ATTACHMENT C

SONGS UNIT 2

PROPOSED TECHNICAL SPECIFICATIONS

TABLE 2.2-1

REACTOR PROTECTIVE INSTRUMENTATION TRIP SETPOINT LIMITS

FUNCTIONAL UNIT	TRIP SETPOINT	ALLOWABLE VALUES
1. Manual Reactor Trip	Not Applicable	Not Applicable
2. Linear Power Level - High -		
Four Reactor Coolant Pumps Operating	≤ 110.0% of RATED THERMAL POWER	≤ 111.3% of RATED THERMAL POWER
3. Logarithmic Power Level - High (1)	≤ 0.89% of RATED THERMAL POWER	≤ 0.96% of RATED THERMAL POWER
4. Pressurizer Pressure - High	≤ 2382 psia	≤ 2389 psia
5. Pressurizer Pressure - Low (2)	≥ 1806 psia	≥ 1763 psia
6. Containment Pressure - High	≤ 2.95 psig	≤ 3.14 psig
7. Steam Generator Pressure - Low (3)	≥ 729 psia	≥ 711 psia
8. Steam Generator Level - Low	≥ 25% (4)	≥ 24.23% (4)
9. Local Power Density - High (5)	≤ 21.0 kw/ft	≤ 21.0 kw/ft
10. DNBR - Low	≥ 1.31 (5)	≥ 1.31 (5)
11. Reactor Coolant Flow - Low		
a) DN Rate	≤ 0.22 psid/sec (6)(8)	≤ 0.231 psid/sec (6)(8)
b) Floor	≥ 13.2 psid (6)(8)	≥ 12.1 psid (6)(8)
c) Step	≤ 6.82 psid (6)(8)	≤ 7.231 psid (6)(8)
12. Steam Generator Level - High	≤ 96% (4)	≤ 90.74% (4)
13. Seismic - High	≤ 0.48/0.60 (7)	≤ 0.48/0.60 (7)
14. Loss of Load	Turbine stop valve closed	Turbine stop valve closed

Linear Power Level-High

The Linear Power Level-High trip provides reactor core protection against rapid reactivity excursions which might occur as the result of an ejected CEA, or certain intermediate steam line breaks. This trip initiates a reactor trip at a linear power level of less than or equal to 111.3% of RATED THERMAL POWER.

Logarithmic Power Level-High

The Logarithmic Power Level - High trip is provided to protect the integrity of fuel cladding and the Reactor Coolant System pressure boundary in the event of an unplanned criticality from a shutdown condition. A reactor trip is initiated by the Logarithmic Power Level - High trip at a THERMAL POWER level of less than or equal to 0.96% of RATED THERMAL POWER unless this trip is manually bypassed by the operator. The operator may manually bypass this trip when the THERMAL POWER level is above 10^{-4}% of RATED THERMAL POWER; this bypass is automatically removed when the THERMAL POWER level decreases to 10^{-4}% of RATED THERMAL POWER.

Pressurizer Pressure-High

The Pressurizer Pressure-High trip, in conjunction with the pressurizer safety valves and main steam safety valves, provides reactor coolant system protection against overpressurization in the event of loss of load without reactor trip. This trip's setpoint is at less than or equal to 2389 psia which is below the nominal lift setting 2500 psia of the pressurizer safety valves and its operation avoids the undesirable operation of the pressurizer safety valves.

Pressurizer Pressure-Low

The Pressurizer Pressure-Low trip is provided to trip the reactor and to assist the Engineered Safety Features System in the event of a Loss of Coolant Accident. During normal operation, this trip's setpoint is set at greater than or equal to 1763 psia. This trip's setpoint may be manually decreased, to a minimum value of 300 psia, as pressurizer pressure is reduced during plant shutdowns, provided the margin between the pressurizer pressure and this trip's setpoint is maintained at less than or equal to 400 psi; this setpoint increases automatically as pressurizer pressure increases until the trip setpoint is reached.

SAFETY LIMITS AND LIMITING SAFETY SYSTEM SETTINGS

BASES

Containment Pressure-High

The Containment Pressure-High trip provides assurance that a reactor trip is initiated concurrently with a safety injection. The setpoint for this trip is identical to the safety injection setpoint.

Prior to

actuation

Steam Generator Pressure-Low

The Steam Generator Pressure-Low trip provides protection against an excessive rate of heat extraction from the steam generators and subsequent cooldown of the reactor coolant. The setpoint is sufficiently below the full load operating point of approximately 900 psia so as not to interfere with normal operation, but still high enough to provide the required protection in the event of excessively high steam flow. This trip's setpoint may be manually decreased as steam generator pressure is reduced during plant shutdowns, provided the margin between the steam generator pressure and this trip's setpoint is maintained at less than or equal to 200 psi; this setpoint increases automatically as steam generator pressure increases until the trip setpoint is reached.

Steam Generator Level-Low

The Steam Generator Level-Low trip provides protection against a loss of feedwater flow incident and assures that the design pressure of the Reactor Coolant System will not be exceeded due to loss of the steam generator heat sink. This specified setpoint provides allowance that there will be sufficient water inventory in the steam generator at the time of the trip to provide a margin of at least 10 minutes before emergency feedwater is required.

Local Power Density-High

The Local Power Density-High trip is provided to prevent the linear heat rate (kw/ft) in the limiting fuel rod in the core from exceeding the fuel design limit in the event of any anticipated operational occurrence. The local power density is calculated in the reactor protective system utilizing the following information:

a. Nuclear flux power and axial power distribution from the excore flux monitoring system;

b. Radial peaking factors from the position measurement for the CEAs;

c. Delta T power from reactor coolant temperatures and coolant flow measurements.

TABLE 3.3-2

REACTOR PROTECTIVE INSTRUMENTATION RESPONSE TIMES

FUNCTIONAL UNIT	RESPONSE TIME
1. Manual Reactor Trip	Not Applicable
2. Linear Power Level - High	≤ 0.40 seconds*
3. Logarithmic Power Level - High	≤ 0.45 seconds*
4. Pressurizer Pressure - High	≤ 0.90 seconds
5. Pressurizer Pressure - Low	≤ 0.90 seconds
6. Containment Pressure - High	≤ 0.90 seconds
7. Steam Generator Pressure - Low	≤ 0.90 seconds
8. Steam Generator Level - Low	≤ 0.90 seconds
9. Local Power Density - High	
a. Neutron Flux Power from Excore Neutron Detectors	≤ 0.68 seconds*
b. CEA Positions	≤ 0.68 seconds**
c. CEA Positions: CEAC Penalty Factor	≤ 0.53 seconds
10. DNBR - Low	
a. Neutron Flux Power from Excore Neutron Detectors	≤ 0.68 seconds*
b. CEA Positions	≤ 0.68 seconds**
c. Cold Leg Temperature	≤ 0.68 seconds##
d. Hot Leg Temperature	≤ 0.68 seconds##
e. Primary Coolant Pump Shaft Speed	≤ 0.68 seconds#
f. Reactor Coolant Pressure from Pressurizer	≤ 0.68 seconds
g. CEA positions: CEAC Penalty Factor	≤ 0.53 seconds

TABLE 4.3-1

REACTOR PROTECTIVE INSTRUMENTATION SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
1. Manual Reactor Trip	N.A.	N.A.	R #	1, 2, 3*, 4*, 5*
2. Linear Power Level - High	S	D(2,4), M(3,4), Q(4), R(4) #	M	1, 2
3. Logarithmic Power Level - High	S	# R(4)	M and S/U(1)	1, 2, 3, 4, 5
4. Pressurizer Pressure - High	S	# R	M	1, 2
5. Pressurizer Pressure - Low	S	# R	M	1, 2
6. Containment Pressure - High	S	# R	M	1, 2
7. Steam Generator Pressure - Low	S	# R	M	1, 2
8. Steam Generator Level - Low	S	# R	M	1, 2
9. Local Power Density - High	S	D(2,4), # R(4,5)	M, R(6) #	1, 2
10. DNBR - Low	S	S(7), D(2,4), M(8), R(4,5) #	M, R(6) #	1, 2
11. Steam Generator Level - High	S	# R	M	1, 2
12. Reactor Protection System Logic	N.A.	N.A.	M	1, 2, 3*, 4*, 5*

TABLE 4.3-1 (Continued)

REACTOR PROTECTIVE INSTRUMENTATION SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
13. Reactor Trip Breakers	N.A.	N.A.	M,(12)	1, 2, 3*, 4*, 5*
14. Core Protection Calculators	S	D(2,4),S(7) R(4,5),M(8)	M(11),R(6)	1, 2
15. CEA Calculators	S	R	M,R(6)	1, 2
16. Reactor Coolant Flow-Low	S	R	M	1, 2
17. Seismic-High	S	R	M	1, 2
18. Loss of Load	S	N.A.	M	1 (9)

TABLE 4.3-1 (Continued)

TABLE NOTATION

* - With reactor trip breakers in the closed position and the CEA drive system capable of CEA withdrawal.

(1) - Each startup or when required with the reactor trip breakers closed and the CEA drive system capable of rod withdrawal, if not performed in the previous 7 days.

(2) - Heat balance only (CHANNEL FUNCTIONAL TEST not included), above 15% of RATED THERMAL POWER; adjust the Linear Power Level signals and the CPC addressable constant multipliers to make the CPC delta T power and CPC nuclear power calculations agree with the calorimetric calculation if absolute difference is greater than 2%. During PHYSICS TESTS, these daily calibrations may be suspended provided these calibrations are performed upon reaching each major test power plateau and prior to proceeding to the next major test power plateau.

(3) - Above 15% of RATED THERMAL POWER, verify that the linear power subchannel gains of the excore detectors are consistent with the values used to establish the shape annealing matrix elements in the Core Protection Calculators.

(4) - Neutron detectors may be excluded from CHANNEL CALIBRATION.

(5) - After each fuel loading and prior to exceeding 70% of RATED THERMAL POWER, the incore detectors shall be used to determine the shape annealing matrix elements and the Core Protection Calculators shall use these elements.

(6) - This CHANNEL FUNCTIONAL TEST shall include the injection of simulated process signals into the channel as close to the sensors as practicable to verify OPERABILITY including alarm and/or trip functions.

(7) - Above 70% of RATED THERMAL POWER, verify that the total RCS flow rate as indicated by each CPC is less than or equal to the actual RCS total flow rate determined by either using the reactor coolant pump differential pressure instrumentation (conservatively compensated for measurement uncertainties) or by calorimetric calculations (conservatively compensated for measurement uncertainties) and if necessary, adjust the CPC addressable constant flow coefficients such that each CPC indicated flow is less than or equal to the actual flow rate. The flow measurement uncertainty may be included in the BERR1 term in the CPC and is equal to or greater than 4%.

(8) - Above 70% of RATED THERMAL POWER, verify that the total RCS flow rate as indicated by each CPC is less than or equal to the actual RCS total flow rate determined by calorimetric calculations (conservatively compensated for measurement uncertainties).

(9) - Above 55% of RATED THERMAL POWER.

(10) - Deleted.

(11) - The monthly CHANNEL FUNCTIONAL TEST shall include verification that the correct values of addressable constants are installed in each OPERABLE CPC per Specification 2.2.2.

(12) - At least once per 18 months and following maintenance or adjustment of the reactor trip breakers, the CHANNEL FUNCTIONAL TEST shall include independent verification of the undervoltage and shunt trips.

At least once per Refueling Interval.

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ATTACHMENT D

SONGS UNIT 3

PROPOSED TECHNICAL SPECIFICATIONS

TABLE 2.2-1

REACTOR PROTECTIVE INSTRUMENTATION TRIP SETPOINT LIMITS

FUNCTIONAL UNIT	TRIP SETPOINT	ALLOWABLE VALUES
1. Manual Reactor Trip	Not Applicable	Not Applicable
2. Linear Power Level - High -		
Four Reactor Coolant Pumps Operating	≤ 110.0% of RATED THERMAL POWER	≤ 111.3% of RATED THERMAL POWER
3. Logarithmic Power Level - High (1)	≤ 0.89% of RATED THERMAL POWER	≤ 0.96% of RATED THERMAL POWER
4. Pressurizer Pressure - High	≤ 2382 psia	≤ 2389 psia
5. Pressurizer Pressure - Low (2)	≥ 1806 psia	≥ 1763 psia
6. Containment Pressure - High	≤ 2.95 psig	≤ 3.14 psig
7. Steam Generator Pressure - Low (3)	≥ 729 psia	≥ 711 psia
8. Steam Generator Level - Low	≥ 25% (4)	≥ 24.23% (4)
9. Local Power Density - High (5)	≤ 21.0 kw/ft	≤ 21.0 kw/ft
10. DNBR - Low	≥ 1.31 (5)	≥ 1.31 (5)
11. Reactor Coolant Flow - Low		
a) DN Rate	≤ 0.22 psid/sec (6)(8)	≤ 0.231 psid/sec (6)(8)
b) Floor	≥ 13.2 psid (6)(8)	≤ 12.1 psid (6)(8)
c) Step	≤ 6.82 psid (6)(8)	≤ 7.231 psid (6)(8)
12. Steam Generator Level - High	≤ 90% (4)	≤ 90.74% (4)
13. Seismic - High	≤ 0.48/0.60 (7)	≤ 0.48/0.60 (7)
14. Loss of Load	Turbine stop valve closed	Turbine stop valve closed

Linear Power Level-High

The Linear Power Level-High trip provides reactor core protection against rapid reactivity excursions which might occur as the result of an ejected CEA, or certain intermediate steam line breaks. This trip initiates a reactor trip at a linear power level of less than or equal to 111.3% of RATED THERMAL POWER.

111.0%

Logarithmic Power Level-High

The Logarithmic Power Level - High trip is provided to protect the integrity of fuel cladding and the Reactor Coolant System pressure boundary in the event of an unplanned criticality from a shutdown condition. A reactor trip is initiated by the Logarithmic Power Level - High trip at a THERMAL POWER level of less than or equal to 0.96% of RATED THERMAL POWER unless this trip is manually bypassed by the operator. The operator may manually bypass this trip when the THERMAL POWER level is above 10^{-4}% of RATED THERMAL POWER; this bypass is automatically removed when the THERMAL POWER level decreases to 10^{-4}% of RATED THERMAL POWER.

0.95%

Pressurizer Pressure-High

The Pressurizer Pressure-High trip, in conjunction with the pressurizer safety valves and main steam safety valves, provides reactor coolant system protection against overpressurization in the event of loss of load without reactor trip. This trip's setpoint is at less than or equal to 2389 psia which is below the nominal lift setting 2500 psia of the pressurizer safety valves and its operation avoids the undesirable operation of the pressurizer safety valves.

2385

Pressurizer Pressure-Low

The Pressurizer Pressure-Low trip is provided to trip the reactor and to assist the Engineered Safety Features System in the event of a Loss of Coolant Accident. During normal operation, this trip's setpoint is set at greater than or equal to 1763 psia. This trip's setpoint may be manually decreased, to a minimum value of 300 psia, as pressurizer pressure is reduced during plant shutdowns, provided the margin between the pressurizer pressure and this trip's setpoint is maintained at less than or equal to 400 psi; this setpoint increases automatically as pressurizer pressure increases until the trip setpoint is reached.

1700

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Containment Pressure-High

The Containment Pressure-High trip provides assurance that a reactor trip is initiated concurrently with a safety injection. The setpoint for this trip is identical to the safety injection setpoint.

Steam Generator Pressure-Low

The Steam Generator Pressure-Low trip provides protection against an excessive rate of heat extraction from the steam generators and subsequent cooldown of the reactor coolant. The setpoint is sufficiently below the full load operating point of approximately 900 psia so as not to interfere with normal operation, but still high enough to provide the required protection in the event of excessively high steam flow. This trip's setpoint may be manually decreased as steam generator pressure is reduced during plant shutdowns, provided the margin between the steam generator pressure and this trip's setpoint is maintained at less than or equal to 200 psi; this setpoint increases automatically as steam generator pressure increases until the trip setpoint is reached.

Steam Generator Level-Low

The Steam Generator Level-Low trip provides protection against a loss of feedwater flow incident and assures that the design pressure of the Reactor Coolant System will not be exceeded due to loss of the steam generator heat sink. This specified setpoint provides allowance that there will be sufficient water inventory in the steam generator at the time of the trip to provide a margin of at least 10 minutes before emergency feedwater is required.

Local Power Density-High

The Local Power Density-High trip is provided to prevent the linear heat rate (kw/ft) in the limiting fuel rod in the core from exceeding the fuel design limit in the event of any anticipated operational occurrence. The local power density is calculated in the reactor protective system utilizing the following information:

a. Nuclear flux power and axial power distribution from the excore flux monitoring system;

b. Radial peaking factors from the position measurement for the CEAs;

c. Delta T power from reactor coolant temperatures and coolant flow measurements.

TABLE 3.3-2

REACTOR PROTECTIVE INSTRUMENTATION RESPONSE TIMES

FUNCTIONAL UNIT		RESPONSE TIME
1.	Manual Reactor Trip	Not Applicable
2.	Linear Power Level - High	≤ 0.40 seconds*
3.	Logarithmic Power Level - High	≤ 0.45 seconds*
4.	Pressurizer Pressure - High	≤ 0.90 seconds
5.	Pressurizer Pressure - Low	≤ 0.90 seconds
6.	Containment Pressure - High	≤ 0.90 seconds
7.	Steam Generator Pressure - Low	≤ 0.90 seconds
8.	Steam Generator Level - Low	≤ 0.90 seconds
9.	Local Power Density - High	
	a. Neutron Flux Power from Excore Neutron Detectors	≤ 0.68 seconds*
	b. CEA Positions	≤ 0.66 seconds**
	c. CEA Positions: CEAC Penalty Factor	≤ 0.53 seconds
10.	DNBR - Low	
	a. Neutron Flux Power from Excore Neutron Detectors	≤ 0.68 seconds*
	b. CEA Positions	≤ 0.68 seconds**
	c. Cold Leg Temperature	≤ 0.68 seconds##
	d. Hot Leg Temperature	≤ 0.68 seconds##
	e. Primary Coolant Pump Shaft Speed	≤ 0.68 seconds#
	f. Reactor Coolant Pressure from Pressurizer	≤ 0.68 seconds
	g. CEA positions: CEAC Penalty Factor	≤ 0.53 seconds

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TABLE 4.3-1

REACTOR PROTECTIVE INSTRUMENTATION SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
1. Manual Reactor Trip	N.A.	N.A.	R	1, 2, 3*, 4*, 5*
2. Linear Power Level - High	S	D(2,4), M(3,4), Q(4), R(4)	M	1, 2
3. Logarithmic Power Level - High	S	R(4)	M and S/U(1)	1, 2, 3, 4, 5
4. Pressurizer Pressure - High	S	R	M	1, 2
5. Pressurizer Pressure - Low	S	R	M	1, 2
6. Containment Pressure - High	S	R	M	1, 2
7. Steam Generator Pressure - Low	S	R	M	1, 2
8. Steam Generator Level - Low	S	R	M	1, 2
9. Local Power Density - High	S	D(2,4), R(4,5)	M, R(6)	1, 2
10. DNBR - Low	S	S(7), D(2,4), M(8), R(4,5)	M, R(6)	1, 2
11. Steam Generator Level - High	S	R	M	1, 2
12. Reactor Protection System Logic	N.A.	N.A.	M	1, 2, 3*, 4*, 5*

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TABLE 4.3-1 (Continued)

REACTOR PROTECTIVE INSTRUMENTATION SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
13. Reactor Trip Breakers	N.A.	N.A.	M,(12)	1, 2, 3*, 4*, 5*
14. Core Protection Calculators	S	D(2,4), S(7), R(4,5), M(8)	M(11), R(6)	1, 2
15. CEA Calculators	S	R	M,R(6)	1, 2
16. Reactor Coolant Flow-Low	S	R	M	1, 2
17. Seismic-High	S	R	M	1, 2
18. Loss of Load	S	N.A.	M	1 (9)

TABLE 4.3-1 (Continued)

TABLE NOTATION

* - With reactor trip breakers in the closed position and the CEA drive system capable of CEA withdrawal.

(1) - Each startup or when required with the reactor trip breakers closed and the CEA drive system capable of rod withdrawal, if not performed in the previous 7 days.

(2) - Heat balance only (CHANNEL FUNCTIONAL TEST not included), above 15% of RATED THERMAL POWER; adjust the Linear Power Level signals and the CPC addressable constant multipliers to make the CPC delta T power and CPC nuclear power calculations agree with the calorimetric calculation if absolute difference is greater than 2%. During PHYSICS TESTS, these daily calibrations may be suspended provided these calibrations are performed upon reaching each major test power plateau and prior to proceeding to the next major test power plateau.

(3) - Above 15% of RATED THERMAL POWER, verify that the linear power subchannel gains of the excore detectors are consistent with the values used to establish the shape annealing matrix elements in the Core Protection Calculators.

(4) - Neutron detectors may be excluded from CHANNEL CALIBRATION.

(5) - After each fuel loading and prior to exceeding 70% of RATED THERMAL POWER, the incore detectors shall be used to determine the shape annealing matrix elements and the Core Protection Calculators shall use these elements.

(6) - This CHANNEL FUNCTIONAL TEST shall include the injection of simulated process signals into the channel as close to the sensors as practicable to verify OPERABILITY including alarm and/or trip functions.

(7) - Above 70% of RATED THERMAL POWER, verify that the total RCS flow rate as indicated by each CPC is less than or equal to the actual RCS total flow rate determined by either using the reactor coolant pump differential pressure instrumentation (conservatively compensated for measurement uncertainties) or by calorimetric calculations (conservatively compensated for measurement uncertainties) and if necessary, adjust the CPC addressable constant flow coefficients such that each CPC indicated flow is less than or equal to the actual flow rate. The flow measurement uncertainty may be included in the BERR1 term in the CPC and is equal to or greater than 4%.

(8) - Above 70% of RATED THERMAL POWER, verify that the total RCS flow rate as indicated by each CPC is less than or equal to the actual RCS total flow rate determined by calorimetric calculations (conservatively compensated for measurement uncertainties).

(9) - Above 55% of RATED THERMAL POWER.

(10) - Deleted.

(11) - The monthly CHANNEL FUNCTIONAL TEST shall include verification that the correct values of addressable constants are installed in each OPERABLE CPC per Specification 2.2.2.

(12) - At least once per 18 months and following maintenance or adjustment of the reactor trip breakers, the CHANNEL FUNCTIONAL TEST shall include independent verification of the undervoltage and shunt trips.

\# At least once per Refueling Interval.

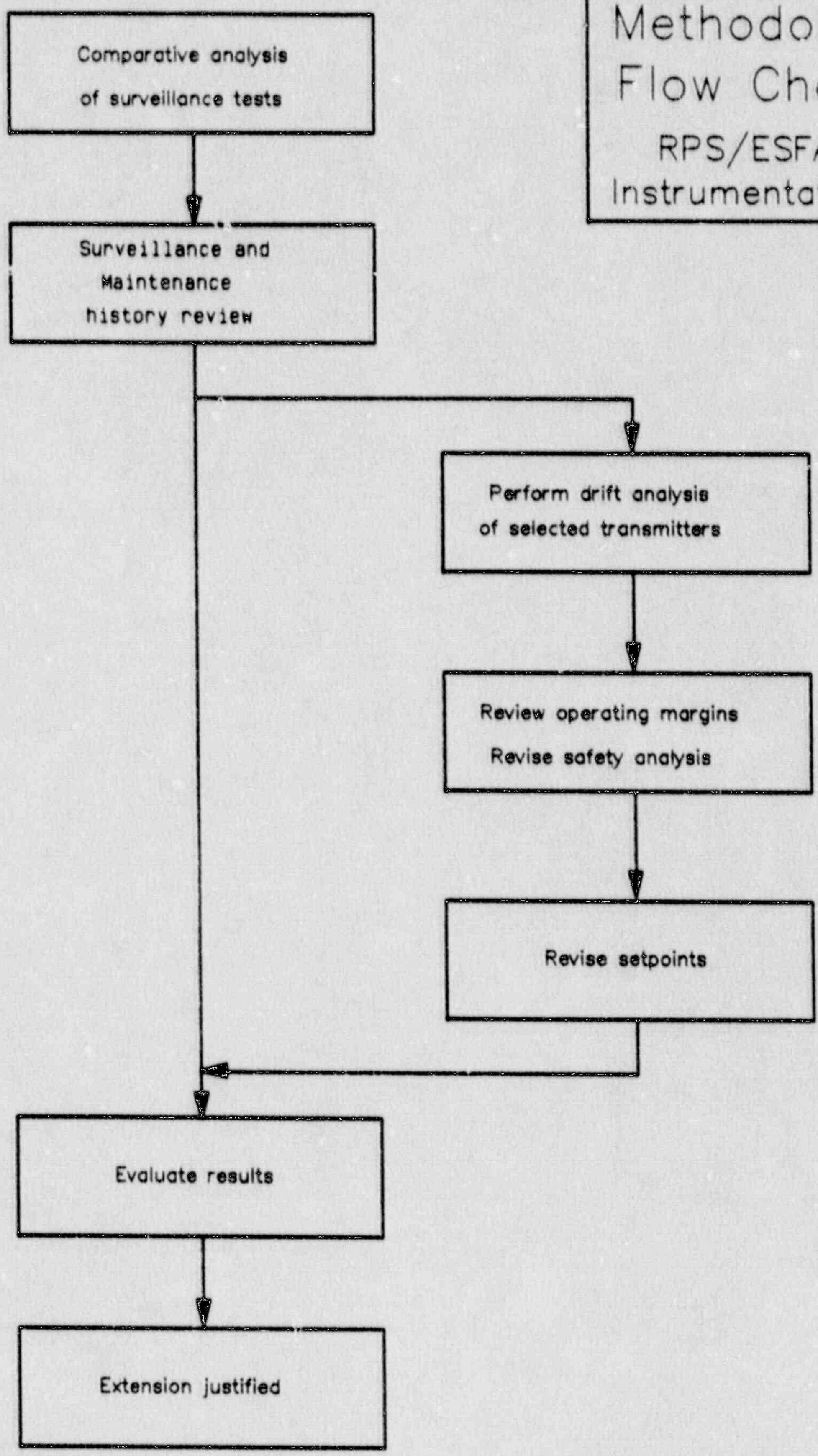
ATTACHMENT E

SONGS UNITS 2 AND 3

FIGURES

Figure 1

Methodology Flow Chart
RPS/ESFAS Instrumentation



RPS COMPONENT BLOCK DIAGRAM

PRESSURE, LEVEL OR FLOW CHANNELS- CALIBRATED AT LEAST ONCE PER REFUELING INTERVAL

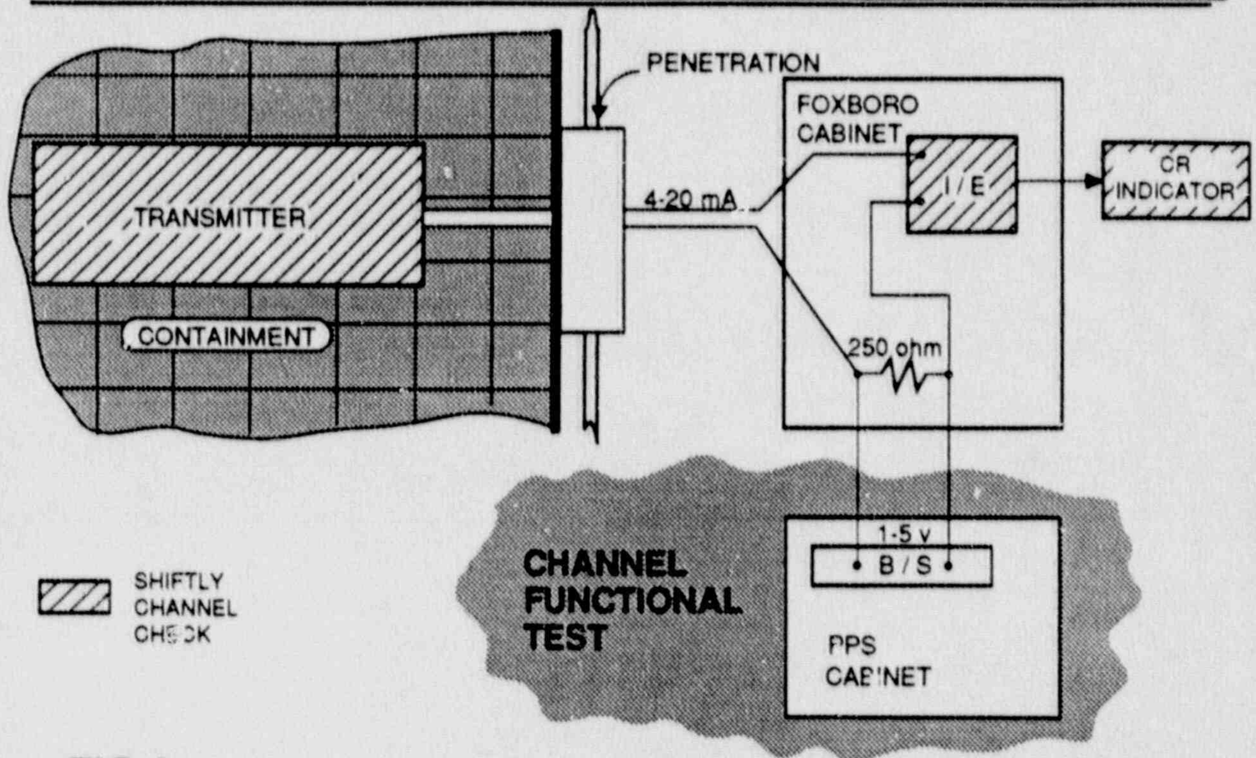


FIG 2

ABBEREVIATIONS FOR FIGURES :

B/S -- BISTABLE

CEAC -- CONTROL ELEMENT ASSEMBLY CALCULATOR

CPC -- CORE PROTECTION CALCULATOR

CR -- CONTROL ROOM

HI-LIN -- HIGH LINEAR POWER

HI-LOG -- HIGH LOGARITHMIC POWER

I/E -- CURRENT-TO-VOLTAGE CONVERTER

NI -- NUCLEAR INSTRUMENTATION

NIS -- NUCLEAR INSRUMENTATION SYSTEM

PPS -- PLANT PROTECTION SYSTEM

RCS -- REACTOR COOLANT SYSTEM

PZR -- PRESSURIZER

RCP -- REACTOR COOLANT PUMP

RCS -- REACTOR COOLANT SYSTEM

RSPT -- REED SWITCH POSITION TRANSMITTERS

RPS COMPONENT BLOCK DIAGRAM

NUCLEAR INSTRUMENTATION-LINEAR POWER LEVEL

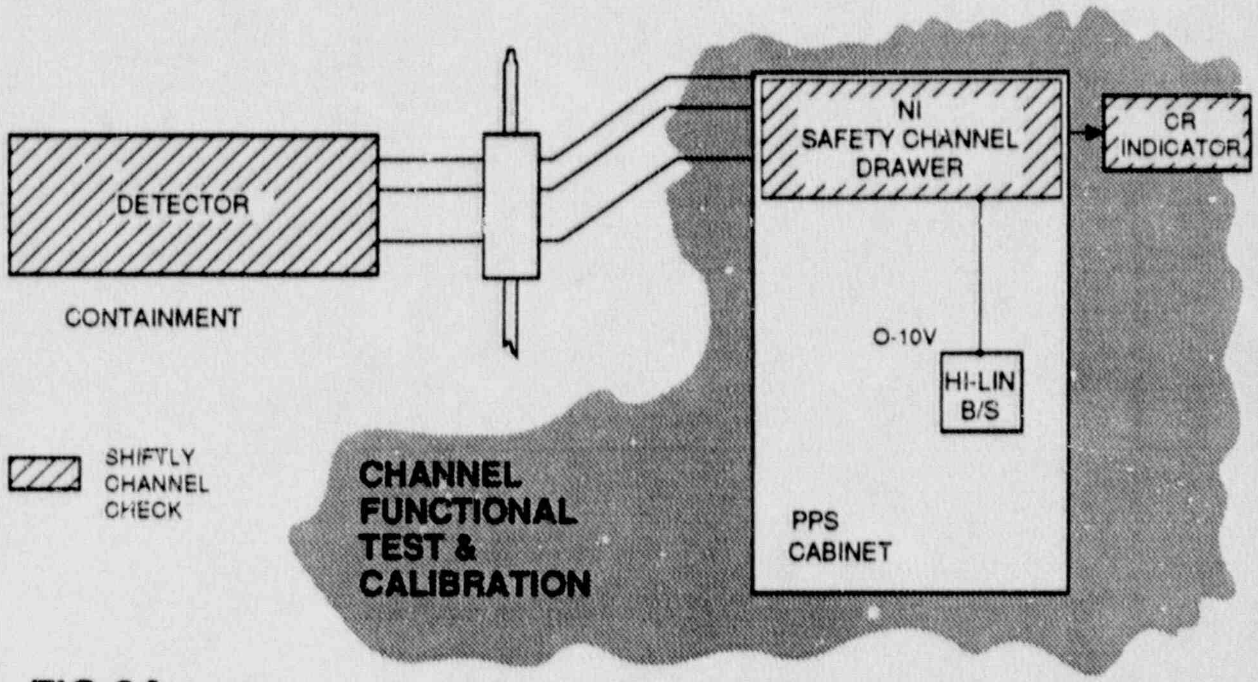


FIG 3A

NUCLEAR INSTRUMENTATION-LOGARITHMIC POWER LEVEL

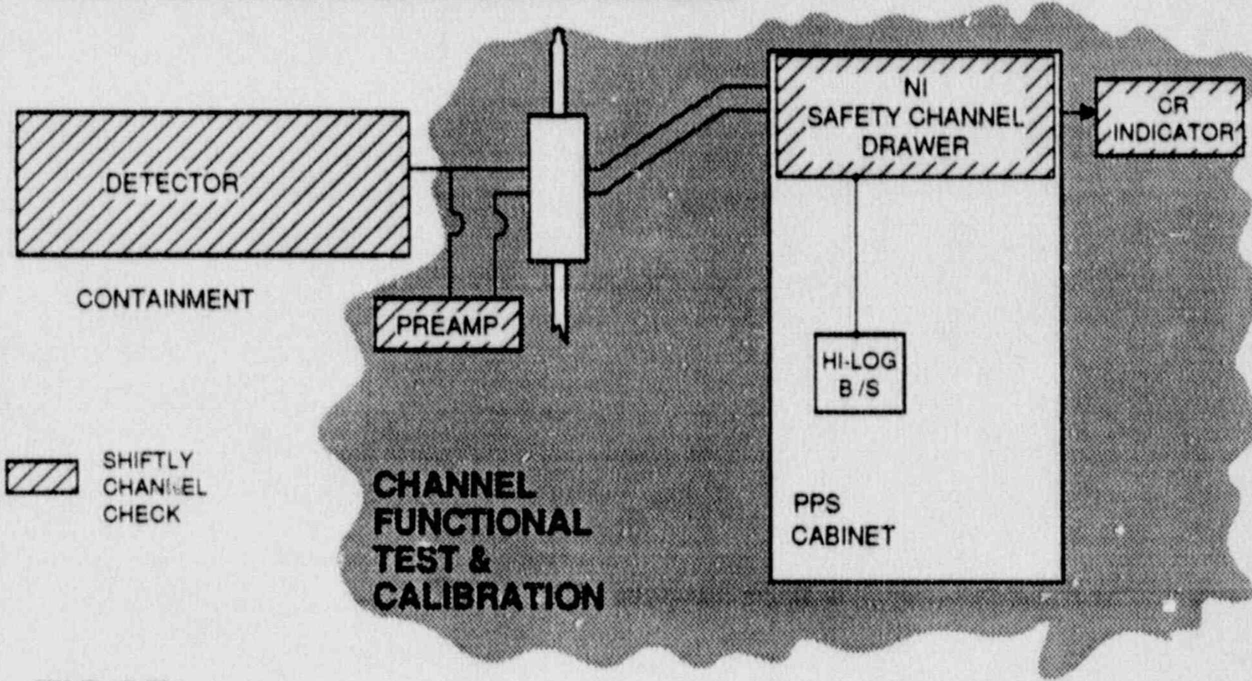


FIG 3B

RPS COMPONENT BLOCK DIAGRAM

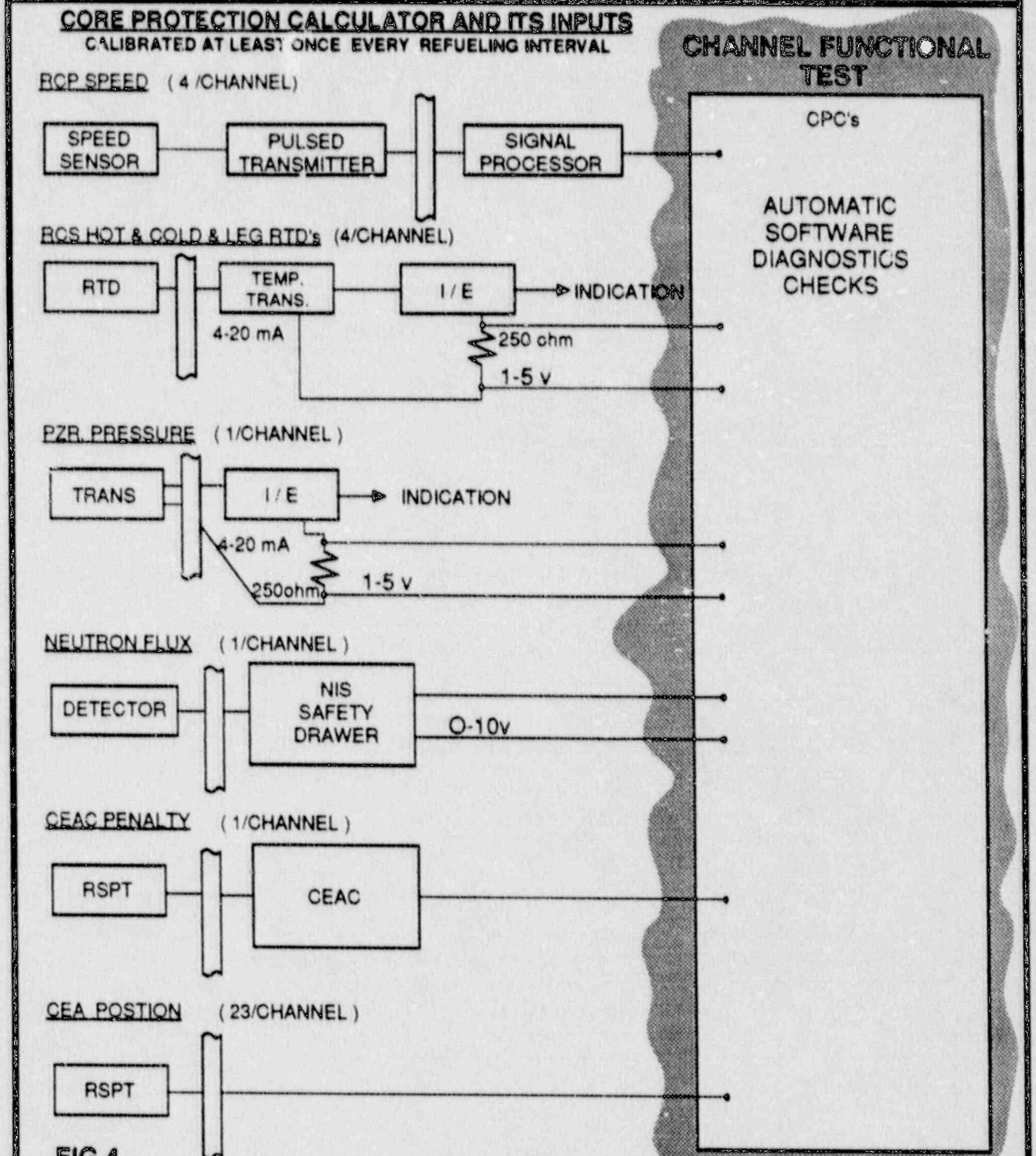


FIG 4

RPS COMPONENT BLOCK DIAGRAM

CONTAINMENT PRESSURE CHANNELS- CALIBRATED AT LEAST ONCE PER REFUELING INTERVAL

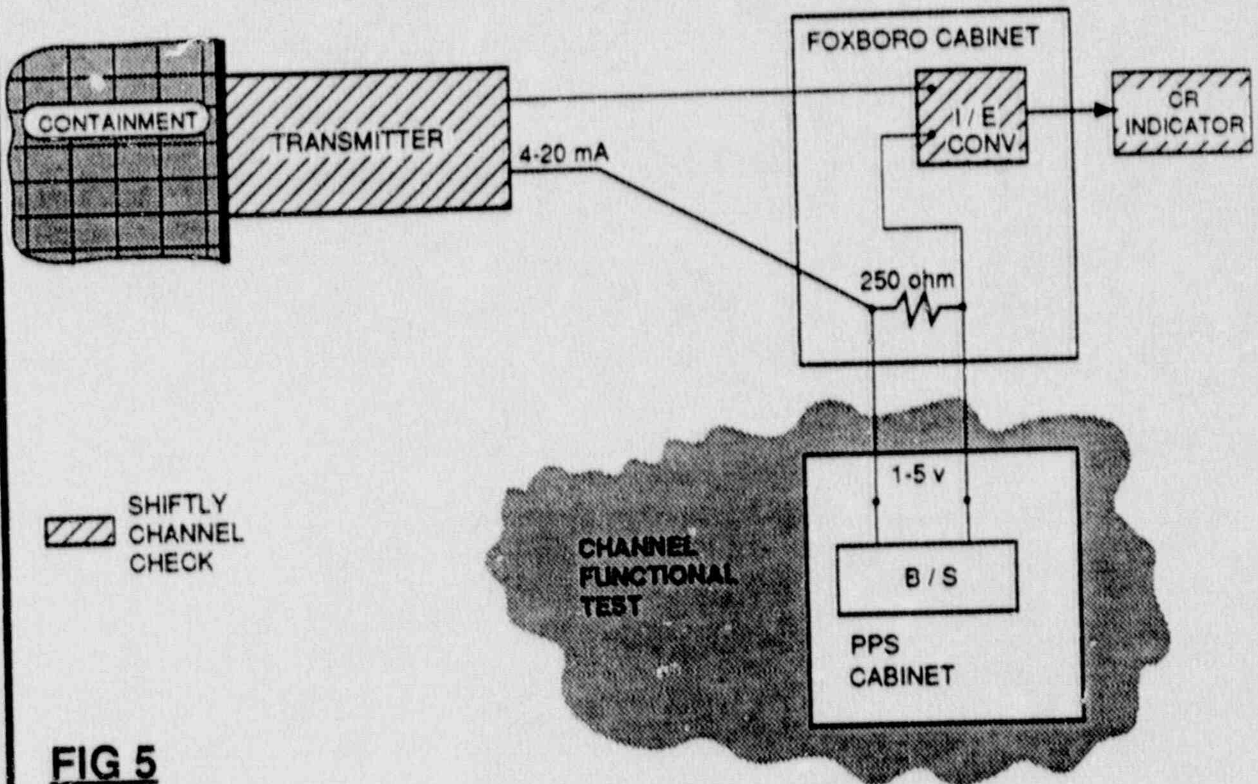


FIG 5

RPS COMPONENT BLOCK DIAGRAM

SEISMIC- HIGH- CALIBRATED AT LEAST ONCE PER REFUELING INTERVAL

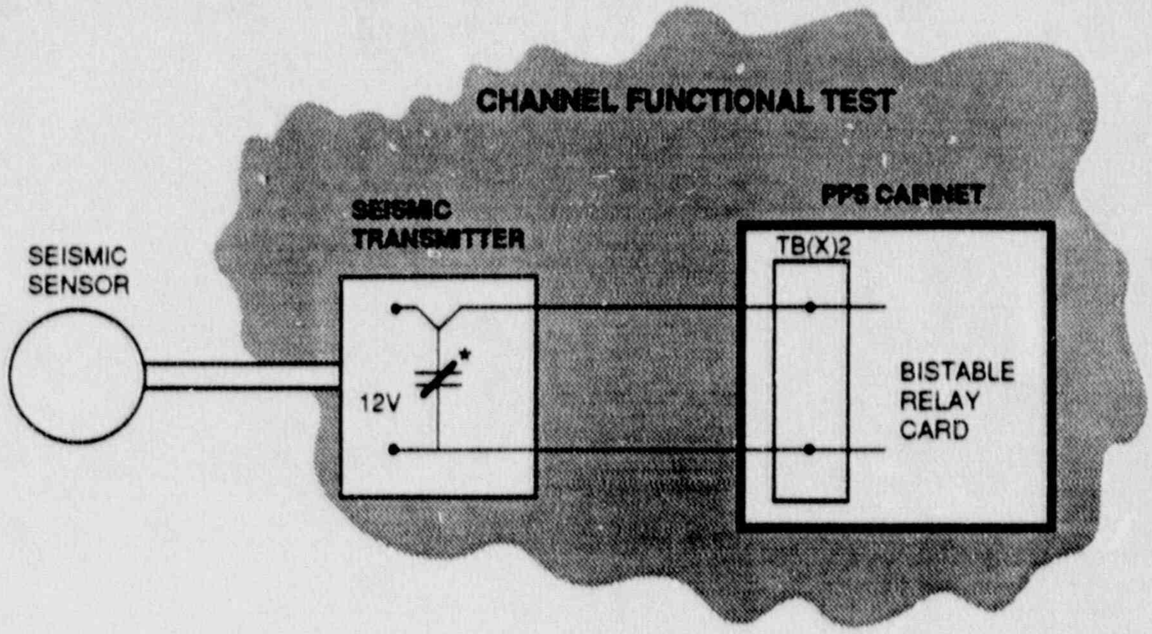


FIG 6

* NOTE: Contact normally closed-OPENS ON A HIGH SEISMIC EVENT.

ATTACHMENT E

TABLE E-1

SURVEILLANCE TEST REQUIREMENTS

Channel Calibration

A Channel Calibration shall be the adjustment, as necessary, of the channel output such that it responds with the necessary range and accuracy to known values of the parameter which the channel monitors. The Channel Calibration shall encompass the entire channel including the sensor and alarm and/or trip functions, and shall include the Channel Functional Test. The Channel Calibration may be performed by any series of sequential, overlapping or total channel steps such that the entire channel is calibrated.

Channel Functional Test

A Channel Functional Test shall be:

a. Analog channels - the injection of a simulated signal into channel as close to the sensor as practicable to verify operability including alarm and/or trip functions.

b. Bistable channels - the injection of a simulated signal into the sensor to verify operability including alarm and/or trip functions.

c. Digital computer channels - the exercising of the digital computer hardware using diagnostic programs and the injection of a simulated process data into the channel to verify operability.

Channel Check

A Channel Check shall be the qualitative assessment of channel behavior during operation by observation. This determination shall include, where possible, comparison of the channel indication and/or status with other indications and/or status derived from independent instrument channels measuring the same parameter.

ATTACHMENT F

SONGS UNITS 2 AND 3

SURVEILLANCE HISTORY REVIEW

Attachment F

SURVEILLANCE HISTORY REVIEW

Methodology

A Corrective Maintenance (CM) history review was conducted for all the instrumentation involved in supporting the subject Technical Specification for the Reactor Protection System (RPS). The CM review was completed in two parts to assure that the operability problems expected to be corrected or prevented by the 18 month surveillances are being captured. The first review is a comprehensive evaluation of all CMs to determine their impact on operability and their method of detection. The second review is an evaluation of all those inoperable conditions found during the 18 month surveillance. The objective of the combination of these evaluations is to ensure that all operability problems are being identified in a timely manner, and to determine the importance of the 18 month surveillances in maintaining operability.

The instruments supporting the RPS system that were evaluated herein are listed on Table F-1. These components are pressure sensors, differential pressure sensors, temperature elements, speed sensors, logic channels, and nuclear power range equipment. The Preventive Maintenance (PM) program for these instruments consists mainly of 18 month Channel Calibrations and shiftly operator checks. The shiftly checks include status panel indicators and cross-channel comparison checks. Abnormalities result in a CM order being issued. In addition to these baseline surveillances, EQ requirements replace the electronic amplifiers and whole transmitter assemblies at 10, 15 and 20 year intervals for the pressure and differential pressure transmitters.

Results

The CM history review determined that almost all of the problems associated with operability are found by operations personnel during once per shift checks, or during routine monitoring of plant parameters. Cross-channel comparisons were responsible for many of the CM requests, while lagging sensor response was noted several times. The corrective action taken on many of the problems were to flush sensing lines, vent and fill transmitters, and repair leaking hardware, and not associated with instrument calibration.

Nine CMs were identified as having been found during the performance of 18 month surveillance activities. Table F-2 summarizes the problems encountered, and provides an evaluation.

Based on the evaluation of the CM review, it can be concluded that most of the sensors have not been experiencing substantial calibration problems. When calibration problems were identified, they were normally found during the shiftly cross-channel checks. Eight instruments were found to be noncalibratable and one failed during 18 month surveillances. These were reviewed separately to determine their significance. The results of this

review showed that had the instrument operated in the affected range or had the error increased even slightly, then the shiftly checks would have alerted the plant to the problem.

No repetitive failures have occurred, and no instances were found involving redundant channels during the same time period, therefore the safety and operability impacts have been minimal. No correlation was found between the number of failures and the interval of calibration. The results of this evaluation support a calibration interval extension from 18 to 24 (30) months.

Table F-1

REACTOR PROTECTION SYSTEM

INSTRUMENTATION LIST

T/S Func. Unit	Loop Components	Description
1.	2(3)HS9132-1,-2,-3,-4	Reactor trip, manual
2.	2(3)JE0001-1,-2,-3,-4 2(3)JY0001-1,-2,-3,-4	Logarithmic power level, high
	2(3)JYK0991 2(3)JYK0992 2(3)JYK0993 2(3)JYK0994	Excore nuclear instrument channel
3.	2(3)JE0001-1,-2,-3,-4 2(3)JY0001-1,-2,-3,-4	Linear power level, high
	2(3)JYK0991 2(3)JYK0992 2(3)JYK0993 2(3)JYK0994	Excore nuclear instrument channel
4.	2(3)PT0101-1,-2,-3,-4	Pressurizer pressure, high
5.	2(3)PT0102-1,-2,-3,-4	Pressurizer pressure, low
6.	2(3)PT0351-1,-2,-3,-4	Containment pressure, high
7.	2(3)PT1013-1,-2,-3,-4 2(3)PT1023-1,-2,-3,-4	Steam generator pressure, low
8.	2(3)LT1113-1,-2,-3,-4 2(3)LT1123-1,-2,-3,-4	Steam generator level, low
9.	2(3)UIK0901 2(3)UIK090A2 2(3)UIK090A3 2(3)UIK0904	Central processing unit, CPC Local power density
10.	Same as Item 9.	DNBR
11.	Same as item 8.	Steam generator level, high

Table F-1 - continued

REACTOR PROTECTION SYSTEM

INSTRUMENTATION LIST

T/S Func. Unit	Loop Components	Description
14.	2(3)PT0101-1,-2,-3,-4	Pressurizer pressure, high
	2(3)SE0113-1,-2,-3,-4	Reactor coolant pump speed
	2(3)ST0113-1,-2,-3,-4	
	2(3)SY0113-1,-2,-3,-4	
	2(3)SE0123-1,-2,-3,-4	
	2(3)ST0123-1,-2,-3,-4	
	2(3)SY0123-1,-2,-3,-4	
	2(3)SE0133-1,-2,-3,-4	
	2(3)ST0133-1,-2,-3,-4	
	2(3)SY0133-1,-2,-3,-4	
	2(3)SE0143-1,-2,-3,-4	
	2(3)ST0143-1,-2,-3,-4	
	2(3)SY0143-1,-2,-3,-4	
	2(3)TE0112-1,-2,-3,-4	Reactor coolant hot leg temperature
	2(3)TT0112-1,-2,-3,-4	
	2(3)TE0122-1,-2,-3,-4	
	2(3)TT0122-1,-2,-3,-4	
	2(3)TE9178-1,-2,-3,-4	Reactor coolant cold leg temperature
	2(3)TT9178-1,-2,-3,-4	
	2(3)TE9179-1,-2,-3,-4	
	2(3)TT9179-1,-2,-3,-4	
	2(3)AB5RCEDM	CEA position indication
	2(3)BB5RCEDM	
	2(3)CB5RCEDM	
	2(3)DB5RCEDM	
	2(3)UIK0901	Central processing unit, CPC
	2(3)UIK090A2	Local power density
	2(3)UIK090A3	
	2(3)UIK0904	

Table F-1 - continued

REACTOR PROTECTION SYSTEM

INSTRUMENTATION LIST

T/S Func. Unit	Loop Components	Description
15	2(3)UIK090B2 2(3)UIK090B3	Central processing unit, CPC CEA calculators
16.	2(3)PDT0978-1,-2,-3,-4 2(3)PDT0979-1,-2,-3,-4	Reactor coolant flow, low
17.	2(3)XS8031-1,-2,-3,-4 2(3)XT8031-1,-2,-3,-4	Seismic acceleration, high

Table F-2

SURVEILLANCE CM HISTORY SUMMARY

Component	Date Completed	Problem Description
2TT9178-2	11/84	(1) Replaced TT after failing to calibrate
2TT9178-3	04/83	(2) Replaced TT after loop failed to calibrate
3PDT0978-4	02/84	(3) Replaced after failing to calibrate
2LT1113-3	11/84	(3) Replaced after failing to calibrate
3LT1113-2	10/85	(3) Replaced after failing to calibrate
3LT1113-3	01/84	(3) Replaced after failing to calibrate
2PT0351-1	02/85	(4) Replaced after failing to calibrate
2PT0351-2	02/85	(4) Replaced after failing to calibrate
3SE-loops	11/85	(5) Several loops found with inoperative probes, and weak transmitters

EVALUATION

(1) The transmitter's circuit card was found failed. Random failure of electronic components is a time independent occurrence. These failures are usually complete electronic part failures, that are readily detected during daily and shiftly Channel Checks. Since most of these shiftly checks are mode 1 through 4 requirements, these channels are not routinely monitored during modes 5 and 6 outage operations. Therefore the Channel Calibrations during these periods sometimes discover failures that would normally have been detected by the shiftly channel checks during mode 1 through 4 operations.

(2) This failure predates commercial operation, and was part of expected initial startup problems. It is included here for completeness of surveillance history documentation.

SURVEILLANCE CM HISTORY SUMMARY

(3) The subject transmitters were not able to meet the stringent five point span accuracy specifications utilized to "tune up" the loop components in the channel calibrations, and were therefore replaced. These failures do not represent gross problems, in that the inaccuracies were not significant enough to be detected by the cross-channel comparison. Since redundant channels were available, there have been no repeat channel failures, and only one failure in the past four years, it is concluded that calibration interval extension would have no significant impact on RPS operability.

(4) These transmitters each represent one of four redundant channels monitoring containment pressure. These transmitters could not be calibrated within the stringent channel calibration specification, and were replaced as discussed in item (1).

(5) These failures that were "found" during the refueling surveillance were the result of two contributors. The first contributor is the mechanical action on the probe assembly, that takes place each time reactor coolant pump maintenance is performed. The process of extracting the probe sometimes causes irreparable damage. Two instances of this occurred during the outage. The second contributor was the system "overhaul" conducted during this outage. To correct system problems, connectors, cabling and transmitters were replaced to ensure reliable operation post-outage. Thus, seven transmitters were replaced along with other hardware, to improve system performance. Therefore the replacements associated with this 18 month surveillance are not the result of undetected conditions being found by this surveillance.

(6) <u>CM History Summary</u> - The maintenance history for these instruments was reviewed. The review showed that relatively few sensor related problems have occurred since beginning commercial operations. This review found that the usual problems encountered during plant operations were sluggish instrument response, deviations between redundant channel readings, erratic indications, and fluctuations causing alarms. Each of these deficiencies was reported by operations personnel, corrective action taken, post-maintenance testing conducted, and the channel returned to service. If the channel was inoperable, a limiting condition of operation was entered until the equipment was returned to service.

ATTACHMENT G

SONGS UNITS 2 AND 3

INSTRUMENT DRIFT STUDY

ATTACHMENT G

INSTRUMENT DRIFT STUDY SUMMARY

1.0 Introduction

This is a summary of an analysis of instrument transmitter drift that has been performed by Southern California Edison, Reference 5.1. The purpose of the study was to quantify the magnitude of transmitter drift that is occurring at the San Onofre Nuclear Generating Station, Units 2 and 3. This is important when considering the extension of transmitter calibration intervals to 30 months.

In order to arrive at trip setpoints for automatic protection systems, many factors are considered. Uncertainties associated with installed equipment, calibration equipment, normal environmental effects, and, if applicable, accident environmental effects are examples of these factors. Drift, or change of calibration of instrumentation over time, of the installed instrumentation is also one of the factors and is the only one with a time dependence. The maximum expected drift is established based on the calibration interval of the installed equipment. Historically, this has been based on information provided by instrumentation suppliers.

This summary describes an analysis of the historical calibration data of certain instrumentation used at the San Onofre Nuclear Generating Station (SONGS) Units 2&3. The purpose of this summary is to provide a reference document of an investigation into extending the calibration interval of this instrumentation from the current technical specification requirement of 18 months to 30 months.

There are four technical specifications where, in addition to conducting specific procedures on logic and actuation devices, it is necessary to perform calibrations of transmitters. These technical specifications are

3/4.3.1	Reactor Protective System (RPS)
3/4.3.2	Engineering Safety Features Actuation System (ESFAS) Instrumentation
3/4.3.3.5	Remote Shutdown Monitoring (RSM) Instrumentation
3/4.3.3.6	Accident Monitoring System (AMS) Instrumentation

These technical specifications cover a large number of instrument channels, which in some cases share a common instrument transmitter. There are three types of transmitters which are addressed by these technical specifications; pressure transmitters (PTs), differential pressure transmitters (DPs), and temperature transmitters (TTs). PT and DP transmitters are electro-mechanical devices that are located remote from the control room while temperature transmitters are solid state, electronic modules located in the control room area. In each instrument loop, the transmitter is a common device that drives a number of output devices.

Estimates for drift are developed for each model of transmitter. These values are provided in terms of % of span. These estimates reflect a "best estimate" value and a "95/95" value. Best estimates are values which reflect an expected performance of 50% of the hardware and is determined by averaging the absolute value of drift data. The 95/95 values are values of drift which will bound all hardware performance with a 95% probability at a 95% confidence level. The probability value establishes the portion of the population that is included within the tolerance interval. The 95% probability was selected for this study. This means that 95% of all past, present, and future values of drift will be bounded by the 95/95 interval value.

The confidence level essentially establishes the repeatability of calculating a value which will fall within the estimated values. A 95% confidence level was selected. This means that if the drift values would be recalculated in the future, there is a 95% chance that the values would be bounded by the 95/95 interval values. Using 95/95 values means that we are 95% sure that 95% of all drift values will be less than the estimated values.

Best estimate values are used in evaluating the acceptability of Accident Monitoring and Remote Shutdown Instrumentation, while 95/95 values are used in evaluating instruments related to the Plant Protection Systems (PPS), i.e., the Reactor Protective and Engineered Safety Features Actuation Systems.

Regulatory Guide 1.105, Reference 5.3, provides the basis for the use of 95/95 values for establishing and maintaining instrument setpoints of individual instrument channels in safety-related systems. These values provide assurance that the PPS will initiate automatic operation of appropriate systems to ensure that specified acceptable design limits are not excluded. Setpoints are not provided for Accident Monitoring and Remote Shutdown instrumentation. AMS and RSM instrumentation results in operator actions and is therefore not required to be as accurate as the PPS. This warrants the use of best estimate values for AMS and RSM instrumentation.

2.0 Method of Analysis

The methods used to determine the experienced drift values are described in this section. A flow chart describing the process is attached. Lotus 1-2-3 was used extensively to perform the calculations. Statistical methods described in Reference 5.2 were used to determine the maximum values for experienced drift for those transmitters which are used in applications covered by the SONGS Units 2&3 technical specifications on the Reactor Protective System and Engineered Safety Features Actuation System. These calculations were verified by an independent check of a sample of the data.

2.1 Individual Transmitter Data

To conduct this analysis, a Lotus 1-2-3 spreadsheet template was constructed. The calibration data for the transmitters of interest were recovered and entered into this spreadsheet template and a unique spreadsheet was constructed for each transmitter. In some cases, transmitters not addressed

by these technical specifications were included in order to increase the amount of historical experience for a particular model of instrument.

Each spreadsheet contains a groups of 5 cells (corresponding to each of the 5 calibration points) that calculate the difference between the as-found readings and the as-left readings of the previous calibration period. This difference is calculated for each set of successive calibration records that were recovered. Once these differences are determined, the maximum value of drift for each set of 5 points is selected. This maximum value is then divided by the time interval between calibrations to determine an annual drift rate. A unique spreadsheet was constructed for each transmitter resulting in several hundred spreadsheets. Each of these spreadsheets may contain multiple one or no calibration drift data.

2.2 Analysis of Data by Model and Process

Once the drift data was determined (as percent of span per year) for individual transmitters, the data was extracted from the transmitter spreadsheets and entered into another spreadsheet to perform a first cut at editing the data. Macros were written to automatically access each transmitter spreadsheet and transfer the data to a "raw data" spreadsheet. This method minimizes the chance for error in transferring data. One raw data spreadsheet was constructed for each of the different types of transmitters, i.e. one for pressure transmitters, one for differential pressure transmitters, and one for temperature transmitters.

The data in these three spreadsheets was then edited using two criteria related to the interval between successive calibration data that had been recovered. Any data that was related to a calibration interval less than 100 days was removed from the data base. This data represents a short term problem which was likely to have been discovered by operators during shiftly surveillances or through some other means. The purpose of this analysis was to determine the magnitude of drift to be expected over a fuel cycle and to exclude problems related to short term effects that are discovered during the fuel cycle.

The second screening criteria was that any interval greater than 2̃ 1/2 months was removed from the data base. These data points were removed because the maximum interval allowed by the Technical Specifications is 22 1/2 months so an interval that is greater than this value is likely to indicate that a calibration occurred in the intervening period but the data was not recovered.

Unique, explicit values exist for transmitters associated with RPS setpoints and CPC uncertainties. Common values exist for each of the following, Foxboro pressure transmitters, Rosemount pressure transmitters, Foxboro differential pressure transmitters and CPC temperature inputs. The product of the drift study is to either validate that these numbers are valid or to define new acceptable values. To accomplish this objective, the data was then grouped and analyzed in a manner consistent with the existing groupings. To assure that these groupings are appropriate, the data was divided into models, then by processes, and then analyzed at each level.

Once the grouping was established, identical final editing and analyses on the data were conducted. Methods described in Reference 5.2 were used to identify and remove outliers from the data base and to determine the 95/95 drift values. They are briefly described here.

2.3 Treatment of Outliers

An outlier is an observation that is significantly different from the rest of the sample and most likely comes from a different distribution. They usually result from mistakes or measuring device problems. To identify outliers, the T-Test described in Reference 5.2 was utilized. The extreme studentized deviate is calculated as

$$T = \frac{| x_e - \bar{x} |}{s}$$

where

T Extreme studentized deviate
x_e Extreme observation
$\bar{x}$ Mean
s Standard deviation of the same sample

If T exceeds the critical value given in Table XVI of Reference 5.2 at the 5% significance level, the extreme observation is considered to be an outlier. Once the outlier is identified, it is removed from the data base.

2.4 Normality Tests

Once the edited data base was finalized and grouped, the Chi-Square Goodness of Fit Test (Reference 5.2) was utilized to assure that the underlying distribution could be represented by a normal distribution. This test assumes a normal distribution and based on the sample mean and deviation, predicts the expected number of observations in each interval. The expected values are compared to the observed values. Since this test requires a rather large number of points, it could only be applied to the groups with a large population.

2.5 Maximum Expected Drift

In order to establish a value for the total drift population that is conservative with a 95% probability at a 95% confidence level, a 95/95 tolerance interval is determined as described in Reference 5.2. A tolerance interval places bounds on the proportion of the sampled population contained within it. This tolerance interval about the mean bounds 95% of the past, present and future drift values. Determining the interval and adding it to the absolute value of the mean determines the maximum expected drift.

The maximum drift values were calculated as follows

$$X_{max} = |\bar{x}| + Ks$$

where

X_{max}	Maximum expected drift with a 95% probability at the 95% confidence level
$\bar{x}$	Sample mean
K	A value from Reference 5.2, Table VII(a), with 95% probability and at the 95% confidence level that is selected based on the sample size
s	Standard deviation of the sample

2.6 Best Estimate of Drift

The best estimates of instrument drift were calculated in much the same manner as the 95/95 values. As before, the maximum value of drift for the five calibration points was determined for each interval. Again, this maximum value was divided by the time duration of the interval to arrive at an annual drift rate. At this point, the process differs from that used to calculate the 95/95 value. The best estimate of drift for the population is determined as follows.

$$X_{exp} = \frac{|x_i|}{n}$$

where

X_{exp}	The best estimate of drift
X_i	Annual drift rate of the ith data point
n	Number of data points

3.0 Results

The purpose of this section is to make comparisons of the results of the drift calculations to the existing drift allowances. Where those allowances are insufficient for 30 month calibration intervals, and where no explicit allowances exist, revised allowances are identified. The experienced values of drift are then compared to these revised allowances.

Selection of the 95/95 interval value or the best estimate value is dependent upon the technical specification that is being addressed. The 95/95 values are selected for those instruments related to PPS setpoints, while best estimate values are selected for instruments related to AMS and RSM instruments.

In general, the value selected for comparison to the existing and revised allowances are based on the drift rates for the particular model of transmitter that is used in support of the technical specification. For the Rosemount 1153GD9 transmitters, this would lead to unnecessarily large conservatisms. The drift rates for the 1153GD9's used in the low range pressurizer pressure application cause the 95/95 interval values to be substantially larger. It is clear that the drift rates for these transmitters are different when used in these distinctly different applications. This is

further discussed in Section 3.1 below.

On the other hand, selection of the best estimate for Foxboro E13DH differential pressure transmitters would underestimate the experienced drift associated with pressurizer level indication. In this case the value for the pressurizer level transmitters taken by themselves was used as the best estimate of their performance.

The revised allowances shown in the tables in this section were chosen based on the groupings originally made for PPS setpoints. Assumptions were made for drift rates for Foxboro pressure transmitters (1.5% for 18 months), Rosemount pressure transmitters (0.75% for 18 months), Foxboro differential pressure transmitters (0.18% for 18 months), and Foxboro temperature transmitters (0.40% for 18 months). These values were extrapolated to the maximum calibration interval allowed by the technical specifications, which is 22.5 months, and used in determining the PPS setpoints. The revised allowances for drift were determined by inspecting the 30 month drift values and selecting a value which would bound the experienced values. In order to keep the number of different allowances to a minimum, the value selected for PPS setpoint is utilized as the allowance for AMS and RSM instrumentation.

3.1 Reactor Protective System Instrumentation

Table 3.1 provides a summary comparison of the results of the analysis of long term drift, the existing allowances for drift in RPS setpoints and revised allowances for long term drift to accommodate 30 month intervals between transmitter calibrations.

All experienced drift values reflect the 95/95 interval value for the model of transmitter related to the functional unit, except for Functional Unit #5, Pressurizer Pressure - Low. In this case, a substantial difference exists between the Rosemount 1153GD9's (wide range, 0 to 3000 psia) used for this trip function and those 1153GD9's used for low range (100 to 765 psia) pressurizer pressure. The drift rates for the transmitters differ in the distinct applications. This can be attributed to two factors. Firstly, the low range transmitters are "ranged down" three times that of the wide range. This is expected to cause approximately three times the drift. Secondly, the low range transmitters are exposed to an over range condition during normal operation, i.e. pressure in excess of 765 psia. Therefore, the 95/95 interval for the wide range Rosemount 1153GD9's is used as representing their performance.

Table 3.1

Reactor Protective System
Comparison of Results to Allowances

Functional Unit	Instrument Model	95/95 Interval Drift[1]	Existing Drift Allow[1,2]	New Drift Allow[1]
1. Manual Reactor Trip	N/A			
2. Lin Power Level - High	N/A			
3. Log Power Level - High	N/A			
4. Pzr Pressure - High	E11GM	3.13	1.88	3.75
5. Pzr Pressure - Low	1153GD9	1.09	0.94	1.25
6. Cont Pressure - High	NE11DM	2.86	1.88	3.75
7. S/G Pressure - Low	E11GM	3.13	1.88	3.75
8. S/G Level - Low	E13DM	6.04	0.22	6.25
9. Local Power Density	N/A			
10. DNBR - Low	See #14			
11. S/G Level - High	E13DM	[3]	0.22	[3]
12. RPS Logic	N/A			
13. Reactor Trip Breakers	N/A			
14. CPCs	2AI-P2V	0.82	0.50	0.94
	E11GM	3.13	1.88	3.75
15. CEA Calculators	N/A			
16. RCS Flow - Low	1153HD6	4.55	[4]	
17. Seismic - High	N/A			
18. Loss of Load	N/A			

NOTES:

1. Drift values are in terms of % of span.

2. The Existing Drift Allowances are derived from generic vendor data.

3. Steam Generator Level - High Trip uses a best estimate value of ±2.25%. This is acceptable because this trip is used for equipment protection only.

4. The Reactor Coolant Flow-low trip uses a Rate-Limited Variable Setpoint (RLVS) module. Transmitter drift errors will be included in the process signal and in the trip setpoint calculate by the RLVS module. These drift errors will therefore cancel each other out.

All of the experienced drift values exceed the existing allowance when extrapolated to 30 month calibration intervals. The revised values are conservatively larger than the experienced drift rates.

3.2 Engineered Safety Features Actuation System

Table 3.2 provides a summary comparison of the results of the analysis of long term drift, the existing allowances for drift in ESFAS setpoints and revised allowances for long term drift to accommodate 30 month intervals between transmitter calibrations.

All experienced drift values reflect the 95/95 interval value for the model of transmitter related to the functional unit, except for Functional Unit 1.c, Pressurizer Pressure - Low. The reason for using the lower value of drift associated with the wide range transmitters is discussed in Section 3.1 above.

Table 3.2
ESFAS Instrumentation
Comparison of Results to Allowances

Functional Unit	Instrument Model	95/95 Interval Drift[1]	Existing Drift Allow[1,2]	New Drift Allow[1]
1. Safety Injection				
a. Manual	N/A			
b. Cont Pressure - High	NE11DM	2.86	1.88	3.75
c. Pzr Pressure - Low	1153GD9	1.09	0.94	1.25
d. Auto Actuation Logic	N/A			
2. Containment Spray				
a. Manual	N/A			
b. Cont Pressure - Hi-Hi	NE11DM	2.86	1.88	3.75
c. Auto Actuation Logic	N/A			
3. Containment Isolation				
a. Manual CIAS	N/A			
b. Manual SIAS	N/A			
c. Cont Pressure - High	NE11DM	2.86	1.88	3.75
d. Auto Actuation Logic	N/A			
4. Main Steam Isolation				
a. Manual	N/A			
b. S/G Pressure - Low	E11GM	3.13	1.88	3.75
c. Auto Actuation Logic	N/A			
5. Recirculation				
a. RWT Level - Low	E13DM	6.04	0.22	6.25
b. Auto Actuation Logic	N/A			
6. Containment Cooling	N/A			
7. Loss of Power	N/A			
8. Emergency Feedwater				
a. Manual	N/A			
b. SG Level (A/B)-Low	E13DM	6.04	0.22	6.25
and DP(A/B) - High	E11GM	3.13	1.88	3.75
c. SG Level (A/B)-Low and No	E13DM	6.04	0.22	6.25
Pressure - Low Trip(A/B)	E11GM	3.13	1.88	3.75
d. Auto Actuation Logic	N/A			

Table 3.2
ESFAS Instrumentation
Comparison of Results to Allowances
(Continued)

Functional Unit	Instrument Model	95/95 Interval Drift(1)	Existing Drift Allow(1,2)	New Drift Allow(1)
9. Control Room Isolation	N/A			
10. Toxic Gas Isolation	N/A			
11. Fuel Handling Isolation	N/A			
12. Cont Purge Isolation	N/A			

Notes:

1. Drift values are in terms of % of span.
2. The Existing Drift Allowances are derived from generic vendor data.

All of the 95/95 experienced drift values exceed the existing allowances when extrapolated to 30 month calibration intervals. The revised allowances are conservatively larger than the experienced drift rates.

3.3 Remote Shutdown Monitoring System Instrumentation

Table 3.3 provides a summary comparison of the results of the analysis of long term drift and revised allowances for long term drift to accommodate 30 month intervals between transmitter calibrations. All experienced drift values reflect the best estimate value for the model of transmitter related to the instrument channel except for wide range pressurizer pressure and pressurizer level. The reason for using a different value for wide range pressurizer pressure is discussed in Section 3.1. Substantial differences exist between pressurizer level transmitters and the same model transmitter, Foxboro E13DH, used to monitor HPSI flow. This is probably due to the normally inactive HPSI system versus the constantly pressurized RCS. The higher best estimate value for the pressurizer level transmitters taken by themselves was selected to represent the best estimate of the performance of these transmitters.

The revised drift allowances were chosen to be consistent with the allowances used for similar equipment used in the PPS except for the transmitters used for condenser vacuum indication. The PPS includes Rosemount 1153GD9 pressure transmitters for monitoring pressurizer pressure. The condenser vacuum loops include Rosemount 1151AP4E transmitters which are calibrated over a range of

only 4 inches of mercury. The drift allowance used for Rosemount pressure transmitters (1.25% of span) is not sufficient to bound the best estimate of long term drift for the Rosemount 1151AP4E transmitters used for monitoring condenser vacuum, so a value of 8.75% of span was established. Although this is a relatively large value in terms of percent of span, it represents a very small change in terms of pressure (less than 0.5 inches Hg per 30 months).

Table 3.3

Remote Shutdown Monitoring Instrumentation
Comparison of Results to Allowances

Instrument	Instrument Model	Best Estimate Drift[2]	Drift Allowance[1,2]
1. Log Power Level	N/A		
2. RCS Cold Leg Temperature	444RL	0.31	0.94[3]
	2AI-P2V	0.28	0.94
3. Pressurizer Pressure	1153GD9	0.29	1.25
4. Pressurizer Level	E13DH	4.96	6.25[3]
5. Steam Generator Level	E13DM	1.98	6.25
6. Steam Generator Pressure	E11GM	0.99	3.75
7. Source Range NIs	N/A		
8. Condenser Vacuum	1151AP4E	7.24	8.75[3]
9. Volume Control Tank Level	E13DM	1.98	6.25
10. Letdown HX Pressure	E11GM	0.99	3.75
11. Letdown HX Temperature	2AI-P2V	0.28	0.94
12. BAMU Tank Level	NE13DM	4.31	6.25[3]
13. Cond Storage Tank Level	1153DD5	0.44	6.25
	1152DP5	1.08	6.25
14. RCS Hot Leg Temperature	444RL	0.31	0.94[3]
15. Pzr Pressure - Low Range	NE11GM	0.59	3.75
16. Pzr Pressure - High Range	E11GM	0.99	3.75
17. Pressurizer Level	E13DH	4.96	6.25[3]
18. Steam Generator Pressure	NE11GM	0.59	3.75
19. Steam Generator Level	E13DM	1.98	6.25

Note:

1. Drift values are in terms of % of span.

2. The Drift Allowances for all Remote Shutdown Monitoring (RSM) instruments except those noted (3) are based on the 95/95 values. The 95/95 values are derived from the Instrument Drift Study for the RSM System instruments.

3. The Drift Allowance has been selected to bound the Best Estimate Drift Value. The best estimate values are derived from the Instrument Drift Study.

As can be seen from the table, the revised allowances for drift over a 30 month period are generally several times the experienced best estimate values.

3.4 Accident Monitoring System Instrumentation

Table 3.4 provides a summary comparison of the results of the analysis of long term drift and revised allowances for long term drift to accommodate 30 month intervals between transmitter calibrations. All experienced drift values reflect the best estimate value for the model of transmitter related to the instrument channel except for pressurizer pressure and pressurizer level. The reasons for treating these instruments differently are discussed in Sections 3.1 and 3.3, respectively.

The revised drift allowances were chosen to be consistent with the allowances used for similar equipment in the PPS.

Table 3.4

Accident Monitoring System Instrumentation
Comparison of Results to Allowances

Instrument	Instrument Model	Best Estimate Drift(1)	Drift Allowance(1,2)
1. Cont Press-Narrow Range	NE11DM	0.66	3.75
2. Cont Press-Wide Range	NE11GM	0.59	3.75
	E11GM	0.99	3.75
3. RCS Outlet Temperature	2AI-P2V	0.28	0.94
4. RCS Inlet Temperature(WR)	2AI-P2V	0.28	0.94
5. Pressurizer Pressure (WR)	1153GD9	0.29	1.25
6. Pressurizer Water Level	E13DH	4.96	6.25(3)
7. Steam Line Pressure	E11GM	0.99	3.75
8. S/G Level (Wide Range)	1153HD5	1.09	6.25
9. RWT Water Level	E13DM	1.98	6.25
10. Auxiliary FW Flow Rate	E13DM	1.98	6.25
11. RCS Subcooling	2AI-P2V	0.28	0.94
Margin Monitor (QSPDS)	1153GD9	0.29	1.25
12. Safety Valve Position Ind	N/A		
13. Spray System Pressure	NE11DM	0.66	3.75
14. LPSI Header Temperature	2AI-P2V	0.28	0.94
15. Containment Temperature	2AI-T2V	0.50	0.94(3)
16. Containment Water Level (Narrow Range)	N/A		
17. Containment Water Level (Wide Range)	N/A		
18. Core Exit Thermocouples	N/A		
19. Cold Leg HPSI Flow	E13DH	1.49	6.25
20. Hot Leg HPSI Flow	E13DH	1.49	6.25
21. HJTC System - RVLMS	N/A		

Table 3.4

Accident Monitoring System Instrumentation
Comparison of Results to Allowances
(Continued)

Note:

1. Drift values are in terms of % of span.

2. The Drift Allowances for all Accident Monitoring System (AMS) instruments except those noted (3) are based on the 95/95 values. The 95/95 values are derived from the Instrument Drift Study for the AMS System instruments.

3. The Drift Allowance has been selected to bound the Best Estimate Drift Value. The best estimate values are derived from the Instrument Drift Study.

Comparisons of the best estimate drift values to the revised allowances show that those allowances conservatively reflect transmitter performance.

4.0 Conclusions

The preceding sections of this summary provide a description of the methods and results of an analysis of the long term drift characteristics of transmitters installed at San Onofre Nuclear Generating Station, Units 2&3. A comparison of the results of analysis of the long term drift data is made to existing allowances for long term drift. The results are also compared to revised allowances for long term drift assuming 30 month intervals between calibrations.

The scope of this summary is sufficient in that all of the models of transmitters used in applications covered by the relevant technical specifications are addressed. The methods used to develop 95/95 interval values and best estimates are accepted and documented. These methods assure results which are consistent with the design assumptions.

There are several inherent conservatisms with using the revised allowances.

- Drift allowances are larger than 95/95 and best estimate values.

  Since bounding values were selected to represent several types of transmitters, the 95/95 and best estimate values are, in general, substantially less than the revised drift allowance.

- o Differences in as-found and as-left values were assumed to be entirely due to drift.

  The differences in as-found and as-left readings were assumed to be entirely due to drift, when factors such as transmitter accuracy, calibration uncertainties, and normal environmental effects are most certainly present. Setpoint calculations treat each of these factors independently resulting in accounting for these factors twice.

- o Only the maximum value of the five calibration points was used.

  A typical calibration is done at five points over the range of the transmitter. Only the maximum value of drift for the five calibration points was utilized as a data point in the drift assessment. Incorporating the data related to the other four points would increase the amount of data by a factor of five, with four of the points of each data set being less than the point in the current data base.

This analysis provides a conservative assessment of transmitter performance for those transmitters addressed within the scope of this summary. Utilization of the revised allowances for long term drift in setpoint and uncertainty calculations, and in evaluations of instrument performance with respect to the EOIs will provide a sound basis for extending the calibration interval of these transmitters to 30 months.

5.0 References

5.1 Instrument Drift Study, CDM Document Number M-89047, R. M. Bockhorst, Southern California Edison Company, May, 1989

5.2 Statistics for Nuclear Engineers and Scientists, Part 1: Basic Statistical Inference, WAPD-TM-1292, DOE Research and Development Report, William J. Beggs, February, 1981, Bettis Atomic Power Laboratory, West Mifflin, Pennsylvania

5.3 U.S. Nuclear Regulatory Commission, Regulatory Guide 1.105, "Instrument Setpoints for Safety-Related Systems," February, 1986.

Instrument Drift Study Flow Chart

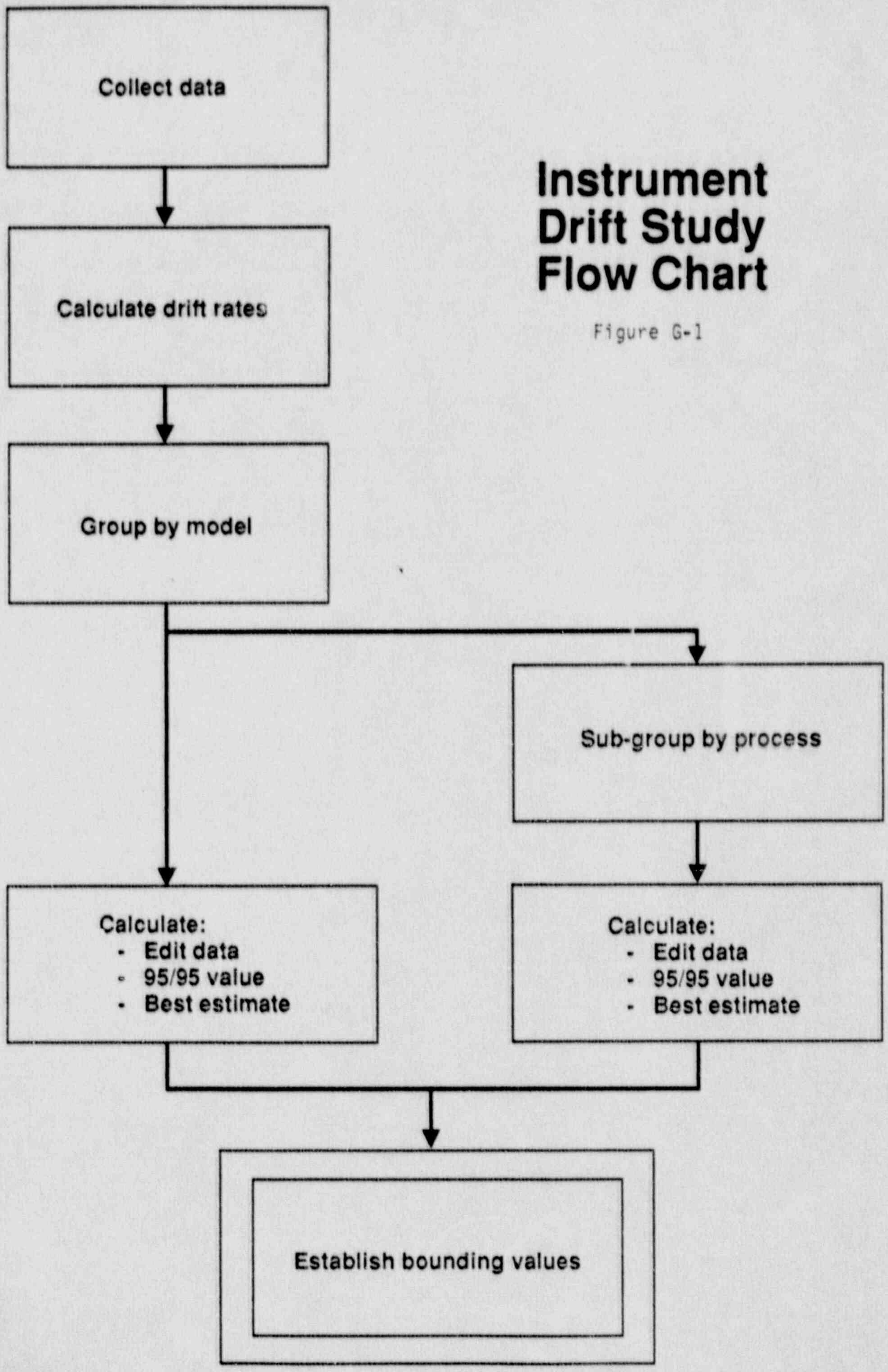


Figure G-1

ATTACHMENT H

SONGS UNITS 2 AND 3

PLANT PROTECTION SYSTEM SETPOINT EVALUATION

ATTACHMENT H

RPS SETPOINT CALCULATIONS

1. INTRODUCTION

The purpose of this attachment is to describe the evaluation of the proposed changes relative to the UFSAR safety analysis and Reactor Protection System (RPS) setpoint calculations for the San Onofre Nuclear Generating Station (SONGS), Units 2 and 3.

Southern California Edison (SCE) has adopted 24 month fuel cycles beginning with Cycle 4 for both SONGS Units 2 and 3. To avoid plant shutdowns solely to perform surveillance testing, SCE initiated a program to extend all refueling technical specification surveillance intervals to a nominal 24 month period. RPS setpoints include assumptions for transmitter drift which are a function of the calibration interval. Therefore, in order to extend the surveillance interval, it was necessary to revise these assumptions to account for the longer time period between calibrations.

Including larger values for transmitter drift in the setpoint calculations results in setpoints which are more restrictive from an operations perspective. More restrictive setpoints may result in an increase in the number of unnecessary reactor trips during normal cycle operations. As part of the process of revising the RPS setpoints, an assessment of the change was made after accounting for the increased values for drift. In instances where the revised trip setpoint was judged to result in a potential increase in the number of unnecessary reactor trips, a review of the SONGS Units 2 and 3 trip setpoint calculations and Safety Analysis Setpoints was performed. The trip setpoint calculations for certain trip functions were revised to reflect more realistic containment environmental conditions and revised assumptions. In several cases, Safety Analysis Setpoints were revised. No changes to safety analysis limits were made.

A second factor which has been incorporated into this revision of the setpoint calculations is a change in the calibration tolerance of the Plant Protection System (PPS) bistable trip units. This change is not related to extending surveillance intervals, however, it provided a convenient opportunity to make this adjustment. This revision to the allowed calibration tolerance was factored into all setpoint calculations described in Section 4.4 of this attachment. The PPS includes both the RPS and the Engineered Safety Features Actuation System (ESFAS).

This appendix provides an overview of the setpoint calculation process and a description of the evaluations that were made relative to the safety analysis and setpoint calculations for each of the RPS technical specification functional units.

2. SCOPE

At the request of SCE and in support of the 18-24 month surveillance interval extension program, Combustion Engineering (C-E) performed instrument setpoint calculations for setpoints associated with SONGS 2&3 Technical Specifications 3.3.1 (Table 3.3-1) Functional Units 2,3,4,5,6,7,8,9,10,11 and 16. These calculations were performed, based on the following assumptions provided by SCE:

- o Functional Units 4,5,6,7,8,9,10 & 11 include sensors which are calibrated only at the Refueling Interval and are affected by the increased surveillance interval.

- o Functional Units 2, 3 & 16 include equipment, for which, setpoint calculations were performed based on a revised calibration tolerance. These functional units include equipment which is calibrated more frequently than during the Refueling Interval, or not subject to drift.

3. RPS INSTRUMENT LOOPS

Four basic configurations of instrument loops were included in the Reactor Protection System (RPS) instrumentation (See Attachment E Fig. 2-5) as follows:

TECH. SPEC.	FUNCTIONAL UNIT	APPLICABLE Figure
3.3.1	2	3A
	3	3B
	4	2
	5	2
	6	5
	7	2
	8	2
	9	4
	10	4
	11	2
	16	2

For all instrument loops included in the C-E calculations, the major components included are the transmitter, bistable (or calculator) and 250Ω (+/-0.01%) resistor. The impact of the extended surveillance interval on other types of components (not included in C-E calculations) is described in Attachments F and I. Attachment I discusses instruments not impacted by drift.

4. C-E SETPOINT CALCULATIONS

4.1 Instrument Drift Study

One of the many input values to an instrument setpoint calculation is the instrument drift associated with the components in the loop. SCE performed an

analysis of transmitter calibration data for the SONGS Units 2 & 3 PPS channel sensors.

The long term drift characteristics of pressure, differential pressure and temperature transmitters, where the present technical specifications require calibration every 18 months (+ 25%), were determined. These values were provided to C-E for use in the setpoint calculations.

A complete discussion of the Instrument Drift Study is included in Attachment G.

4.2 Methodology

The C-E methodology for instrument setpoint calculations is consistent with ANSI/ISA-67.04-1988 "Setpoints for Nuclear Safety Related Instrumentation in Nuclear Power Plants", and includes the following basic components:

I. Safety Analysis Setpoints -

Analytical limits and response times used in the safety analysis to ensure that safety design limits are not exceeded.

II. PPS Cabinet Uncertainties - Includes:

- o Calibration equipment uncertainties
- o Calibration adjustment allowances
- o Temperature effects
- o Power supply effects
- o Vibration (or seismic) uncertainties
- o Bistable drift uncertainties

Independent uncertainties are combined by the Root-Sum-of-the-Squares (RSS) method and dependent uncertainties are combined by algebraic summation.

III. Process Equipment Uncertainties (Loop) - Includes:

- o Calibration equipment uncertainties
- o Calibration adjustment allowances
- o Environmental effects (temperature, pressure, humidity and radiation) for:

  -Worst case normal
  -Accident

- o Power supply effects
- o Vibration (or seismic) uncertainties
- o Transmitter drift uncertainties
- o Process uncertainties

Independent uncertainties are combined by RSS and dependent uncertainties are combined by algebraic summation.

IV. Total Channel Worst Case Normal Error with Seismic:

RSS of II & III

V. Trip Setpoint, Allowable Value and Pretrip Setpoint

Trip Setpoint = Analysis setpoint (I) +/- Total Channel Error (IV)

Added in the conservative direction from the analysis limit based on whether the setpoint is increasing or decreasing.

Allowable Value = Trip Setpoint +/- PPS cabinet periodic test error (II)

Added in the non-conservative direction from the analysis limit based on whether the setpoint is increasing or decreasing.

The pretrip setpoint is qualitatively determined to provide the operator with as much advance notice of potential automatic actuation as possible.

VI. Voltage Equivalent for V

Conversion of the process values to calibration voltage equivalent.

VII. Measurement Channel Response Times For Safety Analysis

The Technical Specification Response Times are derived from vendor design specifications used in the safety analyses and are verified by response time testing on a periodic basis.

Fig. H-1 shows the relationship between the Safety Analysis Setpoint, Trip Setpoint and Allowable Values.

For all PPS loops (with calculations by C-E) the principal loop components are the transmitter, bistable (or calculator) and 250 ohm resistor. A Channel Functional Test (CFT) is performed on the bistable on a monthly basis to ensure that the bistable setpoint is within the tolerance allowance assumed by C-E. The 250 ohm resistor has an accuracy of 0.01%. The instrument drift of the transmitter is included and described in detail in Attachment G. These three component groups are included in the detailed setpoint methodology described in this section. Accordingly, consideration of total uncertainty, including drift, is accomplished in all of the RPS setpoint calculations performed by C-E.

The methodology followed by C-E has been performed in accordance with the C-E Quality Assurance Procedures and is consistent with those used to perform the core reload analysis calculations for SCE for every cycle at SONGS 2 & 3.

4.3 Assumptions

The assumptions used by C-E for the RPS setpoint calculations, have been validated by SCE. These assumptions include such items as calibration tolerances and required accuracy for calibration equipment.

A change to the allowed calibration tolerance, from 5 to 25 mV, was included in the revised trip setpoint calculations. The calibration tolerance is the acceptable tolerance band for each bistable trip function in the periodic surveillance procedure. If the bistable trip occurs within this tolerance band, no adjustment is required, and the "as-Found" and "As-Left" values are recorded without adjustment. If the bistable trip occurs outside of the tolerance band, an adjustment is performed and the before and after readings are recorded.

4.4 Results

The results of the C-E calculations are shown in Table H-1 along with the existing Technical Specification setpoints and allowable values for the RPS setpoints. A number of the new setpoint values provide more operating margin than the existing values. Safety Analysis Setpoints (described in Section 4.2) have been revised in some cases (where indicated below) to provide more operating margin and to reduce the potential for spurious plant trips and the resulting plant transients, while still based on the same safety analysis limits.

A discussion of each of the setpoint calculation changes identified by C-E is provided below:

a) The High Linear and Logarithmic Power Level trip setpoint calculations were revised based on an increased tolerance for PPS bistable functional testing. Setpoint calculations were reviewed in an effort to improve the operating margin for High Linear Power. Assuming a reduction in the allowed nuclear instrumentation calorimetric calibration tolerance (operations procedure) from 2% to 1 % accomplished the desired increase in operating margin. Station Surveillance Procedure SO23-3.3.2 will be revised to reflect the more conservative calibration tolerance. A request to change this tolerance value has been submitted to the Staff as Technical Specification Proposed Change No. NPF-10/15-302 (PCN 302). This proposed change requests a revision to Note (2) of Technical Specification Table 4.3-1 to modify the requirement to calibrate Linear Power and CPC power to a calorimetric measurement anytime they differ by more than 2.0%. The provision would be replaced with a requirement to calibrate the power indications when any Linear Power and CPC power indication is less than the calorimetric calculation by more than 1.0% of RATED THERMAL POWER. The Linear Power and CPC power indication would then be calibrated to within -1.0% or greater than the calorimetric calculation.

TABLE H-1

REACTOR PROTECTIVE INSTRUMENTATION TRIP SETPOINT LIMITS

FUNCTIONAL UNIT	EXISTING T.S. 2.2.1 TRIP SETPOINT	EXISTING T.S. 2.2.1 ALLOWABLE VALUE	PROPOSED T.S. 2.2.1 TRIP SETPOINT	PROPOSED T.S. 2.2.1 ALLOWABLE VALUE
2. Linear Power Level - High	≤ 110.0%	≤ 111.3%	≤ 110.0%	≤ 111.0%
3. Logarithmic Power Level - High	≤ 0.89%	≤ 0.96%	≤ 0.83%	≤ 0.93%
4. Pressurizer Pressure-High	≤ 2382 psia	≤ 2389 psia	≤ 2375 psia	≤ 2385 psia
5. Pressurizer Pressure - Low	≥ 1806 psia	≥ 1763 psia	≥ 1740 psia	≥ 1700 psia
6. Containment Pressure - High	≤ 2.95 psig	≤ 3.14 psig	≤ 3.1 psig	≤ 3.4 psig
7. Steam Generator Pressure-Low	≥ 729 psia	≥ 711 psia	≥ 741 psia	≥ 729 psia
8. Steam Generator Level-Low	≥ 25.0%	≥ 24.23%	≥ 21.0%	≥ 20.0%
9. Local Power Density-Hi	≤ 21.0 kw/ft	≤ 21.0 kw/ft	NO CHANGE	
10. DNBR-Lo	≥ 1.31	≥ 1.31	NO CHANGE	
11. Reactor Coolant Flow - Low				
a.) Dn rate	≤ 0.22 psid/sec	≤ 0.231 psid/sec	≤ 0.22 psid/sec	≤ 0.231 psid/sec
b.) Floor	≥ 13.2 psid	≥ 12.1 psid	≥ 13.2 psid	≥ 12.1 psid
c.) Step	≤ 6.82 psid	≤ 7.231 psid	≤ 6.82 psid	≤ 7.25 psid
12. Steam Generator Level High	≤ 90.0%	≤ 90.74%	≤ 89.0%	≤ 89.7%

Administrative control of this change in tolerance, prior to Staff approval of the proposed change, will ensure that the desired operating margin will be maintained. No change to the Safety Analysis Setpoint nor to assumed values for drift was required.

b) The High Pressurizer Pressure trip setpoint calculation was performed based on a revised Safety Analysis Setpoint, an increased value for transmitter drift, and an increase in the calibration tolerance for the PPS trip bistable functional testing. This resulted in a revised trip setpoint of 2375 psia in place of the existing 2382 psia.

C-E reanalyzed the RCS peak pressure event in the safety analysis. The Safety Analysis Setpoint was increased from 2422 psia to 2437 psia. This resulted in a calculated peak RCS pressure of 2724 psia during the worst case transient, which is less than the maximum allowable pressure of 2750 psia.

c) The Low Pressurizer Pressure trip setpoint calculation was revised to reflect more realistic containment environmental conditions for both large and small break LOCA environments, an increased value for transmitter drift and an increased tolerance for PPS bistable functional testing.

The Low Pressurizer Pressure trip setpoint calculation was recalculated with reduced total channel errors for both large and small break LOCA. Channel errors for containment pressure and temperature, which are inputs in the calculation, were revised from 60 psig and 350 degrees F to 5 psig and 250 degrees F, respectively. The High Containment trip and Safety Injection Actuation Signal (SIAS) functions are credited in limiting containment temperature to less than 250 degrees F and containment pressure to be less than 5 PSIG, in considering the worst case environmental errors for Low Pressurizer Pressure SIAS initiations. The trip setpoint calculation for Low Pressurizer Pressure resulted in a lower trip setpoint of 1740 psia in place of the existing 1806 psia.

d) The High Containment Pressure trip setpoint calculation was revised to reflect an increased Safety Analysis Setpoint, increased value for transmitter drift and an increased tolerance for PPS bistable functional testing.

The High Containment Pressure trip setpoint was revised from 2.95 psig to 3.1 psig. The associated Safety Analysis Setpoint was increased from 4.0 to 5.0 psig. LOCA analyses do not explicitly credit reactor trip or SIAS on high containment pressure. However, high containment pressure trip and SIAS functions are credited in limiting containment temperature to less than 250 degrees F prior to initiation of reactor trip or SIAS functions.

This change in setpoints was evaluated with regard to this criteria, and it was determined that containment temperature will not exceed 250 degrees F prior to containment pressure exceeding 5 psig. The changes in the limiting containment environmental conditions are described in paragraph c) above.

The increase in the High Containment Pressure trip setpoint causes a slight increase in the time to initiation of the Containment Isolation Actuation System (CIAS) and the Containment Cooling Actuation System (CCAS). Credit is taken for CIAS in limiting the amount of steam released through the minipurge line after a LOCA and in limiting the amount of water lost from the Component Cooling Water (CCW) system critical loop. The impact of the High Containment Pressure trip on the time to closure of the minipurge valves on the Containment Isolation signal was reviewed and determined to be bounded by the existing analysis. The slight increase in time to initiation of CIAS results in a minor reduction in the required minimum CCW Surge Tank level of approximately 1%. CCW operability is, therefore, not impacted.

The CCAS is credited in the containment pressure/temperature analyses for LOCA and Main Steam Line Break (MSLB) events. Review of the containment pressure response to design basis events has confirmed that increasing the High Containment Pressure Safety Analysis Setpoint to 5 PSIG is bounded by the existing analysis.

e) The Low Steam Generator Pressure trip setpoint was recalculated based on an increased value for transmitter drift and an increased tolerance for PPS trip bistable functional testing. No change to the existing Safety Analysis Setpoint was required.

f) The Low Steam Generator Water Level trip setpoint calculation was revised to reflect a revised Safety Analysis Setpoint, increased value for transmitter drift, a more realistic value for worst case reference leg temperature and an increased tolerance for PPS trip bistable functional testing. The Low Steam Generator Water Level trip setpoint was reduced from 25% to 21%.

The associated Safety Analysis Setpoint for EFAS was reduced from 5.0% to 2.0%. The Safety Analysis Setpoint for RPS remains at 5.0%. LOCA events do not credit Low Steam Generator Level for reactor trip function, but do credit EFAS on Low Steam Generator Level. Reducing the safety analysis setpoint from 5% to 2% for the EFAS function, will still ensure that the steam generator tubes will be sufficiently covered so that there is no significant degradation in the assumed heat transfer during LOCA. The requirement for EFAS actuation for non-LOCA events is that it is available to prevent intact steam generators from drying out. The Safety Analysis Setpoint of 2.0% of span provides acceptable results for non-LOCA events.

g) The Core Protection Calculator calibration and periodic test uncertainties, A/D conversion uncertainties and CPC Total Channel

uncertainties were analyzed based on the revised transmitter drift values. The CPC inputs were evaluated to determine if they would be affected by the extended cycle length. Only the hot and cold leg temperature and pressurizer pressure inputs were affected. The other CPC inputs of RCP shaft speed, CEA position, and excore power were determined not to be affected by instrument channel drift resulting from an increased cycle length. A complete description of the CPC inputs is included in Attachment I. The increased CPC temperature and pressurizer pressure uncertainties are still bounded by the values used in the latest CPC uncertainty analysis for the SONGS Extended Cycles Program beginning with Units 2 & 3 Cycle 4. As a result, no change to the Local Power Density- High or Departure From Nucleate Boiling Ratio - Low uncertainty allowances or trip setpoints is required.

h) The Low Reactor Coolant Flow trip setpoints were recalculated because of a revised calibration tolerance related to the PPS Rate Limited Variable Setpoint module. No change to the Safety Analysis Setpoint was required. Due to the design of the Rate Limited Variable Setpoint module, no drift allowance is required. This is consistent with previous trip setpoint calculations. An increase in the average delta pressure across the steam generator from 22.5 psid to 27 psid was assumed in the setpoint calculation. This reflects the most recent plant data from Unit 2 and 3 Cycle 4.

i) The High Steam Generator Water Level trip setpoint was calculated based on an increased value for transmitter drift and an increased tolerance for PPS bistable functional testing. This larger drift value resulted in an 89% level trip setpoint instead of the previous Tech. Spec. value of 90%. Since this is an equipment protective trip and no credit is taken in the safety analysis for this trip function, the setpoint calculation was revised to incorporate best estimate value rather than worst case values for transmitter drift. No change to the existing Safety Analysis Setpoint was required.

4.5 Summary

The SONGS Unit 2 & 3 trip setpoints were revised based on changes to the Safety Analysis Setpoints and changes to the trip setpoint calculations. The Safety Analysis Setpoints were revised for High Pressurizer Pressure and High Containment Pressure trip functions. These evaluations demonstrate acceptable results when compared to the existing safety analysis limits. The trip setpoint calculations for Low Pressurizer Pressure, High and Low Steam Generator Level and Low Reactor Coolant Flow were revised to improve the operating margin while accounting for the increased transmitter drift and an increase in the allowed tolerance for trip bistable functional testing. The trip setpoint for High Linear Power was revised to incorporate an increase in the allowed tolerance for trip bistable functional testing and a decrease in the daily secondary calorimetric calibration tolerance to maintain the operating margin. The trip setpoint calculation for Low Steam Generator Pressure and High Steam Generator Level were revised to account for increased drift and the change in allowed tolerance for trip bistable functional test.

The High Logarithmic Trip Setpoint calculation was revised to account for the increase in allowed tolerance for the trip bistable functional test. These changes to the trip setpoint calculations preserve the margin of safety while maintaining adequate operating margins. Operating margin to CPC generated trips has not been changed.

This reanalysis has met all of the objectives which are: adequate protection for design transients; nominal 24 month calibration intervals; and sufficient operating margin.

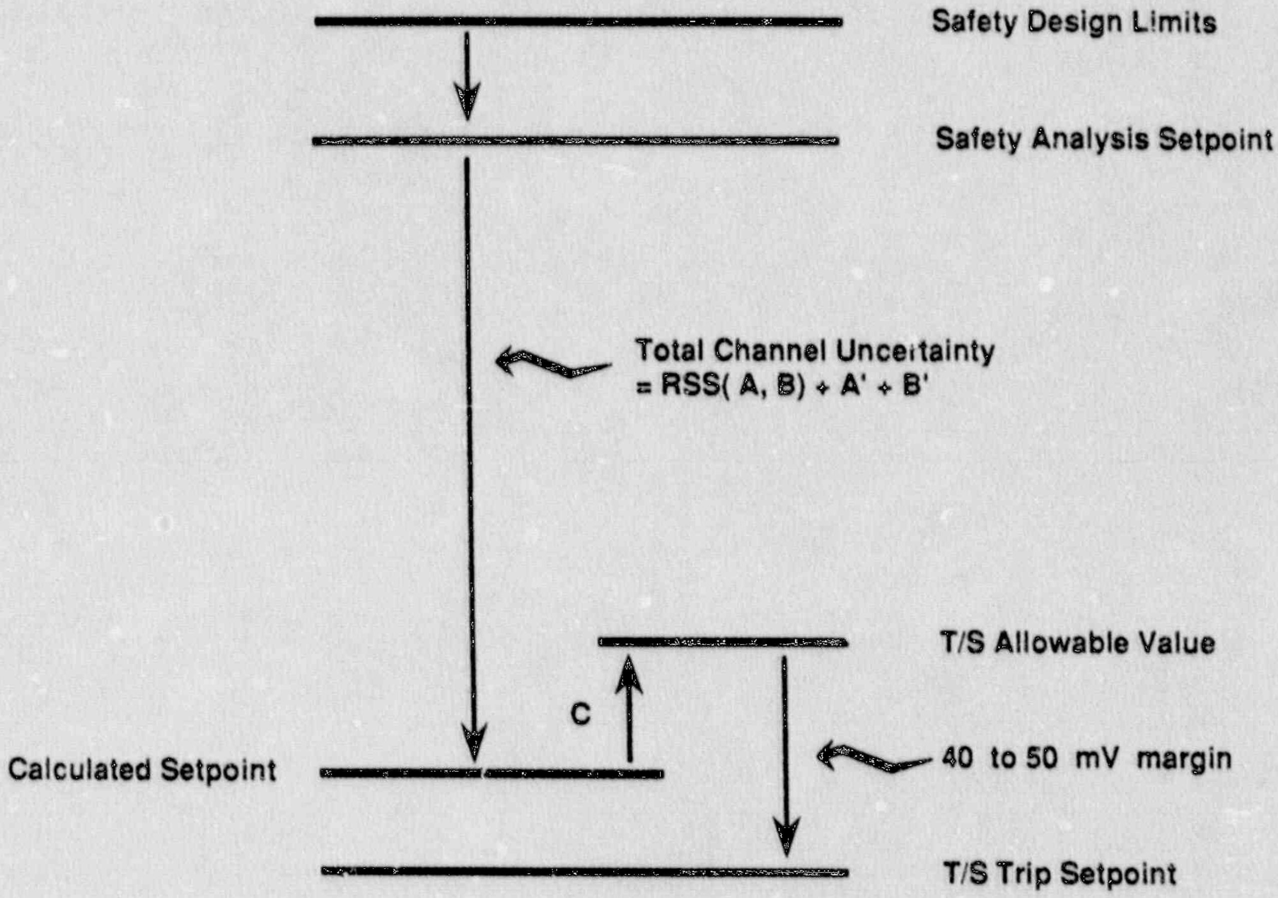
5. RESPONSE TIME TESTING LIMITS

All of the technical specification values for RPS response time testing, identified in Tech Spec 3.3.1 were confirmed by C-E to remain acceptable except for the High Logarithmic Power response time. No technical specification response time changes, other than for High Log. Power, were required because the response times used in the safety evaluations were not changed. For High Log Power, the value used in the safety analysis is 0.450 seconds, and consists of two components. A value of 0.05 seconds is assumed in the safety analysis as the response time of the detector and 0.400 seconds is assumed for the rest of the channel. Since response time testing of the detector is exempted, it is not included in the periodic response time testing performed by SCE. The SONGS Unit 2 and 3 Technical Specifications should be changed to reflect the value for what is actually tested; i.e. 0.400 seconds.

This change is not related to an increase in the surveillance interval or to increased calibration tolerance for PPS trip bistables. However, this inconsistency was noted during the process of extending the surveillance interval. An evaluation of surveillance records verified that all of the results of response time testing of the Logarithmic Power Channels have been less than 0.400 seconds.

Figure H-1

C-E Explicit Method of Trip Setpoint Determination



Normal Operation

A. Cabinet Uncertainties (Random)
A' Cabinet Uncertainties (Non-random)

B. Process Instrumentation Uncertainties (Random)
B' Process Instrumentation Uncertainties (Non-random)

C. Cabinet Periodic Test Error

ATTACHMENT I

SONGS UNITS 2 AND 3

FUNCTIONAL ANALYSIS OF FUNCTIONAL UNITS NOT IMPACTED BY INSTRUMENT DRIFT

ATTACHMENT I

FUNCTIONAL ANALYSIS OF FUNCTIONAL UNITS NOT IMPACTED BY INSTRUMENT DRIFT

For 9 of the 15 functional units which required 18 month surveillances, the functional analysis was adequate to justify the surveillance extension.

The functional analysis consisted of an evaluation of instrument function. a review of preventive maintenance surveillances and corrective maintenances, and a comparison of on-line and Refueling Interval surveillances. The historical surveillance review included all surveillance records since the commencement of commercial operation to November 1, 1989. This methodology will address the following Functional Units as listed in Technical Specification Table 4.3-1.

1	Manual Reactor Trip
2	Linear Power - High
3	Logarithmic Power Level - High
9	Local Power Density - High
10	DNBR - Low
14	Core Protection Calculators (CPC)
15	Control Element Assembly Calculators (CEAC)
16	Reactor Coolant System Flow - Low
17	Seismic - High

Functional Unit 1, "Manual Reactor Trip" is unique in that it is not a process measurement channel as are the other functional units. It consists of switches which ultimately result in the Reactor Trip Breakers opening. No credit is taken in the analyses for any operator action prior to initiation of the event, i.e., no credit is taken for manual reactor trip. The results of surveillance testing of the Manual Reactor Trip verified that there have been no failures associated with the manual trip pushbuttons. Based on these results, there are no detrimental effects expected to be associated with extending the test interval for these switches.

Functional Units 2 and 3, "Linear Power Level - High" and "Logarithmic Power Level - High" consist of neutron detectors and signal conditioning electronics which provide the input to the PPS bistables and the Core Protection Calculators (CPCs). A Channel Functional Test is performed monthly for these two functional units which verifies the calibration of all loop components exclusive of the detectors. The Neutron detectors may be excluded from the Channel Calibration in accordance with Technical Specification requirements. The 18 month calibration essentially duplicates the monthly Channel Functional Test. Since a Channel Calibration is verified monthly, extending the frequency of the Refueling Interval to a nominal 24 months will not adversely impact Technical Specification operability requirements. A review of surveillance calibration requirements for the bistables associated with these functional

units has identified a need to modify the setpoints. These revised setpoints are provided in Table 2 of this proposed change. The calibration requirements also identified a need to revise the response time value for Logarithmic Power Level -High from 0.45 to 0.40 seconds. The surveillance review verified that there have been no failures for these functional units.

Functional Units 9, "Local Power Density (LPD) - High," and 10, "DNBR - Low," are trip signals that are generated by the Core Protection Calculators (CPCs) and their associated inputs. The monthly functional testing conducted on the Plant Protection System, meet the surveillance requirements for these functional units. In addition, the surveillance review verified that there have been no failures for these functional units.

Functional Unit 14, "Core Protection Calculators" and Functional Unit 15 "Control Element Assembly Calculators," are digital computers used to monitor core DNBR and LPD conditions and (Control Element Assembly) CEA positions. As digital devices their trip setpoints are not subject to drift. The addressable constants used in the calculators are verified to be correct on a shiftly basis by the Computer Operators and on a monthly basis by the functional test procedure. The Control Room annunciators are verified to actuate on a monthly basis. The operability of the computers themselves is also verified on a monthly basis by use of surveillance test software. That software performs twelve software performance tests, two hardware diagnostic tests, and a memory test for each CPC. Different software performs six software tests, three hardware diagnostic tests, and one memory test on the CEAC. The computers also monitor their own functions continuously.

A source of a variation in conservative CPC or CEAC operation is a variation in the reference voltage values used to translate analog signals from the field into digital values. The computers perform a check on these reference voltages every CPC operating cycle and an unacceptable drift results in a computer error which sets the CPC trip signals on DNBR and LPD or the CEAC fail flag. The failure is annunciated in the Control Room. The reference voltages are also checked as a part of the monthly surveillance.

The process parameters that provide input to the CPCs and CEACs are shown in Attachment "E", Figure 4. Each of the inputs is described as follows:

a) RCP speed transmitters - The proximity probes used to sense Reactor Coolant Pump speed are devices which provide a pulsed output. The frequency of the pulses is proportional to the speed of the reactor coolant pump. Being essentially digital devices, these probes are not susceptible to long term drift. Credible failure modes will result in a loss of pulse input to the CPC which will then generate a transmitter failure alarm. Evaluation of recent surveillance tests confirm that these devices are reliable and no adverse failure trend is evident.

b) Hot and Cold Leg RTDs - Drift data was developed in the instrument drift study (Attachment G). The hot and cold leg temperature uncertainties calculated with the increased drift allowance were bounded by the uncertainties used in the CPC overall uncertainty analysis since Cycle 3. No change to the CPC addressable constants or setpoints was required.

c) Pressurizer pressure input - Drift data was developed in the instrument drift study (Attachment G). The pressurizer pressure uncertainties calculated with the increased drift allowance were bounded by the uncertainties used in the CPC overall uncertainty analysis since Cycle 3. No change to the CPC addressable constants or setpoints is required.

d) Neutron flux input - Neutron detectors are excluded from the Channel Calibration requirements. The CPC neutron flux power calibration is verified daily, during normal operation, using a calorimetric power measurement. Therefore, only the drift uncertainties which can occur in the time interval between these calibration verifications are considered. The safety channel drawers are calibrated on a monthly basis and are not affected by a change in the Refueling Interval.

f) Control Element Assembly Reed Switch Position Transmitters (RSPTs) - The RSPTs are used to detect CEA positions and provide input to both the CPCs (25% for each CPC) and CEACs. The CEAC transmit a penalty factor to the CPCs. Each CEA is monitored by two RSPTs and by the Plant Monitoring System through a diverse position monitoring system. The RSPTs are based on precision resistors and reed switches. Although individual resistors and reed switches can fail, their characteristics will not change with time. Any change in the calibration of a single RSPT is easily detected by comparison of these three indications of CEA position. The overwhelming majority of plant operation is conducted in an all rods out configuration. With the CEA in the full out position, a separate reed switch provides a fourth method of confirming the position of the CEA.

In summary, the CPC/CEACs are self checking digital computers which are subjected to stringent monthly surveillance tests and detailed shiftly Channel Checks. The extension of the Refueling Interval calibrations has no impact on plant safety because these detailed checks will identify channel problems before they can impact the conservative operation of the CPC/CEAC.

Functional Unit 16, "Reactor Coolant Flow - Low," utilizes a Rate-Limited Variable Setpoint Module to generate a trip signal when required. This module limits the rate at which the trip setpoint value can change. Decreases in steam generator differential pressure (DP) due to partial loss of flow causes a rapid change in the signal which decreases faster than the trip setpoint is allowed to change. Because this trip is based on a rate of change, rather than absolute level, it is insensitive to transmitter drift. Due to the design of this module, there is no need to provide an allowances for long term drift. The surveillance CM history review

identified one failure which required instrument replacement. Attachment "F" provides additional information. Extending the calibration interval provides no impact on the function of this module for the low flow trip setpoint.

Functional Unit 17, "Seismic - High" monitors seismic motion and generates a reactor trip if the signal exceeds 60% of the level associated with a Safe Shutdown Earthquake. The surveillance review verified that there have been no failures for these functional units. Only two problems have been found during the monthly functional testing. On Unit 3, in 1986, a faulty voltage regulator was found, and, in 1987, a defective battery terminal was detected. Each of these problems only affected one channel and were promptly corrected. In addition, no credit is taken in the accident analysis for high seismic acceleration trip as a primary trip.

ATTACHMENT J

SONGS UNITS 2 AND 3

REDUNDANT INSTRUMENT MONITORING SYSTEM (RIMS) DESCRIPTION

ATTACHMENT J

REDUNDANT INSTRUMENT MONITORING SYSTEM (RIMS)

Purpose

Southern California Edison (SCE) has developed a system to monitor the calibration status of selected redundant instrumentation installed in the San Onofre Nuclear Generating Station (SONGS), Units 2 and 3. This system is called the Redundant Instrument Monitoring System (RIMS). The purpose of this system is to provide on-line monitoring of the calibration of these instruments, with a high degree of accuracy. The system can be used to identify those instruments which are performing properly and those whose performance is anomalous. The information can then be used to justify the calibration of only those instruments that are anomalous, thereby reducing the number of calibrations that are required during refueling outages. At the same time, the confidence that the instrumentation is operating within design requirements is increased between calibration intervals.

A second purpose of this system is to support the revised operating schedule of 24 month fuel cycles. Where sufficient redundancy exists, RIMS is available to provide on-line monitoring of instrumentation that provide input to the plant computers and main control panels.

This appendix contains several typical plots to demonstrate the general stability of the SONGS instrumentation and the conservatism of the instrument drift calculations.

History

The design of SONGS 2 & 3 Plant Protection System includes four redundant safety-related channels. For many parameters, the number of transmitters is even greater, as narrow and wide range monitoring is provided. Often, two additional transmitters are installed to provide process control functions.

Safety-related transmitters must undergo a calibration check every 18 months. This calibration check generally consists of applying a simulated condition to the transmitter and comparing the response of the transmitter to a standard whose calibration is traceable to the National Bureau of Standards. The condition is generally simulated at five different levels: 0%; 25%; 50%; 75%; and 100% of full scale. To perform this check, it is necessary to have access to the transmitter, often times inside containment, isolate the device from the system and perform the calibration check.

The combination of the degree of redundancy and the surveillance requirements result in a large amount of work required to perform these calibration checks. The degree of redundancy also presents the opportunity to make an accurate, on-line determination of the process value by averaging the signal from each source. At SONGS 2 & 3, most of the parameters of interest are presently available as inputs to the Plant Monitoring System (PMS) and Critical

Functions Monitoring System (CFMS). As a result of these factors, it has become practical to implement a micro-computer based system to perform a calibration check on-line and obviate the need for the traditional calibration checks.

Monitored Parameters

The following parameters are monitored by RIMS. These inputs are grouped as like parameters for comparison and analysis purposes:

1. Pressurizer pressure
2. Pressurizer level
3. RCS cold leg temperature - Loop 1
4. RCS cold leg temperature - Loop 2
5. RCS hot leg temperature
6. Containment pressure
7. Refueling water tank level
8. Steam generator level - SG-1
9. Steam generator level - SG-2
10. Steam generator pressure
11. Nuclear instrumentation - log power
12. Nuclear instrumentation - linear power
13. Safety injection tank level
14. Safety injection tank pressure
15. Core exit thermocouples

Method of Analysis

RIMS collects data from the Plant Monitoring System and the Critical Function Monitoring System for both Units 2 & 3 at 10 minute intervals. The data acquisition system is shown in the attached Figure 1. The average value for each redundant group is then calculated and the deviation of each parameter from the average is determined in terms of percent of span. Appropriate weighting factors are utilized, based on individual instrument accuracies, to determine the average. A bias is applied to the deviation of each instrument after it is calibrated to bring all instrument readings to near the average value for comparison purposes. The deviations, from the average value, are then trended over time to evaluate the changes in the calibration status of the instrumentation.

Instrument calibration is monitored by RIMS during both steady state and normal transient (heatup and cooldown) operating conditions. During steady state operation, comparison of redundant channels over a relatively narrow range of values provides a high degree of confidence in differentiating between changes in calibration and actual changes in plant conditions. During plant evolutions, such as heatup and cooldown (both scheduled and unscheduled) valuable comparison data is obtained over a larger portion of the instrument range, thereby validating the calibration over a range of values and the response of redundant channels to actual changes in plant conditions.

Operation and Benefits

RIMS has been operational for evaluation purposes since October, 1988. Monthly reports of abnormalities detected by RIMS have been forwarded to Station Maintenance for evaluation and action, if required.

Our experience with RIMS to date has confirmed that the monitored instrumentation exhibits extremely stable operation over extended periods of time. Figures 2, 3, and 4 depict the operation of the Unit 2 instrumentation channels over a two month period immediately prior to recalibrating the transmitters. (Due to the length of Cycle 4, it was necessary to perform the required Channel Calibrations prior to the end of the fuel cycle.) From theses figures, it can be seen that all of these safety-related channels exhibit stable performance.

An example of a case where RIMS provided early indication of a transmitter abnormality occurred in December, 1988 for Unit 2 steam generator level transmitter, 2LT-1113-4. RIMS output (Figure 5 attached) indicated that the transmitter output was higher than the group average by approximately 0.5%. This agreed very well with the "as-found" data from the transmitter calibration performed the following month in January, 1989.

The benefits derived from operation of the system are as follows:

- Significantly improved capability to detect instrument abnormalities during normal operation. Previous method of shiftly surveillance of the control board indicators provided single point analysis inputs with associated errors in readability and indicator accuracy.
- Contribution of the system to the station operating goals of reducing overall radiation exposure (ALARA) and reducing the frequency of surveillances that result in needless cycling of instruments and can accelerate equipment aging.
- Added capability to reduce maintenance costs concurrent with implementation of the single channel (of 4 redundant channels) calibration program during refueling outages. This will allow a reallocation of resources to higher priority maintenance tasks.

In summary, the observed abnormalities (like the example above) have confirmed the benefits for use of the system and the generally stable operation of the instrumentation. Observation of the RIMS data has independently demonstrated the conservatism of the calculated instrument drift values.

Figure J-1

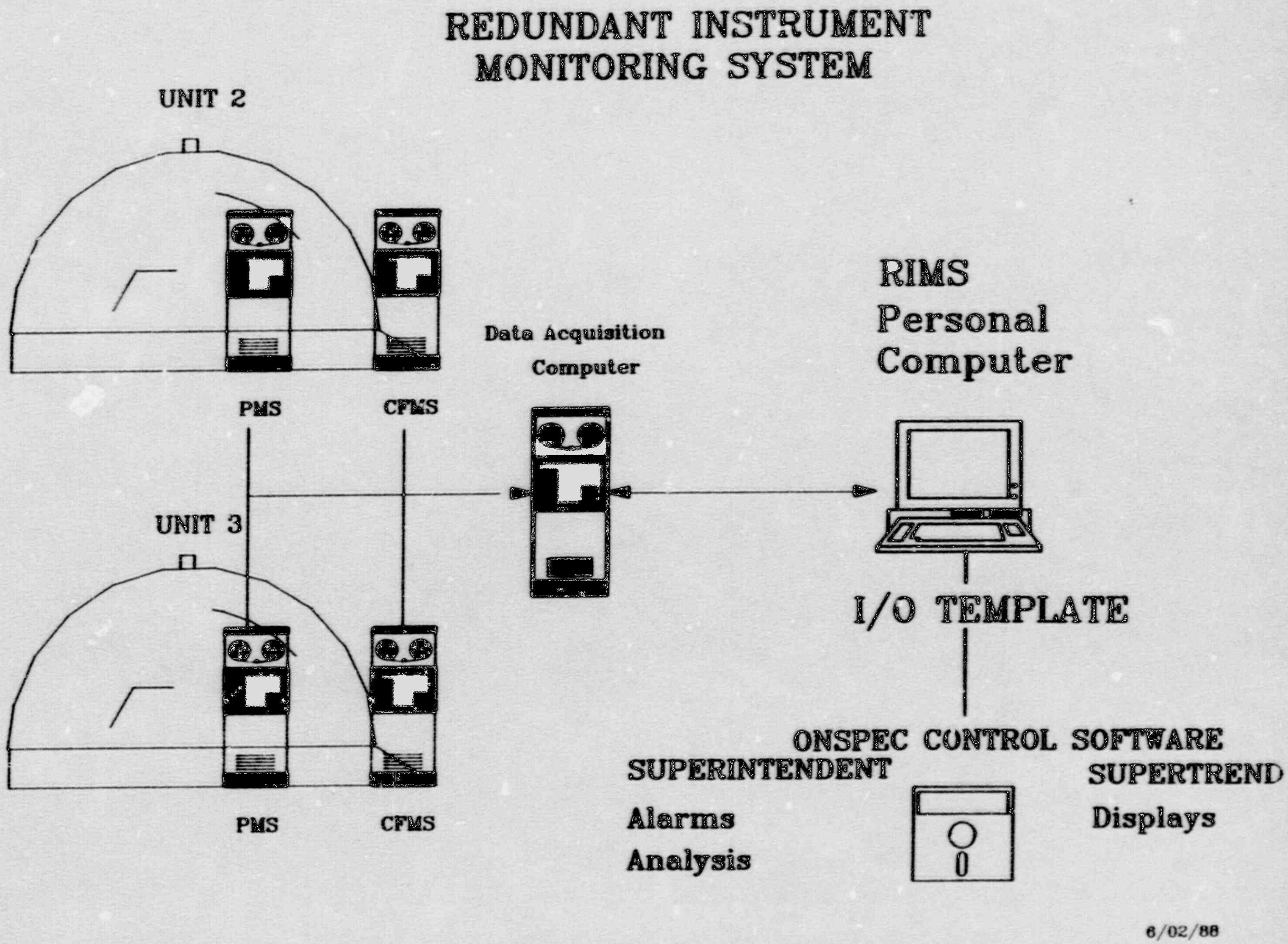
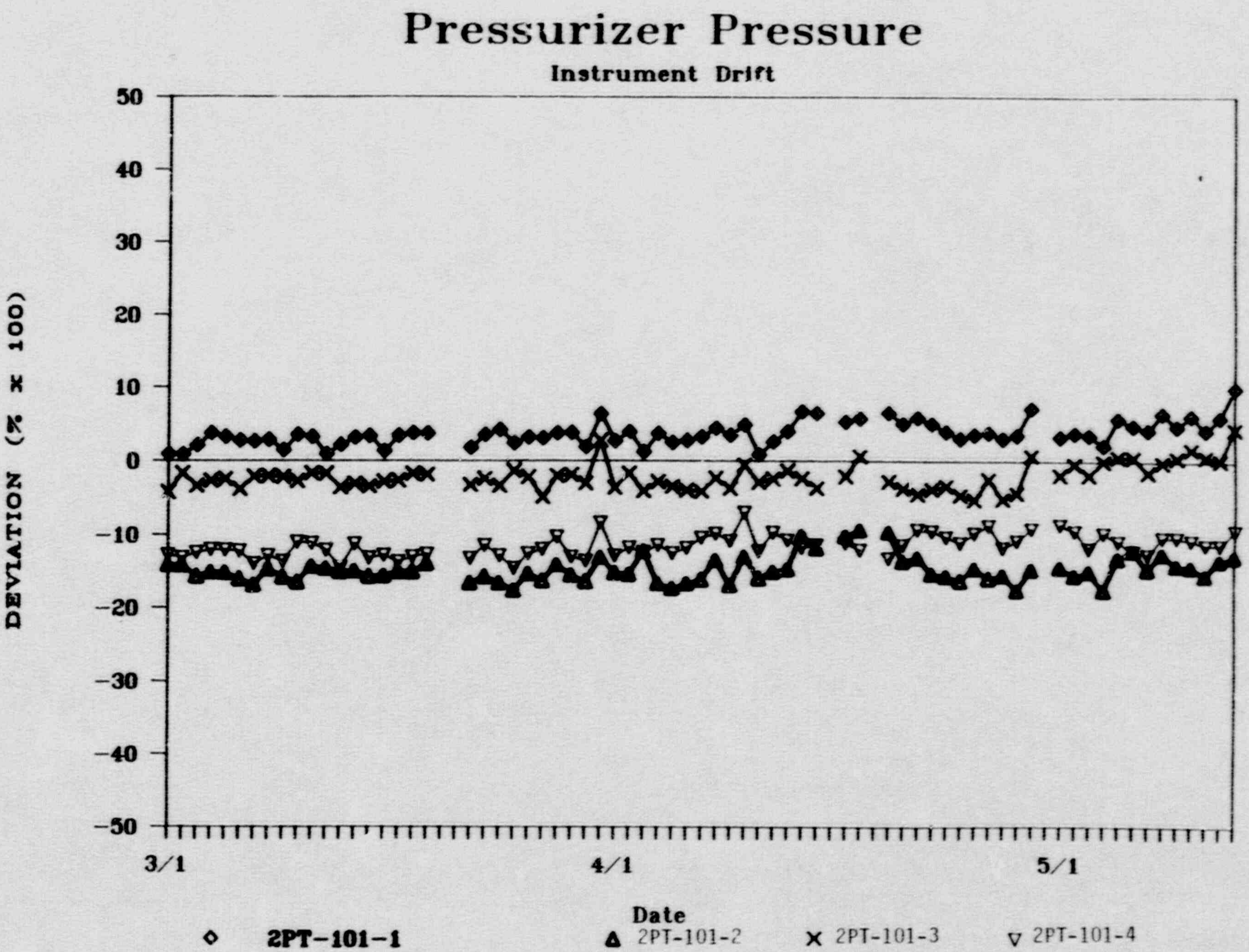
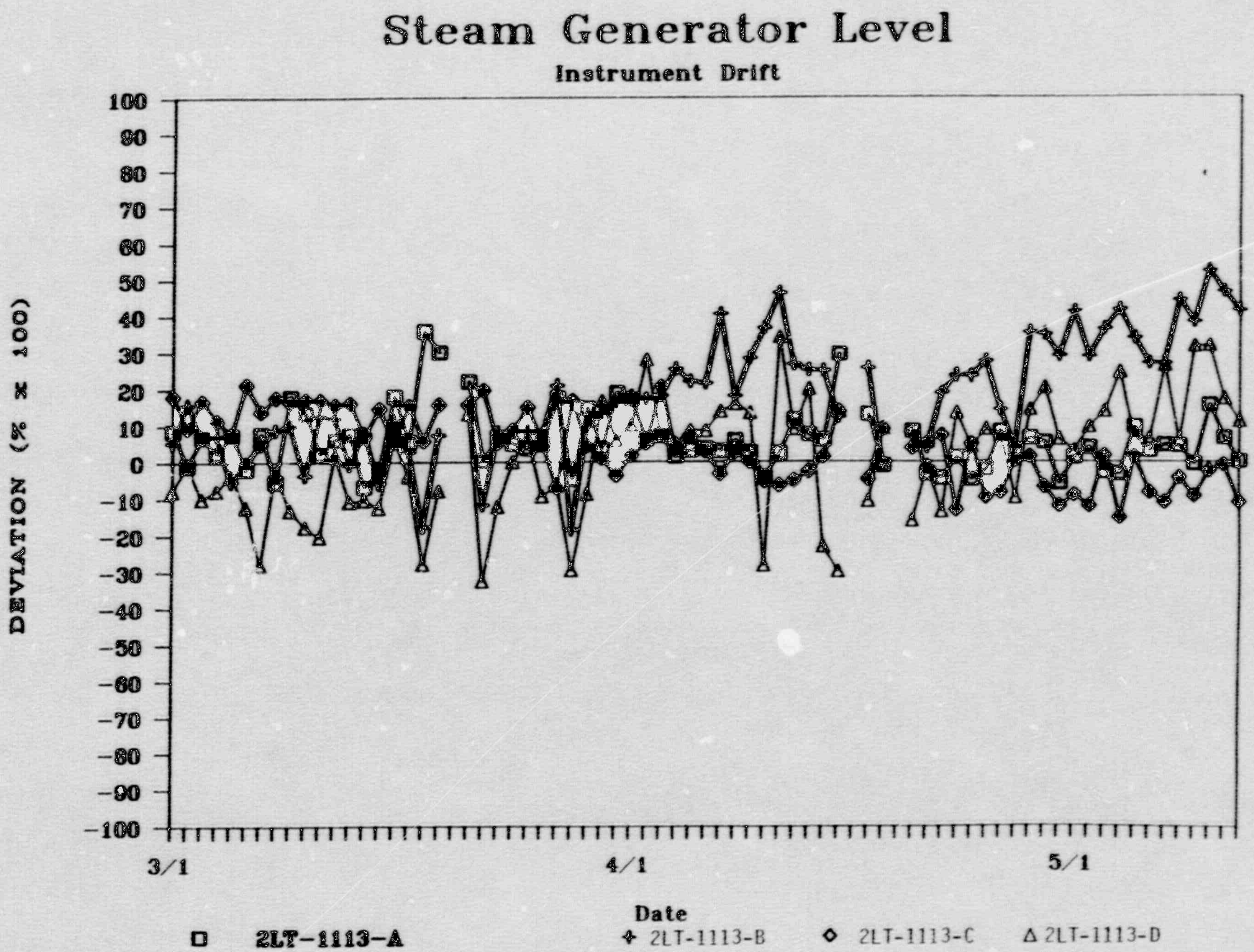

REDUNDANT INSTRUMENT
MONITORING SYSTEM
UNIT 2
PMS
CFMS
UNIT 3
PMS
CFMS
Data Acquisition
Computer
RIMS
Personal
Computer
I/O TEMPLATE
ONSPEC CONTROL SOFTWARE
SUPERINTENDENT
Alarms
Analysis
SUPERTREND
Displays
6/02/88

Figure J-2



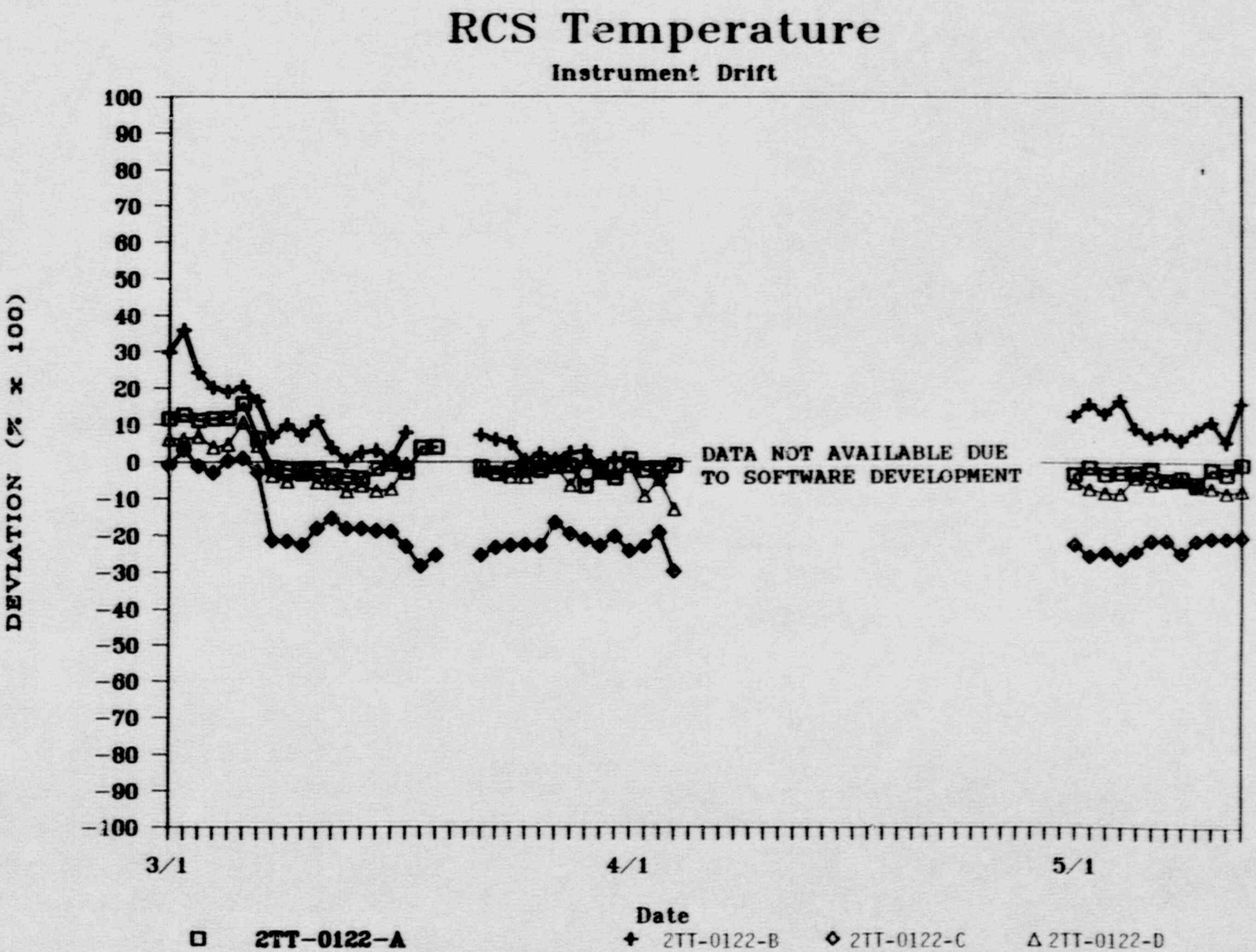
Pressurizer Pressure
Instrument Drift
DEVIATION (% x 100)
50
40
30
20
10
0
-10
-20
-30
-40
-50
3/1
4/1
5/1
Date
2PT-101-1
2PT-101-2
2PT-101-3
2PT-101-4

Figure J-3



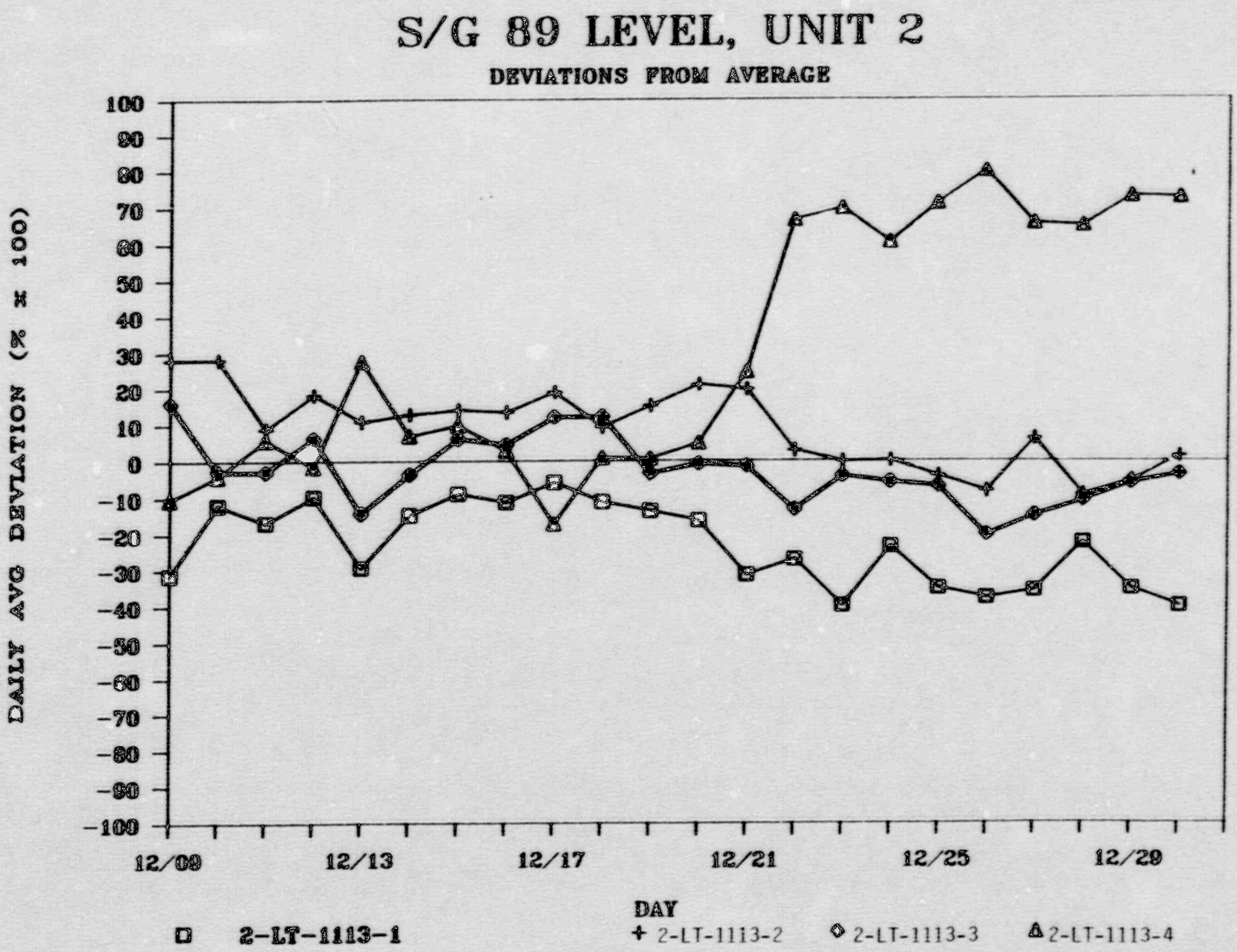
Steam Generator Level
Instrument Drift
DEVIATION (% x 100)
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
3/1
4/1
5/1
Date
2LT-1113-A
2LT-1113-B
2LT-1113-C
2LT-1113-D

Figure J-4



RCS Temperature
Instrument Drift
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
DEVIATION (% x 100)
DATA NOT AVAILABLE DUE
TO SOFTWARE DEVELOPMENT
3/1
4/1
5/1
Date
2TT-0122-A
2TT-0122-B
2TT-0122-C
2TT-0122-D

Figure J-5


S/G 89 LEVEL, UNIT 2
DEVIATIONS FROM AVERAGE
DAILY AVG DEVIATION (% x 100)
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
12/09
12/13
12/17
12/21
12/25
12/29
DAY
2-LT-1113-1
2-LT-1113-2
2-LT-1113-3
2-LT-1113-4