NEXTera ENERGY
POINT BEACH

August 2, 2010

NRC 2010-0112
10 CFR 50.90

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Point Beach Nuclear Plant, Units 1 and 2
Dockets 50-266 and 50-301
Renewed License Nos. DPR-24 and DPR-27

License Amendment Request 261, Extended Power Uprate
Transmittal of Proposed Technical Specifications for Reactor Protection System and Engineered Safety Features Setpoints Not Associated with Extended Power Uprate

References:
(1) FPL Energy Point Beach, LLC letter to NRC, dated April 7, 2009, License Amendment Request 261, Extended Power Uprate (ML091250564)
(2) NextEra Energy Point Beach, LLC letter to NRC, dated February 25, 2010, License Amendment Request 261, Extended Power Uprate, Transmittal of Proposed Technical Specifications for Reactor Protection System and Engineered Safety Features Setpoints Not Associated with Extended Power Uprate (ML100600576)
(3) NextEra Energy Point Beach, LLC letter to NRC, dated December 8, 2009, License Amendment Request 261, Supplement 3, Extended Power Uprate (ML093430114)
(4) NextEra Energy Point Beach, LLC letter to NRC, dated April 30, 2010, License Amendment Request 261, Extended Power Uprate, Response to Request for Additional Information (ML101200544)

NextEra Energy Point Beach, LLC (NextEra) submitted License Amendment Request (LAR) 261 (Reference 1) to the NRC pursuant to 10 CFR 50.90. The proposed amendment would increase each unit's licensed thermal power level from 1540 megawatts thermal (MWt) to 1800 MWt, and revise the Technical Specifications (TS) to support operation at the increased thermal power level. This letter supersedes NextEra letter dated February 25, 2010 (Reference 2) in its entirety.

Supplement 3 to LAR 261 (Reference 3) was submitted to provide revised proposed changes for the reactor protection system (RPS) Instrumentation TS Table 3.3.1-1 and engineered safety features actuation system (ESFAS) Instrumentation TS Table 3.3.2-1. The proposed changes provided in Reference (3) included both EPU and non-EPU related changes. The proposed changes also included the addition of a new column, Nominal Trip Setpoint, and additional

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notes addressing how to deal with as-left and as-found tolerances around the Nominal Trip Setpoint. This column was added to be consistent with the TS Table format in NUREG 1431, Standard Technical Specifications - Westinghouse Plants, and consistent with guidance related to Technical Specification Task Force (TSTF)-493 Revision 4, Clarify the Application of Setpoint Methodology for Limiting Safety System Setting (LSSS) Functions.

In Reference (2), NextEra requested that the proposed changes for non-EPU RPS and ESFAS instrumentation setpoints be approved prior to the review of LAR 261 being completed. To support the setpoint review, NextEra provided sample setpoint calculations in Reference (4).

Per telecon on May 6, 2010, the NRC staff notified NextEra that determining LSSS setpoints using single-sided random uncertainties was not acceptable and that the RPS/ESFAS calculations that used single sided uncertainty factors would have to be revised. As a result, NextEra revised the RPS/ESFAS instrumentation uncertainty/setpoint calculations to eliminate the use of a single-sided reduction factor in the total loop error determination for LSSS setpoints. The revised calculations require changes to some TS allowable values and nominal trip setpoints provided in Reference (4).

Enclosure 1 provides the basis for the selection of non-EPU RPS and ESFAS instrumentation setpoints, for which NextEra requests approval.

Enclosure 2 provides TS Table 3.3.1-1 and TS Table 3.3.2-1 proposed changes for non-EPU related RPS/ESFAS instrumentation setpoints. NextEra requests a 180-day implementation period for the proposed TS changes identified in Enclosure 2.

Enclosure 3 provides a markup of proposed TS Bases associated with the proposed changes listed in Enclosure 2. The bases are being provided for information only. NRC approval is not being requested.

This letter contains no new Regulatory Commitments and no revisions to existing Regulatory Commitments.

The proposed TS changes have been reviewed by the Plant Operations Review Committee.

The information contained in this letter does not alter the no significant hazards consideration contained in Reference (3) and continues to satisfy the criteria of 10 CFR 51.22 for categorical exclusion from the requirements of an environmental assessment.

In accordance with 10 CFR 50.91, a copy of this letter is being provided to the designated Wisconsin Official.

I declare under penalty of perjury that the foregoing is true and correct.
Executed on August 2, 2010.

Very truly yours,

NextEra Energy Point Beach, LLC

Larry Meyer
Site Vice President

Enclosures

cc: Administrator, Region III, USNRC
Project Manager, Point Beach Nuclear Plant, USNRC
Resident Inspector, Point Beach Nuclear Plant, USNRC
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ENCLOSURE 1

NEXTERA ENERGY POINT BEACH, LLC
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

LICENSE AMENDMENT REQUEST 261, EXTENDED POWER UPRATE TRANSMITTAL OF PROPOSED TECHNICAL SPECIFICATIONS FOR REACTOR PROTECTION SYSTEM AND ENGINEERED SAFETY FEATURES SETPOINTS NOT ASSOCIATED WITH EXTENDED POWER UPRATE

BASIS FOR SELECTION OF NON-EPU REACTOR PROTECTION SYSTEM AND ENGINEERED SAFETY FEATURES ACTUATION SYSTEM SETPOINTS

Supplement 6 to License Amendment Request (LAR) 261 (Reference 1) was submitted to the NRC to provide revised proposed changes for the reactor protection system (RPS) instrumentation Technical Specifications (TS) Table 3.3.1-1 and engineered safety features actuation system (ESFAS) instrumentation TS Table 3.3.2-1. The proposed changes provided in Reference (1) included both extended power uprate (EPU) related and non-EPU related changes.

NextEra Energy Point Beach, LLC (NextEra) is requesting the NRC review and approve the proposed changes for the non-EPU RPS and ESFAS setpoints prior to the NRC completing the review of LAR 261. Therefore, proposed changes for TS Table 3.3.1-1 and TS Table 3.3.2-1 associated with the non-EPU setpoints are required.

The following non-EPU proposed changes were submitted in Reference (1):

<u>RPS Setpoints</u>:

- TS Table 3.3.1-1, Function 2.b, Power Range Neutron Flux – Low
- TS Table 3.3.1-1, Function 3, Intermediate Range Neutron Flux
- TS Table 3.3.1-1, Function 4, Source Range Neutron Flux
- TS Table 3.3.1-1, Function 8, Pressurizer Water Level – High
- TS Table 3.3.1-1, Function 9.a, Reactor Coolant Flow-Low – Single Loop
- TS Table 3.3.1-1, Function 9.b, Reactor Coolant Flow-Low – Two Loops
- TS Table 3.3.1-1, Function 11, Undervoltage Bus A01 & A02
- TS Table 3.3.1-1, Function 12, Underfrequency Bus A01 & A02
- TS Table 3.3.1-1, Function 14, Steam Generator Water Level – Low – Coincident With Steam Flow/Feedwater Flow Mismatch
- TS Table 3.3.1-1, Function 17.a, Reactor Trip System Interlocks, Intermediate Range Neutron Flux, P-6

- TS Table 3.3.1-1, Function 17.b(1), Reactor Trip System Interlocks, Low Power Reactor Trips Block, P-7, Power Range Neutron Flux
- TS Table 3.3.1-1, Function 17.b(2), Reactor Trip System Interlocks, Low Power Reactor Trips Block, P-7, Turbine Impulse Pressure
- TS Table 3.3.1-1, Function 17.e, Reactor Trip System Interlocks, Power Range Neutron Flux, P-10

ESFAS Setpoints:

- TS Table 3.3.2-1, Function 1.c, Safety Injection – Containment Pressure – High
- TS Table 3.3.2-1, Function 1.d, Safety Injection – Pressurizer Pressure – Low
- TS Table 3.3.2-1, Function 2.c, Containment Spray – Containment Pressure – High High
- TS Table 3.3.2-1, Function 4.c, Steam Line Isolation – Containment Pressure – High High
- TS Table 3.3.2-1, Function 4.d, Steam Line Isolation – High Steam Flow Coincident with Safety Injection and Coincident with T_{avg} – Low (T_{avg} - Low function is non-EPU; the High Steam Flow function is EPU-related)
- TS Table 3.3.2-1, Function 5.b, Feedwater Isolation on SG Water Level – High
- TS Table 3.3.2-1, Function 6.d, Auxiliary Feedwater – Undervoltage Bus A01 and A02

The proposed TS Table 3.3.1-1 and TS Table 3.3.2-1 changes associated with non-EPU related setpoints are provided in Enclosure 2. Eight of the non-EPU RPS and ESFAS setpoints changes listed above will be implemented with EPU-related setpoints because implementing these TS changes is lower risk when the units are off-line.

The eight setpoints in this category are:

- TS 3.3.1, Function 3, Intermediate Range Neutron Flux – Physical changes to the field instrument settings are required in order to implement the new TS.
- TS 3.3.1, Function 4, Source Range Neutron Flux – Physical changes to the field instrument settings are required in order to implement the new TS.
- TS 3.3.1, Function 14, Steam Generator Water Level – Low Coincident with Steam Flow/Feedwater Flow Mismatch – Physical changes to the field instrument settings for the SG Water Level – Low portion are required to implement the new TS.
- TS 3.3.1, Function 17.a, Reactor Trip System Interlocks, Intermediate Range Neutron Flux P-6 – Physical changes to the field instrument settings are required in order to implement the new TS.
- TS 3.3.1, Function 17.b(1), Reactor Trip System Interlocks, Power Range Neutron Flux - Low Power Reactor Trips Block P-7 Interlock – Physical changes to the field instrument settings are required in order to implement the new TS.
- TS 3.3.1, Function 17.b(2), Reactor Trip System Interlocks, Turbine First Stage Pressure - Low Power Reactor Trips Block P-7 Interlock – Physical changes to the field instrument settings are required in order to implement the new TS.

- TS 3.3.1, Function 17.e, Reactor Trip System Interlocks, Power Range Neutron Flux P-10 Interlock – Physical changes to the field instrument settings are required in order to implement the new TS.
- TS 3.3.2, Function 1.c, Safety Injection on Containment Pressure – High - Physical changes to the field instrument settings are required in order to implement the new TS.

Based on the above, NextEra requests approval of the following non-EPU RPS and ESFAS setpoints:

RPS Setpoints:

- Function 2.b, Power Range Neutron Flux – Low
- Function 8, Pressurizer Water Level – High
- Function 9.a, Reactor Coolant Flow-Low – Single Loop
- Function 9.b, Reactor Coolant Flow-Low – Two Loops
- Function 11, Undervoltage Bus A01 & A02
- Function 12, Underfrequency Bus A01 & A02

ESFAS Setpoints:

- Function 1.d, Safety Injection – Pressurizer Pressure – Low
- Function 2.c, Containment Spray – Containment Pressure – High High
- Function 4.c, Steam Line Isolation – Containment Pressure – High High
- Function 4.d, Steam Line Isolation – High Steam Flow Coincident with Safety Injection and Coincident with T_{avg} – Low (Low T_{avg} Interlock only)
- Function 5.b, Feedwater Isolation – SG Water Level – High
- Function 6.d, Auxiliary Feedwater – Undervoltage Bus A01 and A02

For those RPS and ESFAS setpoints required to be implemented with EPU, administrative notes are provided in the Nominal Trip Setpoint (NTSP) column for the associated functions. These administrative notes are necessary because NTSPs are not available for current licensed power level conditions for those functions associated with EPU.

Additionally, a single asterisk (*) footnote is provided in TS Table 3.3.2-1 to identify that TS 3.3.2-1, Function 7, does not have a NTSP TS established for current licensed power level and that Function 7 will be deleted as part of EPU implementation. A double asterisk (**) footnote is included in TS Table 3.3.1-1 and TS Table 3.3.2-1 to identify that NTSP for functions associated with EPU are proposed in EPU LAR 261, Supplement 6 (Reference 1).

References

(1) NextEra Energy Point Beach, LLC, Letter to NRC, dated July 28, 2010, License Amendment Request 261 Supplement 6, Extended Power Uprate.

ENCLOSURE 2

NEXTERA ENERGY POINT BEACH, LLC
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

LICENSE AMENDMENT REQUEST 261, EXTENDED POWER UPRATE
TRANSMITTAL OF PROPOSED TECHNICAL SPECIFICATIONS FOR
REACTOR PROTECTION SYSTEM AND ENGINEERED SAFETY FEATURES
SETPOINTS NOT ASSOCIATED WITH EXTENDED POWER UPRATE

PROPOSED TECHNICAL SPECIFICATION CHANGES

13 pages follow

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

	FUNCTION	APPLICABLE MODES	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT
1.	Manual Reactor Trip	1,2	2	B	SR 3.3.1.13	NA	**
		3(a), 4(a), 5(a)	2	C	SR 3.3.1.13	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	≤ 108% RTP	**
	b. Low	1(b),2	4	D	SR 3.3.1.1 SR 3.3.1.8(m) SR 3.3.1.11(m)	≤ ~~25%~~ RTP 27%	20% RTP
3.	Intermediate Range Neutron Flux	1(b), 2(c)	2	F,G	SR 3.3.1.1 SR 3.3.1.8 SR 3.3.1.11	≤ 40% RTP	**
4.	Source Range Neutron Flux	2(d)	2	H,I	SR 3.3.1.1 SR 3.3.1.8 SR 3.3.1.11	within span of instrumentation	**
		3(a), 4(a), 5(a)	2	I,J	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.11	within span of instrumentation	**
5.	Overtemperature ΔT	1,2	4	D	SR 3.3.1.1 SR 3.3.1.3 SR 3.3.1.6 SR 3.3.1.7 SR 3.3.1.11	Refer to Note 1 (Page 3.3.1-18)	**
6.	Overpower ΔT	1,2	4	D	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.11	Refer to Note 2 (Page 3.3.1-20)	**

(continued)

(a) With Reactor Trip Breakers (RTBs) closed and Rod Control System capable of rod withdrawal.

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

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

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

(m) Table 3.3.1-1 Notes 3 and 4 are applicable.

** Proposed nominal trip setpoints for these functions were submitted for approval in Extended Power Uprate License Amendment Request 261, Supplement 6.

Table 3.3.1-1 (page 2 of ~~8~~ 9)
Reactor Protection System Instrumentation

FUNCTION	APPLICABLE MODES	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT
7. Pressurizer Pressure						
a. Low	1(e)	4	K	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.11	(h)	**
b. High	1,2	3	D	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.11	(i)	**
8. Pressurizer Water Level — High	1(e)	3	K	SR 3.3.1.1 SR 3.3.1.7(m) SR 3.3.1.11(m)	≤ ~~95% of span~~ 85%	80%
9. Reactor Coolant Flow-Low						
a. Single Loop	1(f)	3 per loop	L	SR 3.3.1.1 SR 3.3.1.7(m) SR 3.3.1.11(m)	≥ ~~90%~~ 91%	93%
b. Two Loops	1(g)	3 per loop	K	SR 3.3.1.1 SR 3.3.1.7(m) SR 3.3.1.11(m)	≥ ~~90%~~ 91%	93%
10. Reactor Coolant Pump (RCP) Breaker Position						
a. Single Loop	1(f)	1 per RCP	M	SR 3.3.1.13	NA	**
b. Two Loops	1(g)	1 per RCP	N	SR 3.3.1.13	NA	**
11. Undervoltage Bus A01 & A02	1(e)	2 per bus	K	SR 3.3.1.9 SR 3.3.1.10(m)	≥ 3120 V	3170 V

(continued)

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

(f) Above the P-8 (Power Range Neutron Flux) interlock.

(g) Above the P-7 (Low Power Reactor Trips Block) interlock and below the P-8 (Power Range Neutron Flux) interlock.

(h) ≥ 1905 psig during operation at 2250 psia, or ≥ 1800 psig during operation at 2000 psia.

(i) ≤ 2385 psig during operation at 2250 psia, or ≤ 2210 psig during operation at 2000 psia.

(m) Table 3.3.1-1 Notes 3 and 4 are applicable.

** Proposed nominal trip setpoints for these functions were submitted for approval in Extended Power Uprate License Amendment Request 261, Supplement 6.

Table 3.3.1-1 (page 3 of 8 9)
Reactor Protection System Instrumentation

	FUNCTION	APPLICABLE MODES	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT
12.	Underfrequency Bus A01 & A02	1(e)	2 per bus	E	SR 3.3.1.10(m)	≥ 55 Hz	57 Hz
13.	Steam Generator (SG) Water Level — Low Low	1,2	3 per SG	D	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.11	≥ 20% of span	**
14.	SG Water Level — Low	1,2	2 per SG	D	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.11	NA	**
	Coincident with Steam Flow/Feedwater Flow Mismatch	1,2	2 per SG	D	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.11	≤ 1 E6 lb/hr	**
15.	Turbine Trip						
	a. Low Autostop Oil Pressure	1(j)	3	O	SR 3.3.1.14	NA	**
	b. Turbine Stop Valve Closure	1(j)	2	O	SR 3.3.1.14	NA	**
16.	Safety Injection (SI) Input from Engineered Safety Feature Actuation System (ESFAS)	1,2	2 trains	P	SR 3.3.1.13	NA	**

(continued)

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

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

(m) Table 3.3.1-1 Notes 3 and 4 are applicable.

** Proposed nominal trip setpoints for these functions were submitted for approval in Extended Power Uprate License Amendment Request 261, Supplement 6.

Table 3.3.1-1 (page 4 of ~~8~~ 9)
Reactor Protection System Instrumentation

FUNCTION	APPLICABLE MODES	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT
17. Reactor Trip System Interlocks						
a. Intermediate Range Neutron Flux, P-6	2(d)	2	R	SR 3.3.1.11 SR 3.3.1.12	> 1E-10 amp	**
b. Low Power Reactor Trips Block, P-7						
(1) Power Range Neutron Flux	1	4	S	SR 3.3.1.11 SR 3.3.1.12	< 10% RTP	**
(2) Turbine Impulse Pressure	1	2	S	SR 3.3.1.11 SR 3.3.1.12	< 10% turbine power	**
c. Power Range Neutron Flux, P-8	1	4	S	SR 3.3.1.11 SR 3.3.1.12	< 50% RTP	**
d. Power Range Neutron Flux, P-9	1(k)	4	S	SR 3.3.1.11 SR 3.3.1.12	< 50% RTP	**
e. Power Range Neutron Flux, P-10	1,2	4	R	SR 3.3.1.11 SR 3.3.1.12	> 8% RTP and < 10% RTP	**
18. Reactor Trip Breakers (RTBs)	1,2	2 trains	Q	SR 3.3.1.4	NA	**
	3(a), 4(a), 5(a)	2 trains	T	SR 3.3.1.4	NA	**
19. Reactor Trip Breaker Undervoltage and Shunt Trip Mechanisms	1,2	1 each per RTB	U	SR 3.3.1.4	NA	**
	3(a), 4(a), 5(a)	1 each per RTB	T	SR 3.3.1.4	NA	**

(continued)

(a) With the RTBs closed and the Rod Control System capable of rod withdrawal.

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

(k) With 1 of 2 circulating water pump breakers closed and condenser vacuum ≥ 22 "Hg.

** Proposed nominal trip setpoints for these functions were submitted for approval in Extended Power Uprate License Amendment Request 261, Supplement 6.

Table 3.3.1-1 (page 5 of ~~8~~ 9)
Reactor Protection System Instrumentation

	FUNCTION	APPLICABLE MODES	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT
20.	Reactor Trip Bypass Breaker and associated Undervoltage Trip Mechanism	1[l], 2[l]	1	V	SR 3.3.1.4	NA	**
		3[l], 4[l], 5[l]	1	W	SR 3.3.1.4	NA	**
21.	Automatic Trip Logic	1, 2	2 trains	P	SR 3.3.1.5 SR 3.3.1.15	NA	**
		3[a], 4[a], 5[a]	2 trains	X	SR 3.3.1.5	NA	**

(a) With RTBs closed and Rod Control System capable of rod withdrawal.

(l) When Reactor Trip Bypass Breakers are racked in and closed and the Rod Control System is capable of rod withdrawal.

** Proposed nominal trip setpoints for these functions were submitted for approval in Extended Power Uprate License Amendment Request 261, Supplement 6.

Table 3.3.1-1 (page 6 of ~~8~~ 9)
Reactor Protection System Instrumentation

Note 1: Overtemperature ΔT

$$\Delta T\left(\frac{1}{1+\tau_3 S}\right) \leq \Delta T_o\left(K_1 - K_2\left(T\left(\frac{1}{1+\tau_4 S}\right) - T'\right)\left(\frac{1+\tau_1 S}{1+\tau_2 S}\right) + K_3(P - P') - f(\Delta I)\right)$$

where (values are applicable to operation at both 2000 psia and 2250 psia unless otherwise indicated)

ΔT_o	=	indicated ΔT at rated power, °F
T	=	average temperature, °F
T'	≤	[*]°F (for cores containing 422V+ fuel assemblies)
T'	≤	[*]°F (for cores not containing 422V+ fuel assemblies)
P	=	pressurizer pressure, psig
P'	=	[*] psig (for 2250 psia operation)
P'	=	[*] psig (for 2000 psia operation and cores not containing 422V+ fuel assemblies)
K_1	≤	[*] (for 2250 psia operation and cores containing 422V+ fuel assemblies)
K_1	≤	[*] (for 2250 psia operation and cores not containing 422V+ fuel assemblies)
K_1	≤	[*] (for 2000 psia operation and cores not containing 422V+ fuel assemblies)
K_2	=	[*] (for 2250 psia operation and cores containing 422V+ fuel assemblies)
K_2	=	[*] (for 2250 psia operation and cores not containing 422V+ fuel assemblies)
K_2	=	[*] (for 2000 psia operation and cores not containing 422V+ fuel assemblies)
K_3	=	[*] (for 2250 psia operation and cores containing 422V+ fuel assemblies)
K_3	=	[*] (for 2250 psia operation and cores not containing 422V+ fuel assemblies)
K_3	=	[*] (for 2000 psia operation and cores not containing 422V+ fuel assemblies)
τ_1	=	[*] sec
τ_2	=	[*] sec
τ_3	=	[*] sec for Rosemont or equivalent RTD
	=	[*] sec for Sostman or equivalent RTD
τ_4	=	[*] sec for Rosemont or equivalent RTD
	=	[*] sec for Sostman or equivalent RTD

and f(ΔI) is an even function of the indicated difference between top and bottom detectors of the power-range nuclear ion chambers; with gains to be selected based on measured instrument response during plant startup tests, where q_t and q_b are the percent power in the top and bottom halves of the core respectively, and $q_t + q_b$ is total core power in percent of rated power, such that:

(a) for $q_t - q_b$ within –[*], +[*] percent, f(ΔI) = 0 for cores not containing 422V+ fuel assemblies; for $q_t - q_b$ within –[*], +[*] percent, f(ΔI) = 0 for cores containing 422V+ fuel assemblies.

(b) for each percent that the magnitude of $q_t - q_b$ exceeds +[*] percent, the ΔT trip setpoint shall be automatically reduced by an equivalent of [*] percent of rated power for cores not containing 422V+ fuel assemblies and reduced by an equivalent of [*] percent of rated power for cores containing 422V+ fuel assemblies.

Table 3.3.1-1 (page 7 of ~~8~~ 9)
Reactor Protection System Instrumentation

Note 1: Overtemperature ΔT (continued)

(c) for cores not containing 422V+ fuel assemblies, for each percent that the magnitude of $q_t - q_b$ exceeds –[*] percent, the ΔT trip setpoint shall be automatically reduced by an equivalent of [*] percent of rated power; for cores containing 422V+ fuel assemblies, for each percent that the magnitude of $q_t - q_b$ exceeds –[*] percent, the ΔT trip setpoint shall be automatically reduced by an equivalent of [*] percent of rated power.

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

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

Note 2: Overpower ΔT

$$\Delta T\left(\frac{1}{1+\tau_3 S}\right) \leq \Delta T_o\left[K_4 - K_5\left(\frac{\tau_5 S}{\tau_5 S+1}\right)\left(\frac{1}{1+\tau_4 S}\right)T - K_6\left[T\left(\frac{1}{1+\tau_4 S}\right) - T'\right]\right]$$

where (values are applicable to operation at both 2000 psia and 2250 psia)

ΔT_o	=	indicated ΔT at rated power, °F
T	=	average temperature, °F
T'	≤	[*]°F (for cores containing 422V+ fuel assemblies)
T'	≤	[*]°F (for cores not containing 422V+ fuel assemblies)
K_4	≤	[*] of rated power (for cores containing 422V+ fuel assemblies)
K_4	≤	[*] of rated power (for cores not containing 422V+ fuel assemblies)
K_5	=	[*] for increasing T
	=	[*] for decreasing T
K_6	=	[*] for T ≥ T' (for cores containing 422V+ fuel assemblies)
K_6	=	[*] for T ≥ T' (for cores not containing 422V+ fuel assemblies)
	=	[*] for T < T'
τ_5	=	[*] sec
τ_3	=	[*] sec for Rosemont or equivalent RTD
		[*] sec for Sostman or equivalent RTD
τ_4	=	[*] sec for Rosemont or equivalent RTD
		[*] sec for Sostman or equivalent RTD

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

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

Note 3:

If the as-found channel setpoint is outside its predefined as-found tolerance, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.

Note 4:

The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the NTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (field setting) to confirm channel performance. The methodologies used to determine the as-found and the as-left tolerances are specified in FSAR Section 7.2.

Table 3.3.2-1 (page 1 of ~~3~~ 4)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT
1. Safety Injection						
a. Manual Initiation	1,2,3,4	2	B	SR 3.3.2.7	NA	**
b. Automatic Actuation Logic and Actuation Relays	1,2,3,4	2 trains	C	SR 3.3.2.2 SR 3.3.2.4 SR 3.3.2.5	NA	**
c. Containment Pressure—High	1,2,3	3	D	SR 3.3.2.1 SR 3.3.2.3 SR 3.3.2.8	≤ 6 psig	**
d. Pressurizer Pressure—Low	1,2,3(a)	3	D	SR 3.3.2.1 SR 3.3.2.3(f) SR 3.3.2.8(f)	~~≥ 1715 psig~~ ≥ 1730 psig	1735 psig
e. Steam Line Pressure—Low	1,2,3(b)	3 per steam line	D	SR 3.3.2.1 SR 3.3.2.3 SR 3.3.2.8	≥ 500(c) psig	**
2. Containment Spray						
a. Manual Initiation	1,2,3,4	2	E	SR 3.3.2.7	NA	**
b. Automatic Actuation Logic and Actuation Relays	1,2,3,4	2 trains	C	SR 3.3.2.2 SR 3.3.2.4 SR 3.3.2.5	NA	**
c. Containment Pressure—High High	1,2,3	2 sets of 3	D	SR 3.3.2.1 SR 3.3.2.3(f) SR 3.3.2.8(f)	~~≤ 30 psig~~ ≤ 28 psig	25 psig

(continued)

(a) Pressurizer Pressure > 1800 psig.

(b) Pressurizer Pressure > 1800 psig, except during Reactor Coolant System hydrostatic testing.

(c) Time constants used in the lead/lag controller are $t_1 \geq 12$ seconds and $t_2 \leq 2$ seconds.

(f) Table 3.3.2-1 Notes 1 and 2 are applicable.

** Proposed nominal trip setpoints for these functions were submitted for approval in Extended Power Uprate License Amendment Request 261, Supplement 6.

Table 3.3.2-1 (page 2 of ~~3~~ 4)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT
3. Containment Isolation						
a. Manual Initiation	1,2,3,4	2	B	SR 3.3.2.7	NA	**
b. Automatic Actuation Logic and Actuation Relays	1,2,3,4	2 trains	C	SR 3.3.2.4 SR 3.3.2.5	NA	**
c. Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements, except Manual SI initiation.					
4. Steam Line Isolation						
a. Manual Initiation	1,2(d),3(d)	1/loop	F	SR 3.3.2.7	NA	**
b. Automatic Actuation Logic and Actuation Relays	1,2(d),3(d)	2 trains	G	SR 3.3.2.2 SR 3.3.2.5	NA	**
c. Containment Pressure—High High	1,2(d),3(d)	3	D	SR 3.3.2.1 SR 3.3.2.3(f) SR 3.3.2.8(f)	~~≤ 20 psig~~ ≤ 18 psig	15 psig
d. High Steam Flow	1,2(d),3(d)	2 per steam line	D	SR 3.3.2.1 SR 3.3.2.3 SR 3.3.2.8	≤ Δp corresponding to 0.66 x 10^6 lb/hr at 1005 psig	**
Coincident with Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements.					
and						
Coincident with T_{avg}—Low	1,2(d),3(d)	3	D	SR 3.3.2.1 SR 3.3.2.3(f) SR 3.3.2.8(f)	~~≥ 540°F~~ 542°F	543°F
e. High High Steam Flow	1,2(d),3(d)	2 per steam line	D	SR 3.3.2.1 SR 3.3.2.3 SR 3.3.2.8	≤ Δp corresponding to 4 x 10^6 lb/hr at 806 psig	**
Coincident with Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements.					

(continued)

(d) Except when all MSIVs are closed and de-activated.

(f) Table 3.3.2-1 Notes 1 and 2 are applicable.

** Proposed nominal trip setpoints for these functions were submitted for approval in Extended Power Uprate License Amendment Request 261, Supplement 6.

Table 3.3.2-1 (page 3 of ~~3~~ 4)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT
5. Feedwater Isolation						
a. Automatic Actuation Logic and Actuation Relays	1,2(e),3(e)	2 trains	G	SR 3.3.2.2 SR 3.3.2.4 SR 3.3.2.5	NA	**
b. SG Water Level—High	1,2(e),3(e)	3 per SG	D	SR 3.3.2.1 SR 3.3.2.3(f) SR 3.3.2.8(f)	~~NA~~ ≤ 90%	78%
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	1,2,3	2 trains	G	SR 3.3.2.2	NA	**
b. SG Water Level—Low Low	1,2,3	3 per SG	D	SR 3.3.2.1 SR 3.3.2.3 SR 3.3.2.8	≥ 20%	**
c. Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements.					
d. Undervoltage Bus A01 and A02	1,2	2 per bus	H	SR 3.3.2.6 SR 3.3.2.8(f)	≥ 3120 V	3255 V
7. Condensate Isolation						
a. Containment Pressure—High	1,2(e),3(e)	3	D	SR 3.3.2.1 SR 3.3.2.3 SR 3.3.2.8	≤ 6 psig	*
b. Automatic Actuation Logic and Actuation Relays	1,2(e),3(e)	2 trains	G	SR 3.3.2.2 SR 3.3.2.4 SR 3.3.2.5	N/A	*
8. SI Block - Pressurizer Pressure	1,2,3	3	I	SR 3.3.2.1 SR 3.3.2.3 SR 3.3.2.8	≤ 1800 psig	**

(e) Except when all MFRVs and associated bypass valves are closed and de-activated.

(f) Table 3.3.2-1 Notes 1 and 2 are applicable.

* Function 7, Condensate Isolation, is proposed to be deleted in Extended Power Uprate License Amendment Request 261.

** Proposed nominal trip setpoints for these functions were submitted for approval in Extended Power Uprate License Amendment Request 261, Supplement 6.

Engineered Safety Feature Actuation System Instrumentation

Note 1:

If the as-found channel setpoint is outside its predefined as-found tolerance, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.

Note 2:

The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the NTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (field setting) to confirm channel performance. The methodologies used to determine the as-found and the as-left tolerances are specified in FSAR Section 7.2.

ENCLOSURE 3

NEXTERA ENERGY POINT BEACH, LLC
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

LICENSE AMENDMENT REQUEST 261, EXTENDED POWER UPRATE
TRANSMITTAL OF PROPOSED TECHNICAL SPECIFICATIONS FOR
REACTOR PROTECTION SYSTEM AND ENGINEERED SAFETY FEATURES
SETPOINTS NOT ASSOCIATED WITH EXTENDED POWER UPRATE

PROPOSED TECHNICAL SPECIFICATION BASES CHANGES BASES

(Provided for information only)

140 pages follow

B 3.3 INSTRUMENTATION

B 3.3.1 Reactor Protection System (RPS) Instrumentation

BASES

NOTE

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

BACKGROUND

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

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

The LSSS, defined in this specification as the Allowable Value Setpoints, in conjunction with the LCOs, establish the threshold for protective system action to prevent exceeding acceptable limits during Design Basis Accidents (DBAs).

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

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

2. Fuel centerline melt shall not occur; and

3. The RCS pressure SL of 2750 psia 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.

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

---NOTE---

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

BACKGROUND (continued)

Meeting the acceptable dose limit for an accident category is considered having acceptable consequences for that event.

The RPS instrumentation is segmented into four distinct but interconnected modules as identified below:

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 Analog Protection System, Nuclear Instrumentation System (NIS), field contacts, and protection channel sets: provides signal conditioning, compatible electrical signal output to protection system devices, and control board/control room/miscellaneous indications;

3. Relay Logic System, including input, logic, and output devices: initiates proper unit shutdown in accordance with the defined logic, which is based on bistable, setpoint comparators, or contact outputs from the signal process control and protection systems; and

4. Reactor trip switchgear, including reactor trip breakers (RTBs) and bypass breakers: provides the means to interrupt power to the control rod drive mechanisms (CRDMs) and allows the rod cluster control assemblies (RCCAs), or "rods," to fall into the core and shut down the reactor. 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 Allowable Values. The OPERABILITY of each transmitter or sensor can be evaluated when its "as found" calibration data are compared against its documented acceptance criteria.

Signal Process Control and Protection System

Generally, three or four channels of process control equipment are used for the signal processing of unit parameters measured by the field instruments. The process control equipment provides signal conditioning, comparable output signals for instruments located on the main control board, and comparison of measured input signals with

---NOTE---

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

BACKGROUND (continued)

setpoints established by safety analyses. If the measured value of a unit parameter exceeds the predetermined setpoint, an output from a bistable is forwarded to the logic relays.

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

Generally, if a parameter is used for input to the relay logic system 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 actuation. Again, a single failure will neither cause nor prevent the protection function actuation. These requirements are described in IEEE-279-1968 (Ref. 3). The actual number of channels required for each unit parameter is specified in Reference 1.

Two logic channels are required to ensure no single random failure of a logic channel will disable the RPS. 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.

Allowable Values

To allow for calibration tolerances, instrumentation uncertainties, instrument drift, and severe environment errors for those RPS channels that must function in harsh environments as defined by 10 CFR 50.49 (Ref. 4), the Allowable Values specified in Table 3.3.1-1 in the accompanying LCO are conservatively adjusted with respect to the analytical limits. A detailed description of the methodology used to calculate the Trip Setpoints, including their explicit uncertainties, is provided in DGI-01, "Instrument Setpoint Methodology" (Ref. 5). The actual nominal Trip Setpoint 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 bistable is considered OPERABLE.

BASES

-NOTE-

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

BACKGROUND (continued)

Setpoints in accordance with the Allowable Value ensure that SLs 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 Allowable Values of Table 3.3.1-1 are the LSSS.

Each 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. 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 SRs section.

The Allowable Values listed in Table 3.3.1-1 are based on the methodology described in Reference 5, which incorporates all of the known uncertainties applicable for each channel. The magnitudes of these uncertainties are factored into the determination of each Allowable Value. All field sensors and signal processing equipment for these channels are assumed to operate within the allowances of these uncertainty magnitudes.

Relay Logic System

The Relay Logic System equipment is used for the decision logic processing of outputs from the signal processing equipment bistables. To meet the redundancy requirements, two trains of Relay Logic System, 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 for the unit. Each train is packaged in its own cabinet for physical and electrical separation to satisfy separation and independence requirements. The system has been designed to trip in the event of a loss of power, directing the unit to a safe shutdown condition.

The Relay Logic System performs the decision logic for actuating a

reactor trip, generates the electrical output signal that will initiate the required trip, 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 Relay Logic System 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. Examples are given in the

BASES

NOTE

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

BACKGROUND (continued)

Applicable Safety Analyses, LCO, and Applicability sections of this Bases.

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 logic system is a voltage 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 logic system output voltage signal is removed, the undervoltage coils are de-energized, the breaker trip lever is actuated by the de-energized undervoltage coil, and the RTBs and bypass breakers are tripped open. This allows the shutdown rods and control rods to fall into the core. In addition to the de-energization of the undervoltage coils, each RTB 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 logic system. Either the undervoltage coil or the shunt trip mechanism is sufficient by itself, thus providing a diverse trip mechanism.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY

The RPS functions to maintain the SLs during all AOOs and mitigates the consequences of DBAs in all MODES in which the RTBs are closed.

Each of the analyzed accidents and transients can be detected by one or more RPS Functions. The accident analysis described in Reference 2 takes credit for most RPS trip Functions. RPS trip Functions not specifically credited in the accident analysis are qualitatively credited in the safety analysis and the NRC staff approved

licensing basis for the unit. These RPS 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 RPS trip Functions that were credited in the accident analysis.

The LCO requires all instrumentation performing an RPS Function, listed in Table 3.3.1-1 in the accompanying LCO, to be OPERABLE. Failure of any instrument renders the affected channel(s) inoperable and reduces the reliability of the affected Functions.

The LCO generally requires OPERABILITY of four or three channels in

---NOTE---
TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

each instrumentation Function, one channel 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 generally required when one RPS channel is also used as a control system input. This configuration accounts for the possibility of the shared channel failing in such a manner that it creates a transient that requires RPS action. In this case, the RPS will still provide protection, even with random failure of one of the other three protection channels. Three 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 RPS trip and disable one RPS channel. The two-out-of-three and two-out-of-four configurations allow one channel to be tripped during maintenance or testing without causing a reactor trip. Specific exceptions to the above general philosophy exist and are discussed below.

Reactor Protection System Functions

The safety analyses and OPERABILITY requirements applicable to each RPS 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 one of four 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 Allowable Value.

The LCO requires two Manual Reactor Trip channels to be

OPERABLE. Each channel consists of two reactor trip switches (one in each train). Each channel activates the reactor trip breaker 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, manual initiation of a reactor 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 manual initiation Function must also be OPERABLE with the RTBs closed and the Rod Control System capable of rod withdrawal. In this condition, inadvertent control rod withdrawal is possible. In MODE 3, 4, or 5, manual initiation of a reactor trip does not have to be OPERABLE if the Rod Control System is not capable of withdrawing the shutdown rods or control rods. If the

-----NOTE-----

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

rods cannot be withdrawn from the core or all of the rods are inserted, there is no need to be able to trip the reactor. In MODE 6, neither the shutdown rods nor the control rods are permitted to be withdrawn and the CRDMs are disconnected from the control rods and shutdown rods. Therefore, the manual initiation Function is not required.

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 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 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, the Power Range Neutron Flux-High trip must be OPERABLE. This Function will terminate the reactivity excursion and shut down the reactor prior to reaching a power level that could damage the fuel. In MODE 3, 4, 5, or 6, the NIS power range detectors cannot detect neutron levels in this range. In these

MODES, the 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.

~~b. Power Range Neutron Flux-Low~~

BASES

---NOTE---

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

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

~~The LCO requires all four of the 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 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.~~

~~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 detectors cannot detect neutron levels in this range. Other RPS trip Functions and administrative controls provide protection against positive reactivity additions or power excursions in MODE 3, 4, 5, or 6.~~

3. 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 do not provide any input to control systems.

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.

In MODE 1 below the P-10 setpoint, and in MODE 2, when there is

---NOTE---

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

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

4. Source Range Neutron Flux

The LCO requirement for the Source Range Neutron Flux trip Function ensures that protection is provided against an uncontrolled RCCA bank rod withdrawal accident from a subcritical condition during startup.

This trip Function provides redundant protection to the Power Range Neutron Flux-Low trip Function. In MODES 3, 4, and 5, administrative controls also prevent the uncontrolled withdrawal of rods. The NIS source range detectors are located external to the reactor vessel and measure neutrons leaking from the core. The NIS source range detectors do not provide any inputs to control systems. The source range trip is the only RPS automatic protection function required in MODES 3, 4, and 5. Therefore, the functional capability at the specified Trip Setpoint is assumed to be available.

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 Source Range Neutron Flux Function provides protection for control rod withdrawal from subcritical and control rod ejection events.

In MODE 2 when below the P-6 setpoint, and in MODES 3, 4 and 5 when there is a potential for an uncontrolled RCAA bank rod withdrawal accident, the Source Range Neutron Flux trip must be OPERABLE. Above the P-6 setpoint, the Intermediate Range Neutron Flux trip and the Power Range Neutron Flux-Low Setpoint trip will provide core protection for reactivity accidents. Above the

BASES

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TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

P-6 setpoint, the NIS source range detectors are de-energized. In MODES 3, 4 and 5 with the Rod Control System not capable of rod withdrawal, and in MODE 6, this Function is not required to 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 3.9.2, "Nuclear Instrumentation," for MODE 6.

5. 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 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:

- reactor coolant average temperature-the Trip Setpoint is varied to correct for changes in coolant density and specific heat capacity with changes in coolant temperature;
- pressurizer pressure-the Trip Setpoint is varied to correct for changes in system pressure; 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 1 of Table 3.3.1-1.

The Overtemperature ΔT trip Function is calculated for each channel as described in Note 1 of Table 3.3.1-1. Reactor Trip occurs if Overtemperature ΔT is indicated in two channels. Because the pressure and temperature signals are used for other control functions, 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

BASES

NOTE

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

providing the protection function actuation. Note that this Function also provides a signal to generate a turbine runback prior to reaching the Trip Setpoint. A turbine runback will reduce turbine power and reactor power. A reduction in power will normally alleviate the

Overtemperature ΔT condition and may prevent a reactor trip.

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

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

6. 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. 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 Trip Setpoint is varied to correct for changes in coolant density and specific heat capacity with changes in coolant temperature; and
- rate of change of reactor coolant average temperature.

The Overpower ΔT trip Function is calculated for each channel as per Note 2 of Table 3.3.1-1. Trip occurs if Overpower ΔT is indicated in two channels. The temperature signals are used for other control functions. 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

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TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

Overpower ΔT condition and may prevent a reactor trip.

The LCO requires four channels of the Overpower ΔT trip Function to be OPERABLE. Note that the Overpower ΔT trip Function receives input from channels shared with other RPS 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.

7. Pressurizer Pressure

The same sensors provide input to the Pressurizer Pressure-High and -Low trips and the Overtemperature ΔT trip. 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.

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 of Pressurizer Pressure-Low to be OPERABLE.

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). On decreasing power, this trip Function is automatically blocked below P-7. Below the P-7 interlock, no conceivable power distributions can occur that would cause DNB concerns.

BASES

NOTE

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

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 channels of the Pressurizer Pressure-High to be OPERABLE.

For operation at 2250 psia, the Pressurizer Pressure-High LSSS 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 pressure increases that can be controlled by the PORVs.

For operation at 2000 psia, a 50% load rejection with steam dump results in a peak pressure below the Pressurizer Pressure-High LSSS. Therefore, even though the PORV setting is above the reactor trip, the transient will not result in PORV actuation or a reactor trip on high Pressurizer Pressure.

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.

~~8. 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~~

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TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

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

~~In MODE 1, when there is a potential for overfilling 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 interlock, 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.~~

~~9. Reactor Coolant Flow-Low~~

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

~~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 50% RTP, a loss of flow in any RCS loop 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.~~

~~The LCO requires three Reactor Coolant Flow-Low channels per loop to be OPERABLE in MODE 1 above P-8.~~

~~In MODE 1 above the P-8 setpoint, a loss of flow in one RCS loop could result in DNB conditions in the core. In MODE 1 below the P-8 setpoint, a loss of flow in two loops is required to actuate a reactor trip (Function 9.b) because of the lower power level and the greater margin to the design limit DNBR.~~

~~b. Reactor Coolant Flow-Low (Two Loops)~~

~~The Reactor Coolant Flow-Low (Two Loops) trip Function ensures that protection is provided against violating the DNBR~~

BASES

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TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

~~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 interlock and below the P-8 setpoint, a loss of flow in two 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 interlock and below the P-8 setpoint, the Reactor Coolant Flow-Low (Two Loops) trip must be OPERABLE. Below the P-7 interlock, all reactor trips on low flow are automatically blocked since no conceivable power distributions could occur that would cause a DNB concern at this low power level. Above the P-7 interlock, the reactor trip on low 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.~~

10. Reactor Coolant Pump (RCP) Breaker Position

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

a. Reactor Coolant Pump Breaker Position (Single Loop)

The RCP Breaker Position (Single Loop) trip Function ensures that protection is provided against violating the DNBR limit due to a loss of flow in one RCS loop. The position of each RCP breaker is monitored. If one RCP breaker is open above the P-8 setpoint, a reactor trip is initiated. This trip Function will generate a reactor trip before the Reactor Coolant Flow-Low (Single Loop) Trip Setpoint is reached.

The LCO requires one RCP Breaker Position channel per RCP to be OPERABLE. A channel consists of the RCP Breaker auxiliary contact and the associated RCP Loss of Power Trip Matrix Relay. One OPERABLE channel is sufficient for this trip Function because the RCS Flow-Low trip alone provides

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TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

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 a pump.

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-8 setpoint, when a loss of flow in any RCS loop could result in DNB conditions in the core, the RCP Breaker Position (Single Loop) trip must be OPERABLE. In MODE 1 below the P-8 setpoint, a loss of flow in two loops is required to actuate a reactor trip because of the lower power level and the greater margin to the design limit DNBR.

b. Reactor Coolant Pump Breaker Position (Two Loops)

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 RCS loops. The position of each RCP breaker is monitored. Above the P-7 interlock and below the P-8 setpoint, a loss of flow in two 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. A channel consists of the RCP Breaker auxiliary contact and the associated RCP Loss of Power Trip Matrix Relay. One OPERABLE channel is sufficient for this Function because the RCS 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 interlock and below the P-8 setpoint, the RCP Breaker Position (Two Loops) trip must be OPERABLE. Below the P-7 interlock, all reactor trips on loss of

flow are automatically blocked since no conceivable power

BASES

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TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

distributions could occur that would cause a DNB concern at this low power level. Above the P-7 interlock, the reactor trip 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.

11. Undervoltage Bus A01 and A02

The Undervoltage Bus A01 and A02 reactor trip Function ensures that protection is provided against violating the DNBR limit due to a loss of flow in both RCS loops. The voltage to Bus A01 and A02 is monitored. Above the P-7 interlock, a loss of voltage detected on both buses will initiate a reactor trip. This trip Function will generate a reactor trip independent of Reactor Coolant Flow—Low (Two Loops) Trip Setpoint. Time delays are incorporated into the Undervoltage Bus A01 and A02 channels to prevent reactor trips due to momentary electrical power transients.

The LCO requires two Undervoltage channels per bus to be OPERABLE. An Undervoltage channel consists of the A01/A02 Bus Undervoltage Relay and the associated Bus Undervoltage Matrix Relay.

In MODE 1 above the P-7 interlock, the Undervoltage Bus A01 and A02 trip must be OPERABLE. Below the P-7 interlock, all reactor trips on loss of flow are automatically blocked since no conceivable power distributions could occur that would cause a DNB concern at this low power level. Above the P-7 interlock, the reactor trip on loss of flow in both RCS loops is automatically enabled.

12. Underfrequency Bus A01 and A02

The Underfrequency Bus A01 and A02 RCP breaker trip Function ensures that protection is provided against violating the DNBR limit due to a loss of flow in two RCS 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 interlock, a loss of frequency detected on two RCP buses will trip both RCP breakers. Tripping both RCP breakers will generate a reactor trip before the Reactor

Coolant Flow—Low (Two Loops) Trip Setpoint is reached. Time

-NOTE-

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

~~delays are incorporated into the Underfrequency Bus A01 and A02 channels to prevent reactor trips due to momentary electrical power transients.~~

~~The LCO requires two Underfrequency Bus A01 channels and two Underfrequency Bus A02 channels to be OPERABLE.~~
~~In MODE 1 above the P-7 interlock, the Underfrequency Bus A01 and A02 RCP breaker trip must be OPERABLE. Below the P-7~~

~~interlock, this trip and all reactor trips on loss of flow are automatically blocked, because no conceivable power distributions could occur that would cause a DNB concern at this low power level. Above the P-7 interlock, the Underfrequency Bus A01 and A02 RCP breaker trip is automatically enabled.~~

13. Steam Generator 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 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 any SG is indicative of a 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.

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

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). 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, or 6, the SG

BASES

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TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

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 by the Residual Heat Removal (RHR) System in MODE 4, 5, or 6.

14. Steam Generator Water Level—Low, Coincident With Steam Flow/Feedwater Flow Mismatch

SG Water Level-Low, in conjunction with the Steam Flow/Feedwater Flow Mismatch, ensures that protection is provided against a loss of heat sink. 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.

Table 3.3.1-1 identifies the Technical Specification Allowable Value for this trip function as not applicable (NA), because LCO 3.3.1, Function 13, Steam Generator Water Level-Low Low, is used to bound the analysis for a loss of feedwater event. The nominal setting required for the Steam Generator Water Level-Low trip function is 30% of span. This nominal setting was developed outside of the setpoint methodology and has been provided by the NSSS supplier.

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

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, or 6, the SG Water Level-Low coincident with Steam

BASES

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TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

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.

15. Turbine Trip

a. Turbine Trip-Low Autostop Oil Pressure

The Turbine Trip-Low Autostop 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 setpoint (approximately 50% power, with at least one circulating water pump breaker closed, and condenser vacuum not high, will not actuate a reactor trip. Three pressure switches monitor the control oil pressure in the Turbine Electrohydraulic Control System. 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.

Table 3.3.1-1 identifies the Technical Specification Allowable Value for this trip function as not applicable (NA). No Analytical Value is assumed in the accident analysis for this function. The nominal setting required for the Turbine Trip – Low Autostop Oil Pressure trip function is 45 psig. This nominal setting was developed outside of the setpoint methodology and has been provided by the NSSS supplier.

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

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TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

Below the P-9 setpoint, a turbine trip does not actuate a reactor trip. In MODE 2, 3, 4, 5, or 6, there is no potential for a turbine trip, and the Turbine Trip-Low Autostop 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 capabilities of the secondary system following a turbine trip. Any turbine trip with from a power level below the P-9 setpoint, approximately 50% power, with at least one circulating water pump breaker closed, and condenser vacuum not high, 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 Autostop Oil Pressure trip Function. Each turbine stop valve is equipped with one limit switch that inputs to the RPS. If both limit switches indicate that the stop valves are all closed, a reactor trip is initiated.

No analytical value is assumed in the accident analyses for this function. The LCO requires two Turbine Trip-Turbine Stop Valve Closure channels, one per valve, to be OPERABLE in MODE 1 above P-9. Both channels must trip to cause reactor trip.

Below the P-9 setpoint, a load rejection can be accommodated by the Steam Dump System. In MODE 2, 3, 4, 5, or 6, there is no potential for a load rejection, and the Turbine Trip-Stop Valve Closure trip Function does not need to be OPERABLE.

16. Safety Injection Input from Engineered Safety Feature Actuation System

BASES

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TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

The SI Input from ESFAS ensures that if a reactor trip has not already been generated by the RPS, the ESFAS automatic actuation logic will initiate a reactor trip upon any signal that initiates SI. This is 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.

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.

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, 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.

17. Reactor Protection 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 when the associated reactor trip functions are outside the applicable MODES. These 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 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:

NOTE

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

- 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.

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.

b. Low Power Reactor Trips Block, P-7

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

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

- Pressurizer Pressure - Low;
- Pressurizer Water Level - High;
- Reactor Coolant Flow - Low (Two Loops);
- RCP Breaker Open (Two Loops);
- Undervoltage Bus A01 and A02; and
- Underfrequency Bus A01 and A02.

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

---NOTE---

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

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

- Pressurizer Pressure - Low;
- Pressurizer Water Level - High;
- Reactor Coolant Flow - Low (Two Loops);
- RCP Breaker Position (Two Loops);
- Undervoltage Bus A01 and A02; and
- Underfrequency Bus A01 and A02.

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

Power Range Neutron Flux

Power Range Neutron Flux 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 to be OPERABLE in MODE 1.

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

Turbine Impulse Pressure

The Turbine Impulse Pressure 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 interlock to be OPERABLE in MODE 1.

The Turbine Impulse Chamber Pressure interlock must be OPERABLE when the turbine generator is operating. The interlock Function is not required OPERABLE in MODE 2, 3, 4,

-----NOTE-----

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

5, or 6 because the turbine generator is not operating.

c. Power Range Neutron Flux, P-8

The Power Range Neutron Flux, P-8 interlock is actuated at approximately 50% power as determined by two-out-of-four NIS power range detectors.

The P-8 interlock automatically enables the Reactor Coolant Flow-Low (Single Loop) and RCP Breaker Position (Single Loop) reactor trips 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 approximately 50% power. On decreasing 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 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 detectors, if the Steam Dump System is available. The LCO requirement for this Function ensures that the Turbine Trip-Low Autostop 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 will cause a load rejection beyond the capacity of the Steam Dump System. 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.

The LCO requires four channels of Power Range Neutron Flux, P-9 interlock, to be OPERABLE in MODE 1 with one of two circulating water pump breakers closed and condenser vacuum

NOTE

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

greater than or equal to 22 "Hg.

In MODE 1, a turbine trip could cause a load rejection beyond the capacity of the Steam Dump System, 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 Steam Dump System.

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 detectors. If power level falls below 10% RTP on 3 of 4 channels, the nuclear instrument trips will be automatically unblocked. The LCO requirement for the P-10 interlock ensures that the following Functions are performed:

- on increasing power, the P-10 interlock allows the operator to manually block the Intermediate Range Neutron Flux reactor trip;
- 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;
- 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.

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 startup or shutdown by the Power Range Neutron Flux-Low and

BASES

---NOTE---

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

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.

18. Reactor Trip Breakers

This trip Function applies to the RTBs exclusive of individual trip mechanisms. The LCO requires two OPERABLE RTBs. Two OPERABLE RTBs ensure no single random failure can disable the RPS trip capability. These trip Functions must be OPERABLE in MODE 1 or 2 when the reactor is critical. In MODE 3, 4, or 5, these RPS trip Functions must be OPERABLE when the RTBs are closed and the Rod Control System is capable of rod withdrawal.

19. Reactor Trip Breaker Undervoltage and Shunt Trip Mechanisms

The LCO requires both the Undervoltage and Shunt Trip Mechanisms to be OPERABLE for each RTB that is in service. The trip mechanisms are not required to be OPERABLE for trip breakers that are open, racked out, incapable of supplying power to the Rod Control System, or declared inoperable under Function 18 above. OPERABILITY of both trip mechanisms on each breaker ensures that no single trip mechanism failure will prevent opening any breaker on a valid signal.

These trip Functions must be OPERABLE in MODE 1 or 2 when the reactor is critical. In MODE 3, 4, or 5, these RPS trip Functions must be OPERABLE when the RTBs are closed and the Rod Control System is capable of rod withdrawal.

20. Reactor Trip Bypass Breaker and associated Undervoltage Trip Mechanism

The LCO requires the Reactor Trip Bypass Breaker and its associated Undervoltage Trip Mechanism to be OPERABLE when the Reactor Trip Bypass Breaker is racked in and closed. The bypass breaker and its associated trip mechanism are not required

to be OPERABLE when the bypass breaker is open or racked out.

These trip Functions must be OPERABLE in MODE 1 or 2 when a Reactor Trip Bypass Breaker is racked in and closed. In MODE 3,

BASES

NOTE

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

4, or 5, this RPS trip Function must be OPERABLE when a Reactor

Trip Bypass Breaker is racked in and closed and the Rod Control System is capable of rod withdrawal.

21. Automatic Trip Logic

The LCO requirement for the RTBs (Functions 18 and 19) and Automatic Trip Logic (Function 21) 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 RPS Automatic Trip Logic cause the RTBs and associated bypass breakers to open and shut down the reactor.

The LCO requires two trains of RPS Automatic Trip Logic to be OPERABLE. Having two OPERABLE channels ensures that random failure of a single logic channel will not prevent reactor trip. These trip Functions must be OPERABLE in MODE 1 or 2 when the reactor is critical. In MODE 3, 4, or 5, these RPS trip Functions must be OPERABLE when the RTBs are closed and the Rod Control System is capable of rod withdrawal.

The RPS instrumentation satisfies Criterion 3 of 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 Trip Setpoint 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 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 outside the safety analysis. Therefore,

---NOTE---

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

ACTIONS (continued)

LCO 3.0.3 must be immediately entered if applicable in the current MODE of operation.

A.1

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

B.1 and B.2

Condition B applies to the Manual Reactor Trip in MODE 1 or 2. 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.

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.

If the Manual Reactor Trip Function 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. The 6 additional hours to reach MODE 3 is reasonable, based on operating experience, to reach MODE 3 from full power operation in an orderly manner and without challenging unit systems. With the unit in MODE 3, this trip Function is no longer required to be OPERABLE.

C.1 and C.2

Condition C applies to the Manual Reactor Trip Function in MODE 3, 4, or 5 with the RTBs closed and the Rod Control System capable of rod withdrawal.

- With one channel inoperable, the inoperable channel must be restored to OPERABLE status within 48 hours. If the Reactor Manual Trip channel cannot be restored to OPERABLE status

BASES

-NOTE-

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

ACTIONS (continued)

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.

The additional hour provides sufficient time to accomplish the action in an orderly manner. With the RTBs open, the Manual Reactor Trip Function is no longer required.

D.1 and D.2

Condition D applies to the following reactor trip Functions:

- Power Range Neutron Flux-High;
- Power Range Neutron Flux-Low;
- Overtemperature ΔT;
- Overpower ΔT;
- Pressurizer Pressure-High;
- SG Water Level-Low Low; and
- SG Water Level - Low coincident with Steam Flow/Feedwater Flow Mismatch.

A known inoperable channel must be placed in the tripped condition within 1 hour. 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.

If the inoperable channel cannot be placed in the tripped 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.

BASES

-----NOTE-----

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

ACTIONS (continued)

E.1 and E.2

Condition E applies to the Underfrequency Bus A01 and A02 trip function. 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 setpoint. The 6 hours to place the channel in the tripped condition is necessary due to plant design requiring maintenance personnel to effect the trip of the channel outside of the Control Room. An additional 6 hours is allowed to reduce THERMAL POWER to below P-7 if the inoperable channel cannot be restored to OPERABLE status or placed in trip within the specified Completion Time.

Allowance of this time interval takes into consideration the redundant capability provided by the remaining redundant OPERABLE channel and the low probability of occurrence of an event during this period that may require the protection afforded by this trip function.

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

BASES

-----NOTE-----

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

ACTIONS (continued)

G.1 and G.2

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. Required Actions specified in this Condition are only applicable when channel failures do not result in reactor trip. Above the P-6 setpoint and below the P-10 setpoint, the

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

H.1

Condition 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.

BASES

---NOTE---

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

ACTIONS (continued) I.1

Condition 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 Rod Control System capable of rod withdrawal. With the unit in this Condition, below P-6, the NIS source range perform the monitoring and protection functions. With both source range channels inoperable, the RTBs must be opened immediately. With the RTBs open, the core is in a more stable condition.

J.1 and J.2

Condition J applies to one inoperable source range channel in MODE 3, 4, or 5 with the RTBs closed and the Rod Control System capable of rod withdrawal. 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, 1 additional hour is allowed to open the RTBs. Once the RTBs are open, the core is in a more stable condition.

K.1 and K.2

Condition K applies to the following reactor trip Functions:

- Pressurizer Pressure-Low;
- Pressurizer Water Level-High;
- Reactor Coolant Flow-Low (Two Loops);
- Undervoltage Bus A01 and A02.

With one channel inoperable, the inoperable channel must be placed in the tripped condition within 1 hour. 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 interlock and below the P-8 setpoint. These Functions do not have to be OPERABLE below the P-7 interlock because there are no loss of flow trips below the P-7 interlock. An additional 6 hours is allowed to reduce THERMAL POWER to below P-7 if the inoperable channel cannot be restored to

-----NOTE-----

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

ACTIONS (continued)

OPERABLE status or placed in trip within the specified Completion Time.

Allowance of this time interval takes into consideration the redundant capability provided by the remaining redundant OPERABLE channel, 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.

L.1 and L.2

Condition L applies to the Reactor Coolant Flow-Low (Single Loop) reactor trip Function. With one channel inoperable, the inoperable channel must be placed in the tripped condition within 1 hour. If the channel cannot be restored to OPERABLE status or the channel placed

in trip within the 1 hour, then THERMAL POWER must be reduced below the P-8 setpoint within the next 4 hours. This places the unit in a MODE where the LCO is no longer applicable. This trip Function does not have to be OPERABLE below the P-8 setpoint because other RPS trip Functions provide core protection below the P-8 setpoint.

M.1 and M.2

Condition M 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(s) must be restored to OPERABLE status within 1 hour. If the channel cannot be restored to OPERABLE status within the 1 hour, then THERMAL POWER must be reduced below the P-8 setpoint within the next 4 hours.

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-8 setpoint because other RPS Functions provide core protection below the P-8 setpoint.

N.1 and N.2

Condition N applies to the RCP Breaker Position (Two Loop) reactor trip Function. With one channel inoperable, the inoperable channel must be restored to OPERABLE status within 1 hour. If the channel cannot be restored to OPERABLE status in 1 hour, then THERMAL

BASES

---NOTE---

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

ACTIONS (continued)

POWER must be reduced below the P-7 interlock within the next 6 hours. 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 interlock because there are no loss of flow trips below the P-7 interlock. The Completion Time of 6 hours is reasonable, based on operating experience, to reduce THERMAL POWER to below the P-7 interlock from full power in an orderly manner without challenging unit systems.

O.1 and O.2

Condition O applies to Turbine Trip on Low Autostop Oil Pressure or on Turbine Stop Valve Closure. With one channel inoperable, the inoperable channel must be placed in the trip condition within 1 hour. 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 reduced below the P-9 setpoint within the next 4 hours.

P.1 and P.2

Condition P applies to the SI Input from ESFAS reactor trip and the RPS Automatic Trip Logic in MODES 1 and 2. These actions address the train orientation of the RPS for these Functions. With one train inoperable, 6 hours are allowed to restore the train to OPERABLE status (Required Action P.1) or the unit must be placed in MODE 3 within the next 6 hours. The Completion Time of 6 hours (Required Action P.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 6 hours (Required Action P.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 for up to 8 hours for surveillance testing, provided the other train is OPERABLE.

Q.1 and Q.2

Condition Q applies to the RTBs in MODES 1 and 2. With one RTB

---NOTE---

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

ACTIONS (continued)

inoperable, 1 hour is allowed to restore the RTB to OPERABLE status or the unit must be placed in MODE 3 within the next 6 hours. The Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power in an orderly manner and without challenging unit systems. The 1 hour and 6 hour Completion Times are equal to the time allowed by LCO 3.0.3 for shutdown actions in the event of a complete loss of RPS Function. Placing the unit in MODE 3 removes the requirement for this particular Function.

The Required Actions have been modified by a Note allowing one channel to be bypassed for up to 8 hours provided the other channel is OPERABLE.

R.1 and R.2

Condition R applies to the P-6 interlock (in MODE 2) and the P-10 interlock. With one or more channels inoperable for one-out-of-two or two-out-of-four coincidence logic, the associated interlock must be verified to be in its required state for the existing unit condition within 1 hour or the unit must be placed in MODE 3 within the next 6 hours. Verifying the interlock status manually accomplishes the interlock's Function. 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 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power in an orderly manner and without challenging unit systems. The 1 hour and 6 hour Completion Times are equal to the time allowed by LCO 3.0.3 for shutdown actions in the event of a complete loss of RPS Function.

S.1 and S.2

Condition S applies to the P-7, P-8, and P-9 interlocks. With one or more channels inoperable for one-out-of-two or two-out-of-four coincidence logic, the associated interlock must be verified to be in its required state for the existing unit condition within 1 hour or the unit must be placed in MODE 2 within the next 6 hours. These actions are conservative for the case where power level is being raised. Verifying the interlock status manually accomplishes the interlock's Function. 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 6 hours is reasonable, based on operating experience, to reach MODE 2 from full power in an orderly manner and

BASES

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TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

ACTIONS (continued) without challenging unit systems.

T.1 and T.2

Condition T applies to the RTBs and the RTB Undervoltage and Shunt Trip Mechanisms in MODES 3, 4, or 5 with the RTBs closed and the Rod Control System capable of rod withdrawal.

With one trip mechanism or RTB inoperable, the inoperable trip mechanism or RTB must be restored to OPERABLE status within 48 hours. The Completion Time is reasonable considering that the remaining OPERABLE trip mechanism or RTB is adequate to perform the safety function, and given the low probability of an event occurring during this interval.

If the RTB or trip mechanism cannot be restored to OPERABLE status within 48 hours, the unit must be placed in a MODE in which the requirement does not apply. This is accomplished by opening the

RTBs within the next hour (49 hours total time). The Completion Time of 1 hour provides sufficient time to accomplish this action in an orderly manner and takes into account the low probability of an event occurring in this interval.

U.1 and U.2

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

With the unit in MODE 3, Condition T would apply to any inoperable RTB trip mechanisms. 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 8 hours for the reasons stated under Condition Q.

BASES

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TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

ACTIONS (continued)

The Completion Time of 48 hours 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 and V.2

Condition V applies to the Reactor Trip Bypass Breaker (RTBB) and associated Undervoltage Trip Mechanism in MODE 1 or 2, when the RTBB is racked in and closed. With the required RTBB inoperable, 1 hour is allowed to restore the RTBB to OPERABLE status or the unit must be placed in MODE 3 within the next 6 hours. The Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power in an orderly manner and without challenging unit systems. The 1 hour and 6 hour completion times are equal to the time allowed by LCO 3.0.3 for shutdown action in the event of a complete loss of RPS Function. Placing the unit in MODE 3 removes the requirement for this particular Function.

W.1 and W.2

Condition W applies to the Reactor Trip Bypass Breaker (RTBB) and associated Undervoltage Trip Mechanism in MODES 3, 4, or 5, when an RTBB is racked in and closed and the Rod Control System is capable of rod withdrawal. With the required RTBB inoperable, 48 hours is allowed to restore the RTBB to OPERABLE status or the unit must be placed in a MODE in which the requirement does not apply. To achieve this status, the RTBs and RTBBs must be opened within the next 1 hour (49 hours total time). The Completion Time of 1 hour provides sufficient time to accomplish the action in an orderly manner. With the RTBs and RTBBs open, this Function is no longer required.

X.1 and X.2

Condition X applies to the RPS Automatic Trip Logic in MODES 3, 4 or 5 with the RTBs closed and the Rod Control System capable of rod withdrawal. With one train inoperable, 48 hours are allowed to restore the train to an OPERABLE status. The Completion Time of 48 hours 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 in this interval.

BASES

-NOTE-

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

If the RPS Automatic Trip Logic cannot be restored to OPERABLE status within 48 hours, the unit must be placed in a MODE where this Function is not required to be OPERABLE. To achieve this status, the RTBs must be opened within the next 1 hour (49 hours total time). The additional hour provides sufficient time to accomplish the action in an orderly manner. With the RTBs open, the Automatic Trip Logic is no longer required.

SURVEILLANCE REQUIREMENTS

The SRs for each RPS 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 RPS Functions.

Note that each channel of process protection supplies both trains of the RPS. 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.

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 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.

BASES

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TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

SURVEILLANCE REQUIREMENTS (continued)

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 hour is 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 every 31 EFPD. SR 3.3.1.3 is performed by means of the moveable incore detection system. If the absolute difference is ≥ 3%, the NIS channel is still OPERABLE, but must be readjusted.

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 ΔT Function.

Two Notes modify SR 3.3.1.3. Note 1 indicates that the excore NIS

-NOTE-

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

SURVEILLANCE REQUIREMENTS (continued)

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 ≥ 50% RTP and that 24 hours is allowed for performing the first Surveillance after reaching 50% RTP.

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.

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.

The RTB test shall include separate verification of the undervoltage and shunt trip mechanisms. The independent test for bypass breakers is included in SR 3.3.1.13. The bypass breaker test shall include an undervoltage trip. A Note has been added to SR 3.3.1.4 to indicate that this test must be performed on the bypass breaker prior to placing it in service.

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.

SR 3.3.1.5

SR 3.3.1.5 is the performance of an ACTUATION LOGIC TEST, every 31 days on a STAGGERED TEST BASIS. The train being tested is placed in the bypass condition, thus preventing inadvertent actuation. All possible logic combinations, with and without applicable permissives, are tested for each protection function. 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.

SR 3.3.1.5 is modified by two Notes. Note 1 provides an 8 hour delay in the requirement to perform this Surveillance for the Source Range Neutron Flux trip function instrumentation when power is reduced to

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TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

SURVEILLANCE REQUIREMENTS (continued)

delay for testing in MODE 2 and for a short time in MODE 3 until the RTBs are open and SR 3.3.1.5 is no longer required to be performed. If the unit is to be in MODE 2 below P-6 for > 8 hours, this Surveillance must be performed prior to 8 hours after reducing power below P-6.

Note 2 excludes the RCP Breaker Position (Two Loop), Reactor Coolant Flow-Low (Two Loop) and Underfrequency Bus A01 and A02 Trip Functions, and the P-6, P-7, P-8, P-9 and P-10 Interlocks. These functions/interlocks are tested at an 18 month frequency via SR 3.3.1.15.

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 ΔT Function.

A Note modifies SR 3.3.1.6. The Note states that this Surveillance is

required only if reactor power is > 50% RTP and that 24 hours is allowed for performing the first surveillance after reaching 50% RTP.

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.

Setpoints 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.

BASES

---NOTE---

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

SURVEILLANCE REQUIREMENTS (continued)

The "as found" and "as left" values must also be recorded and verified to be within the required limits.

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.

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. 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 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. 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 power into the

-----NOTE-----

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

SURVEILLANCE REQUIREMENTS (continued)

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 31 days.

SR 3.3.1.10

A CHANNEL CALIBRATION is performed every 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 a 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 previous test "as left" values must be consistent with the drift allowance used in the setpoint methodology.

The Frequency of 18 months is based on the assumption of an 18 month calibration interval in the determination of the magnitude of equipment drift in the setpoint methodology.

SR 3.3.1.10 is modified by a Note stating that this test shall include verification that the time delays 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 months. This SR is modified by a Note stating that neutron detectors are excluded from the CHANNEL CALIBRATION. 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

BASES

-----NOTE-----

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

SURVEILLANCE REQUIREMENTS (continued)

neutron detectors consists of obtaining the detector plateau or preamp discriminator curves, evaluating those curves, and comparing the curves to the manufacturer's data. 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 18 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown these components usually pass the Surveillance when performed on the 18 month Frequency.

SR 3.3.1.12

SR 3.3.1.12 is the performance of a COT of RPS interlocks every 18 months.

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.

SR 3.3.1.13

SR 3.3.1.13 is the performance of a TADOT of the Manual Reactor Trip, RCP Breaker Position, SI Input from ESFAS, and the Condenser Pressure-High and Circulating Water Pump Breaker Position inputs to the P-9 Interlock. This TADOT is performed every 18 months. The test shall independently verify the OPERABILITY of the undervoltage and shunt trip circuits for the Manual Reactor Trip Function for the Reactor Trip Breakers and the undervoltage trip circuits for the Reactor Trip Bypass Breakers.

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.

BASES

---NOTE---

TS BASES Pages B 3.3.1-1 through B 3.3.1-46 are only applicable to RPS Functions 1, 2.a, 3, 4, 5, 6, 7.a, 7.b, 10.a, 10.b, 13, 14, 15.a, 15.b, 16, 17.a, 17.b(1), 17.b(2), 17.c, 17.d, 17.e, 18, 19, 20, and 21.

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.14

SR 3.3.1.14 is the performance of a TADOT of Turbine Trip Functions. This TADOT is as described in SR 3.3.1.4, except that this test is performed prior to exceeding the P-9 interlock whenever the unit has been in MODE 3. This Surveillance is not required if it has been performed within the previous 31 days. Performance of this test will ensure that the turbine trip Function is OPERABLE prior to exceeding the P-9 interlock.

SR 3.3.1.15

SR 3.3.1.15 is the performance of an ACTUATION LOGIC TEST on the RCP Breaker Position (Two Loop), Reactor Coolant Flow-Low (Two Loop) and Underfrequency Bus A01 and A02 Trip Functions, and P-6, P-7, P-8, P-9 and P-10 Interlocks every 18 months.

The 18 month frequency is based on the need to perform this surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the surveillance were performed with the reactor at power.

REFERENCES

1. FSAR, Chapter 7.
2. FSAR, Chapter 14.
3. IEEE-279-1968.
4. 10 CFR 50.49.
5. DG-I01, Instrument Setpoint Methodology.

B 3.3 INSTRUMENTATION

B 3.3.1 Reactor Protection System (RPS) Instrumentation

BASES

NOTE

TS BASES Pages B.3.3.1-47 through B.3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

BACKGROUND

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

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

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

The Nominal Trip Setpoint (NTSP) specified in Table 3.3.1-1 is a predetermined setting for a protection channel 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 NTSP accounts for uncertainties in setting the channel (e.g. calibration), uncertainties in how the channel might actually perform (e.g., repeatability), changes in the point of action of the channel over time (e.g., drift during surveillance intervals), and any other factors

BASES

---NOTE---

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

BACKGROUND (continued)

which may influence its actual performance (e.g., harsh accident environments). In this manner, the NTSP ensures that SLs are not exceeded. Therefore, the NTSP meets the definition of an LSSS.

Technical Specifications contain values related to the OPERABILITY of equipment required for safe operation of the facility. OPERABLE is defined in the Technical Specifications as "...being capable of performing its safety functions(s)." Relying solely on the NTSP to define OPERABILITY in Technical Specifications would be an overly restrictive requirement if it were applied as an OPERABILITY limit for the 'as-found' value of a protection channel setting during a surveillance. This would result in Technical Specification compliance problems, as well as reports and corrective actions required by the rule which are not necessary to ensure safety. For example, an automatic protection channel with a setting that has been found to be different from the NTSP 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 NTSP and thus the automatic protective action would still have ensured that the SL would not be exceeded with the "as-found" setting of the protection channel. Therefore, the channel would still be OPERABLE since it would have performed its safety function and the only corrective action required would be to reset the channel to the as-left tolerance around the NTSP to account for further drift during the next surveillance interval.

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

1. The Departure from Nucleate Boiling Ratio (DNBR) shall be maintained above the Safety Limit (SL) value to prevent departure from nucleate boiling (DNB);
2. Fuel centerline melt shall not occur; and
3. The RCS pressure SL of 2750 psia shall not be exceeded.

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

BASES

-----NOTE-----

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

BACKGROUND (continued)

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

The RPS instrumentation is segmented into four distinct but interconnected modules as identified below:

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 Analog Protection System, Nuclear Instrumentation System (NIS), field contacts, and protection channel sets: provides signal conditioning, bistable setpoint comparison, process algorithm actuation, compatible electrical signal output to protection system channels, and control board/control room/miscellaneous indications;

3. Relay Logic System, including input, logic, and output devices: initiates proper unit shutdown in accordance with the defined logic, which is based on bistable, setpoint comparators, or contact outputs from the signal process control and protection systems; and

4. Reactor trip switchgear, including reactor trip breakers (RTBs) and bypass breakers: provides the means to interrupt power to the control rod drive mechanisms (CRDMs) and allows the rod cluster control assemblies (RCCAs), or "rods," to fall into the core and shut down the reactor. 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 NTSP and Allowable Value.

BASES

---NOTE---

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

BACKGROUND (continued)

The OPERABILITY of each transmitter or sensor is determined by either "as found" calibration data.evaluated during the CHANNEL CALIBRATION or by qualitative assessment of the field transmitter or sensor as related to the channel behaviour observed during performance of the CHANNEL CHECK.

Signal Process Control and Protection System

Generally, three or four channels of process control equipment are used for the signal processing of unit parameters measured by the field instruments. The process control equipment provides signal conditioning, comparable output signals for instruments located on the main control board, and comparison of measured input signals with NTSPs derived from Analytical Limits (ALs) established by safety analyses. If the measured value of a unit parameter exceeds the predetermined setpoint, an output from a bistable is forwarded to the logic relays.

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

Generally, if a parameter is used for input to the relay logic system 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 actuation. Again, a single failure will neither cause nor prevent the protection function actuation. These requirements are described in IEEE-279-1968 (Ref. 3). The actual number of channels required for each unit parameter is specified in Reference 1.

Two logic channels are required to ensure no single random failure of a logic channel will disable the RPS. 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

BASES

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TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

BACKGROUND (continued)

the logic system's designed reliability.

Allowable Values and Nominal Trip Setpoints

The trip setpoints used in the bistables are based on analytical limits established in the safety analyses. The calculation of the Nominal Trip Setpoints is such that adequate protection is provided when all sensor and processing time delays are taken into account. To allow for calibration tolerances, instrumentation uncertainties, instrument drift, and severe environment errors for those RPS channels that must function in harsh environments as defined by 10 CFR 50.49 (Ref. 4), the Allowable Values specified in Table 3.3.1-1 in the accompanying LCO are conservative-with respect to the analytical limits. A description of the methodology used to calculate the Allowable Values, NTSPs, and as-left and as-found tolerance bands, is provided in FSAR Chapter 7 (Reference 1). The magnitudes of the uncertainties are factored into the determination of each NTSP and corresponding Allowable Value in design basis calculations. The Trip Setpoint entered into the bistable is more conservative than that specified by the Allowable Value to account for measurement errors detectable by a COT.

The NTSP is the value at which the bistable is set and is the expected value to be achieved during calibration. The NTSP value is the LSSS and ensures the safety analysis limits are met for the surveillance interval selected when a channel is adjusted based on the stated channel uncertainties. Any bistable is considered to be properly adjusted when the as-left NTSP value is within the as-left tolerance band for CHANNEL CALIBRATION uncertainty allowance (i.e. + rack calibration and comparator setting uncertainties). The NTSP value is therefore considered a "nominal" value (i.e., expressed as a value without inequalities) for the purposes of COT and CHANNEL CALIBRATION.

A trip setpoint may be set more conservative than the NTSP as necessary in response to plant conditions. However, in this case, the operability of this instrument must be verified based on the field trip setpoint and not the NTSP.

Nominal Trip Setpoints, in conjunction with the use of as-found and as-left tolerances, together with the requirements of the Allowable Value, ensure that SLs are not violated during AOOs (and that the consequences of DBAs will be acceptable, providing the unit is

BASES

-----NOTE-----

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

BACKGROUND (continued)

operated from within the LCOs at the onset of the AOO or DBA and the equipment functions as designed).

Note that the Allowable Values listed in Table 3.3.1-1 are the least conservative value of the as found setpoint that a channel can have during a periodic CHANNEL CALIBRATION, CHANNEL OPERATIONAL TESTS, or a TRIP ACTUATING DEVICE OPERATIONAL TEST that requires trip setpoint verification.

Each 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. 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 SRs section.

Relay Logic System

The Relay Logic System equipment is used for the decision logic processing of outputs from the signal processing equipment bistables. To meet the redundancy requirements, two trains of Relay Logic System, 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 for the unit. Each train is packaged in its own cabinet for physical and electrical separation to satisfy separation and independence requirements. The system has been designed to trip in the event of a loss of power, directing the unit to a safe shutdown condition.

The Relay Logic System performs the decision logic for actuating a reactor trip, generates the electrical output signal that will initiate the required trip, 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 Relay Logic System 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. Examples are given in the Applicable Safety Analyses, LCO, and Applicability sections of this Bases.

BASES

NOTE

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

BACKGROUND (continued)

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 logic system is a voltage 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 logic system output voltage signal is removed, the undervoltage coils are de-energized, the breaker trip lever is actuated by the de-energized undervoltage coil, and the RTBs and bypass breakers are tripped open. This allows the shutdown rods and control rods to fall into the core. In addition to the de-energization of the undervoltage coils, each RTB 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 logic system. Either the undervoltage coil or the shunt trip mechanism is sufficient by itself, thus providing a diverse trip mechanism.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY

The RPS functions to preserve the SLs during all AOOs and mitigates the consequences of DBAs in all MODES in which the RTBs are closed.

Each of the analyzed accidents and transients can be detected by one or more RPS Functions. The accident analysis described in Reference 2 takes credit for most RPS trip Functions. RPS trip Functions that are retained yet not specifically credited in the accident analysis are implicitly credited in the safety analysis and the NRC staff-approved licensing basis for the unit. These RPS 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 RPS trip Functions that were credited in the accident analysis.

Permissive and interlock setpoints allow the blocking of trips during plant start-ups and restoration of trips when the permissive conditions are not satisfied, but they are not explicitly modeled in the Safety Analyses. These permissives and interlocks ensure that the starting

BASES

NOTE

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

conditions are consistent with the safety analysis, before preventative or mitigating actions occur. Because these permissives or interlocks are only one of multiple conservative starting assumptions for the accident analysis, they are generally considered as nominal values with regard to measurement accuracy.

The LCO requires all instrumentation performing an RPS Function, listed in Table 3.3.1-1 to be OPERABLE. The Allowable Value specified in Table 3.3.1-1 is the least conservative value of the as-found setpoint that the channel can have when tested, such that a channel is OPERABLE if the as-found setpoint is conservative with respect to the Allowable Value during a CHANNEL CALIBRATION or CHANNEL OPERATIONAL TEST (COT). As such, the Allowable value differs from the NTSP by an amount greater than or equal to the expected instrument channel uncertainties, such as drift, during the surveillance interval. In this manner, the actual setting of the channel (NTSP) will ensure that a SL is not exceeded at any given point of time as long as the channel has not drifted beyond that expected during the surveillance interval. Note that, although the channel is OPERABLE under these circumstances, the trip setpoint must be left adjusted to a value within the as-left tolerance, 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 (as-found criteria).

If the actual setting of the channel is found to be conservative with respect to the Allowable Value but is beyond the as-found tolerance band, the channel is OPERABLE but degraded. The degraded condition will be further evaluated during performance of the SR. If the channel is functioning as required and is expected to pass the next surveillance, then the channel can be restored to service at the completion of the surveillance. If the evaluation determines that the channel is not performing as expected, the channel operability status cannot be verified. Therefore, it is inoperable because it may not perform its protective function(s) if needed before the next surveillance test.

If the channel setpoint cannot be restored to the NTSP as-left tolerance, or if the actual setting of the channel is found to be non-conservative with respect to the Allowable Value, the channel is

BASES

-----NOTE-----

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

inoperable. For these conditions, after the surveillance is completed, the channel's as-found setting will be entered into the Corrective Action Program for further evaluation.

A trip setpoint may be set more conservative than the NTSP as necessary in response to plant conditions. However, in this case, the operability of the channel must be verified based on the field trip setpoint and not the NTSP. Failure of any instrument renders the affected channel(s) inoperable and reduces the reliability of the affected Functions.

The LCO generally requires OPERABILITY of four or three channels in each instrumentation Function, one channel 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 generally required when one RPS channel is also used as a control system input. This configuration accounts for the possibility of the shared channel failing in such a manner that it creates a transient that requires RPS action. In this case, the RPS will still provide protection, even with random failure of one of the other three protection channels. Three 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 RPS trip and disable one RPS channel. The two-out-of-three and two-out-of-four configurations allow one channel to be tripped during maintenance or testing without causing a reactor trip. Specific exceptions to the above general philosophy exist and are discussed below.

Reactor Protection System Functions

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

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 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

NOTE

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

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

b. Power Range Neutron Flux-Low

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

The LCO requires all four of the 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 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.

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 detectors cannot detect neutron levels in this range. Other RPS trip Functions and administrative controls provide protection against positive reactivity additions or power excursions in MODE 3, 4, 5, or 6.

8. 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

BASES

-----NOTE-----

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

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 the safety valve to lift before reactor high pressure trip.

In MODE 1, when there is a potential for overfilling 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 interlock, 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.

9. Reactor Coolant Flow-Low

a. Reactor Coolant Flow-Low (Single Loop)

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 50% RTP, a loss of flow in any RCS loop 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.

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

In MODE 1 above the P-8 setpoint, a loss of flow in one RCS loop could result in DNB conditions in the core. In MODE 1 below the P-8 setpoint, a loss of flow in two loops is required to actuate a reactor trip (Function 9.b) because of the lower power level and the greater margin to the design limit DNBR.

BASES

---NOTE---

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

b. Reactor Coolant Flow-Low (Two Loops)

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 interlock and below the P-8 setpoint, a loss of flow in two 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 interlock and below the P-8 setpoint, the Reactor Coolant Flow-Low (Two Loops) trip must be OPERABLE. Below the P-7 interlock, all reactor trips on low flow are automatically blocked since no conceivable power distributions could occur that would cause a DNB concern at this low power level. Above the P-7 interlock, the reactor trip on low 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.

11. Undervoltage Bus A01 and A02

The Undervoltage Bus A01 and A02 reactor trip Function ensures that protection is provided against violating the DNBR limit due to a loss of flow in both RCS loops. The voltage to Bus A01 and A02 is monitored. Above the P-7 interlock, a loss of voltage detected on both buses will initiate a reactor trip. This trip Function will generate a reactor trip independent of Reactor Coolant Flow—Low (Two Loops) Trip Setpoint. Time delays are incorporated into the Undervoltage Bus A01 and A02 channels to prevent reactor trips due to momentary electrical power transients.

NOTE

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

The LCO requires two Undervoltage channels per bus to be

OPERABLE. An Undervoltage channel consists of the A01/A02 Bus Undervoltage Relay and the associated Bus Undervoltage Matrix Relay.

In MODE 1 above the P-7 interlock, the Undervoltage Bus A01 and A02 trip must be OPERABLE. Below the P-7 interlock, all reactor trips on loss of flow are automatically blocked since no conceivable power distributions could occur that would cause a DNB concern at this low power level. Above the P-7 interlock, the reactor trip on loss of flow in both RCS loops is automatically enabled.

12. Underfrequency Bus A01 and A02

The Underfrequency Bus A01 and A02 RCP breaker trip Function ensures that protection is provided against violating the DNBR limit due to a loss of flow in two RCS 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 interlock, a loss of frequency detected on two RCP buses will trip both RCP breakers. Tripping both RCP breakers will generate a reactor trip before the Reactor Coolant Flow—Low (Two Loops) Trip Setpoint is reached. Time delays are incorporated into the Underfrequency Bus A01 and A02 channels to prevent reactor trips due to momentary electrical power transients.

The LCO requires two Underfrequency Bus A01 channels and two Underfrequency Bus A02 channels to be OPERABLE.

In MODE 1 above the P-7 interlock, the Underfrequency Bus A01 and A02 RCP breaker trip must be OPERABLE. Below the P-7 interlock, this trip and all reactor trips on loss of flow are automatically blocked, because no conceivable power distributions could occur that would cause a DNB concern at this low power level. Above the P-7 interlock, the Underfrequency Bus A01 and A02 RCP breaker trip is automatically enabled.

BASES

-----NOTE-----

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

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 NTSP is found non-conservative with respect to the Allowable Value, or the channel is not functioning as required, 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 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 outside the safety analysis. Therefore, LCO 3.0.3 must be immediately entered if applicable in the current MODE of operation.

A.1

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

B.1 and B.2

Condition B applies to the Manual Reactor Trip in MODE 1 or 2. 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.

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.

If the Manual Reactor Trip Function 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.

BASES

-----NOTE-----

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

ACTIONS (continued)

To achieve this status, the unit must be brought to at least MODE 3 within

6 additional hours. The 6 additional hours to reach MODE 3 is reasonable, based on operating experience, to reach MODE 3 from full power operation in an orderly manner and without challenging unit systems. With the unit in MODE 3, this trip Function is no longer required to be OPERABLE.

C.1 and C.2

Condition C applies to the Manual Reactor Trip Function in MODE 3, 4, or 5 with the RTBs closed and the Rod Control System capable of rod withdrawal.

- With one channel inoperable, the inoperable channel must be restored to OPERABLE status within 48 hours. If the Reactor Manual Trip channel 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.

The additional hour provides sufficient time to accomplish the action in an orderly manner. With the RTBs open, the Manual Reactor Trip Function is no longer required.

D.1 and D.2

Condition D applies to the following reactor trip Functions:

- Power Range Neutron Flux-High;
- Power Range Neutron Flux-Low;
- Overtemperature ΔT;
- Overpower ΔT;
- Pressurizer Pressure-High;
- SG Water Level-Low Low; and

-NOTE-

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

ACTIONS (continued)

- SG Water Level - Low coincident with Steam Flow/Feedwater Flow Mismatch.

A known inoperable channel must be placed in the tripped condition within 1 hour. 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.

If the inoperable channel cannot be placed in the tripped 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.

E.1 and E.2

Condition E applies to the Underfrequency Bus A01 and A02 trip function. 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 setpoint. The 6 hours to place the channel in the tripped condition is necessary due to plant design requiring maintenance personnel to effect the trip of the channel outside of the Control Room. An additional 6 hours is allowed to reduce THERMAL POWER to below P-7 if the inoperable channel cannot be restored to OPERABLE status or placed in trip within the specified Completion Time.

Allowance of this time interval takes into consideration the redundant capability provided by the remaining redundant OPERABLE channel and the low probability of occurrence of an event during this period that may require the protection afforded by this trip function.

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. Above the P-6 setpoint and

BASES

-----NOTE-----

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

ACTIONS (continued)

below the P-10 setpoint, the NIS intermediate range detector performs the monitoring Functions. If THERMAL POWER is greater than the P-6 setpoint but less than the P-10 setpoint, 24 hours is allowed to

reduce THERMAL POWER below the P-6 setpoint or increase to THERMAL POWER above the P-10 setpoint. The NIS Intermediate Range Neutron Flux channels must be OPERABLE when the power level is above the capability of the source range, P-6, and below the capability of the power range, P-10. If THERMAL POWER is greater than the P-10 setpoint, the NIS power range detectors perform the monitoring and protection functions and the intermediate range is not required. The Completion Times allow for a slow and controlled power adjustment above P-10 or below P-6 and take into account the redundant capability afforded by the redundant OPERABLE channel, and the low probability of its failure during this period. This action does not require the inoperable channel to be tripped because the Function uses one-out-of-two logic. Tripping one channel would trip the reactor. Thus, the Required Actions specified in this Condition are only applicable when channel failure does not result in reactor trip.

G.1 and G.2

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. Required Actions specified in this Condition are only applicable when channel failures do not result in reactor trip. Above the P-6 setpoint and below the P-10 setpoint, the NIS intermediate range detector performs the monitoring Functions. With no intermediate range channels OPERABLE, the Required Actions are to suspend operations involving positive reactivity additions immediately. This will preclude any power level increase since there are no OPERABLE Intermediate Range Neutron Flux channels. The operator must also reduce THERMAL POWER below the P-6 setpoint within two hours. Below P-6, the Source Range Neutron Flux channels will be able to monitor the core power level. The Completion Time of 2 hours will allow 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.

H.1

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TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

ACTIONS (continued)

Condition 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.

I.1

Condition 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 Rod Control System capable of rod withdrawal. With the unit in this Condition, below P-6, the NIS source range perform the monitoring and protection functions. With both source range channels inoperable, the RTBs must be opened immediately. With the RTBs open, the core is in a more stable condition.

J.1 and J.2

Condition J applies to one inoperable source range channel in MODE 3, 4, or 5 with the RTBs closed and the Rod Control System capable of rod withdrawal. 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, 1 additional hour is allowed to open the RTBs. Once the RTBs are open, the core is in a more stable condition.

BASES

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

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

ACTIONS (continued)

K.1 and K.2

Condition K applies to the following reactor trip Functions:

- Pressurizer Pressure-Low;
- Pressurizer Water Level-High;
- Reactor Coolant Flow-Low (Two Loops);
- Undervoltage Bus A01 and A02.

With one channel inoperable, the inoperable channel must be placed in the tripped condition within 1 hour. 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 interlock and below the P-8 setpoint. These Functions do not have to be OPERABLE below the P-7 interlock because there are no loss of flow trips below the P-7 interlock. An additional 6 hours is allowed to reduce THERMAL POWER to below P-7 if the inoperable channel cannot be restored to OPERABLE status or placed in trip within the specified Completion Time.

Allowance of this time interval takes into consideration the redundant capability provided by the remaining redundant OPERABLE channel, 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.

L.1 and L.2

Condition L applies to the Reactor Coolant Flow-Low (Single Loop) reactor trip Function. With one channel inoperable, the inoperable channel must be placed in the tripped condition within 1 hour. If the channel cannot be restored to OPERABLE status or the channel placed in trip within the 1 hour, then THERMAL POWER must be reduced below the P-8 setpoint within the next 4 hours. This places the unit in a MODE where the LCO is no longer applicable. This trip Function does not have to be OPERABLE below the P-8 setpoint because other RPS trip Functions provide core protection below the P-8 setpoint.

BASES

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

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

ACTIONS (continued)

M.1 and M.2

Condition M 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(s) must be restored to OPERABLE status within 1 hour. If the channel cannot be restored to OPERABLE status within the 1 hour, then THERMAL POWER must be reduced below the P-8 setpoint within the next 4 hours.

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-8 setpoint because other RPS Functions provide core protection below the P-8 setpoint.

N.1 and N.2

Condition N applies to the RCP Breaker Position (Two Loop) reactor trip Function. With one channel inoperable, the inoperable channel must be restored to OPERABLE status within 1 hour. If the channel cannot be restored to OPERABLE status in 1 hour, then THERMAL POWER must be reduced below the P-7 interlock within the next 6 hours. 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 interlock because there are no loss of flow trips below the P-7 interlock. The Completion Time of 6 hours is reasonable, based on operating experience, to reduce THERMAL POWER to below the P-7 interlock from full power in an orderly manner without challenging unit systems.

O.1 and O.2

Condition O applies to Turbine Trip on Low Autostop Oil Pressure or on Turbine Stop Valve Closure. With one channel inoperable, the inoperable channel must be placed in the trip condition within 1 hour. 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 reduced below the P-9 setpoint within the next 4 hours.

BASES

---NOTE---

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

ACTIONS (continued)

P.1 and P.2

Condition P applies to the SI Input from ESFAS reactor trip and the RPS Automatic Trip Logic in MODES 1 and 2. These actions address the train orientation of the RPS for these Functions. With one train inoperable, 6 hours are allowed to restore the train to OPERABLE status (Required Action P.1) or the unit must be placed in MODE 3 within the next 6 hours. The Completion Time of 6 hours (Required Action P.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 6 hours (Required Action P.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 for up to 8 hours for surveillance testing, provided the other train is OPERABLE.

Q.1 and Q.2

Condition Q applies to the RTBs in MODES 1 and 2. With one RTB inoperable, 1 hour is allowed to restore the RTB to OPERABLE status or the unit must be placed in MODE 3 within the next 6 hours. The Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power in an orderly manner and without challenging unit systems. The 1 hour and 6 hour Completion Times are equal to the time allowed by LCO 3.0.3 for shutdown actions in the event of a complete loss of RPS Function. Placing the unit in MODE 3 removes the requirement for this particular Function.

The Required Actions have been modified by a Note allowing one channel to be bypassed for up to 8 hours provided the other channel is OPERABLE.

R.1 and R.2

Condition R applies to the P-6 interlock (in MODE 2) and the P-10 interlock. With one or more channels inoperable for one-out-of-two or two-out-of-four coincidence logic, the associated interlock must be verified to be in its required state for the existing unit condition within 1 hour or the unit must be placed in MODE 3 within the next 6 hours.

BASES

---NOTE---

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

ACTIONS (continued)

Verifying the interlock status manually accomplishes 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 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power in an orderly manner and without challenging unit systems. The 1 hour and 6 hour Completion Times are equal to the time allowed by LCO 3.0.3 for shutdown actions in the event of a complete loss of RPS Function.

S.1 and S.2

Condition S applies to the P-7, P-8, and P-9 interlocks. With one or more channels inoperable for one-out-of-two or two-out-of-four coincidence logic, the associated interlock must be verified to be in its required state for the existing unit condition within 1 hour or the unit must be placed in MODE 2 within the next 6 hours. These actions are conservative for the case where power level is being raised. Verifying the interlock status manually accomplishes the interlock's Function. 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 6 hours is reasonable, based on operating experience, to reach MODE 2 from full power in an orderly manner and without challenging unit systems.

T.1 and T.2

Condition T applies to the RTBs and the RTB Undervoltage and Shunt Trip Mechanisms in MODES 3, 4, or 5 with the RTBs closed and the Rod Control System capable of rod withdrawal.

With one trip mechanism or RTB inoperable, the inoperable trip mechanism or RTB must be restored to OPERABLE status within 48 hours. The Completion Time is reasonable considering that the remaining OPERABLE trip mechanism or RTB is adequate to perform the safety function, and given the low probability of an event occurring during this interval.

If the RTB or trip mechanism cannot be restored to OPERABLE status within 48 hours, the unit must be placed in a MODE in which the requirement does not apply. This is accomplished by opening the RTBs within the next hour (49 hours total time). The Completion Time of 1 hour provides sufficient time to accomplish this action in an orderly

BASES

---NOTE---

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

ACTIONS (continued)

manner and takes into account the low probability of an event occurring in this interval.

U.1 and U.2

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

With the unit in MODE 3, Condition T would apply to any inoperable RTB trip mechanisms. 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 8 hours for the reasons stated under Condition Q.

The Completion Time of 48 hours 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 and V.2

Condition V applies to the Reactor Trip Bypass Breaker (RTBB) and associated Undervoltage Trip Mechanism in MODE 1 or 2, when the RTBB is racked in and closed. With the required RTBB inoperable, 1 hour is allowed to restore the RTBB to OPERABLE status or the unit must be placed in MODE 3 within the next 6 hours. The Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power in an orderly manner and without challenging unit systems. The 1 hour and 6 hour completion times are equal to the time allowed by LCO 3.0.3 for shutdown action in the event of a complete loss of RPS Function. Placing the unit in MODE 3 removes the requirement for this particular Function.

BASES

----NOTE----

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

ACTIONS (continued)

W.1 and W.2

Condition W applies to the Reactor Trip Bypass Breaker (RTBB) and associated Undervoltage Trip Mechanism in MODES 3, 4, or 5, when an RTBB is racked in and closed and the Rod Control System is capable of rod withdrawal. With the required RTBB inoperable, 48 hours is allowed to restore the RTBB to OPERABLE status or the unit must be placed in a MODE in which the requirement does not apply. To achieve this status, the RTBs and RTBBs must be opened within the next 1 hour (49 hours total time). The Completion Time of 1 hour provides sufficient time to accomplish the action in an orderly manner. With the RTBs and RTBBs open, this Function is no longer required.

X.1 and X.2

Condition X applies to the RPS Automatic Trip Logic in MODES 3, 4 or 5 with the RTBs closed and the Rod Control System capable of rod withdrawal. With one train inoperable, 48 hours are allowed to restore the train to an OPERABLE status. The Completion Time of 48 hours 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 in this interval.

If the RPS Automatic Trip Logic cannot be restored to OPERABLE status within 48 hours, the unit must be placed in a MODE where this Function is not required to be OPERABLE. To achieve this status, the RTBs must be opened within the next 1 hour (49 hours total time). The additional hour provides sufficient time to accomplish the action in an orderly manner. With the RTBs open, the Automatic Trip Logic is no longer required.

SURVEILLANCE REQUIREMENTS

The SRs for each RPS 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 RPS Functions.

Note that each channel of process protection supplies both trains of the RPS. 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

BASES

---NOTE---

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

SURVEILLANCE REQUIREMENTS (continued)

CALIBRATION and COTs are performed in a manner that is consistent with the assumptions used in analytically calculating the required channel accuracies.

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 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

BASES

-----NOTE-----

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

SURVEILLANCE REQUIREMENTS (continued)

Surveillance is required only if reactor power is ≥ 15% RTP and that 12 hour is 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 every 31 EFPD. SR 3.3.1.3 is performed by means of the moveable incore detection system. If the absolute difference is ≥ 3%, the NIS channel is still OPERABLE, but must be readjusted.

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 ΔT Function.

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 ≥ 50% RTP and that 24 hours is allowed for performing the first Surveillance after reaching 50% RTP.

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.

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.

BASES

---NOTE---

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

SURVEILLANCE REQUIREMENTS (continued)

The RTB test shall include separate verification of the undervoltage and shunt trip mechanisms. The independent test for bypass breakers is included in SR 3.3.1.13. The bypass breaker test shall include an undervoltage trip. A Note has been added to SR 3.3.1.4 to indicate that this test must be performed on the bypass breaker prior to placing it in service.

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.

SR 3.3.1.5

SR 3.3.1.5 is the performance of an ACTUATION LOGIC TEST, every 31 days on a STAGGERED TEST BASIS. The train being tested is placed in the bypass condition, thus preventing inadvertent actuation. All possible logic combinations, with and without applicable permissives, are tested for each protection function. 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.

SR 3.3.1.5 is modified by two Notes. Note 1 provides an 8 hour delay in the requirement to perform this Surveillance for the Source Range Neutron Flux trip function instrumentation when power is reduced to below P-6. 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 3.3.1.5 is no longer required to be performed. If the unit is to be in MODE 2 below P-6 for > 8 hours, this Surveillance must be performed prior to 8 hours after reducing power below P-6.

Note 2 excludes the RCP Breaker Position (Two Loop), Reactor Coolant Flow-Low (Two Loop) and Underfrequency Bus A01 and A02 Trip Functions, and the P-6, P-7, P-8, P-9 and P-10 Interlocks. These functions/interlocks are tested at an 18 month frequency via SR 3.3.1.15.

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

BASES

---NOTE---

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

SURVEILLANCE REQUIREMENTS (continued)

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 ΔT Function.

A Note modifies SR 3.3.1.6. The Note states that this Surveillance is required only if reactor power is > 50% RTP and that 24 hours is allowed for performing the first surveillance after reaching 50% RTP.

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.

Setpoints must be conservative with respect to the Allowable Values specified in Table 3.3.1-1.

The difference between the current "as found" values and the NTSP 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 verified to be within the required limits.

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.

SR 3.3.1.7 is modified by two Notes as identified in Table 3.3.1-1. The first Note requires evaluation of channel performance for the condition where the as-found setting for the channel setpoint is outside its

BASES

-----NOTE-----

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

SURVEILLANCE REQUIREMENTS (continued)

as-found tolerance but conservative with respect to the Allowable Value. Evaluation of channel performance will verify that the channel will continue to behave in accordance with the safety analysis assumptions and the channel performance assumptions in the setpoint methodology. The purpose of the assessment is to ensure confidence in the channel performance prior to returning the channel to service. The performance of these channels will be evaluated under the station's Corrective Action Program. Entry into the Corrective Action Program will ensure required review and documentation of the condition to establish a reasonable expectation for continued OPERABILITY. The second Note requires that the as-left setting for the channel be returned to within the as-left tolerance of the NTSP. Where a setpoint more conservative than the NTSP is used in the plant surveillance procedures, the as-left and as-found tolerances, as applicable, will be applied to the surveillance procedure setpoint. This will ensure that sufficient margin to the Safety Limit and/or Analytical Limit is maintained. If the as-left channel setting cannot be returned to a setting within the as-left tolerance of the NTSP, then the channel shall be declared inoperable.

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. 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 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

BASES

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TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

SURVEILLANCE REQUIREMENTS (continued)

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

SR 3.3.1.8 is modified by two Notes as identified in Table 3.3.1-1. The first Note requires evaluation of channel performance for the condition where the as-found setting for the channel setpoint is outside its as-found tolerance but conservative with respect to the Allowable Value. Evaluation of channel performance will verify that the channel will continue to behave in accordance with safety analysis assumptions and the channel performance assumptions in the setpoint methodology. The purpose of the assessment is to ensure confidence in the channel performance prior to returning the channel to service. The performance of these channels will be evaluated under the station's Corrective Action Program. Entry into the Corrective Action Program will ensure required review and documentation of the condition to establish a reasonable expectation for continued OPERABILITY. The second Note requires that the as-left setting for the channel be returned to within the as-left tolerance of the NTSP. Where a setpoint more conservative than the NTSP is used in the plant surveillance procedures, the as-left and as-found tolerances, as applicable, will be applied to the surveillance procedure setpoint. This will ensure that sufficient margin to the Safety Limit and/or Analytical Limit is maintained. If the as-left channel setting cannot be returned to a setting within the as-left tolerance of the NTSP, then the channel shall be declared inoperable.

SR 3.3.1.9

SR 3.3.1.9 is the performance of a TADOT and is performed every 31 days.

SR 3.3.1.10

A CHANNEL CALIBRATION is performed every 18 months, or

BASES

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TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

SURVEILLANCE REQUIREMENTS (continued)

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.

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 NTSP must be consistent with the drift allowance used in the setpoint methodology.

The Frequency of 18 months is based on the assumption of an 18 month calibration interval in the determination of the magnitude of equipment drift in the setpoint methodology.

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

SR 3.3.1.10 is modified by two Notes as identified in Table 3.3.1-1. The first Note requires evaluation of channel performance for the condition where the as-found setting for the channel setpoint is outside its as-found tolerance but conservative with respect to the Allowable Value. Evaluation of channel performance will verify that the channel will continue to behave in accordance with safety analysis assumptions and the channel performance assumptions in the setpoint methodology. The purpose of the assessment is to ensure confidence in the channel performance prior to returning the channel to service. The performance of these channels will be evaluated under the station's Corrective Action Program. Entry into the Corrective Action Program will ensure required review and documentation of the condition to establish a reasonable expectation for continued OPERABILITY. The second Note requires that the as-left setting for the channel be returned to within the as-left tolerance of the NTSP. Where a setpoint more conservative than the NTSP is used in the plant surveillance procedures, the as-left and as-found tolerances, as applicable, will be applied to the surveillance procedure setpoint. This will ensure that sufficient margin to the Safety Limit and/or Analytical Limit is maintained. If the as-left channel setting cannot be returned to a setting within the as-left tolerance of the NTSP, then the channel shall be declared inoperable.

SR 3.3.1.11

BASES

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TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.11 is the performance of a CHANNEL CALIBRATION, as described in SR 3.3.1.10, every 18 months. This SR is modified by a Note stating that neutron detectors are excluded from the CHANNEL CALIBRATION. 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 plateau or preamp discriminator curves, evaluating those curves, and comparing the curves to the manufacturer's data. 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 18 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown these components usually pass the Surveillance when performed on the 18 month Frequency.

SR 3.3.1.11 is modified by two Notes as identified in Table 3.3.1-1. The first Note requires evaluation of channel performance for the condition where the as-found setting for the channel setpoint is outside its as-found tolerance but conservative with respect to the Allowable Value. Evaluation of channel performance will verify that the channel will continue to behave in accordance with safety analysis assumptions and the channel performance assumptions in the setpoint methodology. The purpose of the assessment is to ensure confidence in the channel performance prior to returning the channel to service. The performance of these channels will be evaluated under the station's Corrective Action Program. Entry into the Corrective Action Program will ensure required review and documentation of the condition to establish a reasonable expectation for continued OPERABILITY. The second Note requires that the as-left setting for the channel be returned to within the as-left tolerance of the NTSP. Where a setpoint more conservative than the NTSP is used in the plant surveillance procedures, the as-left and as-found tolerances, as applicable, will be applied to the surveillance procedure setpoint. This will ensure that sufficient margin to the Safety Limit and/or Analytical Limit is maintained. If the as-left channel setting cannot be returned to a setting within the as-left tolerance of the NTSP, then the channel shall be declared inoperable.

BASES

-----NOTE-----

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.12

SR 3.3.1.12 is the performance of a COT of RPS interlocks every 18 months.

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.

SR 3.3.1.13

SR 3.3.1.13 is the performance of a TADOT of the Manual Reactor Trip, RCP Breaker Position, SI Input from ESFAS, and the Condenser Pressure-High and Circulating Water Pump Breaker Position inputs to the P-9 Interlock. This TADOT is performed every 18 months. The test shall independently verify the OPERABILITY of the undervoltage and shunt trip circuits for the Manual Reactor Trip Function for the Reactor Trip Breakers and the undervoltage trip circuits for the Reactor Trip Bypass Breakers.

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.

SR 3.3.1.14

SR 3.3.1.14 is the performance of a TADOT of Turbine Trip Functions. This TADOT is as described in SR 3.3.1.4, except that this test is performed prior to exceeding the P-9 interlock whenever the unit has been in MODE 3. This Surveillance is not required if it has been performed within the previous 31 days. Performance of this test will ensure that the turbine trip Function is OPERABLE prior to exceeding the P-9 interlock.

SR 3.3.1.15

SR 3.3.1.15 is the performance of an ACTUATION LOGIC TEST on the RCP Breaker Position (Two Loop), Reactor Coolant Flow-Low (Two Loop) and Underfrequency Bus A01 and A02 Trip Functions, and P-6, P-7, P-8, P-9 and P-10 Interlocks every 18 months.

BASES

---NOTE---

TS BASES Pages B 3.3.1-47 through B 3.3.1-80 are only applicable to RPS Functions 2.b, 8, 9.a, 9.b, 11and 12.

SURVEILLANCE REQUIREMENTS (continued)

The 18 month frequency is based on the need to perform this surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the surveillance were performed with the reactor at power.

REFERENCES

1. FSAR, Chapter 7.

2. FSAR, Chapter 14.

3. IEEE-279-1968.

4. 10 CFR 50.49.

B 3.3 INSTRUMENTATION

B 3.3.2 Engineered Safety Feature Actuation System (ESFAS) Instrumentation

BASES

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TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

BACKGROUND

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

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

- Field transmitters or process sensors and instrumentation: provide a measurable electronic signal based on the physical characteristics of the parameter being measured;
- Signal processing equipment including analog protection system, field contacts, and protection channel sets: provide signal conditioning, compatible electrical signal output to protection system devices, and control board/control room/miscellaneous indications; and
- Relay Logic Racks including input, logic and output devices: initiates proper Engineered Safety Feature (ESF) actuation in accordance with the defined logic and based on the bistable outputs from the signal process control and protection system.

Field Transmitters or Sensors

To meet the design demands for redundancy and reliability, more than one, and often as many as four, field transmitters or sensors are used to measure unit parameters. In many cases, field transmitters or sensors that input to the ESFAS are shared with the Reactor Protection System (RPS). 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 Allowable Values. The OPERABILITY of each transmitter or sensor can be evaluated when its "as found" calibration data are compared against its documented acceptance criteria.

BASES

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TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

BACKGROUND (continued)

Signal Processing Equipment

Generally, three or four channels of process control equipment are used for the signal processing of unit parameters measured by the field instruments. The process control equipment provides signal conditioning, comparable output signals for instruments located on the main control board, and comparison of measured input signals with setpoints established by safety analyses. If the measured value of a unit parameter exceeds the predetermined setpoint, an output from a bistable is forwarded to the logic relays.

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

Generally, if a parameter is used for input to the Relay Logic Racks 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 actuation. Again, a single failure will neither cause nor prevent the protection function actuation.

These requirements are described in IEEE-279-1968 (Ref. 3).

Allowable Values

To allow for calibration tolerances, instrumentation uncertainties and instrument drift, the Allowable Values specified in Table 3.3.2-1 in the accompanying LCO are conservatively adjusted with respect to the analytical limits. A detailed description of the methodology used to calculate the Allowable Values, including their explicit uncertainties, is provided in DGI-01, Instrument Setpoint Methodology (Ref. 5). The actual nominal Trip Setpoint 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. If the

BASES

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TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

BACKGROUND (continued)

measured setpoint does not exceed the Allowable Value, the bistable is considered OPERABLE.

Setpoints 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.

Each channel can be tested on line to verify that the signal processing equipment and setpoint accuracy is within the specified allowance requirements. 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 Allowable Values listed in Table 3.3.2-1 are based on the methodology described in Reference 4, which incorporates all of the known uncertainties applicable for each channel. The magnitudes of these uncertainties are factored into the determination of each Allowable Value. All field sensors and signal processing equipment for these channels are assumed to operate within the allowances of these uncertainty magnitudes.

Relay Logic Racks

The Relay Logic Rack equipment is used for the decision logic processing of outputs from the signal processing equipment bistables. To meet the redundancy requirements, two trains of Relay Logic Racks, each performing the same functions, are provided.

The Relay Logic Racks perform 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.

The bistable outputs from the signal processing equipment are sensed by the Relay Logic Rack equipment and combined into logic matrices that represent combinations indicative of various transients. If a required logic matrix combination is completed, the system will 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

BASES

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TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

BACKGROUND (continued)

Applicable Safety Analyses, LCO, and Applicability sections of this Bases.

The actuation of ESF components is accomplished through master and slave relays. The Relay Logic Racks energize 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.

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 Pressure-Low is a primary actuation signal for small loss of coolant accidents (LOCAs) and a backup actuation signal for steam line breaks (SLBs) outside containment. Functions such as 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. 1).

The LCO requires all instrumentation performing an ESFAS Function to be OPERABLE. Failure of any instrument renders the affected channel(s) inoperable and reduces the reliability of the affected Functions.

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

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

BASES

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TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

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

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

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

- Containment Isolation;
- Containment Ventilation Isolation;
- Reactor Trip;
- Feedwater Isolation;
- Start of motor driven auxiliary feedwater (AFW) pumps; and
- Control room ventilation isolation.

These other functions ensure:

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

BASES

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TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

a. Safety Injection-Manual Initiation

The LCO requires one channel 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 of all components in the same manner as any of the automatic actuation signals with the exception of Containment Isolation.

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 and the interconnecting wiring to the actuation logic cabinet. Each push button actuates both trains. This configuration does not allow testing at power.

b. Safety Injection-Automatic Actuation Logic and Actuation Relays

This LCO requires two trains to be OPERABLE. Actuation logic consists of all circuitry housed within the actuation subsystems, including the initiating relay contacts responsible for actuating the ESF equipment.

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 because of the large number of components actuated on a SI, 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.

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

BASES

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TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

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-Containment Pressure-High

This signal provides protection against the following accidents:

- SLB inside containment; and
- LOCA.

Containment Pressure-High provides no input to any control functions. Thus, three OPERABLE channels are sufficient to satisfy protective requirements with a two-out-of-three logic. The transmitters and electronics are located outside of containment with the sensing lines passing through containment penetrations to sense the containment atmosphere in three different locations.

Thus, the high pressure Function will not experience any adverse environmental conditions and the Allowable Value reflects only steady state instrument uncertainties.

Containment Pressure-High must be OPERABLE in MODES 1, 2, and 3 when there is sufficient energy in the primary and secondary systems to pressurize the containment following a pipe break. In MODES 4, 5, and 6, there is insufficient energy in the primary or secondary systems to pressurize the containment.

BASES

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TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

~~d. Safety Injection-Pressurizer Pressure-Low~~

~~This signal provides protection against the following accidents:~~

- ~~Inadvertent opening of a steam generator (SG) relief or safety valve;~~
- ~~SLB;~~
- ~~A spectrum of rod cluster control assembly ejection accidents (rod ejection);~~
- ~~Inadvertent opening of a pressurizer relief or safety valve;~~
- ~~LOCAs; and~~
- ~~SG Tube Rupture.~~

~~Pressurizer pressure provides both control and protection functions: input to the Pressurizer Pressure Control System, reactor trip, and SI. However, two independent 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/SI event. Additionally, in the event of a failed open spray valve, RCS depressurization would be slow enough to be recognized by the operator and mitigated through manual actions to close the spray valve and energize the pressurizer heaters prior to reaching saturated conditions in the RCS. Therefore, there would be no uncontrolled loss of RCS inventory and no need for boron injection. Therefore, only three protection channels are necessary to satisfy the protective requirements.~~

~~This Function must be OPERABLE in MODES 1, 2, and 3 (above the Pressurizer Pressure interlock) to mitigate the consequences of an HELB inside containment. This signal may be manually blocked by the operator below the Pressurizer Pressure interlock. Automatic SI actuation below this pressure setpoint is then performed by the Containment Pressure-High signal.~~

BASES

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TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

~~This Function is not required to be OPERABLE in MODE 3 below the Pressurizer Pressure interlock. Other ESF functions are used to detect accident conditions and actuate the ESF systems in this MODE. In MODES 4, 5, and 6, this Function is not needed for accident detection and mitigation.~~

e. Safety Injection-Steam Line Pressure-Low

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

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

Steam Line Pressure-Low provides a signal for control of the main steam atmospheric steam dump valves. However, a failure in a steam line pressure channel will not create a control failure that would result in a low steamline pressure SI event. Thus, three OPERABLE channels on each steam line are sufficient to satisfy the protective requirements with a two-out-of-three logic on each steam line.

With the transmitters located in the fan rooms and in the fuel pool area, it is possible for them to experience adverse environmental conditions during a secondary side break. Therefore, the Allowable Value reflects both steady state and adverse environmental instrument uncertainties.

This Function is anticipatory in nature and has a lead/lag ratio of 12/2.

BASES

NOTE

TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

Steam Line Pressure-Low must be OPERABLE in MODES 1, 2, and 3 (above the Pressurizer Pressure interlock) 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 Pressurizer Pressure interlock. This Function is not required to be OPERABLE in MODE 4, 5, or 6 because there is insufficient energy in the secondary side of the unit to cause an accident.

2. Containment Spray

Containment Spray provides three primary functions:

1. Lowers containment pressure and temperature after an HELB 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

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

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

BASES

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TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

automatically by Containment Pressure-High High.

a. Containment Spray-Manual Initiation

The operator can initiate containment spray at any time from the control room by simultaneously depressing two containment spray actuation pushbuttons. Because an inadvertent actuation of containment spray could have such serious consequences, two pushbuttons must be pushed simultaneously to initiate both trains of containment spray.

The LCO requires two channels to be OPERABLE. Each channel consists of one pushbutton and two sets of contacts, with one set of contacts in each train. Therefore an inoperable channel fails both trains of manual initiation.

b. Containment Spray-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. Manual and automatic initiation of 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. 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 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.

BASES

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TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

~~c. Containment Spray-Containment Pressure-High High~~

~~This signal provides protection against a LOCA or an SLB inside containment. The transmitters are located outside of containment with the sensing lines passing through containment penetrations to sense the containment atmosphere in three different locations. The transmitters and electronics are located outside of containment. Thus, they will not experience any adverse environmental conditions and the Trip Setpoint reflects only steady state instrument uncertainties.~~

~~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 containment spray, since the consequences of an inadvertent actuation of containment spray could be serious.~~

~~The Containment Pressure-High High Function consists of two sets with three channels in each set. Each set is a two-out-of-three logic where the outputs are combined so that both sets tripped initiates Containment Spray. Since containment pressure is not used for control, this arrangement exceeds the minimum redundancy requirements. Additional redundancy is warranted because this Function is energize to trip. Containment Pressure-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 sides to pressurize the containment and reach the Containment Pressure-High High setpoints.~~

3. Containment Isolation

Containment Isolation provides isolation of the containment atmosphere 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.

Containment Isolation signals isolate all automatically isolable process lines, except component cooling water (CCW), main feedwater lines and main steam lines. The main feedwater and main steam lines are isolated by other functions because forced circulation cooling using the reactor coolant pumps (RCPs) and SGs

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TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

is the preferred (but not required) method of decay heat removal.

Since CCW is required to support RCP operation, not isolating CCW enhances unit safety by allowing operators to use forced RCS circulation to cool the unit. Isolating CCW may force the use of feed and bleed cooling, which could prove more difficult to control.

(a) Containment Isolation-Manual Initiation

The LCO requires two channels to be OPERABLE. A channel consists of one pushbutton and two sets of contacts, with one set of contacts in each train.

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

(b) Containment Isolation-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.

Manual and automatic initiation of 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, but because of the large number of components actuated on a 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 Containment Isolation. There also is adequate time for the operator to evaluate unit conditions and manually actuate individual isolation valves in response to abnormal or accident conditions.

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TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

(c) Containment Isolation-Safety Injection

Containment Isolation is also initiated by all Functions that initiate SI except Manual SI initiation. The Containment Isolation 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.

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 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. 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.

a. Steam Line Isolation-Manual Initiation

The LCO requires one channel per loop to be OPERABLE. A channel consists of the control switch and two sets of contacts, with one set of contacts in each train.

Manual initiation of Steam Line Isolation can be accomplished from the control room. There are two switches in the control room, one for each MSIV.

b. Steam Line Isolation-Automatic Actuation Logic and Actuation Relays

The LCO requires two trains to be OPERABLE. Actuation logic consists of two trains, with each train providing output to each MSIV through individual relays.

Manual and automatic initiation of steam line isolation must be OPERABLE in MODES 1, 2, and 3 when there is sufficient

APPLICABLE

energy in the RCS and SGs to have an SLB or other accident.

BASES

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TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

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 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.

~~c. Steam Line Isolation-Containment Pressure-High High~~

~~This Function actuates closure of the MSIVs in the event of a LOCA or an SLB inside containment to maintain at least one unfaulted SG as a heat sink for the reactor, and to limit the mass and energy release to containment. The transmitters are located outside containment with the sensing lines passing through containment penetrations to sense the containment atmosphere in three different locations. Containment Pressure-High High provides no input to any control functions. Thus, three OPERABLE channels are sufficient to satisfy protective requirements with two-out-of-three logic. The transmitters and electronics are located outside of containment. Thus, they will not experience any adverse environmental conditions, and the Allowable Value reflects only steady state instrument uncertainties.~~

~~Containment Pressure-High High 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 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 all MSIVs are closed and de-activated. In MODES 4, 5, and 6, there is not enough energy in the primary and secondary sides to pressurize the containment to the Containment Pressure-High High setpoint.~~

BASES

-----NOTE-----

TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

-----NOTE-----

For a description of the Coincident with T_{avg}—Low portion of ESFAS Function 4.d go to ESFAS Intrumentation Bases Page B 3.3.2-47.

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d. Steam Line Isolation-High Steam Flow Coincident With Safety Injection and Coincident With T_{avg}-Low

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.

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.

The High Steam Flow Allowable Value is a ΔP corresponding to 20% of full steam flow at no load steam pressure.

With the transmitters (d/p cells) located inside containment, it is possible for them to experience adverse environmental conditions during an SLB event. Therefore, the Allowable Values reflect 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 and 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.

BASES

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TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

~~The T_{avg}-Low Function consists of four channels (two in each loop), providing input to both trains in a two-out-of-four logic configuration. Three channels of T_{avg} are required to be OPERABLE. The accidents that this Function protects against cause reduction of T_{avg} in the entire primary system. Therefore, the provision of three OPERABLE channels ensures no single random failure disables the T_{avg}-Low Function. The T_{avg} channels provide control 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 Trip Setpoint reflects both steady state and adverse environmental instrumental uncertainties.~~

This Function must be OPERABLE in MODES 1 and 2, and in MODE 3, when a secondary side break or stuck open valve could result in rapid depressurization of the steam lines. The Steam Line Isolation Function is required to be OPERABLE in MODES 2 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.

e. Steam Line Isolation-High High Steam Flow Coincident With Safety Injection

This Function provides closure of the MSIVs during a steam 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.

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.

BASES

NOTE

TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

Therefore, two channels are sufficient to satisfy redundancy requirements.

The Allowable Value for high steam flow is a ΔP, corresponding to 120% of full steam flow at full steam pressure.

With the transmitters located inside containment, it is possible for them to experience adverse environmental conditions during an SLB event. Therefore, the Allowable Value reflects both steady state and adverse environmental instrument uncertainties.

The main steam lines isolate only if the high steam 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.

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 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.

5. Feedwater Isolation

The primary function of the Feedwater Isolation signal is to stop the excessive flow of feedwater into the SGs. This Function is necessary to mitigate the effects of a high water level in the SGs, which could result in 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.

BASES

---NOTE---

TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

The Function is actuated on an SI signal, or when the level in either SG exceeds the high setpoint.

An SI signal results in the following actions:

- MFW pumps trip (causes subsequent closure of the MFW pump discharge valves); and
- MFRVs and the bypass regulating valves close.

A SG Water Level-High in either SG results in the closure of the MFRVs and the bypass regulating valves.

a. Feedwater Isolation-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. Feedwater Isolation-Steam Generator Water Level-High~~

~~This signal provides protection against excessive feedwater flow. The ESFAS SG water level instruments provide input to the SG Water Level Control System. If this input to the SG Water Level Control System fails low, it would cause a control action to open the Feedwater Control Valves for the affected SG. The remaining channels, in a two-out-of-two configuration, would be required to detect a high SG Water Level condition and initiate a Feedwater Isolation to prevent an overfill condition. Therefore this configuration does not meet the single failure criteria of Reference 1. However, justification for a two-out-of-three Feedwater Isolation-SG Water Level-High Function is provided in NUREG-1218, Reference 5.~~

~~Table 3.3.2-1 identifies the Technical Specification Allowable Value for the Feedwater Isolation – SG Water Level – High function as not applicable (NA). No Analytical Value is assumed in the accident analysis for this function. The nominal setting required for the Feedwater Isolation – SG Water Level – High~~

BASES

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TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

~~function is 78% of span. This nominal setting was developed outside of the setpoint methodology and has been provided by the NSSS supplier.~~

c. Feedwater Isolation-Safety Injection

Feedwater Isolation is also initiated by all Functions that initiate SI. 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.

Feedwater Isolation Functions must be OPERABLE in MODES 1 and 2 and 3 except when all MFRVs, and associated bypass valves are closed and de-activated. In MODES 4, 5, and 6, the MFW System is 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 two motor driven pumps 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) (not safety related). Upon a low level in the CST, the operators can manually realign the pump suctions to the Service Water System, which is the safety related water source. The AFW System is aligned so that upon a pump start, flow is initiated to the respective SGs immediately.

a. Auxiliary Feedwater-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.

BASES

---NOTE---

TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

b. Auxiliary Feedwater-Steam Generator Water Level-Low Low

SG Water Level-Low Low provides protection against a loss of heat sink. A loss of MFW would result in a loss of SG water level. SG Water Level-Low Low in either SG will cause both motor driven pumps to start. The system is aligned so that upon start of the pumps, water immediately begins to flow to the SGs. SG Water Level-Low Low in both SGs will cause the turbine driven AFW pump to start.

With the transmitters (d/p cells) located inside containment and thus possibly experiencing adverse environmental conditions (feed line break), the Allowable Value reflects the inclusion of both steady state and adverse environmental instrument uncertainties.

c. Auxiliary Feedwater-Safety Injection

An SI signal starts the motor 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.

Functions 6.a through 6.c must be OPERABLE in MODES 1, 2, and 3 to ensure that the SGs remain the heat sink for the reactor. 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 both SGs will cause the turbine driven pump 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.

BASES

---NOTE---

TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

~~d. Auxiliary Feedwater-Undervoltage Bus A01 and A02~~

~~The LCO requires two channels per bus to be OPERABLE. A channel consists of an undervoltage relay and one set of associated contacts.~~

~~A loss of power on the A01 and A02 buses provides indication of a pending loss of both Main Feedwater pumps and the subsequent need for some method of decay heat removal. A loss of power to Buses A01 and A02 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.~~

~~Function 6.d 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 MFW pumps may be normally shut down, and thus a pump trip is not indicative of a condition requiring automatic AFW initiation.~~

~~This function is not credited for FSAR Chapter 14, "Accident Analysis." (Ref. 2)~~

7. Condensate Isolation

The Condensate Isolation Function serves as a backup protection function in the event of a Main Steam Line Break inside containment with a failure of the Main Feedwater lines to isolate. An evaluation of IE Bulletin 80-04 showed that a single failure of a MFRV to close on a SI signal could allow feedwater addition to the faulted SG, leading to containment overpressure.

a. Containment Pressure-Condensate Isolation (CPCI)

The Condensate Isolation Function is actuated when containment pressure exceeds the high setpoint, and performs the following functions:

BASES

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TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

- Trips the condensate pumps; and
- Trips the heater drain pumps.

The Condensate Isolation Function must be OPERABLE in MODES 1, 2 and 3, except when all MFRVs and associated bypass valves 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.

b. Condensate Isolation - 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.

8. Pressurizer Pressure Safety Injection Block

To allow some flexibility in unit operations, the Pressurizer Pressure SI Block is included as part of the ESFAS. The block permits a normal unit cooldown and depressurization without actuation of SI. With two-out-of-three pressurizer pressure channels (discussed previously) less than the setpoint, the operator can manually block the Pressurizer Pressure-Low and Steam Line Pressure-Low SI signals. With two-out-of-three pressurizer pressure channels above the setpoint, the Pressurizer Pressure-Low and Steam Line Pressure-Low SI signals are automatically enabled. The operator can also enable these trips by use of the respective manual reset buttons. The Allowable Value reflects only steady state instrument uncertainties.

This Function must be OPERABLE in MODES 1, 2, and 3 to allow automatic initiation of SI actuation on Pressurizer Pressure-Low or Steam Line Pressure-Low signals. This Function does not have to be OPERABLE in MODE 4, 5, or 6 because system pressure must already be below the setpoint for the requirements of the heatup and cooldown curves to be met.

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

BASES

---NOTE---

TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

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 Setpoint 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 3.3.2-1 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 outside the safety analysis. Therefore, LCO 3.0.3 should be immediately entered if applicable in the current MODE of operation.

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.

B.1, B.2.1 and B.2.2

Condition B applies to manual initiation of:

- SI; and
- Containment Isolation.

BASES

---NOTE---

TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

ACTIONS (continued)

If a channel is inoperable, 48 hours are allowed to return it to OPERABLE status. The specified Completion Time is reasonable considering that there are two automatic actuation trains and another manual initiation train OPERABLE for each Function, and the low probability of an event occurring during this interval. If the channel 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.

C.1, C.2.1 and C.2.2

Condition C applies to the automatic actuation logic and actuation relays for the following functions:

- SI;
- Containment Spray; and
- Containment Isolation.

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.

BASES

---NOTE---

TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

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

Condition D applies to:

- Containment Pressure-High;
- Pressurizer Pressure-Low;
- Steam Line Pressure-Low;
- Containment Pressure-High High;
- High Steam Flow Coincident With Safety Injection Coincident With T_{avg}-Low;
- High High Steam Flow Coincident With Safety Injection;
- SG Water level-Low Low; and
- SG Water level-High.

If one channel is inoperable, 1 hour is allowed to restore the channel to OPERABLE status or to place it in the tripped condition. Placing the channel in the tripped condition is necessary to maintain a logic configuration that satisfies redundancy requirements.

Failure to restore the inoperable channel to OPERABLE status or place it in the tripped condition within 1 hour 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.

E.1, E.2.1, and E.2.2

Condition E applies to manual initiation of Containment Spray. If one or both channels are inoperable, 1 hour is allowed to return the inoperable

BASES

---NOTE---

TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

ACTIONS (continued)

channel(s) to OPERABLE status. The Completion Time of one hour is reasonable considering that there are OPERABLE automatic actuation functions credited to perform the safety function and the low probability of an event occurring during this interval. If the inoperable channel(s) 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 (7 hours total time) and in MODE 5 within an additional 30 hours (37 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.

F.1, F.2.1, and F.2.2

Condition F applies to Manual Initiation of Steam Line Isolation.

If a channel is inoperable, 1 hour is allowed to return it to an OPERABLE status. The Completion Time of one hour is reasonable considering 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.

G.1, G.2.1 and G.2.2

Condition G applies to the automatic actuation logic and actuation relays for the Steam Line Isolation, Feedwater Isolation, Condensate Isolation and AFW actuation Functions.

BASES

---NOTE---

TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

ACTIONS (continued)

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 functions noted above.

H.1 and H.2

Condition H applies to the Undervoltage Bus A01 and A02 Function.

If one channel is inoperable, 6 hours are allowed to restore one channel to OPERABLE status or place it in the tripped condition. If placed in the tripped condition, this Function is then in a partial trip condition where one-out-of-two logic will result in actuation. The 6 hours to place the channel in the tripped condition is necessary due to plant design requiring maintenance personnel to effect the trip of the channel outside of the control room. 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, this Function is no longer required OPERABLE.

BASES

-----NOTE-----

TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

ACTIONS (continued)

I.1, I.2.1 and I.2.2

Condition I applies to the Pressurizer Pressure SI Block.

With one or more channels inoperable, the operator must verify that the interlock is in the required state for the existing unit condition. This action manually accomplishes the function of the block. Determination must be made within 1 hour. The 1 hour Completion Time is equal to the time allowed by LCO 3.0.3 to initiate shutdown actions in the event of a complete loss of ESFAS function. If the block is not in the required state (or placed in the required state) for the existing unit condition, the unit must be placed in MODE 3 within the next 6 hours and MODE 4 within the following 6 hours. 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 Pressurizer Pressure SI block.

SURVEILLANCE REQUIREMENTS

The SRs for each ESFAS Function are identified by the SRs column of Table 3.3.2-1.

A Note has been added to the SR Table to clarify that Table 3.3.2-1 determines which SRs apply to which ESFAS Functions.

Note that each channel of process protection supplies both trains of the ESFAS. 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.

BASES

---NOTE---

TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

SURVEILLANCE REQUIREMENTS (continued)

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 CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined 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 on all ESFAS Automatic Actuation Logic every 31 days on a STAGGERED TEST BASIS. This test includes the application of various simulated or actual input combinations in conjunction with each possible interlock state and verification of the required logic output. 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.

BASES

NOTE

TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.2.3

SR 3.3.2.3 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.

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 the surveillance interval extension analysis (Ref. 5) when applicable.

The Frequency of 92 days is justified in Reference 5.

SR 3.3.2.4

SR 3.3.2.4 is the performance of a MASTER RELAY TEST. The MASTER RELAY TEST is the energizing of the master relay and verifying contact operation. This test is performed every 18 months.

SR 3.3.2.5

SR 3.3.2.5 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. This test is performed every 18 months.

SR 3.3.2.6

SR 3.3.2.6 is the performance of a TADOT every 31 days. This test is a check of the Undervoltage Bus A01 and A02 Function.

The Frequency is adequate. It is based on industry operating

BASES

---NOTE---

TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

SURVEILLANCE REQUIREMENTS (continued)

experience, considering instrument reliability and operating history data.

SR 3.3.2.7

SR 3.3.2.7 is the performance of a TADOT. This test is a check of the Manual Actuation Functions. It is performed every 18 months. The Frequency is adequate, based on industry operating experience and is consistent with the typical refueling cycle.

SR 3.3.2.8

SR 3.3.2.8 is the performance of a CHANNEL CALIBRATION.

A CHANNEL CALIBRATION is performed every 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 measured parameter within the necessary range and accuracy.

CHANNEL CALIBRATIONS must be performed consistent with the assumptions of the 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 months is based on the assumption of an 18 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.

BASES

NOTE

TS BASES Pages B.3.3.2-1 through B.3.3.2-33 are only applicable to ESFAS Functions 1.a, 1.b, 1.c, 1.e, 2.a, 2.b, 3.a, 3.b, 3.c, 4.a, 4.b, 4.d (steam flow), 4.e, 5.a, 5.c, 6.a, 6.b, 6.c, 7.a, 7.b, and 8.

REFERENCES

1. FSAR, Chapter 14.
2. FSAR, 7.3.3.2.
3. IEEE-279-1968.
4. 10 CFR 50.49.
5. DGI-01, Instrument Setpoint Methodology.
6. NUREG-1218, April 1988.

B 3.3.2 Engineered Safety Feature Actuation System (ESFAS) Instrumentation

BASES

---NOTE---

TS BASES Pages B.3.3.2-34 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

BACKGROUND

The ESFAS initiates necessary safety systems, based on the values of selected unit parameters, to protect against violating core design limits and the Reactor Coolant System (RCS) pressure boundary, and to mitigate accidents. This is achieved by specifying limiting safety system settings (LSSS) in terms of parameters directly monitored by the ESFAS, as well as specifying LCOs on other reactor system parameters and equipment performance.

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

The Nominal Trip Setpoint (NTSP) specified in Table 3.3.2-1 is a predetermined setting for a protection channel 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 NTSP accounts for uncertainties in setting the channel (e.g. calibration), uncertainties in how the channel might actually perform (e.g., repeatability), changes in the point of action of the channel 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 NTSP ensures that SLs are not exceeded. Therefore, the NTSP meets the definition of an LSSS.

Technical Specifications contain values related to the OPERABILITY of equipment required for safe operation of the facility. Operable is defined in the Technical Specifications as "...being capable of performing its safety functions(s)." Relying solely on the NTSP to

BASES

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TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

BACKGROUND (continued)

define OPERABILITY in Technical Specifications would be an overly restrictive requirement if it were applied as an OPERABILITY limit for the 'as-found' value of a protection channel setting during a surveillance. This would result in Technical Specification compliance problems, as well as reports and corrective actions required by the rule which are not necessary to ensure safety. For example, an automatic protection channel with a setting that has been found to be different from the NTSP 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 NTSP and thus the automatic protective action would still have ensured that the SL would not be exceeded with the "as-found" setting of the protection channel. Therefore, the channel would still be OPERABLE since it would have performed its safety function and the only corrective action required would be to reset the channel to the NTSP to account for further drift during the next surveillance interval.

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

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

2. Fuel centerline melt shall not occur, and

3. The RCS pressure SL 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 CFR50 and 10CFR 00 criteria during AOOs.

Accidents are events that are analyzed even though they are not expected to occur during the unit life. The acceptable limit during accidents is the 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 of the event.

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

BASES

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TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

BACKGROUND (continued)

- Field transmitters or process sensors and instrumentation: provide a measurable electronic signal based on the physical characteristics of the parameter being measured;
- Signal processing equipment including analog protection system, field contacts, and protection channel sets: provide signal conditioning, compatible electrical signal output to protection system channels, and control board/control room/miscellaneous indications; and
- Relay Logic Racks including input, logic and output devices: initiates proper Engineered Safety Feature (ESF) actuation in accordance with the defined logic and based on the bistable outputs from the signal process control and protection system.

Field Transmitters or Sensors

To meet the design demands for redundancy and reliability, more than one, and often as many as four, field transmitters or sensors are used to measure unit parameters. In many cases, field transmitters or sensors that input to the ESFAS are shared with the Reactor Protection System (RPS). 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 NTSP and Allowable Value. The OPERABILITY of each transmitter or sensor 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 the channel behaviour observed during performance of the CHANNEL CHECK.

Signal Processing Equipment

Generally, three or four channels of process control equipment are used for the signal processing of unit parameters measured by the field instruments. The process control equipment provides signal conditioning, comparable output signals for instruments located on the main control board, and comparison of measured input signals with NTSPs derived from Analytical Limits established by the safety analyses. If the measured value of a unit parameter exceeds the predetermined setpoint, an output from a bistable is forwarded to the logic relays.

BASES

-----NOTE-----

TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

BACKGROUND (continued)

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

Generally, if a parameter is used for input to the Relay Logic Racks 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 actuation. Again, a single failure will neither cause nor prevent the protection function actuation.

These requirements are described in IEEE-279-1968 (Ref. 3).

NTSPs and ESFAS Setpoints

The trip setpoints used in the bistables are based on analytical limits established in the safety analyses. The calculation of the Nominal Trip Setpoints specified in Table 3.3.2-1 is such that adequate protection is provided when all sensors and processing time delays are taken into account. To allow for calibration tolerances, instrumentation uncertainties, instrument drift, and severe environments as defined by 10 CFR 50.49 (Reference 4), the Allowable Values specified in Table 3.3.2-1 in the accompanying LCO are conservative with respect to the analytical limits. A description of the methodology used to calculate the Allowable Values and Nominal Trip Setpoints (including their explicit uncertainties), as well as the as-left and as-found tolerances, is provided in FSAR Chapter 7, Reference 1. The magnitude of the uncertainties are factored into the determination of each NTSP and corresponding Allowable Value in design basis calculations. The field trip setpoint entered into the bistable is equal to or more conservative than that specified by the NTSP to account for changes in random measurement errors detectable by a COT. The Allowable Value serves as the as-found trip setpoint Technical Specification OPERABILITY limit for the purpose of the COT.

BASES

---NOTE---

TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

BACKGROUND (continued)

The NTSP is the value at which the bistables are set and is the expected value to be achieved during calibration. The NTSP value is the LSSS and ensures 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" NTSP value is within the as-left tolerance for CHANNEL CALIBRATION uncertainty allowance (i.e., ± rack calibration and comparator setting uncertainties). The NTSP value is therefore considered a "nominal value" for the purposes of the COT and CHANNEL CALIBRATION.

Nominal Trip Setpoints, in conjunction with the use of the as-found and as-left tolerances together with the requirements of 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.

Note that the Allowable Values listed in Table 3.3.2-1 are the least conservative value of the as-found setpoint that a channel can have during a periodic CHANNEL Calibration, COT, or a TADOT that requires trip setpoint verification.

Setpoints 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.

Each channel can be tested on line to verify that the signal processing equipment and setpoint accuracy is within the specified allowance requirements. 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.

Relay Logic Racks

The Relay Logic Rack equipment is used for the decision logic processing of outputs from the signal processing equipment bistables. To meet the redundancy requirements, two trains of Relay Logic Racks, each performing the same functions, are provided.

---NOTE---

TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

BACKGROUND (continued)

The Relay Logic Racks perform 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.

The bistable outputs from the signal processing equipment are sensed by the Relay Logic Rack equipment and combined into logic matrices that represent combinations indicative of various transients. If a required logic matrix combination is completed, the system will 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.

The actuation of ESF components is accomplished through master and slave relays. The Relay Logic Racks energize 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 channels.

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 Pressure-Low is a primary actuation signal for small loss of coolant accidents (LOCAs) and a backup actuation signal for steam line breaks (SLBs) outside containment. Functions such as manual initiation, not specifically credited in the accident safety analysis, are implicitly 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. 2).

Permissive and interlock setpoints allow the blocking of trips during plant start-ups and restoration of trips when the permissive conditions are not satisfied, but they are not explicitly modeled in the Safety

BASES

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TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

Analyses. These permissives and interlocks ensure that the starting conditions are consistent with the safety analysis, before preventative or mitigating actions occur. Because these permissives or interlocks are only one of multiple conservative starting assumptions for the accident analysis, they are generally considered as nominal values with regard to measurement accuracy, (i.e. the value indicated is sufficiently close to the necessary value to ensure proper operation of the safety system to turn the AOO).

The LCO requires all instrumentation performing an ESFAS Function listed in Table 3.3.2-1 in the accompanying LCO, to be OPERABLE. The Allowable Value specified in Table 3.3.2-1 is the least conservative value of the as-found setpoint that the channel can have when tested, such that a channel is OPERABLE if the as-found setpoint is conservative with respect to the Allowable Value during a CHANNEL CALIBRATION or CHANNEL OPERATIONAL TEST (COT). As such, the Allowable Value differs from the NTSP by an amount greater than or equal to the expected instrument channel uncertainties, such as drift, during the surveillance interval. In this manner, the actual setting of the channel (NTSP) will ensure that a SL is not exceeded at any given point of time as long as the channel has not drifted beyond that expected during the surveillance interval. Note that, although the channel is OPERABLE under these circumstances, the trip setpoint must be left adjusted to a value within the as-left tolerance, 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 (as-found criteria).

If the actual setting of the channel is found to be conservative with respect to the Allowable Value but is beyond the as-found tolerance band, the channel is OPERABLE but a degraded condition has been identified. During the SR performance, the condition of the channel will be evaluated. If the channel is functioning as required and is expected to pass the next surveillance, then the channel can be restored to service at the completion of the surveillance. If any of the above described evaluations determine that the channel is not performing as expected, the channel is degraded because it may not pass its next surveillance test. If the channel setpoint cannot be reset to the as-left tolerance around the NTSP, it is inoperable. After the surveillance is completed, the channels as-found setting will be entered into the Corrective Action Program for further evaluation.

BASES

---NOTE---

TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

A trip setpoint may be set more conservative than the NTSP as necessary in response to plant conditions. However, in this case, the operability of this instrument must be verified based on the field trip setpoint and not the NTSP. Failure of any instrument renders the affected channel(s) inoperable and reduces the reliability of the affected Functions.

If the actual setting of the channel is found to be non-conservative with respect to the Allowable Value, the channel would be considered inoperable. This requires corrective action including those actions required by 10 CFR 50.36 when automatic protection channels do not function as required. The LCO generally requires OPERABILITY of four or three channels in each instrumentation function and two channels in each logic function. The two-out-of-three and the two-out-of-four configurations allow one channel to be tripped during maintenance or testing without causing an ESFAS initiation. Two logic channels are required to ensure no single random failure disables the ESFAS.

The required channels of ESFAS instrumentation provide unit protection in the event of any of the analyzed accidents. 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

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

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

BASES

---NOTE---

TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

- Containment Isolation;
- Containment Ventilation Isolation;
- Reactor Trip;
- Feedwater Isolation;
- Start of motor driven auxiliary feedwater (AFW) pumps; and
- Control room ventilation isolation.

These other functions ensure:

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

d. Safety Injection-Pressurizer Pressure-Low

This signal provides protection against the following accidents.

- Inadvertent opening of a steam generator (SG) relief or safety valve;
- SLB;
- A spectrum of rod cluster control assembly ejection accidents (rod ejection);

BASES

-----NOTE-----

TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

- Inadvertent opening of a pressurizer relief or safety valve;
- LOCAs; and
- SG Tube Rupture.

Pressurizer pressure provides both control and protection functions: input to the Pressurizer Pressure Control System, reactor trip, and SI. However, two independent 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/SI event. Additionally, in the event of a failed open spray valve, RCS depressurization would be slow enough to be recognized by the operator and mitigated through manual actions to close the spray valve and energize the pressurizer heaters prior to reaching saturated conditions in the RCS. Therefore, there would be no uncontrolled loss of RCS inventory and no need for boron injection.

Therefore, only three protection channels are necessary to satisfy the protective requirements.

This Function must be OPERABLE in MODES 1, 2, and 3 (above the Pressurizer Pressure interlock) to mitigate the consequences of an HELB inside containment. This signal may be manually blocked by the operator below the Pressurizer Pressure interlock. Automatic SI actuation below this pressure setpoint is then performed by the Containment Pressure-High signal.

This Function is not required to be OPERABLE in MODE 3 below the Pressurizer Pressure interlock. 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.

2. Containment Spray

Containment Spray provides three primary functions:

1. Lowers containment pressure and temperature after an HELB in

BASES

---NOTE---

TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

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

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

c. Containment Spray-Containment Pressure-High High

This signal provides protection against a LOCA or a SLB inside containment. The transmitters are located outside of containment with the sensing lines passing through containment penetrations to sense the containment atmosphere in three different locations. The transmitters and electronics are located outside of containment. Thus, they will not experience any adverse environmental conditions and the NTSP reflects only steady state instrument uncertainties.

BASES

---NOTE---

TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

This is one of the only Functions that require the bistable output to energize to perform its required action. It is not desirable to have a loss of power actuate containment spray, since the consequences of an inadvertent actuation of containment spray could be serious.

The Containment Pressure-High High Function consists of two sets with three channels in each set. Each set is a two-out-of-three logic where the outputs are combined so that both sets tripped initiates Containment Spray. Since containment pressure is not used for control, this arrangement exceeds the minimum redundancy requirements. Additional redundancy is warranted because this Function is energized to trip. Containment Pressure-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 sides to pressurize the containment and reach the Containment Pressure-High High setpoints.

4. Steam Line Isolation

Isolation of the main steam lines provides protection in the event of a 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 a SLB upstream of the main steam isolation valves (MSIVs), inside or outside of containment, closure of the MSIVs limits the accident to the blowdown from only the affected SG. For a SLB downstream of the MSIVs, closure of the MSIVs terminates the accident as soon as the steam lines depressurize. 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.

BASES

-----NOTE-----

TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

c. Steam Line Isolation-Containment Pressure-High High

This Function actuates closure of the MSIVs in the event of a LOCA or a SLB inside containment to maintain at least one unfaulted SG as a heat sink for the reactor, and to limit the mass and energy release to containment. The transmitters are located outside containment with the sensing lines passing through containment penetrations to sense the containment atmosphere in three different locations. Containment Pressure-High High provides no input to any control functions. Thus, three OPERABLE channels are sufficient to satisfy protective requirements with two-out-of-three logic. The transmitters and electronics are located outside of containment. Thus, they will not experience any adverse environmental conditions, and the NTSP reflects only steady-state instrument uncertainties.

Containment Pressure-High High 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 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 all MSIVs are closed and de-activated. In MODES 4, 5, and 6, there is not enough energy in the primary and secondary sides to pressurize the containment to the Containment Pressure-High High setpoint.

BASES

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

TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

APPLICABLE SAFETY ANALYSES, LCO AND APPLICABILITY (continued)

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

For a description of the High Steam Flow portion of ESFAS Function 4.d go to ESFAS Instrumentation Bases Page B 3.3.2-16.

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d. Steam Line Isolation-High Steam Flow Coincident With Safety Injection and Coincident With T_{avg}-Low

This Function provides closure of the MSIVs during a 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.

The main steam line isolates only if the high steam flow signal occurs coincident with an SI and 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.

The T_{avg}-Low Function consists of four channels (two in each loop), providing input to both trains in a two-out-of-four logic configuration. Three channels of T_{avg} are required to be OPERABLE. The accidents that this Function protects against cause reduction of T_{avg} in the entire primary system. Therefore, the provision of three OPERABLE channels ensures no single random failure disables the T_{avg}-Low Function. The T_{avg} channels provide control 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 a SLB event. Therefore, the NTSP reflects both steady state and adverse environmental instrumental uncertainties.

BASES

-----NOTE-----

TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

This Function must be OPERABLE in MODES 1 and 2, and in MODE 3, when a secondary side break or stuck open valve could result in rapid depressurization of the steam lines. The Steam Line Isolation Function is required to be OPERABLE in MODES 2 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.

5. Feedwater Isolation

The primary function of the Feedwater Isolation signal is to stop the excessive flow of feedwater into the SGs. This Function is necessary to mitigate the effects of a high water level in the SGs, which could result in 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.

The Function is actuated on an SI signal, or when the level in either SG exceeds the high setpoint.

An SI signal results in the following actions:

- MFW pumps trip (causes subsequent closure of the MFW pump discharge vales) and
- MFRVs and the bypass regulating valves close.

A SG Water Level-High in either SG results in the closure of the MFRVs and the bypass regulating valves.

b. Feedwater Isolation-Steam Generator Water Level-High

This signal provides protection against excessive feedwater flow. The ESFAS SG water level instruments provide input to the SG Water Level Control System. If this input to the SG Water Level Control System fails low, it would cause a control action to open the Feedwater Control Valves for the affected SG.

BASES

---NOTE---

TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

The remaining channels, in a two-out-of-two configuration, would be required to detect a high SG Water Level condition and initiate a Feedwater Isolation to prevent an overfill condition. Therefore this configuration does not meet the single failure criteria of Reference 2. However, justification for a two-out-of-three Feedwater Isolation-SG Water Level-High Function is provided in NUREG-1218, Reference 5.

Feedwater Isolation Functions must be OPERABLE in MODES 1 and 2 and 3 except when all MFRVs, and associated bypass valves are closed and de-activated. In MODES 4, 5, and 6, the MFW System is 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 two motor driven pumps 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) (not safety related). Upon a low level in the CST, the operators can manually realign the pump suctions to the Service Water System, which is the safety related water source. The AFW System is aligned so that upon a pump start, flow is initiated to the respective SGs immediately.

d. Auxiliary Feedwater-Undervoltage Bus A01 and A02

The LCO requires two channels per bus to be OPERABLE. A channel consists of an undervoltage relay and one set of associated contacts.

BASES

---NOTE---

TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

APPLICABLE SAFETY ANALYSES, LCO, AND APPLICABILITY (continued)

A loss of power on the A01 and A02 buses provides indication of a pending loss of both Main Feedwater pumps and the subsequent need for some method of decay heat removal. A loss of power to Buses A01 and A02 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.

Function 6.d 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 MFW pumps may be normally shut down, and thus a pump trip is not indicative of a condition requiring automatic AFW initiation.

The ESFAS instrumentation satisfies Criterion 3 of 10 CFR 50.36(c)2(ii).

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 NTSP is found non-conservative with respect to the Allowable Value, or the Channel is not functioning as required, 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 3.3.2-1 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 outside the safety analysis. Therefore, LCO 3.0.3 should be immediately entered if applicable in the current MODE of operation.

A.1

Condition A applies to all ESFAS protection functions.

BASES

---NOTE---

TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

ACTIONS (continued)

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 arethose from the referenced Conditions and Required Actions.

B.1, B.2.1 and B.2.2

Condition B applies to manual initiation of:

- SI; and
- Containment Isolation.

If a channel is inoperable, 48 hours are allowed to return it to OPERABLE status. The specified Completion Time is reasonable considering that there are two automatic actuation trains and another manual initiation train OPERABLE for each Function, and the low probability of an event occurring during this interval. If the channel 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.

C.1, C.2.1 and C.2.2

Condition C applies to the automatic actuation logic and actuation relays for the following functions:

- SI;
- Containment Spray; and
- Containment Isolation.

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

BASES

---NOTE---

TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

ACTIONS (continued)

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.

D.1, D.2.1 and D.2.2

Condition D applies to:

- Containment Pressure-High;
- Pressurizer Pressure-Low;
- Steam Line Pressure-Low;
- Containment Pressure-High High;
- High Steam Flow Coincident With Safety Injection Coincident With T_{avg}-Low;
- High High Steam Flow Coincident With Safety Injection;
- SG Water level-Low Low; and
- SG Water level-High.

If one channel is inoperable, 1 hour is allowed to restore the channel to OPERABLE status or to place it in the tripped condition. Placing the channel in the tripped condition is necessary to maintain a logic configuration that satisfies redundancy requirements.

Failure to restore the inoperable channel to OPERABLE status or place it in the tripped condition within 1 hour requires the unit be placed in MODE 3 within the following 6 hours and MODE 4 within the next 6 hours.

BASES

-----NOTE-----

TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

ACTIONS (continued)

The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems. In MODE 4, these Functions are no longer required OPERABLE.

E.1, E.2.1, and E.2.2

Condition E applies to manual initiation of Containment Spray. If one or both channels are inoperable, 1 hour is allowed to return the inoperable channel(s) to OPERABLE status. The Completion Time of one hour is reasonable considering that there are OPERABLE automatic actuation functions credited to perform the safety function and the low probability of an event occurring during this interval. If the inoperable channel(s) 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 (7 hours total time) and in MODE 5 within an additional 30 hours (37 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.

F.1, F.2.1, and F.2.2

Condition F applies to Manual Initiation of Steam Line Isolation.

If a channel is inoperable, 1 hour is allowed to return it to an OPERABLE status. The Completion Time of one hour is reasonable considering 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.

BASES

---NOTE---

TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

ACTIONS (continued)

G.1, G.2.1 and G.2.2

Condition G applies to the automatic actuation logic and actuation relays for the Steam Line Isolation, Feedwater Isolation, Condensate Isolation and AFW actuation 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 functions noted above.

H.1 and H.2

Condition H applies to the Undervoltage Bus A01 and A02 Function.

If one channel is inoperable, 6 hours are allowed to restore one channel to OPERABLE status or place it in the tripped condition. If placed in the tripped condition, this Function is then in a partial trip condition where one-out-of-two logic will result in actuation. The 6 hours to place the channel in the tripped condition is necessary due to plant design requiring maintenance personnel to effect the trip of the channel outside of the control room. Failure to restoré 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, this Function is no longer required OPERABLE.

-NOTE-

TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

ACTIONS (continued)

I.1, I.2.1 and I.2.2

Condition I applies to the Pressurizer Pressure SI Block.

With one or more channels inoperable, the operator must verify that the interlock is in the required state for the existing unit condition. This action manually accomplishes the function of the block. Determination must be made within 1 hour. The 1 hour Completion Time is equal to the time allowed by LCO 3.0.3 to initiate shutdown actions in the event of a complete loss of ESFAS function. If the block is not in the required state (or placed in the required state) for the existing unit condition, the unit must be placed in MODE 3 within the next 6 hours and MODE 4 within the following 6 hours. 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 Pressurizer Pressure SI block.

The SRs for each ESFAS Function are identified by the SRs column of Table 3.3.2-1.

A Note has been added to the SR Table to clarify that Table 3.3.2-1 determines which SRs apply to which ESFAS Functions.

Note that each channel of process protection supplies both trains of the ESFAS. 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.

BASES

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TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

SURVEILLANCE REQUIREMENTS

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 CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined 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 on all ESFAS Automatic Actuation Logic every 31 days on a STAGGERED TEST BASIS. This test includes the application of various simulated or actual input combinations in conjunction with each possible interlock state and verification of the required logic output. 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.

SR 3.3.2.3

SR 3.3.2.3 is the performance of a COT.

BASES

---NOTE---

TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

SURVEILLANCE REQUIREMENTS (continued)

A COT is performed on each required channel to ensure the entire channel will perform the intended Function. Setpoints must be found conservative with respect to the Allowable Values specified in Table 3.3.2-1.

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-eft" values must also be recorded and reviewed for consistency with the assumptions of the setpoint methodology.

The Frequency of 92 days is justified in Reference 5.

SR 3.3.2.3 is modified by two Notes as identified in Table 3.3.2-1. The first Note requires evaluation of channel performance for the condition where the as-found setting for the channel setpoint is outside its as-found tolerance but conservative with respect to the Allowable Value. Evaluation of channel performance will verify that the channel will continue to behave in accordance with the safety analysis assumptions and the channel performance assumptions in the setpoint methodology. The purpose of the assessment is to ensure confidence in the channel performance prior to returning the channel to service. The performance of these channels will be evaluated under the station's Corrective Action Program. Entry into the Corrective Action Program will ensure required review and documentation of the condition to establish a reasonable expectation for continued OPERABILITY. The second Note requires that the as-left setting for the channel be returned to within the as-left tolerance of the NTSP. Where a setpoint more conservative than the NTSP is used in the plant surveillance procedures (field trip setpoint), the as-left and as-found tolerances, as applicable, will be applied to the surveillance procedure setpoint. This will ensure that sufficient margin to the Safety Limit and/or Analytical Limit is maintained. If the as-left channel setting cannot be returned to a setting within the as-left tolerance of the NTSP, then the channel shall be declared inoperable.

BASES

---NOTE---

TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

SURVEILLANCE REQUIREMENTS (continued)

The second Note also requires that the methodologies for calculating the as-left and as-found tolerances be in the FSAR Chapter 7, Reference 1.

SR 3.3.2.4

SR 3.3.2.4 is the performance of a MASTER RELAY TEST. The MASTER RELAY TEST is the energizing of the master relay and verifying contact operation. This test is performed every 18 months.

SR 3.3.2.5

SR 3.3.2.5 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. This test is performed every 18 months.

SR 3.3.2.6

SR 3.3.2.6 is the performance of a TADOT every 31 days. This test is a check of the Undervoltage Bus A01 and A02 Function.

The Frequency is adequate. It is based on industry operating experience, considering instrument reliability and operating history data.

SR 3.3.2.7

SR 3.3.2.7 is the performance of a TADOT. This test is a check of the Manual Actuation Functions. It is performed every 18 months. The Frequency is adequate, based on industry operating experience and is consistent with the typical refueling cycle.

SR 3.3.2.8

SR 3.3.2.8 is the performance of a CHANNEL CALIBRATION.

BASES

-----NOTE-----

TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

SURVEILLANCE REQUIREMENTS (continued)

A CHANNEL CALIBRATION is performed every 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 measured parameter within the necessary range and accuracy.

CHANNEL CALIBRATIONS must be performed consistent with the assumptions of the 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 months is based on the assumption of an 18 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 3.3.2.8 is modified by two Notes as identified in Table 3.3.2-1. The first Note requires evaluation of channel performance for the condition where the as-found setting for the channel setpoint is outside its as-found tolerance but conservative with respect to the Allowable Value. Evaluation of channel performance will verify that the channel will continue to behave in accordance with the safety analysis assumptions and the channel performance assumptions in the setpoint methodology. The purpose of the assessment is to ensure confidence in the channel performance prior to returning the channel to service. The performance of these channels will be evaluated under the station's Corrective Action Program. Entry into the Corrective Action Program will ensure required review and documentation of the condition to establish a reasonable expectation for continued OPERABILITY. The second Note requires that the as-left setting for the channel be returned to within the as-left tolerance of the NTSP. Where a setpoint more conservative than the NTSP is used in the plant surveillance procedures(field trip setpoint), the as-left and as-found tolerances, as applicable, will be applied to the surveillance procedure setpoint. This will ensure that sufficient margin to the Safety Limit and/or Analytical Limit is maintained. If the as-left channel setting cannot be returned to a setting within the as-left tolerance of the NTSP, then the channel shall be declared inoperable.

BASES

-----NOTE-----

TS BASES Pages B.3.3.2-35 through B.3.3.2-60 are only applicable to ESFAS Functions 1.d, 2.c, 4.c, 4.d (Tavg), 5.b, and 6.d.

SURVEILLANCE REQUIREMENTS (continued)

The second Note also requires that the methodologies for calculating the as-left and as-found tolerances be in the FSAR, Chapter 7, Reference 1.

REFERENCES

1. FSAR Chapter 7
2. FSAR, Chapter 14.
3. IEEE-279-1968.
4. 10 CFR 50.49.
5. NUREG-1218, April 1988.