sufficient water is available in containment to support the recirculation phase of the accident. A Containment Sump Level - High signal must be present, in addition to the SI signal and the RWST Level - Low Low signal, to transfer the suctions of the RHR pumps to the containment sump. The containment sump is equipped with four level transmitters. These transmitters provide no control functions. Therefore, a two-out-of-four logic is adequate to initiate the protection function actuation. Although only three channels would be sufficient, a fourth channel has been added for increased reliability. The containment sump level Trip Setpoint/Allowable Value is selected to ensure enough borated water is injected to ensure the reactor remains shut down. The high limit also ensures adequate water inventory in the containment sump to provide ECCS pump suction. The transmitters are located inside containment and thus possibly experience adverse environmental conditions. Therefore, the trip setpoint reflects the inclusion of both steady state and environmental instrument uncertainties.

Units only have one of the Functions, 7.b or 7.c.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

b. c. Automatic Switchover to Containment Sump - Refueling Water Storage Tank (RWST) Level - Low Low Coincident With Safety Injection and Coincident With Containment Sump Level - High (continued)

(continued)

BASES

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These Functions must be OPERABLE in MODES 1, 2, 3, and 4 when there is a potential for a LOCA to occur, to ensure a continued supply of water for the ECCS pumps. These Functions are not required to be OPERABLE in MODES 5 and 6 because there is adequate time for the operator to evaluate unit conditions and respond by manually starting systems, pumps, and other equipment to mitigate the consequences of an abnormal condition or accident. System pressure and temperature are very low and many ESF components are administratively locked out or otherwise prevented from actuating to prevent inadvertent overpressurization of unit systems.

8. Engineered Safety Feature Actuation System Interlocks

CL3.3-231

To allow some flexibility in unit operations, several interlocks are included as part of the ESFAS. These interlocks permit the operator to block some signals, automatically enable other signals, prevent some actions from occurring, and cause other actions to occur. The interlock Functions back up manual actions to ensure bypassable functions are in operation under the conditions assumed in the safety analyses.

a. Engineered Safety Feature Actuation System Interlocks - Reactor Trip, P-4

The P-4 interlock is enabled when a reactor trip breaker (RTB) and its associated bypass breaker is open. Once the P-4 interlock is enabled, automatic SI initiation is blocked after a [ ] second time delay. This Function allows operators to take manual control of SI systems after the initial phase of injection is complete. Once SI is blocked, automatic actuation of SI

(continued)

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cannot occur until the RTBs have been manually closed. The functions of the P-4 interlock are:

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

a. Engineered Safety Feature Actuation System Interlocks - Reactor Trip, P-4 (continued)

- Trip the main turbine;
- Isolate MFW with coincident low T_{avg};
- Prevent reactuation of SI after a manual reset of SI;
- Transfer the steam dump from the load rejection controller to the unit trip controller; and
- Prevent opening of the MFW isolation valves if they were closed on SI or SG Water Level - High High.

Each of the above Functions is interlocked with P-4 to avert or reduce the continued cooldown of the RCS following a reactor trip. An excessive cooldown of the RCS following a reactor trip could cause an insertion of positive reactivity with a subsequent increase in generated power. To avoid such a situation, the noted Functions have been interlocked with P-4 as part of the design of the unit control and protection system.

None of the noted Functions serves a mitigation function in the unit licensing basis safety analyses. Only the turbine trip Function is explicitly assumed since it is an immediate consequence of the reactor trip Function. Neither turbine trip, nor any of the other four

(continued)

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Functions associated with the reactor trip signal, is required to show that the unit licensing basis safety analysis acceptance criteria are not exceeded.

The RTB position switches that provide input to the P-4 interlock only function to energize or de-energize or open or close contacts. Therefore, this Function has no adjustable trip setpoint with which to associate a Trip Setpoint and Allowable Value.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

a. Engineered Safety Feature Actuation System Interlocks - Reactor Trip, P-4 (continued)

This Function must be OPERABLE in MODES 1, 2, and 3 when the reactor may be critical or approaching criticality. This Function does not have to be OPERABLE in MODE 4, 5, or 6 because the main turbine, the MFW System, and the Steam Dump System are not in operation.

b. Engineered Safety Feature Actuation System Interlocks - Pressurizer Pressure, P-11

The P-11 interlock permits a normal unit cooldown and depressurization without actuation of SI or main steam line isolation. With two-out-of-three pressurizer pressure channels (discussed previously) less than the P-11 setpoint, the operator can manually block the Pressurizer Pressure - Low and Steam Line Pressure - Low SI signals and the Steam Line Pressure - Low steam line isolation signal (previously discussed). When the Steam Line Pressure - Low steam line isolation signal is manually blocked, a main

(continued)

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BASES

steam isolation signal on Steam Line Pressure - Negative Rate - High is enabled. This provides protection for an SLB by closure of the MSIVs. With two-out-of-three pressurizer pressure channels above the P-11 setpoint, the Pressurizer Pressure - Low and Steam Line Pressure - Low SI signals and the Steam Line Pressure - Low steam line isolation signal are automatically enabled. The operator can also enable these trips by use of the respective manual reset buttons. When the Steam Line Pressure - Low steam line isolation signal is enabled, the main steam isolation on Steam Line Pressure - Negative Rate - High is disabled. The Trip Setpoint reflects only steady state instrument uncertainties.

This Function must be OPERABLE in MODES 1, 2, and 3 to allow an orderly cooldown and depressurization of the unit without the actuation of SI or main steam isolation. This Function does not have to be OPERABLE in MODE 4,

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

b. Engineered Safety Feature Actuation System Interlocks - Pressurizer Pressure, P-11 (continued)

5, or 6 because system pressure must already be below the P-11 setpoint for the requirements of the heatup and cooldown curves to be met.

c. Engineered Safety Feature Actuation System Interlocks - T_{avg} - Low Low, P-12

On increasing reactor coolant temperature, the P-12 interlock reinstates SI on High Steam Flow Coincident With Steam Line Pressure - Low or Coincident With T_{avg} - Low Low and provides an

(continued)

BASES (continued) PA3.3-356

arming signal to the Steam Dump System. On decreasing reactor coolant temperature, the P-12 interlock allows the operator to manually block SI on High Steam Flow Coincident With Steam Line Pressure - Low or Coincident with T_{avg} - Low Low. On a decreasing temperature, the P-12 interlock also removes the arming signal to the Steam Dump System to prevent an excessive cooldown of the RCS due to a malfunctioning Steam Dump System.

Since T_{avg} is used as an indication of bulk RCS temperature, this Function meets redundancy requirements with one OPERABLE channel in each loop. In three loop units, these channels are used in two-out-of-three logic. In four loop units, they are used in two-out-of-four logic.

This Function must be OPERABLE in MODES 1, 2, and 3 when a secondary side break or stuck open valve could result in the rapid depressurization of the steam lines. This Function does not have to be OPERABLE in MODE 4, 5, or 6 because there is insufficient energy in the secondary side of the unit to have an accident.

The ESFAS instrumentation satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii) the NRC Policy Statement.

ACTIONS

A Note has been added in the ACTIONS to clarify the application of Completion Time rules. The Conditions of this Specification may be entered independently for each Function listed on Table 3.3.2-1.

In the event a channel's Trip Ssetpoint is found nonconservative with respect to the Allowable Value, or PA3.3-384

(continued)

BASES (continued)

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the transmitter, instrument Lloop, signal processing electronics, or bistable is found inoperable, then all affected Functions provided by that channel must be declared inoperable and the LCO Condition(s) entered for the protection Function(s) affected.

When the Required Channels in Table 3.3.2-1 are specified (e.g., on a per steam line, per loop, per SG, etc., basis), then the Condition may be entered separately for each steam line, loop, SG, etc., as appropriate.

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

Reviewer's Note: Certain LCO Completion Times are based on approved topical reports. In order for a licensee to use these times, the licensee must justify the Completion Times as required by the staff Safety Evaluation Report (SER) for the topical report.

A.1

Condition A applies to all ESFAS protection functions.

Condition A addresses the situation where one or more channels or trains for one or more Functions are inoperable at the same time. The Required Action is to refer to Table 3.3.2-1 and to take the Required Actions for the protection functions affected. The Completion Times are those from the referenced Conditions and Required Actions.

(continued)

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ACTIONS (continued)

B.1, B.2.1 and B.2.2

Condition B applies to manual initiation of:

- SI;
- Containment Spray (CS); and
- ~~Phase A~~Containment Isolation (CI)~~; and~~ CL3.3-252
- ~~Phase B Isolation~~. CL3.3-359

This action addresses the train orientation of the ESF relay logic~~SSPS~~ for the functions listed above. If a channel or train is inoperable, 48 hours is allowed to return it to an OPERABLE status.~~ Note that for containment spray and Phase B isolation, failure of one or both channels in one train renders the train inoperable. Condition B, therefore, encompasses both situations.~~ The specified Completion Time is reasonable considering that there are two automatic actuation trains and another manual initiation channel~~train~~ OPERABLE for each Function (except for CS), and the low probability of an event occurring during this interval. If the channel~~train~~ cannot be restored to OPERABLE status, the unit must be placed in a MODE in which the LCO does not apply. This is done by placing the unit in at least MODE 3 within an additional 6 hours (54 hours total time) and in MODE 5 within an additional 30 hours (84 hours total time). The allowable Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems. CL3.3-246 CL3.3-252

(continued)

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C.1, C.2.1 and C.2.2

Condition C applies to the automatic actuation relay logic and actuation relays for the following functions: CL3.3-238

- SI;
- Containment Spray; and
- Phase AC Isolation; CL3.3-252

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

- Phase B Isolation; and
- Automatic Switchover to Containment Sump. CL3.3-267

This action addresses the train orientation of the ESF relay logic SSPS and the master and slave relays. If one train is inoperable, 6 hours are allowed to restore the train to OPERABLE status. The specified Completion Time is reasonable considering that there is another train OPERABLE, and the low probability of an event occurring during this interval. If the train cannot be restored to OPERABLE status, the unit must be placed in a MODE in which the LCO does not apply. This is done by placing the unit in at least MODE 3 within an additional 6 hours (12 hours total time) and in MODE 5 within an additional 30 hours (42 hours total time). The Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

The Required Actions are modified by a Note that allows one train to be bypassed for up to [4] 8 hours for CL3.3-221

(continued)

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surveillance testing, provided the other train is OPERABLE. This allowance is based on the reliability analysis assumption of WCAP-10271-P-A (Ref. 58) that 48 hours is the average time required to perform relay logic trainchannel surveillance.

D.1, D.2.1, and D.2.2

Condition D applies to:

- High Containment Pressure - High 1;
- Pressurizer Low Pressure - Low (two, three, and four loop units);
- Steam Line Low Pressure - Low;
- Steam Line Differential Pressure - High; CL3.3-255
- High Steam Flow in Two Steam Lines Coincident With T_{avg} - Low Low or Coincident With Steam Line Pressure - LowCS High High Containment Pressure; CL3.3-222

ACTIONS D.1, D.2.1, and D.2.2 (continued)

- Steam Line Isolation High High Containment Pressure - High 2;
- Steam Line Pressure - Negative Rate - High; CL3.3-255
- Low Low T_{avg} High Steam Flow Coincident With Safety Injection Coincident With T_{avg} - Low Low; X3.3-239
- High High Steam Flow Coincident With Safety Injection; and

(continued)

BASES PA3.3-356

- ~~High Steam Flow in Two Steam Lines Coincident With T_{avg} - Low Low;~~ CL3.3-255

- Low Low SG Water level - ~~Low Low (two, three, and four loop units); and~~

- ~~SG Water level - High High (P-14) (two, three, and four loop units).~~

If one channel is inoperable, 6 hours are allowed to restore the channel to OPERABLE status or to place it in the tripped condition. Generally this Condition applies to functions that operate on two-out-of-three logic. Therefore, failure of one channel places the Function in a two-out-of-two configuration. One channel must be tripped to place the Function in a one-out-of-three configuration that satisfies redundancy requirements.

Failure to restore the inoperable channel to OPERABLE status or place it in the tripped condition within 6 hours requires the unit be placed in MODE 3 within the following 6 hours and MODE 4 within the next 6 hours.

The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems. In MODE 4, these Functions are no longer required OPERABLE.

The Required Actions are modified by a Note that allows the inoperable channel to be bypassed for up to [4] hours for surveillance testing of other channels. The 6 hours allowed to restore the channel to OPERABLE status or to place the inoperable channel in the tripped condition, and the 4 hours allowed for testing, are justified in Reference 58.

(continued)

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BASES

ACTIONS (continued)

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

Condition E applies to:

- Containment Spray CS High High Containment Pressure - High 3 (High, High) (two, three, and four loop units); and

- Containment Phase B Isolation Containment Pressure - High 3 (High, High). CL3.3-252

CL3.3-401

None of these signals has input to a control function. Thus, two-out-of-three logic is necessary to meet acceptable protective requirements. However, a two-out-of-three design would require tripping a failed channel. Condition E addresses the situation where two of the six containment pressure channels are inoperable at the same time. With one channel tripped per Condition D, one of the three sets is actuated. Tripping the second channel could actuate the second set. This is undesirable because a single failure would then cause spurious containment spray initiation. Spurious spray actuation is undesirable because of the cleanup problems presented. Therefore, these channels are designed with two-out-of-four logic so that a failed channel may be bypassed rather than tripped. Note that one channel may be bypassed and still satisfy the single failure criterion. With one channel bypassed, one OPERABLE channel remains available to actuate the second set and two OPERABLE channels are available to provide the one of two logic for the third set to actuate CS. Furthermore, with one channel bypassed, a single instrumentation channel failure will not spuriously initiate containment spray. CL3.3-222

To avoid the inadvertent actuation of containment spray and Phase B containment isolation, both the inoperable channels should not be placed in the tripped condition. Instead CL3.3-222

(continued)

BASES

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itone is bypassed. Restoring the channel(s) to OPERABLE status, or placing the other inoperable channel in the bypass condition within 6 hours, is sufficient to assure that the Function remains OPERABLE and minimizes the time that the Function may be in a partial trip condition (assuming the inoperable channel has failed high). The Completion Time is further justified based on the low probability of an event occurring during this interval. Failure to restore the inoperable channel(s) to OPERABLE status, or place oneit in the bypassed condition within 6 hours, requires the unit be placed in MODE 3 within the following 6 hours and MODE 4 within the next 6 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems. In MODE 4, thiese Functions is are no longer required OPERABLE.

ACTIONS E.1, E.2.1, and E.2.2 (continued)

CL3.3-222

The Required Actions are modified by a Note that allows one additionalthe tripped channel to be bypassed for up to [4] hours for surveillance testing. Placing a second channel in the bypass condition for up to 4 hours for testing purposes is acceptable based on the results of Reference 58.

F.1, F.2.1, and F.2.2

Condition F applies to:

- Manual Initiation of Steam Line Isolation; CL3.3-223

- Loss of Offsite Power; CL3.3-263

(continued)

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- Auxiliary Feedwater Pump Suction Transfer on Suction Pressure - Low; and CL3.3-266

- P-4 Interlock. CL3.3-231

For the Manual Initiation and the P-4 Interlock Functions, this action addresses the train orientation of the SSPS. For the Loss of Offsite Power Function, this action recognizes the lack of manual trip provision for a failed channel. For the AFW System pump suction transfer channels, this action recognizes that placing a failed channel in trip during operation is not necessarily a conservative action. Spurious trip of this function could align the AFW System to a source that is not immediately capable of supporting pump suction. If a train or channel is inoperable, 48 hours is allowed to return it to OPERABLE status. The specified Completion Time is reasonable considering the nature of these Functions, the available redundancy, and the low probability of an event occurring during this interval. If the Function cannot be returned to OPERABLE status, the unit must be placed in MODE 3 within the next 6 hours and MODE 4 within the following 6 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power in an orderly manner and without challenging unit systems. In MODE 4, the unit does not have any analyzed transients or conditions that require the explicit use of the protection functions noted above.

ACTIONS (continued)

G.1, G.2.1 and G.2.2.2

CL3.3-238

Condition G applies to the automatic actuation relay logic and actuation relays for the Steam Line Isolation [, Turbine Trip and Feedwater Isolation,] and AFW actuation Functions. CL3.3-227

(continued)

BASES

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The action addresses the train orientation of the SSPSESF relay logicand the master and slave relays for these functions. If one train is inoperable, 6 hours are allowed to restore the train to OPERABLE status. The Completion Time for restoring a train to OPERABLE status is reasonable considering that there is another train OPERABLE, and the low probability of an event occurring during this interval. If the train cannot be returned to OPERABLE status, the unit must be brought to MODE 3 within the next 6 hours and MODE 4 within the following 6 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems. Placing the unit in MODE 4 removes all requirements for OPERABILITY of the protection channels and actuation functions. In this MODE, the unit does not have analyzed transients or conditions that require the explicit use of the protection Ffunctions noted above. CL3.3-359

The Required Actions are modified by a Note that allows one train to be bypassed for up to [4]8 hours for surveillance testing provided the other train is OPERABLE. This allowance is based on the reliability analysis (Ref. 58) assumption that 84 hours is the average time required to perform relay logic trainchannel surveillance. CL3.3-224 CL3.3-359

H.1 and H.2

Condition H applies to the automatic actuation logic and actuation relays for the Turbine Trip and Feedwater Isolation Function. CL3.3-225

This action addresses the train orientation of the SSPS and the master and slave relays for this Function. If one train is inoperable, 6 hours are allowed to restore the train to OPERABLE status or the unit must be placed in MODE 3 within

(continued)

BASES

PA3.3-356

ACTIONS (continued)

the following 6 hours. The Completion Time for restoring a train to OPERABLE status is reasonable considering that there is another train OPERABLE, and the low probability of H.1 and H.2 (continued)

an event occurring during this interval. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging unit systems. These Functions are no longer required in MODE 3. Placing the unit in MODE 3 removes all requirements for OPERABILITY of the protection channels and actuation functions. In this MODE, the unit does not have analyzed transients or conditions that require the explicit use of the protection functions noted above.

The Required Actions are modified by a Note that allows one train to be bypassed for up to [4] hours for surveillance testing provided the other train is OPERABLE. This allowance is based on the reliability analysis (Ref. 8) assumption that 4 hours is the average time required to perform channel surveillance.

GI.1 and GI.2

CL3.3-225

Condition GI applies to:

- High High SG Water Level – High High (P-14) (two, three, and four loop units); and
- Undervoltage Reactor Coolant Pump.

CL3.3-226

If one channel is inoperable, 6 hours are allowed to restore one channel to OPERABLE status or to place it in the tripped condition. If placed in the tripped condition, the Function

(continued)

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is then in a partial trip condition where one-out-of-two ~~or one-out-of-three~~ logic will result in actuation. The 6 hour Completion Time is justified in Reference 5~~8~~. Failure to restore the inoperable channel to OPERABLE status or place it in the tripped condition within 6 hours requires the unit to be placed in MODE 3 within the following 6 hours. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging unit systems. In MODE 3, thiese Function~~s~~ is~~are~~ no longer required OPERABLE.

ACTIONS

G~~I~~.1 and G~~I~~.2 (continued)

The Required Actions are modified by a Note that allows the inoperable channel to be bypassed for up to [4] hours for surveillance testing of other channels. The 6 hours allowed to place the inoperable channel in the tripped condition, and the 4 hours allowed for a second channel to be in the bypassed condition for testing, are justified in Reference 5~~8~~.

H.1 and H.2

Condition H applies to Undervoltage on Buses 11 and 12 (21 and 22). CL3.3-226

If one or both channel(s) on one bus is inoperable, 6 hours are allowed to restore the channel(s) to OPERABLE status or to place it in the tripped condition. If placed in the tripped condition, the Function is then in a partial trip condition where one-out-of-two channels on the other bus will result in actuation. The 6 hour Completion Time is justified in Reference 5. Failure to restore the inoperable channel(s) to OPERABLE status or place it in the tripped

(continued)

BASES

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condition within 6 hours requires the unit to be placed in MODE 3 within the following 6 hours. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging unit systems. In MODE 3, this Function is no longer required OPERABLE.

The Required Actions are modified by a Note that allows the inoperable channel to be bypassed for up to 4 hours for surveillance testing of other channels. The 6 hours allowed to place the inoperable channel in the tripped condition, and the 4 hours allowed for a second channel to be in the bypassed condition for testing, are justified in Reference 5.

I~~J~~.1 and I~~J~~.2

Condition I~~J~~ applies to the AFW pump start on trip of both~~all~~ MFW pumps and to the AFW automatic actuation relay logic functions. CL3.3-227

~~This action addresses the train orientation of the SSPS for the auto start function of the AFW System on loss of all MFW pumps.~~ The OPERABILITY of the AFW System must be assured by allowing automatic start of the AFW System pumps. If a channel or logic train is inoperable, ~~48 hours are allowed to return it to an OPERABLE status. If the function cannot be returned to an OPERABLE status, 6 hours are allowed to place the unit in MODE 3. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging unit systems. In MODE 3, the unit does not have any analyzed transients or conditions that require the explicit use of the protection function noted above. The allowance of 48 hours to return the train to an OPERABLE status is justified in Reference 8.~~ the applicable CL3.3-402

(continued)

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Condition(s) and Required Action(s) of LCO 3.7.5, "Auxiliary Feedwater (AFW) System," are entered for the associated AFW Train.

K.1, K.2.1 and K.2.2

CL3.3-267

Condition K applies to:

- RWST Level - Low Low Coincident with Safety Injection; and
- RWST Level - Low Low Coincident with Safety Injection and Coincident with Containment Sump Level - High.

RWST Level - Low Low Coincident With SI and Coincident With Containment Sump Level - High provides actuation of switchover to the containment sump. Note that this Function

ACTIONS K.1, K.2.1 and K.2.2 (continued)

requires the bistables to energize to perform their required action. The failure of up to two channels will not prevent the operation of this Function. However, placing a failed channel in the tripped condition could result in a premature switchover to the sump, prior to the injection of the minimum volume from the RWST. Placing the inoperable channel in bypass results in a two-out-of-three logic configuration, which satisfies the requirement to allow another failure without disabling actuation of the switchover when required. Restoring the channel to OPERABLE status or placing the inoperable channel in the bypass condition within 6 hours is sufficient to ensure that the Function remains OPERABLE, and minimizes the time that the Function may be in a partial trip condition (assuming the

(continued)

BASES

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inoperable channel has failed high). The 6 hour Completion Time is justified in Reference 8. If the channel cannot be returned to OPERABLE status or placed in the bypass condition within 6 hours, the unit must be brought to MODE 3 within the following 6 hours and MODE 5 within the next 30 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems. In MODE 5, the unit does not have any analyzed transients or conditions that require the explicit use of the protection functions noted above.

The Required Actions are modified by a Note that allows placing a second channel in the bypass condition for up to [4] hours for surveillance testing. The total of 12 hours to reach MODE 3 and 4 hours for a second channel to be bypassed is acceptable based on the results of Reference 8.

L.1, L.2.1 and L.2.2

CL3.3-231

Condition L applies to the P-11 and P-12 [and P-14] interlocks.

With one channel inoperable, the operator must verify that the interlock is in the required state for the existing unit condition. This action manually accomplishes the function of the interlock. Determination must be made within 1 hour. The 1 hour Completion Time is equal to the time allowed by

ACTIONS L.1, L.2.1 and L.2.2 (continued)

LCO 3.0.3 to initiate shutdown actions in the event of a complete loss of ESFAS function. If the interlock is not in the required state (or placed in the required state) for the existing unit condition, the unit must be placed in MODE 3

(continued)

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BASES

~~within the next 6 hours and MODE 4 within the following 6 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems. Placing the unit in MODE 4 removes all requirements for OPERABILITY of these interlocks.~~

SURVEILLANCE REQUIREMENTS

The SRs for each ESFAS Function are identified by the SRs column of Table 3.3.2-1.

A Note has been added to the SR Table to clarify that Table 3.3.2-1 determines which SRs apply to which ESFAS Functions.

Note that each channel of reactor~~process~~ protection analog system supplies both trains of the ESFAS. When testing Cchannel I, Ttrain A and Ttrain B must be examined. Similarly, Ttrain A and Ttrain B must be examined when testing Cchannel II, Cchannel III, and Cchannel IV (if applicable). The CHANNEL CALIBRATION and COTs are performed in a manner that is consistent with the assumptions used in analytically calculating the required channel accuracies.

~~Reviewer's Note: Certain Frequencies are based on approved topical reports. In order for a licensee to use these times, the licensee must justify the Frequencies as required by the staff SER for the topical report.~~

SR 3.3.2.1

Performance of the CHANNEL CHECK once every 12 hours ensures that a gross failure of instrumentation has not occurred. A

(continued)

BASES PA3.3-356

CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read

ACTIONS SR 3.3.2.1 (continued)

approximately the same value. Significant deviations between the two instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

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

The Frequency is based on operating experience that demonstrates channel failure is rare. The CHANNEL CHECK supplements less formal, but more frequent, checks of channels during normal operational use of the displays associated with the LCO required channels.

SR 3.3.2.2

SR 3.3.2.2 is the performance of an ACTUATION LOGIC TEST. The SSPSESF relay logic is tested every 31 days on a STAGGERED TEST BASIS, using the semiautomatic tester. The train being tested is placed in the testbypass condition, thus preventing inadvertent actuation. Through the semiautomatic tester, aAll possible logic combinations, with and without applicable permissives, are tested for CL3.3-359 CL3.3-364 CL3.3-231

(continued)

BASES

PA3.3-356

each ESFASprotection function. The test includes actuation of master and slave relays whose contact outputs remain within the relay logic. The test condition inhibits actuation of the master and slave relays whose contact outputs provide direct ESF equipment actuation. Where the relays are not actuated, the test circuitry provides a continuity check of the relay coilIn addition, the master relay coil is pulse tested for continuity. This verifies that the logic modules areis OPERABLE and that there is an intact voltage signal path to the outputmaster relay coils. The Frequency of every 31 days on a STAGGERED TEST BASIS is adequate. It is based on industry operating experience, considering instrument reliability and operating history data. CL3.3-233

SR 3.3.2.3

CL3.3-232

SR 3.3.2.3 is the performance of an ACTUATION LOGIC TEST as described in SR 3.3.2.2, except that the semiautomatic

SURVEILLANCE REQUIREMENTS

SR 3.3.2.3 (continued)

tester is not used and the continuity check does not have to be performed, as explained in the Note. This SR is applied to the balance of plant actuation logic and relays that do not have the SSPS test circuits installed to utilize the semiautomatic tester or perform the continuity check. This test is also performed every 31 days on a STAGGERED TEST BASIS. The Frequency is adequate based on industry operating experience, considering instrument reliability and operating history data.

SR 3.3.2.4

CL3.3-233

(continued)

BASES PA3.3-356

~~SR 3.3.2.4 is the performance of a MASTER RELAY TEST. The MASTER RELAY TEST is the energizing of the master relay, verifying contact operation and a low voltage continuity check of the slave relay coil. Upon master relay contact operation, a low voltage is injected to the slave relay coil. This voltage is insufficient to pick up the slave relay, but large enough to demonstrate signal path continuity. This test is performed every 31 days on a STAGGERED TEST BASIS. The time allowed for the testing (4 hours) and the surveillance interval are justified in Reference 8.~~

SR 3.3.2.~~5~~3

SR 3.3.2.~~5~~3 is the performance of a COT.

A COT is performed on each required channel to ensure the entire channel will perform the intended Function. Setpoints must be found within the Allowable Values specified in Table 3.3.2~~1~~-1. A successful test of the required contact(s) of a channel (logic input) relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable CHANNEL OPERATIONAL TEST of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications and non-Technical Specifications tests at least once per refueling interval with applicable extensions. TA3.3-395

The difference between the current "as found" values and the previous test "as left" values must be consistent with the drift allowance used in the setpoint methodology. The setpoint shall be left set consistent with the assumptions of the current unit specific setpoint methodology.

(continued)

BASES PA3.3-356

The "as found" and "as left" values must also be recorded and reviewed for consistency with the assumptions of the

~~SURVEILLANCE REQUIREMENTS~~ ~~SR 3.3.2.5 (continued)~~

surveillance interval extension analysis (Ref. 5~~8~~) when applicable.

The Frequency of 92 days is justified in Reference 5~~8~~.

~~SR 3.3.2.6~~ CL3.3-233

~~SR 3.3.2.6 is the performance of a SLAVE RELAY TEST. The SLAVE RELAY TEST is the energizing of the slave relays. Contact operation is verified in one of two ways. Actuation equipment that may be operated in the design mitigation MODE is either allowed to function, or is placed in a condition where the relay contact operation can be verified without operation of the equipment. Actuation equipment that may not be operated in the design mitigation MODE is prevented from operation by the SLAVE RELAY TEST circuit. For this latter case, contact operation is verified by a continuity check of the circuit containing the slave relay. This test is performed every [92] days. The Frequency is adequate, based on industry operating experience, considering instrument reliability and operating history data.~~

~~SR 3.3.2.7~~ CL3.3-234

~~SR 3.3.2.7 is the performance of a TADOT every [92] days. This test is a check of the Loss of Offsite Power, Undervoltage RCP, and AFW Pump Suction Transfer on Suction Pressure - Low Functions. Each Function is tested up to, and including, the master transfer relay coils.~~

(continued)

BASES PA3.3-356

~~The test also includes trip devices that provide actuation signals directly to the SSPS. The SR is modified by a Note that excludes verification of setpoints for relays. Relay setpoints require elaborate bench calibration and are verified during CHANNEL CALIBRATION. The Frequency is adequate. It is based on industry operating experience, considering instrument reliability and operating history data.~~

~~SURVEILLANCE~~ REQUIREMENTS (continued)

SR 3.3.2.84

SR 3.3.2.84 is the performance of a TADOT. This SRtest is a check of the ~~Manual Actuation Functions and AFW pump start on trip of all MFW pumps~~following ESFAS Instrumentation Functions: PA3.3-422

1. CS Manual Initiation;

2. CI Manual Initiation;

3. AFW pump start on Undervoltage on Buses 11 and 12 (21 and 22); and CL3.3-234

4. AFW pump start on trip of both MFW pumps.

This SR ~~It~~ is performed every ~~[18]~~24 months. ~~Each Manual Actuation Function is tested up to, and including, the master relay coils. In some instances, the test includes actuation of the end device (i.e., pump starts, valve cycles, etc.).~~ A successful test of the required contact(s) of a channel (logic input) relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable TADOT of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications and non-Technical X3.3-172 PA3.3-422 TA3.3-395

(continued)

PA3.3-356

BASES

Specifications tests at least once per refueling interval with applicable extensions. The Frequency is adequate, based on industry operating experience and is consistent with the typical refueling cycle. The SR is modified by a Note that excludes verification of setpoints during the TADOT ~~for manual initiation Functions~~. The ~~manual initiation~~ Functions, except the undervoltage start of the AFW pumps, have no associated setpoints. For the undervoltage start of the AFW pumps, setpoint verification is covered by other SR's. CL3.3-235

SR 3.3.2.5 CL3.3-236

This SR is the performance of a TADOT to check the Safety Injection Manual Initiation Function. It is performed every 24 months on a STAGGERED TEST BASIS. The Frequency is adequate, based on industry operating experience and is consistent with a typical refueling cycle.

The SR is modified by a Note that excludes verification of setpoints during the TADOT. The manual initiation Function has no associated setpoints.

SR 3.3.2.~~9~~6

SR 3.3.2.~~9~~6 is the performance of a CHANNEL CALIBRATION.

X3.3-172

A CHANNEL CALIBRATION is performed every ~~[18]~~24 months, or approximately at every refueling. CHANNEL CALIBRATION is a complete check of the instrument loop, including the sensor. The test verifies that the channel responds to measured parameter within the necessary range and accuracy.

CHANNEL CALIBRATIONS must be performed consistent with the assumptions of the unit specific setpoint methodology. The difference between the current "as found" values and the

X3.3-172

(continued)

BASES

PA3.3-356

previous test "as left" values must be consistent with the drift allowance used in the setpoint methodology.

The Frequency of ~~[18]~~24 months is based on the assumption of a~~n~~ ~~[18]~~24 month calibration interval in the determination of the magnitude of equipment drift in the setpoint methodology.

This SR is modified by a Note stating that this test should include verification that the time constants are adjusted to the prescribed values where applicable.

~~SR 3.3.2.10~~

CL3.3-237

~~This SR ensures the individual channel ESF RESPONSE TIMES are less than or equal to the maximum values assumed in the~~

~~SURVEILLANCE REQUIREMENTS~~

~~SR 3.3.2.10 (continued)~~

~~accident analysis. Response Time testing acceptance criteria are included in the Technical Requirements Manual, Section 15 (Ref. 9). Individual component response times are not modeled in the analyses. The analyses model the overall or total elapsed time, from the point at which the parameter exceeds the Trip Setpoint value at the sensor, to the point at which the equipment in both trains reaches the required functional state (e.g., pumps at rated discharge pressure, valves in full open or closed position).~~

~~For channels that include dynamic transfer functions (e.g., lag, lead/lag, rate/lag, etc.), the response time test may be performed with the transfer functions set to one with the resulting measured response time compared to the appropriate FSAR response time. Alternately, the response time test can be performed with the time constants set to their nominal value provided the required response time is analytically~~

(continued)

BASES

PA3.3-356

calculated assuming the time constants are set at their nominal values. The response time may be measured by a series of overlapping tests such that the entire response time is measured.

ESF RESPONSE TIME tests are conducted on an [18] month STAGGERED TEST BASIS. Testing of the final actuation devices, which make up the bulk of the response time, is included in the testing of each channel. The final actuation device in one train is tested with each channel. Therefore, staggered testing results in response time verification of these devices every [18] months. The [18] month Frequency is consistent with the typical refueling cycle and is based on unit operating experience, which shows that random failures of instrumentation components causing serious response time degradation, but not channel failure, are infrequent occurrences.

This SR is modified by a Note that clarifies that the turbine driven AFW pump is tested within 24 hours after reaching [1000] psig in the SGs.

SR 3.3.2.11

CL3.3-231

SR 3.3.2.11 is the performance of a TADOT as described in SR 3.3.2.8, except that it is performed for the P-4 Reactor

SURVEILLANCE REQUIREMENTS

SR 3.3.2.11 (continued)

Trip Interlock, and the Frequency is once per RTB cycle. This Frequency is based on operating experience demonstrating that undetected failure of the P-4 interlock sometimes occurs when the RTB is cycled.

The SR is modified by a Note that excludes verification of setpoints during the TADOT. The Function tested has no associated setpoint.

BASES

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REFERENCES

1. AEC "General Design Criteria for Nuclear Power Plant Construction Permits," Criterion 15, issued for comment July 10, 1967, as referenced in USAR Section 1.2~~FSAR, Chapter [6]~~. PA3.3-357

2. UFSAR, Section ~~Chapter [7]~~. CL3.3-392

3. UFSAR, ~~Chapter~~Section 14~~[15]~~.

4. ~~IEEE-279-1971.~~

5. ~~10 CFR 50.49.~~

6. ~~RTS/ESFAS~~ Engineering Manual Section 3.3.4.1, Engineering Design Standard for Instrument Setpoint/Uncertainty Calculations.

7. ~~NUREG-1218, April 1988.~~

~~8~~5. WCAP-10271-P-A, Supplement 2, Rev. 1, June 1990.

9. ~~Technical Requirements Manual, Section 15, "Response Times."~~

B 3.3 INSTRUMENTATION

B 3.3.3 Post AccidentEvent Monitoring (PAEM) Instrumentation

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BASES

BACKGROUND

The primary purpose of the PAEM instrumentation is to display unit variables that provide information required by the control room operators during accident situations. ~~This information provides the necessary support for the operator to take the manual actions for which no automatic control is provided and that are required for safety systems to accomplish their safety functions for Design Basis Accidents (DBAs).~~ PA3.3-440

The OPERABILITY of the accident monitoring instrumentation ensures that there is sufficient information available on selected unit parameters to monitor and to assess unit status and behavior following an accident.

The availability of accident monitoring instrumentation is important so that responses to corrective actions can be observed and the need for, and magnitude of, further actions can be determined. These essential instruments are identified by ~~unit specific documents (~~the USAR (Ref. 1) addressing the recommendations of Regulatory Guide 1.97 (Ref. 2) as required by Supplement 1 to NUREG-0737~~(Ref. 3)~~.

The instrument channels required to be OPERABLE by this LCO include two classes of parameters identified during unit specific implementation of Regulatory Guide 1.97 as Type A and Category I variables.

Type A variables are included in this LCO because they provide the primary information required for the control room operator to take specific manually controlled actions for which no automatic control is provided, and that are required for safety systems to accomplish their safety

(continued)

functions for DBAs. ~~Because the list of Type A variables differs widely between units, Table 3.3.3-1 in the accompanying LCO contains no examples of Type A variables, except for those that may also be Category I variables.~~ PA3.3-441

Category I variables are the key variables deemed risk significant because they are needed to:

BACKGROUND (continued)

- Determine whether other systems important to safety are performing their intended functions;
- Provide information to the operators that will enable them to determine the likelihood of a gross breach of the barriers to radioactivity release; and
- Provide information regarding the release of radioactive materials to allow for early indication of the need to initiate action necessary to protect the public, and to estimate the magnitude of any impending threat.

These key variables are identified by the unit specific Regulatory Guide 1.97 analyses (Ref. 1). These analyses identify the unit specific Type A and Category I variables and provide justification for deviating from Reference 2~~from the NRC proposed list of Category I variables~~.

[~~Reviewer's Note: Table 3.3.3-1 provides a list of variables typical of those identified by the unit specific Regulatory Guide 1.97 analyses. Table 3.3.3-1 in unit specific Technical Specifications (TS) shall list all Type A and Category I variables identified by the unit specific Regulatory Guide 1.97 analyses, as amended by the NRC's Safety Evaluation Report (SER).~~]

(continued)

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The specific instrument Functions listed in Table 3.3.3-1 are discussed in the LCO section.

APPLICABLE SAFETY ANALYSES

The PAEM instrumentation ensures the operability of Regulatory Guide 1.97 Type A and Category I variables so that the control room operating staff can:

- Perform the diagnosis specified in the emergency operating procedures (these variables are restricted to preplanned actions for the primary success path of DBAs), e.g., loss of coolant accident (LOCA);
- Take the specified, pre-planned, manually controlled actions, for which no automatic control is provided, and that are required for safety systems to accomplish their safety function;

APPLICABLE SAFETY ANALYSES (continued)

- Determine whether systems important to safety are performing their intended functions;
- Determine the likelihood of a gross breach of the barriers to radioactivity release;
- Determine if a gross breach of a barrier has occurred; and
- Initiate action necessary to protect the public and to estimate the magnitude of any impending threat.

PAEM instrumentation that meets the definition of Type A in Regulatory Guide 1.97 satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii)~~the NRC Policy Statement~~. Category I, non-Type A, instrumentation ~~must be retained~~is included in TS because it is intended to assist operators in minimizing the consequences of accidents. Therefore, Category I, CL3.3-460

(continued)

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BASES

non-Type A, variables are important for reducing public risk and satisfy Criterion 4 of 10 CFR 50.36(c)(2)(ii).

LCO

The PAEM instrumentation LCO provides OPERABILITY requirements for Regulatory Guide 1.97 Type A variablesmonitors, which provide information required by the control room operators to perform certain manual actions specified in theunit Emergency Operating Procedures. These manual actions ensure that a system can accomplish its safety function, and are credited in the safety analyses. Additionally, this LCO addresses Regulatory Guide 1.97 instruments that have been designated Category I, non-Type A.

The OPERABILITY of the PAEM instrumentation ensures there is sufficient information available on selected unit parameters to monitor and assess unit status following an accident. This capability is consistent with the recommendations of Reference 1. CL3.3-462

LCO 3.3.3 requires two OPERABLE channels for most Functions. Two OPERABLE channels ensure no single failure prevents operators from getting the information necessary for them to determine the safety status of the unit, and to bring the unit to and maintain it in a safe condition following an accident.

LCO (continued)

Furthermore, OPERABILITY of two channels allows a CHANNEL CHECK during the post accident phase to confirm the validity of displayed information. More than two channels may be required at some units if the unit specific Regulatory Guide 1.97 analyses (Ref. 1) determined that failure of one accident monitoring channel results in information CL3.3-443

(continued)

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BASES

~~ambiguity (that is, the redundant displays disagree) that could lead operators to defeat or fail to accomplish a required safety function.~~

An~~The~~ exception to the two channel requirement is Containment Isolation Valve (CIV) Position. In this case, the important information is the status of the containment penetrations. The LCO requires one position indicator for each active CIV. This is sufficient to redundantly verify the isolation status of each isolable penetration either via indicated status of the active valve and prior knowledge of a passive valve, or via system boundary status. If a normally active CIV is known to be closed and deactivated, position indication is not needed to determine status. Therefore, the position indication for valves in this state is not required to be OPERABLE.

~~Table 3.3.3-1 provides a list of variables typical of those identified by the unit specific Regulatory Guide 1.97 (Ref. 1) analyses.~~Table 3.3.3-1 ~~in unit specific TS should~~ lists all Type A and Category I variables identified by the unit specific Regulatory Guide 1.97 analyses, as amended by the NRC's SER, as identified in Reference 3. PA3.3-441

Type A and Category I variables are required to meet Regulatory Guide 1.97 Category I (Ref. 2) design and qualification requirements for seismic and environmental qualification, single failure criterion, utilization of emergency standby power, immediately accessible display, continuous readout, and recording of display.

Listed below are discussions of the specified instrument Functions listed in Table 3.3.3-1.~~These discussions are intended as examples of what should be provided for each Function when the unit specific list is prepared.~~ PA3.3-441

(continued)

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BASES

LCO (continued)

1, 2. Power Range and Source Range Neutron Flux (Logarithmic Scale)

Power Range and Source Range Neutron Flux (Logarithmic Scale) indication is provided to verify reactor shutdown. The two ranges are necessary to cover the full range of flux that may occur post accident.

Neutron flux is used for accident diagnosis, verification of subcriticality, and diagnosis of positive reactivity insertion.

3, 4. Reactor Coolant System (RCS) Hot and Cold Leg Temperatures

RCS Hot and Cold Leg Temperatures are Category I variables provided for verification of core cooling and long term surveillance.

~~RCS hot and cold leg temperatures are used to determine RCS subcooling margin. RCS subcooling margin will allow termination of safety injection (SI), if still in progress, or reinitiation of SI if it has been stopped. RCS subcooling margin is also used for unit stabilization and cooldown control.~~ CL3.3-444

In addition, RCS cold leg temperature is used in conjunction with RCS hot leg temperature to verify the unit conditions necessary to establish natural circulation in the RCS. RCS hot and cold leg temperature is also used for unit stabilization and cooldown control. CL3.3-444

~~Reactor outlet temperature inputs to the Reactor Protection System are provided by two fast response~~ CL3.3-444

(continued)

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resistance elements and associated transmitters in each loop. The channels provide indication over a range of 5032°F to 700°F.

5. Reactor Coolant System (RCS) Pressure (Wide Range)

RCS wide range pressure is a Category I variable provided for verification of core cooling and RCS integrity long term surveillance.

RCS pressure is used to verify delivery of when there should be SI flow to RCS from at least one train, when the RCS pressure is

LCO 5. Reactor Coolant System Pressure (Wide Range) (continued)

below the pump shutoff head. RCS pressure is also used to verify closure of manually closed spray line valves and pressurizer power operated relief valves (PORVs). CL3.3-451

In addition to these verifications, RCS pressure is used for determining RCS subcooling margin. RCS subcooling margin will allow termination of SI, if still in progress, or reinitiation of SI if it has been stopped. RCS pressure can also be used:

- to determine whether to terminate actuated SI or to reinitiate stopped SI;
- to determine when to reset SI and shut off RHR low head SI;
- to determine when to manually restart Emergency Core Cooling System (ECCS) Pumps low head SI; CL3.3-463

(continued)

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BASES

- as reactor coolant pump (RCP) trip criteria; and
- to make a determination on the nature of the accident in progress and where to go next in the procedure.

RCS subcooling margin is also used for unit stabilization and cooldown control.

RCS pressure is also related to three decisions about depressurization. They are:

- to determine whether to proceed with primary system depressurization;
- to verify termination of depressurization; and
- to determine whether to close accumulator isolation valves during a controlled cooldown/depressurization.

~~A final use of RCS pressure is to determine whether to operate the pressurizer heaters.~~ CL3.3-451

~~LCO~~

~~5. Reactor Coolant System Pressure (Wide Range) (continued)~~

~~In some units,~~ RCS pressure is a Category I Type A variable because the operator uses this indication to monitor the cooldown of the RCS following a steam generator tube rupture (SGTR) or small break LOCA. Operator actions to maintain a controlled cooldown, such as adjusting steam generator (SG) pressure or level, would use this indication. Furthermore, RCS pressure is one factor that may be used in decisions to terminate RCP operation.

(continued)

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BASES

6. Reactor Vessel Water Level

Reactor Vessel Water Level is provided for verification and long term surveillance of core cooling. It is also used for accident diagnosis and to determine reactor coolant inventory adequacy.

The Reactor Vessel Water Level Monitoring System provides a direct measurement of the collapsed liquid level above the bottom of the vessel ~~fuel alignment plate~~. The collapsed level represents the amount of liquid mass that is in the reactor vessel. ~~above the core.~~ Measurement of the collapsed water level is selected because it is a direct indication of the water inventory. CL3.3-445

7. Containment Sump Water Level (Wide Range)

Containment Sump Water Level is provided for verification and long term surveillance of RCS integrity.

Containment Sump Water Level is used ~~to determine~~ for

~~• containment sump level~~ accident diagnosis~~;~~ and to determine CL3.3-446

~~•~~ when to begin the recirculation procedure~~; and~~

~~• whether to terminate SI, if still in progress~~.

~~LCO (continued)~~

8. Containment Pressure (Wide Range)

Containment Pressure (Wide Range) is provided for verification of RCS and containment OPERABILITY.

(continued)

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BASES

~~Containment pressure is used to verify closure of main steam isolation valves (MSIVs), and containment spray Phase B isolation when High-3 containment pressure is reached.~~ CL3.3-445

9. Penetration Flow Path Automatic Containment Isolation Valve (CIV) Position

CIV Position is provided for verification of Containment OPERABILITY~~,~~ and containment~~Phase A and Phase B~~ isolation. CL3.3-252

When used to verify containment~~Phase A and Phase B~~ isolation, the important information is the isolation status of the containment penetrations. The LCO requires one channel of valve position indication in the control room to be OPERABLE for each active CIV in a containment penetration flow path, i.e., two total channels of CIV position indication for a penetration flow path with two active valves. The position indication in the control room requirement is satisfied by the individual valve position indication lights (red or green) or the Containment Isolation panel 44104 (44515) white status lights. CL3.3-473 For containment penetrations with only one active CIV having control room indication, Note (b) requires a single channel of valve position indication to be OPERABLE. This is sufficient to redundantly verify the isolation status of each isolable penetration either via indicated status of the active valve, as applicable, and prior knowledge of a passive valve, or via system boundary status. If a normally active CIV is known to be closed and deactivated, position indication is not needed to determine status. Therefore, the position indication for valves in this state is not required to be OPERABLE. Note (a) to the

(continued)

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CL3.3-281

BASES

Required Channels states that the Function is not required for isolation valves whose associated penetration is isolated by at least one closed and deactivated automatic valve, closed manual valve, blind flange, or check valve with flow through the valve secured. Each penetration is treated separately and each penetration flow path is considered a separate Function. Therefore, separate Condition entry is allowed for each penetration flow path.

LCO (continued)

10. Containment Area Radiation (High Range)

Containment Area Radiation is provided to monitor for the potential of significant radiation releases and to provide release assessment for use by operators in determining the need to invoke site emergency plans. Containment radiation level is used to determine if a ~~high energy line break (HELB)~~LOCA with core damage has occurred~~, and whether the event is inside or outside of containment~~. CL3.3-466

11. Hydrogen Monitors

Hydrogen Monitors are provided to detect high hydrogen concentration conditions that represent a potential for containment breach from a hydrogen explosion. This variable is also important in verifying the adequacy of mitigating actions.

12. Pressurizer Level

Pressurizer Level is used to determine whether to terminate SI, if still in progress, or to reinitiate

(continued)

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BASES

SI if it has been stopped. Knowledge of pressurizer water level is also used to verify the unit conditions necessary to establish natural circulation in the RCS and to verify that the unit is maintained in a safe shutdown condition.

13. Steam Generator Water Level (Wide Range)

SG Water Level is provided to monitor operation of decay heat removal via the SGs. The Category I indication of SG level is the wideextended startup range level instrumentation. The wideextended startup range level covers a span of ≥ 6 inches to ≤ 394 inches above0% to 100% between the lower tubesheet and the separator. The measured differential pressure is displayed in inches of water at 68°F. CL3.3-449

Temperature compensation of this indication is performed manually by the operator. Redundant CL3.3-449

LCO 13. Steam Generator Water Level (Wide Range) (continued)

monitoring capability is provided by two trains of instrumentation. The uncompensated level signal is input to the unit computer, a control room indicator, and the Emergency Feedwater Control System.

SG Water Level (Wide Range) is used to:

- identify the faulted SG following a tube rupture; CL3.3-468
- verify that the intact SGs are an adequate heat sink for the reactor;

(continued)

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BASES

- determine the nature of the accident in progress (e.g., verify an SGTR); and

- verify unit conditions for termination of SI ~~during secondary unit HELBs outside containment~~.

~~At some units,~~ ~~o~~Operator action is based on the control room indication of SG level. ~~The RCS response during a design basis small break LOCA depends on the break size. For a certain range of break sizes, the boiler condenser mode of heat transfer is necessary to remove decay heat. Extended startup~~Wide range level is a Type A variable because the operator must manually raise and control SG level to ensure decay heat removal ~~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.~~ CL3.3-469

14. Condensate Storage Tank (CST) Level

CST Level is provided to ensure water supply for auxiliary feedwater (AFW). The CSTs provide~~s~~ ~~the~~a ~~ensured~~nonsafety grade water supply for the AFW System. The CSTs consist~~s~~ of ~~two identical~~three 150,000 gallon tanks connected to both units by a common outlet header. Inventory is monitored by a 0% to 100%~~0 inch to 144 inch~~ level indication~~for each tank~~. CST Level is displayed on a control room indicator~~, strip chart recorder,~~ and unit computer. CL3.3-445

~~LCO 14. Condensate Storage Tank (CST) Level (continued)~~

(continued)

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BASES

In addition, a control room annunciator alarms on low level.

~~At some units,~~ CST Level is considered a Type AD variable. ~~because the control room meter and annunciator are considered the primary indication used by the operator.~~ CL3.3-445

The DBAs that require AFW are the ~~loss of electric power,~~ steam line break (SLB)~~,~~ and ~~small break~~ LOCA. CL3.3-470

~~The CST is the initial source of water for the AFW System. However, as the CST is depleted, manual operator action is necessary to replenish the CST or align suction to the AFW pumps from the hotwell~~. Reference Technical Specification Bases 3.7.6, "Condensate Storage Tanks," for additional information. CL3.3-445

15~~, 16, 17, 18~~. 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 (CET) necessary for measuring core cooling. The evaluation determined the reduced complement of CETs 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, excore effects of condensate runback in the hot legs, and nonuniform inlet temperatures. Based on these evaluations,~~ ~~a~~Adequate core cooling monitoring is ensured with ~~two~~four valid ~~Core Exit~~ ~~T~~temperature ~~channels~~ per quadrant (Ref. 3) ~~with two CETs per required channel. The CET pair are oriented~~ CL3.3-448

(continued)

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BASES

~~radially to permit evaluation of core radial decay power distribution.~~ Core Exit Temperature is used to determine RCS subcooling margin. RCS subcooling margin will allow termination of safety injection (SI), if still in progress, or reinitiation of ~~used to determine whether to terminate SI, if still in progress, or to reinitiate~~ SI if it has been stopped. ~~Core Exit Temperature~~ RCS subcooling margin is also used for unit stabilization and cooldown control. CL3.3-444

~~LCO 15, 16, 17, 18.~~ ~~Core Exit Temperature (continued)~~

~~Two OPERABLE channels of Core Exit Temperature are required in each quadrant to provide indication of radial distribution of the coolant temperature rise across representative regions of the core. Power distribution symmetry was considered in determining the specific number and locations provided for diagnosis of local core problems. Therefore, two randomly selected thermocouples are not sufficient to meet the two thermocouples per channel requirement in any quadrant. The two thermocouples in each channel must meet the additional requirement that one is located near the center of the core and the other near the core perimeter, such that the pair of Core Exit Temperatures indicate the radial temperature gradient across their core quadrant. Unit specific evaluations in response to Item II.F.2 of NUREG-0737 (Ref. 3) should have identified the thermocouple pairings that satisfy these requirements.~~ In accordance with Reference 3, due to the size of the reactor core, four thermocouples OPERABLE in the center region of the core and at least one thermocouple in each quadrant of the outside core region are needed to provide radial temperature gradient monitoring. The center core region is defined by the following CETs and their locations: CL3.3-283

(continued)

PA3.3-356 CL3.3-281

BASES

CET Number	CET Location
9	D-5
10	D-7
12	E-4
13	E-6
14	E-10
16	F-7
18	G-4
19	G-6
22	H-5
23	H-9
28	I-4
29	I-8
30	I-10
32	J-6
33	J-8
34	J-9

~~Two sets of two~~These required thermocouples ensure a single failure will not disable the ability to determine the radial temperature gradient.

16. Refueling Water Storage Tank (RWST) Level

The RWST Level is a Category I, Type A variable provided for verifying a water source to the ECCS and Containment Spray, determining the time for initiation of recirculation following a LOCA, and event diagnosis. CL3.3-296

(continued)

PA3.3-356

CL3.3-281

BASES

19. Auxiliary Feedwater Flow

CL3.3-296

AFW Flow is provided to monitor operation of decay heat removal via the SGs.

The AFW Flow to each SG is determined from a differential pressure measurement calibrated for a range of 0 gpm to 1200 gpm. Redundant monitoring capability is provided by two independent trains of instrumentation for each SG. Each differential pressure transmitter provides an input to a control room indicator and the unit computer. Since the primary indication used by the operator during an accident is the control room indicator, the PAM

LCO

19. Auxiliary Feedwater Flow (continued)

specification deals specifically with this portion of the instrument channel.

AFW flow is used three ways:

- to verify delivery of AFW flow to the SGs;
- to determine whether to terminate SI if still in progress, in conjunction with SG water level (narrow range); and
- to regulate AFW flow so that the SG tubes remain covered.

(continued)

PA3.3-356 CL3.3-281

BASES

At some units, AFW flow is a Type A variable because operator action is required to throttle flow during an SLB accident to prevent the AFW pumps from operating in runout conditions. AFW flow is also used by the operator to verify that the AFW System is delivering the correct flow to each SG. However, the primary indication used by the operator to ensure an adequate inventory is SG level.

APPLICABILITY

The PAEM instrumentation LCO is applicable in MODES 1, and 2 and 3. These variables are related to the diagnosis and pre-planned actions required to mitigate DBAs. The applicable DBAs are assumed to occur in MODES 1, 2, and 3. In MODES 3, 4, 5, and 6, unit conditions are such that the likelihood of an event that would require PAEM instrumentation is low; therefore, the PAEM instrumentation is not required to be OPERABLE in these MODES. CL3.3-282

ACTIONS

Note 1 has been added in the ACTIONS to exclude the MODE change restriction of LCO 3.0.4. This exception allows entry into the applicable MODE while relying on the ACTIONS even though the ACTIONS may eventually require unit shutdown. This exception is acceptable due to the passive function of the instruments, the operator's ability to respond to an accident using alternate instruments and methods, and the low probability of an event requiring these instruments.

ACTIONS (continued)

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 on Table 3.3.3-1. The Completion Time(s) of the inoperable channel(s) of a Function will be tracked

(continued)

separately for each Function starting from the time the Condition was entered for that Function.

Note 3 has been added in the ACTIONS to clarify that the required CET channels shall be OPERABLE prior to entering MODE 2 following each refueling outage. CL3.3-283

A.1

Condition A applies when one or more Functions have one required channel that is inoperable. Required Action A.1 requires restoring the inoperable channel to OPERABLE status within 30 days. The 30 day Completion Time is based on operating experience and takes into account the remaining OPERABLE channel ~~(or in the case of a Function that has only one required channel, other non-Regulatory Guide 1.97 instrument channels to monitor the Function)~~, the passive nature of the instrument (no critical automatic action is assumed to occur from these instruments), and the low probability of an event requiring PAEM instrumentation during this interval. CL3.3-471

A Note has been added stating that Condition A is not applicable to the CETs. The CETs are controlled under Conditions B, F, and G. CL3.3-283

B.1

Condition B applies when there is one or more required CET channel(s) inoperable and with at least 4 CETs OPERABLE in the center region of the core, and at least one CET OPERABLE in each quadrant of the outside core region. Required Action B.1 requires restoring the required CET channel(s) to OPERABLE status within 30 days. The 30 CL3.3-283

(continued)

PA3.3-356 CL3.3-281

BASES

day Completion Time is acceptable based on operating experience and takes into account the remaining OPERABLE GETs, and the low probability of an event requiring EM Instrumentation during this interval. CL3.3-283

BC.1

Condition CB applies when the Required Action and associated Completion Time for Condition A or B are not met. This Required Action specifies ~~initiation of actions in Specification 5.6.8.~~ a written report to be submitted to the NRC within 14 days~~immediately~~. This report discusses the results of the ~~root cause~~ evaluation of the inoperability and identifies proposed restorative actions. This action is appropriate in lieu of a shutdown requirement since alternative actions are identified before loss of functional capability, and given the likelihood of unit conditions that would require information provided by this instrumentation. CL3.3-284

CD.1

Condition DC applies when one or more Functions have two inoperable required channels (i.e., two channels inoperable in the same Function). Required Action DC.1 requires restoring one channel in the Function(s) to OPERABLE status within 7 days. The Completion Time of 7 days is based on the relatively low probability of an event requiring PAEM instrument operation and the availability of alternate means to obtain the required information. Continuous operation with two required channels inoperable in a Function is not acceptable because the alternate indications may not fully meet all performance qualification requirements applied to the PAEM instrumentation. Therefore, requiring restoration of one inoperable channel of the Function limits the risk that the PAEM Function will be in a degraded condition

(continued)

PA3.3-356 CL3.3-281

BASES

should an accident occur. Condition DC is modified by a Note that excludes hydrogen monitor channels and CET channel(s). CL3.3-283

DE.1

Condition ED applies when two hydrogen monitor channels are inoperable. Required Action ED.1 requires restoring one hydrogen monitor channel to OPERABLE status within 72 hours. The 72 hour Completion Time is reasonable based on the backup capability of the Post Accident Sampling System to monitor the hydrogen concentration for evaluation of core damage and to provide information for operator decisions. Also, it is unlikely that a LOCA (which would cause core damage) would occur during this time.

F.1 CL3.3-283

Condition F applies when three or more required CET channels are inoperable in one or more quadrants and less than four CET channels OPERABLE in the center region of the core. Required Action F.1 requires restoring the required inoperable channels to OPERABLE status within 7 days. The 7 day Completion Time is acceptable based on operating experience and taking into account the remaining CETs and the low probability of an event occurring that would require the CETs to assess the reactor core.

G.1

Condition G applies when three or more required CET channels are inoperable in one or more quadrants and less than one CET channel OPERABLE in each quadrant of the outside core region. Required Action G.1 requires restoring the required inoperable channels to OPERABLE status within 7 days. The 7 day Completion Time is acceptable based on CL3.3-283

(continued)

PA3.3-356 CL3.3-281

BASES

operating experience taking into account the remaining CETs and the low probability of an event occuring that would require the CETs to assess the reactor core.

EH.1

Condition HE applies when the Required Action and associated Completion Time of Condition C orD, E, F, or G are not met. Required Action HE.1 requires entering the appropriate Condition referenced in Table 3.3.3-1 for the channel immediately. The applicable Condition referenced in the Table is Function dependent. Each time an inoperable channel has not met any Required Action of Condition C or D, E, F, or G and the associated Completion Time has expired, Condition HE is entered for that channel and provides for transfer to the appropriate subsequent Condition.

FI.1 and F.2

If the Required Action and associated Completion Time of Condition H isC or D are not met and Table 3.3.3-1 directs entry into Condition IF, the unit must be brought to a MODE where the requirements of this LCO do not apply. To achieve

ACTIONS

F.1 and F.2 (continued)

this status, the unit must be brought to at least MODE 3 within 6 hours and MODE 4 within 12 hours. CL3.3-285

The allowed Completion Times areis 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)

PA3.3-356 CL3.3-281

BASES

GJ.1

At this unit, aAlternate means (e.g., CETs) of monitoring Reactor Vessel Water Level and Containment Area Radiation have been developed and tested. These alternate means may be temporarily installed if the normal PAEM channel cannot be restored to OPERABLE status within the allotted time. If these alternate means are used, the Required Action is not to shut down the unit but rather to follow the directions of Specification 5.6.8, in the Administrative Controls section of the TS. submit a report to the NRC. The report provided to the NRC should discuss the alternate means used, describe the degree to which the alternate means are equivalent to the installed PAEM channels, justify the areas in which they are not equivalent, and provide a schedule for restoring the normal PAEM channels. CL3.3-474 CL3.3-284

SURVEILLANCE REQUIREMENTS

A Note has been added to the SR Table to clarify that SR 3.3.3.1 and SR 3.3.3.2 apply to each PEM instrumentation Function in Table 3.3.3-1, except Item 9. SR 3.3.3.3 only applies to Item 9. PA3.3-287

SR 3.3.3.1

Performance of the CHANNEL CHECK once every 31 days ensures that a gross instrumentation failure has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two instrument channels could be an

SURVEILLANCE SR 3.3.3.1 (continued)

(continued)

PA3.3-356 CL3.3-281

BASES

~~REQUIREMENTS~~

indication of excessive instrument drift in one of the channels or of something even more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION. The high radiation instrumentation should be compared to similar unit instruments located throughout the unit.

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

As specified in the SR, a CHANNEL CHECK is only required for those channels that are normally energized.

The Frequency of 31 days is based on operating experience that demonstrates that channel failure is rare. The CHANNEL CHECK supplements less formal, but more frequent, checks of channels during normal operational use of the displays associated with the LCO required channels.

SR 3.3.3.2

A CHANNEL CALIBRATION is performed every 24~~[18]~~ months, or approximately at every refueling. CHANNEL CALIBRATION is a complete check of the instrument loop, including the sensor. The test verifies that the channel responds to the measured parameter with the necessary range and accuracy. This SR is modified by a Note that excludes neutron detectors. ~~The calibration method for neutron detectors is specified in the Bases of LCO 3.3.1, "Reactor Trip System~~ X3.3-172 CL3.3-472

PA3.3-356 CL3.3-281

BASES

(RTS) Instrumentation." The Frequency is based on operating experience and consistency with the typical PI industry refueling cycle.

SR 3.3.3.3

This SR is the performance of a TADOT for the Penetration Flow Path Automatic Containment Isolation Valve Position every 24 months. PA3.3-287

The Frequency of every 24 months is adequate based on operating experience, reliability, and consistency with the typical PI refueling cycle.

The SR is modified by a Note that excludes verification of setpoints from the TADOT. The Functions affected have no setpoints associated with them.

REFERENCES

1. [Unit specific document (e.g., FSAR, NRC Regulatory Guide 1.97 SER letter).] USAR Section 7.10.

2. Regulatory Guide 1.97, [date] Revision 2.

3. NUREG-0737, Supplement 1, "TMI Action Items."

3. NRC approved LAR 121 dated November 9, 1995.

PA3.3-356 PA3.3-311 X3.3-312

B 3.3 INSTRUMENTATION

B 3.3.4~~5~~ 4 kV Safeguards Bus Voltage~~Loss of Power (LOP) Diesel Generator (DG) Start~~ Instrumentation

BASES

BACKGROUND

The Diesel Generators (DGs) provide a source of emergency power when offsite power is either unavailable or is insufficiently stable to allow safe unit operation. Redundant offsite power sources ensure an available source of offsite power to the Engineered Safety Features when one offsite path becomes unavailable. Undervoltage protection via load sequencers will provide voltage and load restoration, including DG~~generate an LOP~~ start if an under~~loss of~~ voltage (UV) or degraded voltage (DV) condition occurs at the 4 kV safeguards buses~~in the switchyard~~. There are two trains of load sequencers and UV and DV~~LOP start~~ signals, one train for each 4~~.16~~ kV safeguards~~vital~~ bus. These features are described in the USAR (Ref. 1).

Eight~~Three~~ ~~under~~voltage relays ~~with inverse time characteristics are~~ provide~~d~~ input to the load sequencer for~~on~~ each 4~~160 Class 1E instrument~~ kV safeguards bus for detecting a sustained DV, approximately 95% of 4160V, or a UV, approximately 75% of 4160V ~~degraded voltage~~ condition~~ or a loss of bus voltage~~. The relays~~'~~ inputs are paired in the load sequencer into two DV and two UV channels. Either channel initiates the DV or UV function. ~~combined in a two-out-of-three logic to generate an LOP signal if the voltage is below 75% for a short time or below 90% for a long time. The LOP start actuation is described in FSAR, Section 8.3 (Ref. 1).~~ Time delays are applied within the UV and DV functions to prevent actuation during normal transients. A DG start time delay is also provided in the DV function to allow the condition to be corrected by external actions within a time period that will not cause damage to operating equipment. PA3.3-320

(continued)

PA3.3-356 PA3.3-311 X3.3-312

BASES

The load sequencer provides a DG start signal from the UV function if neither offsite path is available. The DV function provides a DG start signal and transfers the bus from the grid to the DG. Load rejection and load restoration sequencing is actuated by an SI signal input, or when the bus is being automatically transferred. The load sequencer is considered to be a support system to the associated DG. An inoperable load sequencer would not allow the associated DG to automatically start, connect to the bus, and provide load reception. However, when a load sequencer is inoperable, the associated DG can still be manually started and loaded, thus providing its intended safety function. PA3.3-320

Trip Setpoints and Allowable Values and Trip Setpoints

The tTrip sSetpoints used in the relays are based on the plant specific voltage analysis discussed analytical limits presented in the UFSAR, Chapter 15 (Ref. 12). The selection of these Trip Setpoints is such that adequate protection is provided when all sensor and processing time delays are taken into account. TA3.3-324

The actual nominal Trip Setpoint entered into the relays is normally still more conservative than that required by the Allowable Value. If the measured setpoint does not exceed the Allowable Value, the relay is considered OPERABLE. The Allowable Value in conjunction with the trip setpoint and LCO establishes the threshold for protective action to ensure that the consequences of Design Basis Accidents (DBA's) in coincidence with offsite power unavailability or instability will be acceptable. The Allowable Value is considered a limiting value such that a channel is OPERABLE if the measured setpoint is found not to exceed the Allowable Value during the CHANNEL OPERATIONAL TEST (COT). Note that, although a channel is OPERABLE under these TA3.3-324

(continued)

PA3.3-356 PA3.3-311 X3.3-312

BASES

circumstances, the setpoint must be left adjusted to within the established calibration tolerance band of the trip setpoint in accordance with the uncertainty assumptions stated in the referenced setpoint methodology (as left criteria).

Setpoints adjusted consistentin accordance with the requirements of the Allowable Values provide a conservative margin with regard to instrument uncertainties to ensure that the consequences of accidents DBAs will be acceptable, providing the unit is operated from within the LCOs at the onset of the accident and that the equipment functions as designed. TA3.3-324

Allowable Values and/or Trip Setpoints are specified as applicable for each Function in SR 3.3.4.2the LCO. Nominal Trip sSetpoints are also specified in the unit specific setpoint calculations. The nominalspecified trip setpoints are selected to ensure that the setpoint measured by the surveillance procedure does not exceed the TA3.3-324

BACKGROUND Trip Setpoints and Allowable Values (continued)

Allowable Value if the relay is performing as required. If the measured setpoint does not exceed the Allowable Value, the relay is considered OPERABLE. Operation with a measured Trip Ssetpoint less conservative than the specifiednominal Ttrip Ssetpoint, but within the Allowable Value, is acceptable provided that operation and testing is consistent with the assumptions of the unit specific setpoint calculation. Each Allowable Value and/or Trip Setpoint specified is more conservative than the analytical limitwith respect to the values assumed in the transient and accident analyses described in Reference 1 in order to account for instrument uncertainties appropriate to the trip function. These uncertainties are defined in the "Unit Specific RTS/ESFAS Setpoint Methodology Study" (Ref. 3)Reference 2.

(continued)

PA3.3-356 PA3.3-311 X3.3-312

BASES

APPLICABLE SAFETY ANALYSES

The 4 kV safeguards bus voltage~~LOP DG start~~ instrumentation is required for the Engineered Safety Features (ESF) Systems to function in any accident with a loss of offsite power. Its design basis is that of the ESF Actuation System (ESFAS).

Accident analyses credit the loading of the DG based on the loss of offsite power during a small break loss of coolant accident (LOCA). The actual DG start has historically been associated with the ESFAS actuation. The DG loading has been included in the delay time associated with each safety system component requiring DG supplied power following a loss of offsite power. The analyses assume a non-mechanistic DG loading, which does not explicitly account for each individual component of loss of power detection and subsequent actions. CL3.3-319

The required ~~channels of~~4 kV safeguards bus voltage ~~LOP DG start~~ instrumentation, in conjunction with the ESF systems powered from the DGs, provide unit protection in the event of any of the analyzed accidents discussed in Reference 32, in which a loss of offsite power is assumed.

The delay times assumed in the safety analysis for the ESF equipment include the 10 second DG start delay, and the appropriate sequencing delay, if applicable. ~~The response times for ESFAS actuated equipment in LCO 3.3.2, "Engineered Safety Feature Actuation System (ESFAS) Instrumentation," include the appropriate DG loading and sequencing delay.~~ CL3.3-237

~~APPLICABLE SAFETY ANALYSES (continued)~~

The 4 kV safeguards bus voltage~~LOP DG start~~ instrumentation ~~channels~~ satisfyies Criterion 3 of 10 CFR 50.36(c)(2)(ii) ~~the NRC Policy Statement.~~

(continued)

PA3.3-356 PA3.3-311 X3.3-312

BASES

LCO

The LCO for 4 KV safeguards bus voltageLOP DG start instrumentation requires that two[three] channels per bus of both the UVloss of voltage and DVdegraded voltage Functions, and two trains of automatic load sequencers, shall be OPERABLE in MODES 1, 2, 3, and 4 when the LOP DG start instrumentation supports safety systems associated with the ESFAS. In MODES 5 and 6, the two[three] channels and the associated load sequencer must be OPERABLE whenever the associated DG is required to be OPERABLE to ensure that the automatic start of the DG is available when needed. Loss of the 4 KV Safeguards Bus VoltageLOP DG Start Instrumentation Function could result in the delay of safety systems initiation when required. This could lead to unacceptable consequences during accidents. During the loss of offsite power the DG powers the motor driven auxiliary feedwater pumps. Failure of these pumps to start would leave only one turbine driven pump, as well as an increased potential for a loss of decay heat removal through the secondary system. CL3.3-318

A channel is OPERABLE with a trip setpoint outside its calibration tolerance band provided the trip setpoint "as-found" value does not exceed its associated Allowable Value and provided the trip setpoint "as-left" value is adjusted to within the calibration tolerance band. TA3.3-324

APPLICABILITY

The 4 KV Safeguards Bus VoltageLOP DG Start Instrumentation Functions are required in MODES 1, 2, 3, and 4 because ESF Functions are designed to provide protection in these MODES. Actuation in MODE 5 or 6 is required whenever the required DG must be OPERABLE so that it can perform its function on an UV LOP or degraded power to the vitalsafeguards bus.

(continued)

PA3.3-356 | PA3.3-311 | X3.3-312

BASES

ACTIONS

In the event a channel's tTrip sSetpoint is found nonconservative with respect to the Allowable Value, or the channel is found inoperable, then the function that channel provides must be declared inoperable and the LCO Condition entered for the particular protection function affected.

Because the required channels are specified on a per bus basis, the Condition may be entered separately for each bus as appropriate.

A Note has been added in the ACTIONS to clarify the application of Completion Time rules. The Conditions of

~~ACTIONS (continued)~~

this Specification may be entered independently for each Function listed in the LCO. The Completion Time(s) of the inoperable channel(s) of a Function will be tracked separately for each Function starting from the time the Condition was entered for that Function.

A.1

Condition A applies to the 4 kV safeguards bus voltage~~LOP DG start~~ Function with one UV~~loss of voltage~~ or one DV~~degraded voltage~~ or both (one UV and one DV) channel(s) per bus inoperable.

If one channel is inoperable, Required Action A.1 requires that channel to be placed in bypass~~trip~~ within 6 hours. With a channel in bypass~~trip~~, the remaining 4 kV safeguards bus voltage~~LOP DG start~~ instrumentation channel~~s are configured to~~ provides UV or DV Function ~~a one-out-of-three logic to~~ initiation~~e a trip of the incoming offsite power~~.

(continued)

PA3.3-356 PA3.3-311 X3.3-312

BASES

A Note is added to allow bypassing an inoperable channel for up to 4 hours for surveillance testing of other channels. This allowance is made where bypassing the channel does not cause an actuation and where at least two other channels are monitoring that parameter. CL3.3-315

The specified Completion Time and time allowed for bypassing one channel are reasonable considering the Function will operate remains fully OPERABLE on every bus and the low probability of an event occurring during these intervals.

CB.1

Condition CB applies when the Required Action and associated Completion Time of Condition B are not met. The unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hoursmore than one loss of voltage or more than one degraded voltage channel on a single bus is inoperable.

Required Action B.1 requires restoring all but one channel to OPERABLE status. The 1 hour Completion Time should allow ample time to repair most failures and takes into account
the low probability of an event requiring an LOP start occurring during this interval. CL3.3-316

ACTIONS (continued)

BC.1 CL3.3-317

Condition C applies to each of the LOP DG start Functions when the Required Action and associated Completion Time for Condition A or B are not met.

(continued)

PA3.3-356 PA3.3-311 X3.3-312

BASES

Condition B applies in MODES 1, 2, 3, or 4 when Required Action and associated Completion Time of Condition A is not met, when Functions a or b or both with two channels per bus are inoperable, or when one required load sequencer is inoperable. CL3.3-317

Required Action B.1 requires the performance of SR 3.3.4.1 for the OPERABLE automatic load sequencer. The 6 hour Completion Time provides a reasonable time for performance of the SR. Performance of this SR on a more frequent basis, once per 24 hours thereafter, ensures that the OPERABLE load sequencer remains OPERABLE while in this Condition. If the redundant train load sequencer fails to pass the SR it is inoperable and Condition D must then be entered. CL3.3-317

B.2 and B.3

To ensure a highly reliable power source remains with an inoperable load sequencer, the offsite paths for the associated 4 kV safeguards bus must be capable of accepting the block loading that could result from an SI signal and availability must be verified on a more frequent basis. The 8 hour Completion Time is consistent with the Completion Time for an inoperable 4 kV safeguards bus, as required in LCO 3.8.9, "Distribution Systems - Operating." The verification of the operability of the offsite paths for associated 4kV safeguards on a more frequent basis, once per 8 hours thereafter, ensures that the OPERABLE paths remain OPERABLE while in this Condition.

An inoperable load sequencer results in associated DG unavailability for automatic start, connection to the bus and load reception. In Condition B, the remaining OPERABLE DG and offsite paths are adequate to supply electrical power to the onsite Safeguards AC Distribution System. CL3.3-317

(continued)

PA3.3-356 PA3.3-311 X3.3-312

BASES

Offsite power block loading capability is established by administrative control of selected distribution system loads to reduce potential starting inrush.

B.4

Required Action B.4 requires that the automatic load sequencer be restored to OPERABLE status. The 7 day Completion Time allows a reasonable time to repair the inoperable load sequencer. The Completion Time is consistent with the Completion Time to restore an inoperable DG, as required in LCO 3.8.1, "AC Sources - Operating."

~~In these circumstances the Conditions specified in LCO 3.8.1, "AC Sources - Operating," or LCO 3.8.2, "AC Sources - Shutdown," for the DG made inoperable by failure of the LOP DG start instrumentation are required to be entered immediately. The actions of those LCOs provide for adequate compensatory actions to assure unit safety.~~

D.1

Required Action D.1 requires that LCO 3.8.2, "AC Sources - Shutdown" Condition(s) and Required Action(s) for the associated DG be entered immediately when Required Action and Completion Time of Condition A is not met, or Functions a and b or both with two channels per bus inoperable, or when one required automatic load sequencer is inoperable in MODE 5 or 6. The Completion Time of immediately is consistent with the required times for actions requiring

(continued)

PA3.3-356 PA3.3-311 X3.3-312

BASES

prompt attention. The restoration of the required AC electrical power sources should be completed as quickly as possible in order to minimize the time during which the unit safety systems may be without sufficient power.

SURVEILLANCE REQUIREMENTS

SR 3.3.45.1

CL3.3-321

~~Performance of the CHANNEL CHECK once every 12 hours ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.~~

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

~~The Frequency is based on operating experience that demonstrates channel failure is rare. The CHANNEL CHECK supplements less formal, but more frequent, checks of channels during normal operational use of the displays associated with the LCO required channels.~~

(continued)

PA3.3-356 PA3.3-311 X3.3-312

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.5.2

CL3.3-322

SR 3.3.45.12 is the performance of a TADCOT. This test is performed every [31 days].

A COT is performed on each required voltage relay channel and automatic load sequencer to ensure they will perform the intended function. The test checks trip devices that provide actuation signals directly, bypassing the analog process control equipment. For these tests, the relay [Trip sSetpoints are verified and adjusted as necessary. The Frequency is based on the known reliability of the relays and load sequencerscontrols and the multichannel redundancy available, and has been shown to be acceptable through operating experience.

SR 3.3.4 5.23

SR 3.3.45.23 is the performance of a CHANNEL CALIBRATION.

The setpoints, as well as the response to a UVloss of voltage and a DVdegraded voltage test, shall include a single point verification that an actuationthe trip occurs within the required time delay, as shown in Reference 1.

A CHANNEL CALIBRATION is performed every 24[18] months, or approximately at every refueling. CHANNEL CALIBRATION is a complete check of the voltage relay channelinstrument loop, including the sensor. The test verifies that the channel responds to a measured parameter within the necessary range and accuracy. X3.3-172

The Frequency of 24[18] months is based on operating experience and consistency with the typical PIindustry refueling cycle and is justified by the assumption of an 24[18] month calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis. X3.3-172

PA3.3-356 PA3.3-311 X3.3-312

BASES

REFERENCES

1. UFSAR, Section [8.43].

2. Engineering Manual Section 3.3.4.1 Engineering Design Standard for Instrument Setpoint/Uncertainty Calculations FSAR, Chapter [15].

3. USAR Section 14 Unit Specific RTS/ESFAS Setpoint Methodology Study.

PA3.3-356 CL3.3-331

B 3.3 INSTRUMENTATION

B 3.3.65 Containment VentilationPurge and Exhaust Isolation Instrumentation

BASES

BACKGROUND

Containment ventilationpurge and exhaust isolation (CVI) instrumentation closes the containment isolation valves in the Containment Inservice (low flow)Mini Purge System and the Shutdown Purge System. This action isolates the containment atmosphere from the environment to minimize releases of radioactivity in the event of an accident. The Containment Inservice (low flow)Mini Purge System may be in use during reactor operation and the Shutdown Purge System will be in use with the reactor shutdown.

Containment ventilationpurge and exhaust isolation initiates on a automatic safety injection (SI) signal, through theby manual actuation of cContainment iIsolation - Phase A Function, or by manual actuation of containment sprayPhase A Isolation. The Bases for LCO 3.3.2, "Engineered Safety Feature Actuation System (ESFAS) Instrumentation," discuss these modes of initiation. CL3.3-252 CL3.3-343

FourThree radiation monitoring channels are also provided as input to CVIthe containment purge and exhaust isolation. OneThe four channels measures gaseous radiation in containment exhaust airradiation at two locations. This channel provides an input to one train of CVI actuation relay logic. The other two channels measure either gaseous or particulate containment exhaust air radiation. These two channels provide inputs to the other train of CVI actuation relay logic where either channel will actuate the train.One channel is a containment area gamma monitor, and the other three measure radiation in a sample of the containment purge exhaust. The three purge exhaust radiation detectors are of three different types: gaseous, particulate, and iodine CL3.3-333

(continued)

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BASES

~~monitors. All~~ These three ~~four~~ detectors will respond to most events that release radiation to containment. ~~However, analyses have not been conducted to demonstrate that all credible events will be detected by more than one monitor. Therefore, for the purposes of this LCO the four channels are not considered redundant. Instead, they are treated as four one-out-of-one Functions.~~ Since the ~~purge exhaust~~ monitors constitute a sampling system, various components such as sample line valves~~, sample line heaters,~~ and sample pumps~~, and filter motors~~ are required to support monitor OPERABILITY.

~~BACKGROUND (Continued)~~

~~Each of the purge systems has inner and outer containment isolation valves in its supply and exhaust ducts.~~ The Containment Inservice (low flow) Purge System has two containment isolation valves on each supply and exhaust line. A high radiation signal from any one of the ~~four~~three channels initiates one train of CVI logic~~containment purge isolation~~, which closes one ~~both~~ supply ~~inner~~ and one~~outer~~ exhaust containment isolation valve~~s~~ in the ~~Mini-Purge System and the Shutdown~~ Containment Inservice (low flow) Purge System. Th~~ese~~is system~~s are~~is described in the Bases for LCO 3.6.3, "Containment Isolation Valves."

APPLICABLE SAFETY ANALYSES

The safety analyses assume that the containment remains intact with penetrations unnecessary for core cooling isolated early in the event~~, within approximately 60 seconds~~. The isolation of the purge valves has not been analyzed mechanistically in the dose calculations, although its rapid isolation is assumed. The containment ~~purge and~~ exhaust air~~isolation~~ radiation monitors act as backup to the SI signal to ensure closing of the purge and exhaust valves. They are also the primary means for automatically isolating containment in the event of a fuel handling accident during shutdown. Containment isolation in turn ensures meeting the containment leakage rate assumptions of the safety analyses,

(continued)

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and ensures that the calculated accidental offsite radiological doses are below 10 CFR 100 (Ref. 1) limits.

The CVIcontainment purge and exhaust isolation instrumentation satisfies Criterion 3 of 10 CFR 50.36 (c)(2)(ii)the NRC Policy Statement.

LCO

The LCO requirements ensure that the instrumentation necessary to initiate CVIContainment Purge and Exhaust Isolation, listed in Table 3.3.56-1, is OPERABLE.

1. Manual Initiation

LCO (continued) System

The LCO requires two channels OPERABLE. The operator can initiate Containment Purge IsolationCVI at any time by using either of two switches in the control room. Either switch actuates both trains. This action will cause actuation of all components in one train of Containment Inservice (low flow) Purge containment isolation valves in the same manner as any of the automatic actuation signals.

The LCO for Manual Initiation ensures the proper amount of redundancy is maintained in the manual actuation circuitry to ensure the operator has manual initiation capability.

Each channel consists of one switchpush button and the interconnecting wiring to the valves actuation logic cabinet.

2. Automatic Actuation Relay Logic and Actuation Relays

(continued)

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BASES

The LCO requires two trains of CVI relay~~Automatic Actuation L~~logic~~ and Actuation Relays~~ OPERABLE to ensure that no single random failure can prevent automatic actuation. CL3.3-337

The CVI Automatic Actuation Relay Logic ~~and Actuation Relays~~ consists of the same features and operate in the same manner as described for ESFAS Function 1.b, SI, and ESFAS Function 3.~~a~~b, Containment~~ Phase A~~ Isolation. The applicable MODES and specified conditions for the CVI~~containment purge isolation~~ portion of these Functions are different and less restrictive than those for their~~ Phase A~~ containment isolation and SI roles. If one or more of the SI or ~~Phase A~~ containment isolation Functions becomes inoperable in such a manner that only the CVI~~Containment Purge Isolation~~ Function is affected, the Conditions applicable to their SI and ~~Phase A~~containment isolation Functions need not be entered. The less restrictive Actions specified for inoperability of the CVI~~Containment Purge Isolation~~ Functions specify sufficient compensatory measures for this case. CL3.3-252

3. ~~Containment Radiation~~High Radiation in Exhaust Air

The LCO specifies ~~four~~two required trains~~channels~~ of radiation monitors to ensure that the radiation monitoring instrumentation necessary to initiate CVI~~Containment Purge Isolation~~ remains OPERABLE. CL3.3-333

~~LCO (continued)~~

For sampling systems, channel OPERABILITY involves more than OPERABILITY of the channel electronics. OPERABILITY may also require correct valve lineups,

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BASES

and sample pump operation, and filter motor operation, as well as detector OPERABILITY, if these supporting features are necessary for trip to occur under the conditions assumed by the safety analyses.

4. Manual Containment Isolation - Phase A CL3.3-342

Refer to LCO 3.3.2, Function 3.a., for all initiating Functions and requirements.

5. Safety Injection CL3.3-343

Refer to LCO 3.3.2, Function 1, for all initiating Functions and requirements.

6. Manual Containment Spray CL3.3-343

Refer to LCO 3.3.2, Function 2, for all initiating Functions and requirements.

APPLICABILITY

All Functions in Table 3.3.5-1 are required to be OPERABLE in MODES 1, 2, 3, and 4 when the Containment Inservice (low flow) Purge System is not isolated. In addition, TA3.3-332

Tthe Manual Initiation, Automatic Actuation Relay Logic and Actuation Relays, Containment Isolation - Phase A, and High Containment Radiation in Exhaust Air Functions are required OPERABLE in MODES 1, 2, 3, and 4, and during CORE ALTERATIONS or movement of irradiated fuel assemblies within containment when the Containment Inservice (low flow) Purge System is not isolated. Under these conditions, the potential exists for an accident that could release fission product radioactivity into containment. Therefore, CL3.3-337 CL3.3-333 CL3.3-252 CL3.3-344

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BASES

the CVIcontainment purge and exhaust isolation instrumentation must be OPERABLE in these MODES.

While in MODES 5 and 6 without CORE ALTERATIONS or irradiated fuel handling in progress, the CVIcontainment ventilationpurge and exhaust isolation instrumentation need not be OPERABLE since the potential for radioactive releases is minimized and operator action is sufficient to ensure post accident offsite doses are maintained within the limits of Reference 1.

ACTIONS

The most common cause of channel inoperability is outright failure or drift of the bistable or process module sufficient to exceed the tolerance allowed by unit specific calibration procedures. 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 COT, when the process instrumentation is set up for adjustment to bring it within specification. If the Ttrip Ssetpoint is less conservative than the Allowable Valuetolerance specified by the calibration procedure, the channel must be declared inoperable immediately and the appropriate Condition entered.

ACTIONS (continued)

A Note has been added to the ACTIONS to clarify the application of Completion Time rules. The Conditions of this Specification may be entered independently for each Function listed in Table 3.3.65-1. 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.

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BASES

A.1

CL3.3-333

Condition A applies to the failure of one CVIcontainment purge isolation radiation monitor trainchannel. Since the four containment radiation monitors measure different parameters,

failure of a single channel may result in loss of the radiation monitoring Function for certain events. Consequently, the failed channel must be restored to OPERABLE status. The 4 hours allowed to restore the affected trainchannel is justified by the low likelihood of events occurring during this interval, and recognition that one or more of the remaining trainchannels will respond to most events.

B.1 and B.2

CL3.3-359

Condition B applies to all CVIContainment Purge and Exhaust Isolation Functions and addresses the train orientation of the Solid State Protection System (SSPS) and the master and slave relays for these Functions. It also addresses the failure of multiple radiation monitoring channels, or the inability to restore a single failed channel to OPERABLE status in the time allowed for Required Action A.1.

CL3.3-333

If a train is inoperable, multiple channels are inoperable, or the Required Action and associated Completion Time of Condition A are not met, operation may continue as long as the Required Action to place and maintain containment inservice (low flow) purge valves in the closed position is met, or the Required Action for the applicable Conditions of LCO 3.6.3 is met for each valve made inoperable by failure of isolation instrumentation.

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BASES (continued)

B.1

A Note is added stating that Condition B is only applicable in MODE 1, 2, 3, or 4.

C.1 and C.2

CL3.3-359

Condition C applies to all CVIContainment Purge and Exhaust Isolation Functions and addresses the train orientation of the SSPS and the master and slave relays for these Functions. It also addresses the failure of multiple radiation monitoring channels, or the inability to restore a single failed channel to OPERABLE status in the time allowed for Required Action A.1. If a train is inoperable, multiple channels are inoperable, or the Required Action and associated Completion Time of Condition A are not met, operation may continue as long as the Required Action to place and maintain containment inservice (low flow) purge and exhaust isolation valves in their closed position is met or the applicable Conditions of LCO 3.9.4, "Containment Penetrations," are met for each valve made inoperable by failure of isolation instrumentation. The Completion Time for these Required Actions is Immediately. CL3.3-333

A Note states that Condition C is only applicable during CORE ALTERATIONS and during movement of irradiated fuel assemblies within containment.

SURVEILLANCE REQUIREMENTS

A Note has been added to the SR Table to clarify that Table 3.3.56-1 determines which SRs apply to which CVI Containment Purge and Exhaust Isolation Functions.

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BASES (continued)

SR 3.3.56.1

Performance of the CHANNEL CHECK once every 12 hours ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations

SURVEILLANCE REQUIREMENTS SR 3.3.5.1 (continued)

between the two instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

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

The Frequency is based on operating experience that demonstrates channel failure is rare. The CHANNEL CHECK supplements less formal, but more frequent, checks of

channels during normal operational use of the displays associated with the LCO required channels.

(continued)

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BASES (continued)

SR 3.3.56.2

CL3.3-233

SR 3.3.56.2 is the performance of an ACTUATION LOGIC TEST. ~~The train being tested is placed in the bypass condition, thus preventing inadvertent actuation. Through the semiautomatic tester, all possible logic combinations, with and without applicable permissives, are tested for each protection function. In addition, the master relay coil is pulse tested for continuity. This verifies that the logic modules are OPERABLE and there is an intact voltage signal path to the master relay coils.~~ This test is performed every 31 days on a STAGGERED TEST BASIS. The Surveillance interval is acceptable based on instrument reliability and industry operating experience.

~~SR 3.3.6.3~~

~~SR 3.3.6.3 is the performance of a MASTER RELAY TEST. The MASTER RELAY TEST is the energizing of the master relay, verifying contact operation and a low voltage continuity check of the slave relay coil. Upon master relay contact~~

~~SURVEILLANCE REQUIREMENTS~~ ~~SR 3.3.5.2 (continued)~~

~~operation, a low voltage is injected to the slave relay coil. This voltage is insufficient to pick up the slave relay, but large enough to demonstrate signal path continuity. This test is performed every 31 days on a STAGGERED TEST BASIS. The Surveillance interval is acceptable based on instrument reliability and industry operating experience.~~

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BASES (continued)

SR 3.3.5.36.4

A COT is performed every [92] days on each required channel to ensure the entire channel will perform the intended Function. The Frequency is based on the staff recommendation for increasing the availability of radiation monitors according to NUREG-1366 (Ref. 2). This test verifies the capability of the instrumentation to provide the containment purge and exhaust system isolation. The setpoint shall be left consistent with the current unit specific calibration procedure tolerance. CL3.3-335

SR 3.3.6.5

CL3.3-233

SR 3.3.6.5 is the performance of a SLAVE RELAY TEST. The SLAVE RELAY TEST is the energizing of the slave relays. Contact operation is verified in one of two ways. Actuation equipment that may be operated in the design mitigation mode is either allowed to function or is placed in a condition where the relay contact operation can be verified without operation of the equipment. Actuation equipment that may not be operated in the design mitigation mode is prevented from operation by the SLAVE RELAY TEST circuit. For this latter case, contact operation is verified by a continuity check of the circuit containing the slave relay. This test is performed every [92] days. The Frequency is acceptable based on instrument reliability and industry operating experience.

SR 3.3.5.4 6.6

SR 3.3.5.46.6 is the performance of a TADOT. This test is a check of the Manual InitiationActuation Function and is

(continued)

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BASES (continued)

performed every [18]24 months. Each Manual Actuation Function is tested up to, and including, the master relay coils. In some instances, the test includes actuation of the end device (i.e., pump starts, valve cycles, etc.). X3.3-172 CL3.3-233

The test also includes trip devices that provide actuation signals directly to the SSPS, bypassing the analog process control equipment. The SR is modified by a Note that excludes verification of setpoints during the TADOT. The Functions tested have no setpoints associated with them. CL3.3-359

The Frequency is based on the known reliability of the Function and the redundancy available, and has been shown to be acceptable through operating experience.

SR 3.3.5.56.7

A CHANNEL CALIBRATION is performed every [18]24 months, or approximately at every refueling. CHANNEL CALIBRATION is a complete check of the instrument loop, including the sensor. The test verifies that the channel responds to a measured parameter within the necessary range and accuracy. X3.3-172

The Frequency is based on operating experience and is consistent with the typical PIindustry refueling cycle.

REFERENCES

1. 10 CFR 100.11.

2. NUREG-1366, [date].

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