2.2 LIMITING SAFETY SYSTEM SETTINGS

REACTOR TRIP SYSTEM INSTRUMENTATION SETPOINTS

2.2.1 The reactor trip system instrumentation and interlocks setpoints shall be consistent with the Trip Setpoint values shown in Table 2.2-1.

APPLICABILITY: As shown for each channel in Table 3.3-1.

ACTION:

a. With a reactor trip system instrumentation or interlock setpoint less conservative than the value shown in the Trip Setpoint column of Table 2.2-1 adjust the setpoint consistent with the Trip Setpoint value.

b. With the reactor trip system instrumentation or interlock setpoint less conservative than the value shown in the Allowable Values column of Table 2.2-1, place the channel in the tripped condition within 1 hour, and within the following 12 hours either:

1. Determine that Equation 2.2-1 was satisfied for the affected channel and adjust the setpoint consistent with the Trip Setpoint value of Table 2.2-1, or

2. Declare the channel inoperable and apply the applicable ACTION statement requirement of Specification 3.3.1 until the channel is restored to OPERABLE status with its setpoint adjusted consistent with the Trip Setpoint value.

EQUATION 2.2-1 $Z + R + S \leq TA$

where:

Z = the value for column Z of Table 2.2-1 for the affected channel,

R = the "as measured" value (in percent span) of rack error for the affected channel,

S = either the "as measured" value (in percent span) of the sensor error, or the value is column S of Table 2.2-1 for the affected channel, and

TA = the value from column TA of Table 2.2-1 for the affected channel.

declare the channel inoperable and apply the applicable ACTION statement requirements of Specification 3.3.1 until the channel is restored to OPERABLE status with its setpoint adjusted consistent with the Trip Setpoint Value.

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2.2 LIMITING SAFETY SYSTEM SETTINGS

REACTOR TRIP SYSTEM INSTRUMENTATION SETPOINTS

2.2.1 The reactor trip system instrumentation and interlocks setpoints shall be consistent with the Trip Setpoint values shown in Table 2.2-1.

APPLICABILITY: As shown for each channel in Table 3.3-1.

ACTION:

a. With a reactor trip system instrumentation or interlock setpoint less conservative than the value shown in the Trip Setpoint column of Table 2.2-1 adjust the setpoint consistent with the Trip Setpoint value.

b. With the reactor trip system instrumentation or interlock setpoint less conservative than the value shown in the Allowable Values column of Table 2.2-1, declare the channel inoperable and apply the applicable ACTION statement requirements of Specification 3.3.1 until the channel is restored to OPERABLE status with its setpoint adjusted consistent with the Trip Setpoint Value.

TABLE 2.2-1

REACTOR TRIP SYSTEM INSTRUMENTATION TRIP SETPOINTS

Functional Unit	Total Allowance (TA)	Z	S	Trip Setpoint	Allowable Value
1. Manual Reactor Trip	Not Applicable	NA	NA	NA	NA
2. Power Range, Neutron Flux High Sepoint Low Setpoint	 7.5 8.3	 4.56 4.56	 0 0	 ≤109% of RTP ≤25% of RTP	 ≤111.2% of RTP ≤27.2% of RTP
3. Power Range, Neutron Flux High Positive Rate	1.6	0.5	0	≤5% of RTP with a time constant ≥2 seconds	≤6.3% of RTP with a time constant ≥2 seconds
4. Power Range, Neutron Flux High Negative Rate	1.6	0.5	0	≤5% of RTP with a time constant ≥ 2 seconds	≤6.3% of RTP with a time constant ≥2 seconds
5. Intermediate Range, Neutron Flux	17.0	8.4	0	≤25% of RTP	≤31% of RTP
6. Source Range, Neutron Flux	17.0	10.0	0	$\leq 10^5$ cps	$\leq 1.4 \times 10^5$ cps
7. Overtemperature ΔT	10.3	7.8	1.6 & 1.2**	See note 1	See note 2
8. Overpower ΔT	5.2	1.96	1.6	See note 3	See note 4
9. Pressurizer Pressure-Low	3.1	0.71	1.5	≥1870 psig	≥1859 psig
10. Pressurizer Pressure-High	3.1	0.71	1.5	≤2380 psig	≤2391 psig
11. Pressurizer Water Level-High	5.0	2.18	1.5	≤92% of instrument span	≤93.8% of instrument span
12. Loss of Flow	2.5	1.48	[illegible]6	≥90% of loop design flow*	≥88.9% of loop design flow*

*Loop design flow = 94,870 gpm
RTP - RATED THERMAL POWER
~~**1.6% span for Delta-T (RTDs) and 1.2% for Pressurizer Pressure.~~

TABLE 2.2-1

REACTOR TRIP SYSTEM INSTRUMENTATION TRIP SETPOINTS

	Functional Unit	Trip Setpoint	Allowable Value
1.	Manual Reactor Trip	NA	NA
2.	Power Range, Neutron Flux High Setpoint Low Setpoint	 $\leq$109% of RTP $\leq$25% of RTP	 $\leq$111.2% of RTP $\leq$27.2% of RTP
3.	Power Range, Neutron Flux High Positive Rate	$\leq$5% of RTP with a time constant $\geq$2 seconds	$\leq$6.3% of RTP with a time constant $\geq$2 seconds
4.	Power Range, Neutron Flux High Negative Rate	$\leq$5% of RTP with a time constant $\geq$2 seconds	$\leq$6.3% of RTP with a time constant $\geq$2 seconds
5.	Intermediate Range, Neutron Flux	$\leq$25% of RTP	$\leq$31% of RTP
6.	Source Range, Neutron Flux	$\leq 10^5$ cps	$\leq 1.4 \times 10^5$ cps
7.	Overtemperature ΔT	See note 1	See note 2
8.	Overpower ΔT	See note 3	See note 4
9.	Pressurizer Pressure-Low	$\geq$1870 psig	$\geq$1859 psig
10.	Pressurizer Pressure-High	$\leq$2380 psig	$\leq$2391 psig
11.	Pressurizer Water Level-High	$\leq$92% of instrument span	$\leq$93.8% of instrument span
12.	Loss of Flow	$\geq$90% of loop design flow*	$\geq$88.9% of loop design flow*

*Loop design flow = 94,870 gpm
RTP - RATED THERMAL POWER

TABLE 2.2-1 (continued)

REACTOR TRIP SYSTEM INSTRUMENTATION TRIP SETPOINTS

Functional Unit	Total Allowance (TA)	Z	S	Trip Setpoint	Allowable Value
13. Steam Generator Water Level Low-Low	12.0	~~9.58~~ 10.5	~~1.6~~ 1.7	>12% of span from 0 to 30% RTP increasing linearly to >30.0% of span from 30% to 100% RTP	>~~10.2~~ 11.2% of span from 0 to 30% RTP increasing linearly to >~~28.2~~% of span from 30% to 100% RTP ≥ 29.2
14. Steam/Feedwater Flow Mis-Match Coincident With	16.0	13/24	1.5/ 1.5	<40% of full steam flow at RTP	<42.5% of full steam flow at RTP
Steam Generator Water Level Low-Low	12.0	~~9.18~~ 10.5	~~1.6~~ 1.7	>12% of span from 0 to 30% RTP increasing linearly to >30.0% of span from 30% to 100% RTP	>~~10.2~~ 11.2% of span from 0 to 30% RTP increasing linearly to >~~28.2~~% of span from 30% to 100% RTP ≥ 29.2
15. Undervoltage - Reactor Coolant Pump	2.1	1.28	0.23	≥4830 volts	≥4760
16. Underfrequency - Reactor Coolant Pumps	7.5	0	0.1	≥57.5 Hz	≥57.1 Hz
17. Turbine Trip					
A. Low Trip System Pressure	NA	NA	NA	>800 psig	>750 psig
B. Turbine Stop Valve Closure	NA	NA	NA	≥1% open	≥1% open

** RATED THERMAL POWER

TABLE 2.2-1 (continued)

REACTOR TRIP SYSTEM INSTRUMENTATION TRIP SETPOINTS

	Functional Unit	Trip Setpoint	Allowable Value
13.	Steam Generator Water Level Low-Low	≥12% of span from 0 to 30% RTP increasing linearly to ≥30.0% of span from 30% to 100% RTP	≥11.2% of span from 0 to 30% RTP increasing linearly to ≥29.2% of span from 30% to 100% RTP
14.	Steam/Feedwater Flow Mis-Match Coincident With	≤40% of full steam flow at RTP	≤42.5% of full steam flow at RTP
	Steam Generator Water Level Low-Low	≥12% of span from 0 to 30% RTP increasing linearly to ≥30.0% of span from 30% to 100% RTP	≥11.2% of span from 0 to 30% RTP increasing linearly to ≥29.2% of span from 30% to 100% RTP
15.	Undervoltage - Reactor Coolant Pump	≥4830 volts	≥4760
16.	Underfrequency - Reactor Coolant Pumps	≥57.5 Hz	≥57.1 Hz
17.	Turbine Trip		
	A. Low Trip System Pressure	≥800 psig	≥750 psig
	B. Turbine Stop Valve Closure	≥1% open	≥1% open

RTP - RATED THERMAL POWER

TABLE 2.2-1 (continued)

REACTOR TRIP SYSTEM INSTRUMENTATION TRIP SETPOINTS

Functional Unit	Total Allowance (TA)	Z	S	Trip Setpoint	Allowable Value
18. Safety Injection Input from ESF	NA	NA	NA	NA	NA
19. Reactor Trip System Interlocks					
A. Intermediate Range Neutron Flux, P-6	NA	NA	NA	>7.5 x 10-6% Indication	>4.5 x 10-6% Indication
B. Low Power Reactor Trips Block, P-7					
a. P-10 Input	7.5	4.56	0	≤10% of RTP	≤12.2% of RTP
b. P-13 Input	7.5	4.56	0	<10% turbine impulse pressure equivalent	<12.2% of turbine impulse pressure equivalent
C. Power Range Neutron Flux P-8	7.5	4.56	0	≤38% of RTP	≤40.2% of RTP
D. Low Setpoint Power Range Neutron Flux, P-10	7.5	4.56	0	≥10% of RTP	≥7.8% of RTP
E. Turbine Impulse Chamber Pressure, P-13	7.5	4.56	0	<10% turbine impulse pressure equivalent	<12.2% turbine pressure equivalent
F. Power Range Neutron Flux, P-9	7.5	4.56	0	≤50% of RTP	≤52.2% of RTP
20. Reactor Trip Breakers	NA	NA	NA	NA	NA
21. Automatic Actuation Logic	NA	NA	NA	NA	NA

RTP = RATED THERMAL POWER

TABLE 2.2-1 (continued)

REACTOR TRIP SYSTEM INSTRUMENTATION TRIP SETPOINTS

	Functional Unit	Trip Setpoint	Allowable Value
18.	Safety Injection Input from ESF	NA	NA
19.	Reactor Trip System Interlocks		
	A. Intermediate Range Neutron Flux, P-6	$\geq 7.5 \times 10^{-6}$% indication	$\geq 4.5 \times 10^{-6}$% indication
	B. Low Power Reactor Trips Block, P-7 a. P-10 input	≤10% of RTP	≤12.2% of RTP
	b. P-13 input	≤10% turbine impulse pressure equivalent	≤12.2% of turbine impulse pressure equivalent
	C. Power Range Neutron Flux P-8	≤38% of RTP	≤40.2% of RTP
	D. Low Setpoint Power Range Neutron Flux, P-10	≥10% of RTP	≥7.8% of RTP
	E. Turbine Impulse Chamber Pressure, P-13	≤10% turbine impulse pressure equivalent	≤12.2% turbine pressure equivalent
	F. Power Range Neutron Flux, P-9	≤50% of RTP	≤52.2% of RTP
20.	Reactor Trip Breakers	NA	NA
21.	Automatic Actuation Logic	NA	NA

RTP - RATED THERMAL POWER

TABLE 2.2-1 (Continued)

REACTOR TRIP SYSTEM INSTRUMENTATION TRIP SETPOINTS

NOTATION (Continued)

NOTE 1: (Continued)

and $f_1(\Delta I)$ is a 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 such that:

(i) for $q_t - q_b$ between -24 percent and +4 percent $f_1(\Delta I) = 0$ where q_t and q_b are percent RATED THERMAL POWER in the top and bottom halves of the core respectively, and $q_t + q_b$ is total THERMAL POWER in percent of RATED THERMAL POWER.

(ii) for each percent that the magnitude of $q_t - q_b$ exceeds -24 percent, the ΔI trip setpoint shall be automatically reduced by 2.27 percent of its value at RATED THERMAL POWER.

(iii) for each percent that the magnitude of $q_t - q_b$ exceeds +4 percent, the ΔI trip setpoint shall be automatically reduced by 2.34 percent of its value at RATED THERMAL POWER.

NOTE 2: The channel's maximum trip setpoint shall not exceed its computed trip point by more than 2.2 percent ΔT Span.

NOTE 3: OVERPOWER ΔT

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

Where:

ΔT	=	as defined in Note 1
ΔT_o	=	as defined in Note 1
K_4	$\le$	1.0875
K_5	$\ge$	0.02/°F for increasing average temperature and 0 for decreasing average temperature
$\frac{\tau_3 S}{1 + \tau_3 S}$	=	The function generated by the rate-lag controller for T_{avg} dynamic compensation

TABLE 2.2-1 (Continued)

REACTOR TRIP SYSTEM INSTRUMENTATION TRIP SETPOINTS

NOTATION (Continued)

NOTE 1: (Continued)

and f_1 (ΔI) is a 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 such that:

(i) for q_t - q_b between -24 percent and +4 percent f_1 (ΔI) = 0 where q_t and q_b are percent RATED THERMAL POWER in the top and bottom halves of the core respectively, and q_t + q_b is total THERMAL POWER in percent of RATED THERMAL POWER.

(ii) for each percent that the magnitude of q_t - q_b exceeds -24 percent, the ΔT trip setpoint shall be automatically reduced by 2.27 percent of its value at RATED THERMAL POWER.

(iii) for each percent that the magnitude of q_t - q_b exceeds +4 percent, the ΔT trip setpoint shall be automatically reduced by 2.34 percent of its value at RATED THERMAL POWER.

NOTE 2: The channel's maximum trip setpoint shall not exceed its computed trip point by more than 2.2 percent ΔT Span.

NOTE 3: OVERPOWER ΔT

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

where: ΔT = as defined in Note 1

ΔT_o = as defined in Note 1

K_4 ≤ 1.0875

K_5 ≥ 0.02/°F for increasing average temperature and 0 for decreasing average temperature

$\frac{\tau_3 S}{1 + \tau_3 S}$ = The function generated by the rate-lag controller for T_{avg} dynamic compensation

TABLE 2.2-1 (Continued)

REACTOR TRIP SYSTEM INSTRUMENTATION TRIP SETPOINTS

NOTATION (Continued)

NOTE 3 (continued)

τ_3	=	Time constant utilized in the rate lag controller for T_{avg}, τ_3 ≤ 10 secs
K_6	≥	0.00156/°F for T > T" and K_6 = 0 for T ≤ T"
T	=	as defined in Note 1
T"	≤	587.4°F Reference T_{avg} at RATED THERMAL POWER
S	=	as defined in Note 1

NOTE 4: The channel's maximum trip setpoint shall not exceed its computed trip point by more than 2.4 percent ΔI Span.

TABLE 2.2-1 (Continued)

REACTOR TRIP SYSTEM INSTRUMENTATION TRIP SETPOINTS

NOTATION (Continued)

NOTE 3: (continued)

τ_3	=	Time constant utilized in rate-lag controller for T_{avg}, $\tau_3 \geq 10$ secs.
K_6	$\geq$	0.00156/°F for $T > T''$ and $K_6 = 0$ for $T \leq T''$
T	=	as defined in Note 1
T''	$\leq$	587.4°F Reference T_{avg} at RATED THERMAL POWER
S	=	as defined in Note 1

NOTE 4: The channel's maximum trip setpoint shall not exceed its computed trip point by more than 2.4 percent ΔT Span.

2.2.1 REACTOR TRIP SYSTEM INSTRUMENTATION SETPOINTS

The Reactor Trip Setpoint Limits specified in Table 2.2-1 are the nominal values at which the Reactor Trips are set for each functional unit. The Trip Setpoints have been selected to ensure that the reactor core and reactor coolant system are prevented from exceeding their safety limits during normal operation and design basis anticipated operational occurrences and to assist the Engineered Safety Features Actuation System in mitigating the consequences of accidents. The setpoint for a reactor trip system or interlock function is considered to be adjusted consistent with the nominal value when the "as measured" setpoint is within the band allowed for calibration accuracy.

To accommodate the instrument drift assumed to occur between operational tests and the accuracy to which setpoints can be measured and calibrated, Allowable Values for the reactor trip setpoints have been specified in Table 2.2-1. Operation with setpoints less conservative than the Trip Setpoint but within the Allowable Value is acceptable since an allowance has been made in the safety analysis to accommodate this error. An optional provision has been included for determining the OPERABILITY of a channel when its trip setpoint is found to exceed the Allowable Value. The methodology of this option utilizes the "as measured" deviation from the specified calibration point for rack and sensor components in conjunction with a statistical combination of the other uncertainties of the instrumentation to measure the process variable and the uncertainties in calibrating the instrumentation. In Equation 2.2-1, $Z + R + S \leq TA$, the interactive effects of the errors in the rack and the sensor, and the "as measured" values of the errors are considered. Z, as specified in Table 2.2-1, in percent span, is the statistical summation of errors assumed in the analysis excluding those associated with the sensor and rack drift and the accuracy of their measurement. TA or Total Allowance is the difference, in percent span, between the trip setpoint and the value used in the analysis for reactor trip. R or Rack Error is the "as measured" deviation, in percent span, for the affected channel from the specified trip setpoint. S or Sensor Error is either the "as measured" deviation of the sensor from its calibration point or the value specified in Table 2.2-1, in percent span, from the analysis assumptions. Use of Equation 2.2-1 allows for a sensor drift factor, an increased rack drift factor, and provides a threshold value for REPORTABLE EVENTS.

The methodology to derive the trip setpoints is based upon combining all of the uncertainties in the channels. Inherent to the determination of the trip setpoints are the magnitudes of these channel uncertainties. Sensors and other instrumentation utilized in these channels are expected to be capable of operating within the allowances of these uncertainty magnitudes. Rack drift in excess of the Allowable Value exhibits the behavior that the rack has not met its allowance. Being that there is a small statistical chance that this will happen, an infrequent excessive drift is expected. Rack or sensor drift, in excess of the allowance that is more than occasional, may be indicative of more serious problems and should warrant further investigation.

2.2.1 REACTOR TRIP SYSTEM INSTRUMENTATION SETPOINTS

The Reactor Trip Setpoint Limits specified in Table 2.2-1 are the nominal values at which the Reactor Trips are set for each functional unit. The Trip Setpoints have been selected to ensure that the reactor core and reactor coolant system are prevented from exceeding their safety limits during normal operation and design basis anticipated operational occurrences and to assist the Engineered Safety Features Actuation System in mitigating the consequences of accidents. The setpoint for a reactor trip system or interlock function is considered to be adjusted consistent with the nominal value when the "as measured" setpoint is within the band allowed for calibration accuracy.

To accommodate the instrument drift assumed to occur between operational tests and the accuracy to which setpoints can be measured and calibrated, Allowable Values for the reactor trip setpoints have been specified in Table 2.2-1. Operation with setpoints less conservative than the Trip Setpoint but within the Allowable Value is acceptable since an allowance has been made in the safety analysis to accomodate this error.

The methodology to derive the trip setpoints is based upon combining all of the uncertainties in the channels. Inherent to the determination of the trip setpoints are the magnitudes of these channel uncertainties. Sensors and other instrumentation utilized in these channels are expected to be capable of operating within the allowances of these uncertainty magnitudes. Rack drift in excess of the Allowable Value exhibits the behavior that the rack has not met its allowance. Being that there is a small statistical chance that this will happen, an infrequent excessive drift is expected. Rack or sensor drift, in excess of the allowance that is more than occasional, may be indicative of more serious problems and should warrant further investigation.

LIMITING CONDITION FOR OPERATION

3.3.2 The Engineered Safety Feature Actuation System (ESFAS) instrumentation channels and interlocks shown in Table 3.3-3 shall be OPERABLE with their trip setpoints set consistent with the values shown in the Trip Setpoint column of Table 3.3-4 and with RESPONSE TIMES as shown in Table 3.3-5.

APPLICABILITY: As shown in Table 3.3-3.

ACTION:

a. With an ESFAS Instrumentation or Interlock Trip Setpoint trip less conservative than the value shown in the Trip Setpoint Column but more conservative than the value shown in the Allowable Value Column of Table 3.3-4, adjust the Setpoint consistent with the Trip Setpoint value.

b. With an ESFAS Instrumentation or Interlock Trip Setpoint less conservative than the value shown in the Allowable Value Column of Table 3.3-4, declare either:

1. Adjust the Setpoint consistent with the Trip Setpoint value of Table 3.3-4, and determine within 12 hours that Equation 2.2-1 was satisfied for the affected channel or,

2. Declare the channel inoperable and apply the applicable ACTION statement requirements of Table 3.3.3 until the channel is restored to OPERABLE status with its setpoint adjusted consistent with the Trip Setpoint value.

EQUATION 2.2-1 $Z + R + S \leq TA$

where:

Z = the value from column Z of Table 3.3-4 for the affected channel,

R = the "as measured" value (in percent span) of rack error for the affected channel,

S = either the "as measured" value (in percent span) of the sensor error, or the value in column S of Table 3.3-4 for the affected channel, and

TA = the value from column TA of Table 3.3-4 for the affected channel.

c. With an ESFAS instrumentation channel or interlock inoperable take the ACTION shown in Table 3.3-3.

the channel inoperable and apply the applicable ACTION statement requirements of Table 3.3-3 until the channel is restored to its OPERABLE status with its Setpoint adjusted consistent with the Trip Setpoint value.

LIMITING CONDITION FOR OPERATION

3.3.2 The Engineered Safety Feature Actuation System (ESFAS) instrumentation channels and interlocks shown in Table 3.3-3 shall be OPERABLE with their trip setpoints set consistent with the values shown in the Trip Setpoint column of Table 3.3-4 and with RESPONSE TIMES as shown in Table 3.3-5.

APPLICABILITY: As shown in Table 3.3-3.

ACTION:

a. With an ESFAS Instrumentation or Interlock Trip Setpoint trip less conservative than the value shown in the Trip Setpoint Column but more conservative than the value shown in the Allowable Value Column of Table 3.3-4, adjust the Setpoint consistent with the Trip Setpoint value.

b. With an ESFAS Instrumentation or Interlock Trip Setpoint less conservative than the value shown in the Allowable Value Column of Table 3.3-4, declare the channel inoperable and apply the applicable ACTION statement requirements of Table 3.3-3 until the channel is restored to its OPERABLE status with its setpoint adjusted consistent with the Trip Setpoint value.

c. With an ESFAS instrumentation channel or interlock inoperable take the ACTION shown in Table 3.3-3.

SURVEILLANCE REQUIREMENTS

4.3.2.1 Each ESFAS instrumentation channel and interlock and the automatic actuation logic and relays shall be demonstrated OPERABLE by performance of the engineered safety feature actuation system instrumentation surveillance requirements specified in Table 4.3-2.

4.3.2.2 The ENGINEERED SAFETY FEATURES RESPONSE TIME of each ESFAS function shall be demonstrated to be within the limit at least once per 18 months. Each test shall include at least one train such that both trains are tested at least once per 36 months and one channel per function such that all channels are tested at least once per N times 18 months where N is the total number of redundant channels in a specific ESFAS function as shown in the "Total No. of Channels" Column of Table 3.3-3.

SURVEILLANCE REQUIREMENTS

4.3.2.1 Each ESFAS instrumentation channel and interlock and the automatic actuation logic and relays shall be demonstrated OPERABLE by performance of the engineered safety feature actuation system instrumentation surveillance requirements specified in Table 4.3-2.

4.3.2.2 The ENGINEERED SAFETY FEATURES RESPONSE TIME of each ESFAS function shall be demonstrated to be within the limit at least once per 18 months. Each test shall include at least one train such that both trains are tested at least once per 36 months and one channel per function such that all channels are tested at least once per N times 18 months where N is the total number of redundant channels in a specific ESFAS function as shown in the "Total No. of Channels" Column of Table 3.3-3.

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TABLE 3.3-4

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION TRIP SETPOINTS

Functional Unit	Total Allowance (TA)	Z	S	Trip Setpoint	Allowable Value
1. SAFETY INJECTION, REACTOR TRIP, FEEDWATER ISOLATION, CONTROL ROOM ISOLATION, START DIESEL GENERATORS, CONTAINMENT COOLING FANS AND ESSENTIAL SERVICE WATER.					
a. Manual Initiation	NA	NA	NA	NA	NA
b. Automatic Actuation Logic	NA	NA	NA	NA	NA
c. Reactor Building Pressure-High 1	3.0	0.71	1.5	≤3.6 psig	≤3.86 psig
d. Pressurizer Pressure--Low	13.1	10.71	1.5	≥1850 psig	≥1839 psig
e. Differential Pressure Between Steamlines--High	3.0	0.87	1.5 1.5	≤97 psig	≤106 psi
f. Steamline Pressure--Low	20.0	10.71	1.5	≥675 psig	≥635 psig(1)
2. REACTOR BUILDING SPRAY					
a. Manual Initiation	NA	NA	NA	NA	NA
b. Automatic Actuation Logic and Actuation Relays	NA	NA	NA	NA	NA
c. Reactor Building Pressure-High 3 (Phase 'A' isolation aligns spray system discharge valves and NaOH tank suction valves)	3.0	0.71	1.5	≤12.05 psig	12.31 psig

(1) Time constants utilized in lead lag controll...

TABLE 3.3-4

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION TRIP SETPOINTS

	Functional Unit	Trip Setpoint	Allowable Value
1.	SAFETY INJECTION, REACTOR TRIP, FEEDWATER ISOLATION, CONTROL ROOM ISOLATION, START DIESEL GENERATORS, CONTAINMENT COOLING FANS AND ESSENTIAL SERVICE WATER.		
	a. Manual Initiation	NA	NA
	b. Automatic Actuation Logic	NA	NA
	c. Reactor Building Pressure-High 1	≤3.6 psig	≤3.86 psig
	d. Pressurizer Pressure--Low	≥1850 psig	≥1839 psig
	e. Differential Pressure Between Steamlines--High	≤97 psig	≤106 psi
	f. Steamline Pressure--Low	≥675 psig	≥635 psig(1)
2.	REACTOR BUILDING SPRAY		
	a. Manual Initiation	NA	NA
	b. Automatic Actuation Logic and Actuation Relays	NA	NA
	c. Reactor Building Pressure-High 3 (Phase 'A' isolation aligns spray system discharge valves and NaOH tank suction valves)	≤12.05 psig	≤12.31 psig

(1) Time constants utilized in lead lag controller for steamline pressure-low are as follows:
$\tau_1 \geq$ 50 secs. $\tau_2 \leq$ 5 secs.

TABLE 3.3-4 (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION TRIP SETPOINTS

Functional Unit	Total Allowance (TA)	Z	S	Trip Setpoint	Allowable Value
3. CONTAINMENT ISOLATION					
a. Phase "A" Isolation					
1. Manual	NA	NA	NA	NA	NA
2. Safety Injection	See 1 above for all safety injection setpoints and allowable values				
3. Automatic Actuation Logic and Actuation Relays	NA	NA	NA	NA	NA
b. Phase "B" Isolation					
1. Automatic Actuation Logic and Actuation Relays	NA	NA	NA	NA	NA
2. Reactor Building Pressure-High 3	3.0	0.71	1.5	≤12.05 psig	≤12.31 psig
c. Purge and Exhaust Isolation					
1. Safety Injection	See 1 above for all safety injection setpoints and allowable values				
2. Containment Radioactivity High	NA	NA	NA	*	*
3. Automatic Actuation Logic and Actuation Relays	NA	NA	NA	NA	NA

* Trip setpoints shall be set to ensure that the limits of Specification 3.11.2.1 are not exceeded.

TABLE 3.3-4 (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION TRIP SETPOINTS

	Functional Unit	Trip Setpoint	Allowable Value
3.	CONTAINMENT ISOLATION		
	a. Phase "A" Isolation		
	1. Manual	NA	NA
	2. Safety Injection	See 1 above for all safety injection setpoints and allowable values	See 1 above for all safety injection setpoints and allowable values
	3. Automatic Actuation Logic and Actuation Relays	NA	NA
	b. Phase "B" Isolation		
	1. Automatic Actuation Logic and Actuation Relays	NA	NA
	2. Reactor Building Pressure-High 3	≤12.05 psig	≤12.31 psig
	c. Purge and Exhaust Isolation		
	1. Safety Injection	See 1 above for all safety injection setpoints and allowable values	See 1 above for all safety injection setpoints and allowable values
	2. Containment Radioactivity High	*	*
	3. Automatic Actuation Logic and Actuation Relays	NA	NA

* Trip setpoints shall be set to ensure that the limits of ODCM Specification 1.2.2.1 are not exceeded.

TABLE 3.3-4 (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION TRIP SETPOINTS

Functional Unit	Total Allowance (TA)	Z	S	Trip Setpoint	Allowable Value
4. STEAM LINE ISOLATION					
a. Manual	NA	NA	NA	NA	NA
b. Automatic Actuation Logic and Actuation Relays	NA	NA	NA	NA	NA
c. Reactor Building Pressure-High 2	3.0	0.71	1.5	≤6.35	≤6.61
d. Steam Flow in Two Steamlines-High, Coincident with	20.0	13.16	1.5/ 1.5	≤ a function defined as follows: A ΔP corresponding to 40% of full steam flow between 0% and 20% load and then a Δp increasing linearly to a Δp corresponding to 110% of full steam flow at full load	≤ a function defined as follows: A Δp corresponding to 44% of full steam flow between 0% and 20% load and then a Δp increasing linearly to a Δp corresponding to 114.0% of full steam flow at full load
T_{avg} - Low Low	4.0	.71	.8	≥552.0°F	≥548.4°F
e. Steamline Pressure - Low	20.0	10.71	1.5	≥675 psig	≥635 psig(1)

(1) Time constants utilized in lead lag controller for steamline pressure low are as follows: $\tau_1 \geq 50$ secs. $\tau_2 \leq 5$ secs.

TABLE 3.3-4 (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION TRIP SETPOINTS

	Functional Unit	Trip Setpoint	Allowable Value
4.	STEAM LINE ISOLATION		
	a. Manual	NA	NA
	b. Automatic Actuation Logic and Actuation Relays	NA	NA
	c. Reactor Building Pressure-High 2	≤6.35	≤6.61
	d. Steam Flow in Two Steamlines-High, Concident with	≤ a function defined as follows: A Δp corresponding to 40% of full steam flow between 0% and 20% load and then a Δp increasing linearly to a Δp corresponding to 100% of full steam flow at full load	≤ a function defined as follows: A Δp corresponding to 44% of full steam flow between 0% and 20% load and then a Δp increasing linearly to a Δp corresponding to 114.0% of full steam flow at full load
	T_{avg} - Low-Low	≥552.0°F	≥548.4°F
	e. Steamline Pressure-Low	≥675 psig	≥635 psig(1)

(1) Time constants utilized in lead lag controller for steamline pressure low are as follows:
$\tau_1 \geq$ 50 secs. $\tau_2 \leq$ 5 secs.

TABLE 3.3-4

Functional Unit	Total Allowance (TA)	Z	S	Trip Setpoint	Allowable Value
5. TURBINE TRIP AND FEEDWATER ISOLATION					
a. Steam Generator Water Level - High-High	5.0	2.18	1.5	≤82.4% of narrow range instrument span	≤84.2% of narrow range instrument span
6. EMERGENCY FEEDWATER					
a. Manual	NA	NA	NA	NA	NA
b. Automatic Actuation Logic	NA	NA	NA	NA	NA
c. Steam Generator Water Level - Low-Low	12.0	9.18	1.5	≥12% of span from 0% to 30% RTP increasing linearly to ≥30.0% of span from 30% to 100% RTP	≥~~10.2%~~ 11.2% of span from 0% to 30% RTP increasing linearly to ≥~~28.2%~~ 29.2% of span from 30% to 100% RTP
d. & f. Undervoltage-ESF Bus				≥5760 Volts with a ≤0.25 second time delay	≥5652 Volts with a ≤0.275 second time delay
				≥6576 volts with a ≤3.0 second time delay	≥6511 volts with a ≤3.3 second time delay

TABLE 3.3-4 (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION TRIP SETPOINTS

	Functional Unit	Trip Setpoint	Allowable Value
5.	TURBINE TRIP AND FEEDWATER ISOLATION		
	a. Steam Generator Water Level - High-High	≤82.4% of narrow range instrument span	≤84.2% of narrow range instrument span
6.	EMERGENCY FEEDWATER		
	a. Manual	NA	NA
	b. Automatic Actuation Logic	NA	NA
	c. Steam Generator Water Level - Low-Low	≥12% of span from 0% to 30% RTP increasing linearly to ≥30.0% of span from 30% to 100% RTP	≥11.2% of span from 0% to 30T% RTP increasing linearly to ≥29.2% of span from 30% to 100% RTP
	d. & f. Undervoltage-ESF Bus	≥5760 Volts with a ≤0.25 second time delay ≥6576 Volts with a ≤3.0 second time delay	≥5652 Volts with a ≤0.275 second time delay ≥5511 Volts with a ≤3.3 second time delay

TABLE 3.3-4 (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION TRIP SETPOINTS

Functional Unit	Total Allowance (TA)	Z	S	Trip Setpoint	Allowable Value
e. Safety Injection	See 1 above (all SI Setpoints)				
g. Trips of Main Feedwater Pumps	NA	NA	NA	NA	NA
h. Suction transfer on Low Pressure	NA	NA	NA	≥442 ft. 4in.(2)	≥441 ft. 3 in.
7. LOSS OF POWER					
a. 7.2 kv Emergency Bus Undervoltage (Loss of Voltage)	NA	NA	NA	≥5760 volts with a ≤0.25 second time delay	≥5652 volts with a ≤0.275 second time delay
b. 7.2 kv Emergency Bus Undervoltage	NA	NA	NA	≥6576 volts with a ≤3.0 second time delay	≥6511 volts with a ≤3.3 second time delay
8. AUTOMATIC SWITCHOVER TO CONTAINMENT SUMP					
a. RWST Level Low-Low	NA	NA	NA	≥18%	≥15%
b. Automatic Actuation Logic and Actuation Relays	NA	NA	NA	NA	NA

(2) Pump suction head at which transfer is initiated is stated in effective water elevation in the condensate storage tank.

TABLE 3.3-4 (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION TRIP SETPOINTS

	Functional Unit	Trip Setpoint	Allowable Value
	e. Safety Injection	See 1 above (all SI Setpoints)	See 1 above (all SI Setpoints)
	g. Trips of Main Feedwater Pumps	NA	NA
	h. Suction transfer on Low Pressure	$\geq$442 ft. 4in. (2)	$\geq$441 ft. 3 in.
7.	LOSS OF POWER		
	a. 7.2 kv Emergency Bus Undervoltage (Loss of Voltage)	$\geq$5760 volts with a $\geq$0.25 second time delay	$\geq$5652 volts with a $\geq$0.275 second time delay
	b. 7.2 kv Emergency Bus Undervoltage	$\geq$6576 volts with a $\leq$3.0 second time delay	$\geq$6511 volts with a $\leq$3.3 second time delay
8.	AUTOMATIC SWITCHOVER TO CONTAINMENT SUMP		
	a. RWST Level Low-Low	$\geq$18%	$\geq$15%
	b. Automatic Actuation Logic and Actuation Relays	NA	NA

(2) Pump suction head at which transfer is initiated is stated in effective water elevation in the condensate storage tank.

TABLE 3.3-4 (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION TRIP SETPOINTS

Functional Unit	Total Allowance (TA)	Z	S	Trip Setpoint	Allowable Value
9. ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INTERLOCKS					
INTERLOCKS					
a. Pressurizer Pressure, P-11	3.1	.71	1.5	1985 psig	≥1974 psig & ≤1996 psig
b. T_{avg} Low-Low, P-12	4.0	.71	.8	552°F	≥548.4°F & ≤555.6°F
c. Reactor Trip, P-4	NA	NA	NA	NA	NA

TABLE 3.3-4 (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION TRIP SETPOINTS

	Functional Unit	Trip Setpoint	Allowable Value
9.	ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INTERLOCKS		
	INTERLOCKS		
	a. Pressurizer Pressure, P-11	1985 psig	≥1974 psig & ≤1996 psig
	b. T_{avg} Low-Low, P-12	552°F	≥548.4°F & ≤555.6°F
	c. Reactor Trip, P-4	NA	NA

3/4.3.1 and 3/4.3.2 REACTOR TRIP AND ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION

The OPERABILITY of the Reactor Protection System and Engineered Safety Feature Actuation System Instrumentation and interlocks ensure that 1) the associated action and/or reactor trip will be initiated when the parameter monitored by each channel or combination thereof reaches its setpoint, 2) the specified coincidence logic and sufficient redundancy is maintained to permit a channel to be out of service for testing or maintenance consistent with maintaining an appropriate level of reliability of the Reactor Protection and Engineered Safety Features instrumentation and, 3) sufficient system functions capability is available from diverse parameters.

The OPERABILITY of these systems is required to provide the overall reliability, redundancy, and diversity assumed available in the facility design for the protection and mitigation of accident and transient conditions. The integrated operation of each of these systems is consistent with the assumptions used in the accident analyses. The surveillance requirements specified for these systems ensure that the overall system functional capability is maintained comparable to the original design standards. The periodic surveillance tests performed at the minimum frequencies are sufficient to demonstrate this capability. Specified surveillance and surveillance and maintenance outage times have been determined in accordance with WCAP-10271, "Evaluation of Surveillance Frequencies and Out of Service Times for Reactor Protection Instrumentation System," and supplements to that report. Surveillance intervals and out of service times were determined based on maintaining an appropriate level of reliability of the Reactor Protection System and Engineered Safety Features instrumentation.

The Engineered Safety Feature Actuation System Instrumentation Trip Setpoints specified in Table 3.3-4 are the nominal values at which the bistables are set for each functional unit. A setpoint is considered to be adjusted consistent with the nominal value when the "as measured" setpoint is within the band allowed for calibration accuracy.

To accommodate the instrument drift assumed to occur between operational tests and the accuracy to which setpoints can be measured and calibrated, Allowable Values for the setpoints have been specified in Table 3.3-4. Operation with setpoints less conservative than the Trip Setpoint but within the Allowable Value is acceptable since an allowance has been made in the safety analysis to accommodate this error. An optional provision has been included for determining the OPERABILITY of a channel when its trip setpoint is found to exceed the Allowable Value. The methodology of this option utilizes the "as measured" deviation from the specified calibration point for rack and sensor components in conjunction with a statistical combination of the other uncertainties of the instrumentation to measure the process variable and the uncertainties in calibrating the instrumentation. In Equation 3.3-1, Z + R + S ≤ TA, the interactive effects of the errors in the rack and the sensor, and the "as measured" values of the errors are considered. Z, as

3/4.3.1 and 3/4.3.2 REACTOR TRIP AND ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION

The OPERABILITY of the Reactor Protection System and Engineered Safety Feature Actuation System Instrumentation and interlocks ensure that 1) the associated action and/or reactor trip will be initiated when the parameter monitored by each channel or combination thereof reaches its setpoints, 2) the specified coincidence logic and sufficient redundancy is maintained to permit a channel to be out of service for testing or maintenance consistent with maintaining an appropriate level of reliability of the Reactor Protection and Engineered Safety Features instrumentation and, 3) sufficient system functions capability is available from diverse parameters.

The OPERABILITY of these systems is required to provide the overall reliability, redundancy, and diversity assumed available in the facility design for the protection and mitigation of accident and transient conditions. The integrated operation of each of these systems is consistent with the assumptions used in the accident analyses. The surveillance requirements specified for these systems ensure that the overall system functional capability is maintained comparable to the original design standards. The periodic surveillance tests performed at the minimum frequencies are sufficient to demonstrate this capability. Specified surveillance and surveillance and maintenance outage times have been determined in accordance with WCAP-10271, "Evaluation of Surveillance Frequencies and Out of Service Times for Reactor Protection Instrumentation System," and supplements to that report. Surveillance intervals and out of service times were determined based on maintaining an appropriate level of reliability of the Reactor Protection System and Engineered Safety Features instrumentation.

The Engineered Safety Feature Actuation System Instrumentation Trip Setpoints specified in Table 3.3-4 are the nominal values at which the bistables are set for each functional unit. A setpoint is considered to be adjusted consistent with the nominal value when the "as measured" setpoint is within the band allowed for calibration accuracy.

To accommodate the instrument drift assumed to occur between operational tests and the accuracy to which setpoints can be measured and calibrated, Allowable Values for the setpoints have been specified in Table 3.3-4. Operation with setpoints less conservative than the Trip Setpoint but within the Allowable Value is acceptable since all allowance has been made in the safety analysis to accommodate this error.

The methodology to derive the trip setpoints is based upon combining all of the uncertainties in the channels. Inherent to the determination of the trip setpoints are the magnitudes of these channel uncertainties. Sensor and rack instrumentation utilized in these channels are expected to be capable of operating within the allowances of these uncertainty magnitudes. Rack drift in excess of the Allowable Value exhibits the behavior that the rack has not met its allowance. Being that there is a small statistical chance that this

REACTOR TRIP AND ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION (continued)

specified in Table 3.3-4, in percent span, is the statistical summation of errors assumed in the analysis excluding those associated with the sensor and rack drift and the accuracy of their measurement. TA or Total Allowance is the difference, in percent span, between the trip setpoint and the value used in the analysis for the actuation. R or Rack Error is the "as measured" deviation, in percent span, for the affected channel from the specified trip setpoint. S or Sensor Error is either the "as measured" deviation of the sensor from its calibration point or the value specified in Table 3.3-4, in percent span, from the analysis assumptions. Use of Equation 3.3-1 allows for a sensor drift factor, an increased rack drift factor, and provides a threshold value for REPORTABLE EVENTS.

The methodology to derive the trip setpoints is based upon combining all of the uncertainties in the channels. Inherent to the determination of the trip setpoints are the magnitudes of these channel uncertainties. Sensor and rack instrumentation utilized in these channels are expected to be capable of operating within the allowances of these uncertainty magnitudes. Rack drift in excess of the Allowable Value exhibits the behavior that the rack has not met its allowance. Being that there is a small statistical chance that this will happen, an infrequent excessive drift is expected. Rack or sensor drift, in excess of the allowance that is more than occasional, may be indicative of more serious problems and should warrant further investigation.

The measurement of response time at the specified frequencies provides assurance that the reactor trip and the engineered safety feature actuation associated with each channel is completed within the time limit assumed in the accident analyses. No credit was taken in the analyses for those channels with response times indicated as not applicable. Response time may be demonstrated by any series of sequential, overlapping or total channel test measurements provided that such tests demonstrate the total channel response time as defined. Sensor response time verification may be demonstrated by either 1) in place, onsite, or offsite test measurements or 2) utilizing replacement sensors with certified response times.

The Engineered Safety Features Actuation System senses selected plant parameters and determines whether or not predetermined limits are being exceeded. If they are, the signals are combined into logic matrices sensitive to combinations indicative of various accidents, events, and transients. Once the required logic combination is completed, the system sends actuation signals to those engineered safety features components whose aggregate function best serves the requirements of the condition. As an example, the following actions may be initiated by the Engineered Safety Features Actuation System to mitigate the consequences of a steam line break or loss of coolant accident 1) safety injection pumps start and automatic valves position, 2) reactor trip, 3) feedwater isolation, 4) startup of the emergency diesel generators, 5) containment spray pumps start and automatic valves position, 6) containment isolation, 7) steam line isolation, 8) turbine trip, 9) auxiliary feedwater pumps start and automatic valves position, 10) containment cooling fans start and automatic valves position, 11) essential service water pumps start and automatic valves position, and 12) control room isolation and ventilation systems start.

REACTOR TRIP AND ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION (continued)

will happen, an infrequent excessive drift is expected. Rack or sensor drift, in excess of the allowance that is more than occasional, may be indicative of more serious problems and should warrant further investigation.

The measurement of response time at the specified frequencies provides assurance that the reactor trip and the engineered safety feature actuation associated with each channel is completed within the time limit assumed in the accident analyses. No credit was taken in the analyses for those channels with response times indicated as not applicable. Response time may be demonstrated by any series of sequential, overlapping or total channel test measurements provided that such tests demonstrate the total channel response time as defined. Sensor response time verification may be demonstrated by either 1) in place, onsite, or offsite test measurements or 2) utilizing replacement sensors with certified response times.

The Engineered Safety Features response times specified in Table 3.3-5 which include sequential operation of the RWST and VCT valves (Notes 2 and 3) are based on values assumed in the non-LOCA safety analyses. These analyses are for injection of borated water from the RWST. Injection of borated water is assumed not to occur until the VCT charging pump suction isolation valves are closed following opening of the RWST charging pumps suction valves. When the sequential operation of the RWST and VCT valves is not included in the response times (Note 1) the values specified are based on the LOCA analyses. The LOCA analyses take credit for injection flow regardless of the source. Verification of the response times specified in Table 3.3-5 will assure that the assumptions used for the LOCA and non-Loca analyses with respect to the operation of the VCT and RWST valves are valid.

The Engineered Safety Features Actuation System senses selected plant parameters and determines whether or not predetermined limits are being exceeded. If they are, the signals are combined into logic matrices sensitive to combinations indicative of various accidents, events, and transients. Once the required logic combination is completed, the system sends actuation signals to those engineered safety features components whose aggregate function best serves the requirements of the condition. As an example, the following actions may be initiated by the Engineered Safety Features Actuation System to mitigate the consequences of a steam line break or loss of coolant accident 1) safety injection pumps start and automatic valves position, 2) reactor trip, 3) feedwater isolation, 4) startup of the emergency diesel generators, 5) containment spray pumps start and automatic valves position, 6) containment isolation, 7) steam line isolation, 8) turbine trip, 9) auxiliary feedwater pumps start and automatic valves position, 10) containment cooling fans start and automatic valves position, 11) essential service water pumps start and automatic valves position, and 12) control room isolation and ventilation systems start.