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.

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	1.6	≥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	 ≤109% of RTP ≤25% of RTP	 ≤111.2% of RTP ≤27.2% of RTP
3.	Power Range, Neutron Flux High Positive Rate	≤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	≤5% of RTP with a time constant ≥2 seconds	≤6.3% of RTP with a time constant ≥2 seconds
5.	Intermediate Range, Neutron Flux	≤25% of RTP	≤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	≥1870 psig	≥1859 psig
10.	Pressurizer Pressure-High	≤2380 psig	≤2391 psig
11.	Pressurizer Water Level-High	≤92% of instrument span	≤93.8% of instrument span
12.	Loss of Flow	≥90% of loop design flow*	≥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	~~9.18~~ 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~~ 29.2% of span from 30% to 100% RTP
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~~ 29.2% of span from 30% to 100% RTP
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

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	$>7.5 \times 10^{-6}$% Indication	$>4.5 \times 10^{-6}$% 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	$\leq$10% of RTP	$\leq$12.2% of RTP
	b. P-13 input	$\leq$10% turbine impulse pressure equivalent	$\leq$12.2% of turbine impulse pressure equivalent
	C. Power Range Neutron Flux P-8	$\leq$38% of RTP	$\leq$40.2% of RTP
	D. Low Setpoint Power Range Neutron Flux, P-10	$\geq$10% of RTP	$\geq$7.8% of RTP
	E. Turbine Impulse Chamber Pressure, P-13	$\leq$10% turbine impulse pressure equivalent	$\leq$12.2% turbine pressure equivalent
	F. Power Range Neutron Flux, P-9	$\leq$50% of RTP	$\leq$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 (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 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 ΔI Span.

NOTE 3: OVERPOWER ΔT

$$\Delta T \leq \Delta T_o \left[K_4 - K_5 \frac{\cancel{(\tau_1 S)}\ (\tau_3 S)}{(1 + \tau_3 S)} T - K_6 \left| T - T'' \right| \right]$$

Where:

ΔT	=	as defined in Note 1
ΔT_o	=	as defined in Note 1
K_4	$\leq$	1.0875
K_5	$\geq$	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 $\leq$ 1.0875

K_5 $\geq$ 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}, $\tau_3 \geq 10$ 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.

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 LIMITING SAFETY SYSTEM SETTINGS

BASES

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 their "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 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.

~~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.

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.

Move to page 3/4 3-15 and delete this page

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.

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	A
b. Automatic Actuation Logic and Actuation Relays	NA	NA	NA	NA	A
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 controller for steamline pressure-low are as follow

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.

OCM see 1.2.2.1

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 ≥6511 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	≥442 ft. 4in. (2)	≥441 ft. 3 in.
7.	LOSS OF POWER		
	a. 7.2 kv Emergency Bus Undervoltage (Loss of Voltage)	≥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	≥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	≥18%	≥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, $Z + R + S \leq TA$, the interactive effects of the errors in the rack and the sensor and the "as measured" values of the errors are considered. Z, as~~

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.

PROPOSED TECHNICAL SPECIFICATION CHANGE REQUEST - TSP 930002
VIRGIL C. SUMMER NUCLEAR STATION

DESCRIPTION AND SAFETY EVALUATION

DESCRIPTION OF AMENDMENT REQUEST

Existing Technical Specification (TS) Table 2.2-1, "Reactor Trip System Instrumentation Trip Setpoints," and TS Table 3.3-4 "Engineered Safety Feature Actuation System Instrumentation Trip Setpoints," present setpoint information for each function in a five column format. The five columns of information are:

Total Allowance:	Total Allowance (TA) is the difference, in percent instrument span, between the nominal trip setpoint and value used in the safety analysis limit for the trip setpoint.
Z:	Z, 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.
S:	S or Sensor Error is either the "as measured" deviation of the sensor from its calibration point or the value specified in the table, in percent span, from the analysis assumptions.
Trip Setpoint:	Nominal value at which the trip is set.
Allowable Value:	Allowable Value is a value chosen to accommodate the instrument drift assumed to occur between operational tests and the accuracy to which setpoints can be measured and calibrated. 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.

The five column format included provisions which sometimes eliminated the need for formal reporting through a Licensee Event Report (LER). The issuance of 10 CFR 50.73 changed the filing requirements associated with a LER when an Allowable Value was exceeded. According to 10 CFR 50.73, filing a LER would not be required in response to the loss of a single channel; only a loss of a function would require a LER. Therefore, the benefit of the five column methodology was no longer needed to prevent filing a LER.

The Trip Setpoints in TS Table 2.2-1 prevent the reactor core and reactor coolant system from exceeding their safety limits during normal operation and design basis operational occurrences and assist the Engineered Safety

Features (ESF) Actuation System in mitigating the consequences of accidents. The Trip Setpoints for the ESF Actuation System are presented in TS Table 3.3-4. The setpoints, in accordance with the Allowable Value, provided in TS Table 3.3-4 ensure that the consequences of Design Basis Accidents (DBAs) will be acceptable, provided the unit is operated from within the Limiting Condition for Operation (LCO) at the onset of the DBA and the equipment functions as designed. These Technical Specifications provide the setpoint information needed to determine the setpoint operability of the trip function.

The current VCSNS Model D3 steam generator narrow range water level Process Measurement Accuracy (PMA) uncertainty and protection system setpoints have been recalculated to account for additional PMA uncertainties. PMA uncertainties are based on the type of measurement done but are not directly related to the accuracy of the measurement device; however, overall instrument channel accuracy is affected.

For Function 13 and Function 14 of TS Table 2.2-1 and Function 6.c of TS Table 3.3-4 (steam generator water level low-low), the recalculated PMA uncertainties result in changes to the Allowable Value column. Specifically, the Allowable Value is changed from ≥10.2% to ≥11.2% of span from 0 to 30% RTP increasing linearly and from ≥28.2% to ≥ 29.2% of span from 30% to 100% RTP.

SAFETY EVALUATION

The current VCSNS Model D3 steam generator narrow range water level Process Measurement Accuracy (PMA) uncertainty and protection system setpoints have been recalculated to account for additional uncertainties that were not in the original PMA value. PMA uncertainties are based on the type of measurement taken, but are not directly related to the accuracy of the measurement device; however, overall instrument channel accuracy is affected.

Previously, a random value of 2.0% of span was used for the PMA uncertainty in the setpoint uncertainty calculations for all steam generator design models. This value was based on the density variation as a function of power and level and the assumption that calibration was done for 50% power conditions. For several steam generator models, a fluid velocity effect was known to introduce a significant bias in the low direction that was incorporated into the protection system setpoints.

Improved understanding of ΔP level measurement system uncertainties (G. E. Lang and J. P. Cunningham, "Delta-P Level Measurement Systems," Instrumentation, Controls, and Automation in the Power Industry, Vol. 34, Proceedings of the Thirty-Fourth Power Instrumentation Symposium, June 1991), has led to a reinvestigation of the Steam Generator Level PMA uncertainties. The conclusions are that two additional uncertainty components must be accounted for explicitly (i.e., reference leg temperature changes from calibration temperature and downcomer subcooling) and that fluid velocity effects must be considered for all steam generator models. These uncertainty

components are not considered to be random in nature and must be treated as biases.

A protection system setpoint study was originally done by Westinghouse to determine the instrument uncertainties for all Reactor Trip and ESFAS protection functions (WCAP-11770). Neither the safety analysis limit (SAL) nor the TS low-low steam generator water level setpoint require a change.

Although no changes are required to the Trip Setpoint column of the TS, changes are required to Allowable Value columns of TS Table 2.2-1, "Reactor Trip System Instrumentation Trip Setpoints," and TS Table 3.3-4, "Engineered Safety Feature Actuation System Instrumentation Trip Setpoints," to accommodate the additional PMA uncertainties associated with the narrow range steam generator water level setpoints. The proposed change to TS Tables 2.2-1 and 3.3-4 present setpoint information for each function in a two column format. The proposed two-column format of the TS tables provide setpoint information used to determine the setpoint operability of the trip function. The two columns of information are:

Trip Setpoint:	Nominal value at which the trip is set.
Allowable Value:	Allowable Value is a value chosen to accommodate the instrument drift assumed to occur between operational tests and the accuracy to which setpoints can be measured and calibrated. 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 integrated safety evaluation was prepared to review the following areas to determine the effect of additional PMA uncertainties for the narrow range steam generator water level protection setpoints:

LOCA and LOCA-Related Accidents
Non-LOCA Accidents
Steam Generator Tube Rupture
Containment Integrity
Setpoint Evaluation
Technical Specifications
Fluid and Auxiliary Systems Performance
Mechanical Systems Performance
I&C Systems Performance
Equipment Qualification
Radiological Consequences
Emergency Operating Procedures
Component Performance
Probabilistic Risk Analysis

The additional PMA uncertainties impact the Protection System Setpoint calculations, the excessive feedwater flow malfunction event (non-LOCA

accident and the VCSNS Technical Specifications. No other areas were affected by the additional PMA uncertainties for the narrow range steam generator water level protection functions.

An evaluation of the protection system setpoints provided the following narrow range steam generator water level PMA uncertainties for the Model D3 steam generators for the low-low level protection functions:

Process Pressure Variations	+ 0.3 % span
Reference Leg Temperature Variations	+ 0.4 % span
Fluid Velocity Effects	0.0 % span
Downcomer Subcooling Effects	+ 0.6 % span
Total PMA Effects	+ 1.3 % span

Using these values and the Westinghouse statistical setpoint methodology, the narrow range steam generator water level protection system setpoints were recalculated. The study shows that the narrow range steam generator water level low-low Technical Specification and SAL trip setpoints are acceptable; however, changes to the values presented in the Technical Specification Allowable Value column are required.

On the VCSNS Model D3 steam generators, the following are the elevations of the key dimensional parameters:

Lower Narrow Range Tap:	333 inches above tubesheet	(0% of span)
Upper Narrow Range Tap:	566 inches above tubesheet	(100% of span)
Mid Deck Plate Elevation:	545 inches above tubesheet	(91% of span)

The steam generator water level low-low nominal trip setpoint is maintained at the present value of 12% of span between 0% and 30% power, then linearly increasing to 30% of span at full power. This setpoint is acceptable from an operational standpoint based upon plant operating experience.

The effect of additional PMA uncertainties for the VCSNS Model D3 steam generator narrow range water level protection setpoints has been evaluated against the standards of 10CFR50.59 and does not represent an unreviewed safety question based on the following justification.

1. **Will the probability of an accident previously evaluated in the FSAR be increased?**

   No. The probability of accidents previously evaluated in the FSAR will not be increased. There is no change in the affected protection function response times. Although there is an increase in instrument channel uncertainties, these are not initiators of any transient, and the analysis shows that the FSAR acceptance criteria for the postulated design basis events have been satisfied. Therefore, the probability of occurrence is not affected.

2. **Will the consequences of an accident previously evaluated in the FSAR be increased?**

   No. The consequences of accidents previously evaluated in the FSAR will not be increased. The affected protection functions will respond within the assumed times. The evaluation indicates that although the instrument channel uncertainties increases, the FSAR acceptance criteria for the postulated design basis events have been satisfied. Since it has been concluded that the transient results are unaffected by this parameter modification, it is concluded that the consequences of an accident previously evaluated are not increased.

3. **May the possibility of a different accident than already evaluated in the FSAR be created?**

   No. There is no significant possibility of creating an accident which is different than any already being evaluated in the FSAR. The affected protection functions will respond in a manner consistent with the current FSAR analyses. The change to the Allowable Value Column does not create the possibility of a new or different kind of accident from any accident previously evaluated, and does not affect the assumed accident initiation sequences. No new operating configuration is being imposed by the change to the Allowable Value Columns that would create a new failure scenario. In addition, no new failure modes are being created for any plant equipment. Therefore, the types of accidents defined in the FSAR continue to represent the credible spectrum of events to be analyzed which determine safe plant operation.

4. **Will the probability of a malfunction of equipment important to safety previously evaluated in the FSAR be increased?**

   No. There is no significant increase in the probability of a previously evaluated malfunction of equipment important to safety in the FSAR. There is no additional hardware introduced into the protection system. The instrument channel uncertainties increased for the new PMA uncertainties increased. The evaluation demonstrates that the FSAR acceptance criteria for the postulated design basis events have been satisfied. The changes to the Allowable Value Column will not adversely affect system performance or safety system functions assumed in the accident analyses. The original design specifications such as for seismic requirements, electrical separation, and environmental qualification are unaffected. The revised setpoints will not adversely affect the operation of the Reactor Protection System or any other device required for accident mitigation. In addition, no new failure modes are being created for any plant equipment. Therefore, probability of a malfunction of equipment important to safety previously evaluated in the FSAR will not be increased.

5. **Will the consequences of a malfunction of equipment important to safety previously evaluated in the FSAR be increased?**

   No. The consequences of a malfunction of equipment important to safety previously evaluated in the FSAR will not be increased. The current failure modes as analyzed are unchanged. With no change to the analyzed failure modes, the FSAR acceptance criteria for the postulated design basis events remain satisfied. The changes to the Allowable Value Column will not adversely affect the ability of existing components and systems or the integrity of the fission product barriers to mitigate the radiological dose consequences of any accident. Both the margin to DNB and fuel temperature limits remain protected. In addition, the offsite dose predictions previously assumed are unaffected and remain within the acceptance criteria. Therefore, the radiological consequences of a malfunction of equipment important to safety previously evaluated in the FSAR will not increase.

6. **May the possibility of a malfunction of equipment important to safety be different than any already evaluated in the FSAR be created?**

   No. There is no significant possibility of creating a malfunction of equipment important to safety different than any already evaluated in the FSAR. There is no change to hardware or plant procedures as a result of this evaluation. Operation remains consistent with the FSAR assumptions. All original design and performance criteria continue to be met, and no new failure modes have been created for any system, component, or piece of equipment. No new single failure mechanisms have been introduced nor will the core operate in excess of pertinent design basis operating limits. Therefore, the possibility of a malfunction of equipment important to safety of a different type than any previously evaluated in the FSAR has not been created.

7. **Will the margin of safety as described in the bases to any technical specification be reduced?**

   No. The margin of safety as defined in the Bases of the Technical Specifications will not be reduced. All initial conditions of the FSAR with respect to steam generator level are maintained, and the results of the FSAR remain valid. Therefore, the change in the Allowable Value Column does not involve a reduction in the margin of safety.

PROPOSED TECHNICAL SPECIFICATION CHANGE REQUEST - TSP 930002
VIRGIL C. SUMMER NUCLEAR STATION

DETERMINATION OF NO SIGNIFICANT HAZARDS CONSIDERATION

DESCRIPTION OF AMENDMENT REQUEST

Existing Technical Specification (TS) Table 2.2-1, "Reactor Trip System Instrumentation Trip Setpoints," and TS Table 3.3-4, "Engineered Safety Feature Actuation System Instrumentation Trip Setpoints," present setpoint information for each function in a five column format. The five columns of information are:

Total Allowance:	Total Allowance (TA) is the difference, in percent instrument span, between the nominal trip setpoint and value used in the safety analysis limit for the trip setpoint.
Z:	Z, 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.
S:	S or Sensor Error is either the "as measured" deviation of the sensor from its calibration point or the value specified in the table, in percent span, from the analysis assumptions.
Trip Setpoint:	Nominal value at which the trip is set.
Allowable Value:	Allowable Value is a value chosen to accommodate the instrument drift assumed to occur between operational tests and the accuracy to which setpoints can be measured and calibrated. 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.

The five column format included provisions which in some cases eliminated the need for formal reporting through a Licensee Event Report (LER). The issuance of 10 CFR 50.73 changed the filing requirements associated with a LER when an Allowable Value was exceeded. According to 10 CFR 50.73, filing a LER would not be required in response to the loss of a single channel; only as a result of a function would a LER be required. Therefore, the benefit of the five column methodology was no longer needed to prevent filing a LER.

The Trip Setpoints in TS Table 2.2-1 prevent the reactor core and reactor coolant system from exceeding their safety limits during normal operation and design basis operational occurrences and assist the Engineered Safety Features (ESF) Actuation System in mitigating the consequences of accidents.

The Trip Setpoints for the ESF Actuation System are presented in TS Table 3.3-4. The setpoints, in accordance with the Allowable Value, provided in TS Table 3.3-4 ensure that the consequences of Design Basis Accidents (DBAs) will be acceptable, provided the unit is operated from within the Limiting Condition for Operation (LCO) at the onset of the DBA and the equipment functions as designed. These Technical Specifications provide the setpoint information needed to determine the setpoint operability of the trip function.

The current VCSNS Model D3 steam generator narrow range water level Process Measurement Accuracy (PMA) uncertainty and protection system setpoints have been recalculated to account for additional PMA uncertainties. PMA uncertainties are based on the type of measurement performed but are not directly related to the accuracy of the measurement device; however, overall instrument channel accuracy is affected.

For Function 13 and Function 14 of TS Table 2.2-1 and Function 6.c of TS Table 3.3-4 (steam generator water level low-low), the recalculated PMA uncertainties result in changes to the Allowable Value column. Specifically, the Allowable Value is changed from ≥10.2% to ≥11.2% of span from 0 to 30% RTP increasing linearly and from ≥28.2% to ≥29.2% of span from 30% to 100% RTP.

BASIS FOR DETERMINATION OF NO SIGNIFICANT HAZARDS CONSIDERATION

Although no changes are required to the Trip Setpoint column of the VCSNS Technical Specifications, changes are required to other columns of TS Table 2.2-1, "Reactor Trip System Instrumentation Trip Setpoints," and TS Table 3.3-4, "Engineered Safety Feature Actuation System Instrumentation Trip Setpoints," to accommodate the additional PMA uncertainties associated with the VCSNS Model D3 steam generator narrow range water level setpoints. For the steam generator water level low-low trip function, a TS change is required to the Allowable Value columns.

Pursuant to 10 CFR 50.92 each application for amendment to an operating license must be reviewed to determine if the proposed change involves a significant hazards consideration. The amendment describing the technical specification changes associated with the additional PMA uncertainties for the narrow range steam generator water level protection functions has been reviewed and deemed not to involve significant hazards considerations. As discussed below, all applicable acceptance criteria are satisfied and the conclusions presented in the VCSNS FSAR remain valid. Thus, the proposed Technical Specification changes do not constitute an unreviewed safety question and the accident analyses support the changes. The basis for this determination follows:

1. **Operation of VCSNS in accordance with the proposed license amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated.**

   The probability or consequences of accidents previously evaluated in the FSAR will not be increased. There is no change in the affected protection function response times or the Technical Specification Trip Setpoint. The changes to the Allowable Value column for the steam generator water level low-low reactor trip function do not invalidate the design basis acceptance criteria for the transients evaluated. The narrow range steam generator water level setpoints are part of the accident mitigation response and are not themselves an initiator for any transient. Since it has been concluded that the transient results are unaffected by the parameter modifications, it is concluded that the probability or consequences of an accident previously evaluated are not increased.

2. **The proposed license amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated.**

   The changes to the Allowable Value columns for the steam generator water level low-low reactor trip function will not introduce any new accident initiator mechanisms. The affected protection functions will respond in a manner consistent with the current FSAR analyses. No new failure modes or limiting single failures have been identified. Furthermore, the setpoint adjustment does not affect the assumed accident initiation sequences. In addition, no new operating configuration is being imposed by the setpoint adjustment that would create a new failure scenario. Since the safety and design requirements continue to be met and the integrity of the reactor coolant system pressure boundary is not challenged, no new accident scenarios have been created. Therefore, in light of the above, an accident which is different than any already evaluated in the FSAR will not be created as a result of this change.

3. **The proposed license amendment does not involve a significant reduction in a margin of safety.**

   Although the additional PMA uncertainties for the narrow range steam generator water level trip functions will require a change to the plant Technical Specifications,it will not invalidate the design basis acceptance criteria presented in the FSAR accident analyses. All initial conditions of the FSAR with respect to the steam generator level are maintained, and the results of the FSAR remain valid. Therefore, there is no reduction in the margin to safety as defined in the Bases of the VCSNS Technical Specifications.

6.0 CONCLUSION

The various facets of the VCSNS licensing basis that are potentially affected by the additional PMA uncertainties for the narrow range steam generator water level trip functions have been evaluated. All applicable acceptance criteria are satisfied. In conclusion, while Technical Specification changes are necessary to reflect the additional PMA uncertainties for the narrow range steam generator water level trip functions, all the conclusions presented in the FSAR remain valid.