ATTACHMENT C

SONGS UNIT 2

PROPOSED TECHNICAL SPECIFICATIONS

TABLE 3.3-4

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION TRIP VALUES

FUNCTIONAL UNIT	TRIP VALUE	ALLOWABLE VALUES
1. SAFETY INJECTION (SIAS)		
a. Manual (Trip Buttons)	Not Applicable	Not Applicable
b. Containment Pressure - High	≤ 2.95 psig	≤ 3.14 psig
c. Pressurizer Pressure - Low	≥ 1806 psia (1)	≥ 1763 psia (1)
d. Automatic Actuation Logic	Not Applicable	Not Applicable
2. CONTAINMENT SPRAY (CSAS)		
a. Manual (Trip Buttons)	Not Applicable	Not Applicable
b. Containment Pressure -- High-High	≤ 16.14 psig	≤ 16.83 psig
c. Automatic Actuation Logic	Not Applicable	Not Applicable
3. CONTAINMENT ISOLATION (CIAS)		
a. Manual CIAS (Trip Buttons)	Not Applicable	Not Applicable
b Manual SIAS (Trip Buttons)(5)	Not Applicable	Not Applicable
c. Containment Pressure - High	≤ 2.95 psig	≤ 3.14 psig
d. Automatic Actuation Logic	Not Applicable	Not Applicable
4. MAIN STEAM ISOLATION (MSIS)		
a. Manual (Trip Buttons)	Not Applicable	Not Applicable
b. Steam Generator Pressure - Low	≥ 729 psia (2)	≥ 711 psia (2)
c. Automatic Actuation Logic	Not Applicable	Not Applicable
5. RECIRCULATION (RAS)		
a. Refueling Water Storage Tank	18.5% of tap span	19.27% ≥ tap span ≥ 17.73%
b. Automatic Actuation Logic	Not Applicable	Not Applicable

TABLE 3.3-4 (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION TRIP VALUES

FUNCTIONAL UNIT	TRIP VALUE	ALLOWABLE VALUES
6. CONTAINMENT COOLING (CCAS)		
a. Manual CCAS (Trip Buttons)	Not Applicable	Not Applicable
b. Manual SIAS (Trip Buttons)	Not Applicable	Not Applicable
c. Automatic Actuation Logic	Not Applicable	Not Applicable
7. LOSS OF POWER (LOV)		
a. 4.16 kv Emergency Bus Undervoltage (Loss of Voltage and Degraded Voltage)	See Fig. 3.3-1 (4)	See Fig. 3.3-1 (4)
8. EMERGENCY FEEDWATER (EFAS)		
a. Manual (Trip Buttons)	Not Applicable	Not Applicable
b. Steam Generator (A&B) Level-Low	$\geq$ 25% (3)	$\geq$ 24.23% (3)
c. Steam Generator ΔP-High (SG-A > SG-B)	$\leq$ 50 psi	$\leq$ 66.25 psi
d. Steam Generator ΔP-High (SG-B > SG-A)	$\leq$ 50 psi	$\leq$ 66.25 psi
e. Steam Generator (A&B) Pressure - Low	$\geq$ 729 psia (2)	$\geq$ 711 psia (2)
f. Automatic Actuation Logic	Not Applicable	Not Applicable

TABLE 4.3-2

ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTAION SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
1. SAFETY INJECTION (SIAS)				
a. Manual (Trip Buttons)	N.A.	N.A.	R (6)	1, 2, 3, 4
b. Containment Pressure - High	S	R (6)	M	1, 2, 3
c. Pressurizer Pressure - Low	S	R (6)	M	1, 2, 3
d. Automatic Actuation Logic	N.A.	N.A.	M(1)(3), SA(4)	1, 2, 3, 4
2. CONTAINMENT SPRAY (CSAS)				
a. Manual (Trip Buttons)	N.A.	N.A.	R (6)	1, 2, 3
b. Containment Pressure -- High - High	S	R (6)	M	1, 2, 3
c. Automatic Actuation Logic	N.A.	N.A.	M(1)(3), SA(4)	1, 2, 3
3. CONTAINMENT ISOLATION (CIAS)				
a. Manual CIAS (Trip Buttons)	N.A.	N.A.	R (6)	1, 2, 3, 4
b. Manual SIAS (Trip Buttons)(5)	N.A.	N.A.	R (6)	1, 2, 3, 4
c. Containment Pressure - High	S	R (6)	M	1, 2, 3
d. Automatic Actuation Logic	N.A.	N.A.	M(1)(3), SA(4)	1, 2, 3, 4
4. MAIN STEAM ISOLATION (MSIS)				
a. Manual (Trip Buttons)	N.A.	N.A.	R (6)	1, 2, 3
b. Steam Generator Pressure - Low	S	R (6)	M	1, 2, 3
c. Automatic Actuation Logic	N.A.	N.A.	M(1)(3), SA(4)	1, 2, 3
5. RECIRCULATION (RAS)				
a. Refueling Water Storage Tank - Low	S	R	M	1, 2, 3, 4
b. Automatic Actuation Logic	N.A.	N.A.	M(1)(3), SA(4)	1, 2, 3, 4
6. CONTAINMENT COOLING (CCAS)				
a. Manual CCAS (Trip Buttons)	N.A.	N.A.	R (6)	1, 2, 3, 4
b. Manual SIAS (Trip Buttons)	N.A.	N.A.	R (6)	1, 2, 3, 4
c. Automatic Actuation Logic	N.A.	N.A.	M(1)(3), SA(4)	1, 2, 3, 4

TABLE 4.3-2 (Continued)

ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
7. LOSS OF POWER (LOV)				
a. 4.16 kV Emergency Bus Undervoltage (Loss of Voltage and Degraded Voltage)	S	R	R	1, 2, 3, 4
8. EMERGENCY FEEDWATER (EFAS)				
a. Manual (Trip Buttons)	N.A.	N.A.	R	1, 2, 3
b. SG Level (A/B)-Low and ΔP (A/B) - High	S	R	M	1, 2, 3
c. SG Level (A/B) - Low and No Pressure - Low Trip (A/B)	S	R	M	1, 2, 3
d. Automatic Actuation Logic	N.A.	N.A.	M(1)(3), SA(4)	1, 2, 3
9. CONTROL ROOM ISOLATION (CRIS)				
a. Manual CRIS (Trip Buttons)	N.A.	N.A.	R	N.A.
b. Manual SIAS (Trip Buttons)	N.A.	N.A.	R	N.A.
c. Airborne Radiation				
i. Particulate/Iodine	S	R	M	All
ii. Gaseous	S	R	M	All
d. Automatic Actuation Logic	N.A.	N.A.	R(3)	All
10. TOXIC GAS ISOLATION (TGIS)				
a. Manual (Trip Buttons)	N.A.	N.A.	R	N.A.
b. Chlorine - High	S	R	M	All
c. Ammonia - High	S	R	M	All
d. Butane/Propane - High	S	R	M	All
e. Automatic Actuation Logic	N.A.	N.A.	R (3)	All

TABLE 4.3-2 (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
11. FUEL HANDLING ISOLATION (FHIS)				
a. Manual (Trip Buttons)	N.A.	N.A.	R	N.A.
b. Airborne Radiation				
i. Gaseous	S	R	M	*
ii. Particulate/Iodine	S	R	M	*
c. Automatic Actuation Logic	N.A.	N.A.	R(3)	*
12. CONTAINMENT PURGE ISOLATION (CPIS)				
a. Manual (Trip Buttons)	N.A.	N.A.	R	N.A.
b. Airborne Radiation				
i. Gaseous	S	R	M	1,2,3,4,6
ii. Particulate	W	R	M	1,2,3,4,6
iii. Iodine	W	R	M	6
c. Containment Area Radiation (Gamma)	S	R	M	1,2,3,4,6
d. Automatic Actuation Logic	N.A.	N.A.	R (3)	1,2,3,4,6

TABLE NOTATION

(1) Each train or logic channel shall be tested at least every 62 days on a STAGGERED TEST BASIS.

(2) Deleted.

(3) Testing of Automatic Actuation Logic shall include energization/de-energization of each initiation relay and verification of the OPERABILITY of each initiation relay.

(4) A subgroup relay test shall be performed which shall include the energization/de-energization of each subgroup relay and verification of the OPERABILITY of each subgroup relay. Relays exempt from testing during plant operation shall be limited to only those relays associated with plant equipment which cannot be operated during plant operation. Relays not testable during plant operation shall be tested during each COLD SHUTDOWN exceeding 24 hours unless tested during the previous 6 months.

(5) Actuated equipment only; does not result in CIAS.

* With irradiated fuel in the storage pool.

(1) At least once per Refueling Interval.

ATTACHMENT D

SONGS UNIT 3

PROPOSED TECHNICAL SPECIFICATIONS

TABLE 3.3-4

ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION TRIP VALUES

FUNCTIONAL UNIT	TRIP VALUE	ALLOWABLE VALUES
1. SAFETY INJECTION (SIAS)		
a. Manual (Trip Buttons)	Not Applicable	Not Applicable
b. Containment Pressure - High	≤ 2.95 psig 3.4	≤ 3.14 psig 3.7
c. Pressurizer Pressure - Low	≥ 1806 psia (1) 1740	≥ 1763 psia (1) 1700
d. Automatic Actuation Logic	Not Applicable	Not Applicable
2. CONTAINMENT SPRAY (CSAS)		
a. Manual (Trip Buttons)	Not Applicable	Not Applicable
b. Containment Pressure -- High-High	≤ 16.14 psig 14.0	≤ 16.83 psig 15.0
c. Automatic Actuation Logic	Not Applicable	Not Applicable
3. CONTAINMENT ISOLATION (CIAS)		
a. Manual CIAS (Trip Buttons)	Not Applicable	Not Applicable
b. Manual SIAS (Trip Buttons)(5)	Not Applicable	Not Applicable
c. Containment Pressure - High	≤ 2.95 psig 3.4	≤ 3.14 psig 3.7
d. Automatic Actuation Logic	Not Applicable	Not Applicable
4. MAIN STEAM ISOLATION (MSIS)		
a. Manual (Trip Buttons)	Not Applicable	Not Applicable
b. Steam Generator Pressure - Low	≥ 729 psia (2) 741	≥ 711 psia (2) 724
c. Automatic Actuation Logic	Not Applicable	Not Applicable
5. RECIRCULATION (RAS)		
a. Refueling Water Storage Tank	18.5% of tap span	19.27% ≥ tap span ≥ 17.73%
b. Automatic Actuation Logic	Not Applicable	Not Applicable

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TABLE 3.3-4 (Continued)

ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION TRIP VALUES

FUNCTIONAL UNIT	TRIP VALUE	ALLOWABLE VALUES
6. CONTAINMENT COOLING (CCAS)		
a. Manual CCAS (Trip Buttons)	Not Applicable	Not Applicable
b. Manual SIAS (Trip Buttons)	Not Applicable	Not Applicable
c. Automatic Actuation Logic	Not Applicable	Not Applicable
7. LOSS OF POWER (LOV)		
a. 4.16 kV Emergency Bus Undervoltage (Loss of Voltage and Degraded Voltage)	See Fig. 3.3-1 (4)	See Fig. 3.3-1 (4)
8. EMERGENCY FEEDWATER (EFAS)		
a. Manual (Trip Buttons)	Not Applicable	Not Applicable
b. Steam Generator (A&B) Level-Low	≥ 25% (3) 21%	≥ 24.23% (3) 20%
c. Steam Generator ΔP-High (SG-A > SG-B)	≤ 50 psi 125	≤ 66.25 psi 140
d. Steam Generator ΔP-High (SG-B > SG-A)	≤ 50 psi 125	≤ 66.25 psi 140
e. Steam Generator (A&B) Pressure - Low	≥ 729 psia (2) 741	≥ 711 psia (2) 729
f. Automatic Actuation Logic	Not Applicable	Not Applicable

TABLE 4.3-2

ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTAION SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
1. SAFETY INJECTION (SIAS)				
a. Manual (Trip Buttons)	N.A.	N.A.	R (6)	1, 2, 3, 4
b. Containment Pressure - High	S	R (6)	M	1, 2, 3
c. Pressurizer Pressure - Low	S	R (6)	M	1, 2, 3
d. Automatic Actuation Logic	N.A.	N.A.	M(1)(3), SA(4)	1, 2, 3, 4
2. CONTAINMENT SPRAY (CSAS)				
a. Manual (Trip Buttons)	N.A.	N.A.	R (6)	1, 2, 3
b. Containment Pressure -- High - High	S	R (6)	M	1, 2, 3
c. Automatic Actuation Logic	N.A.	N.A.	M(1)(3), SA(4)	1, 2, 3
3. CONTAINMENT ISOLATION (CIAS)				
a. Manual CIAS (Trip Buttons)	N.A.	N.A.	R (6)	1, 2, 3, 4
b. Manual SIAS (Trip Buttons)(5)	N.A.	N.A.	R (6)	1, 2, 3, 4
c. Containment Pressure - High	S	R (6)	M	1, 2, 3
d. Automatic Actuation Logic	N.A.	N.A.	M(1)(3), SA(4)	1, 2, 3, 4
4. MAIN STEAM ISOLATION (MSIS)				
a. Manual (Trip Buttons)	N.A.	N.A.	R (6)	1, 2, 3
b. Steam Generator Pressure - Low	S	R (6)	M	1, 2, 3
c. Automatic Actuation Logic	N.A.	N.A.	M(1)(3), SA(4)	1, 2, 3
5. RECIRCULATION (RAS)				
a. Refueling Water Storage Tank - Low	S	R	M	1, 2, 3, 4
b. Automatic Actuation Logic	N.A.	N.A.	M(1)(3), SA(4)	1, 2, 3, 4
6. CONTAINMENT COOLING (CCAS)				
a. Manual CCAS (Trip Buttons)	N.A.	N.A.	R (6)	1, 2, 3, 4
b. Manual SIAS (Trip Buttons)	N.A.	N.A.	R (6)	1, 2, 3, 4
c. Automatic Actuation Logic	N.A.	N.A.	M(1)(3), SA(4)	1, 2, 3, 4

TABLE 4.3-2 (Continued)

ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
7. LOSS OF POWER (LOV)				
a. 4.16 kV Emergency Bus Undervoltage (Loss of Voltage and Degraded Voltage)	S	R	R	1, 2, 3, 4
8. EMERGENCY FEEDWATER (EFAS)				
a. Manual (Trip Buttons)	N.A.	N.A.	R	1, 2, 3
b. SG Level (A/B)-Low and ΔP (A/B) - High	S	R	M	1, 2, 3
c. SG Level (A/B) - Low and No Pressure - Low Trip (A/B)	S	R	M	1, 2, 3
d. Automatic Actuation Logic	N.A.	N.A.	M(1)(3), SA(4)	1, 2, 3
9. CONTROL ROOM ISOLATION (CRIS)				
a. Manual CRIS (Trip Buttons)	N.A.	N.A.	R	N.A.
b. Manual SIAS (Trip Buttons)	N.A.	N.A.	R	N.A.
c. Airborne Radiation				
i. Particulate/Iodine	S	R	M	All
ii. Gaseous	S	R	M	All
d. Automatic Actuation Logic	N.A.	N.A.	R(3)	All
10. TOXIC GAS ISOLATION (TGIS)				
a. Manual (Trip Buttons)	N.A.	N.A.	R	N.A.
b. Chlorine - High	S	R	M	All
c. Ammonia - High	S	R	M	All
d. Butane/Propane - High	S	R	M	All
e. Automatic Actuation Logic	N.A.	N.A.	R (3)	All

TABLE 4.3-2 (Continued)

ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
11. FUEL HANDLING ISOLATION (FHIS)				
a. Manual (Trip Buttons)	N.A.	N.A.	R	N.A.
b. Airborne Radiation				
i. Gaseous	S	R	M	*
ii. Particulate/Iodine	S	R	M	*
c. Automatic Actuation Logic	N.A.	N.A.	R(3)	*
12. CONTAINMENT PURGE ISOLATION (CPIS)				
a. Manual (Trip Buttons)	N.A.	N.A.	R	N.A.
b. Airborne Radiation				
i. Gaseous	S	R	M	1,2,3,4,6
ii. Particulate	W	R	M	1,2,3,4,6
iii. Iodine	W	R	M	6
c. Containment Area Radiation (Gamma)	S	R	M	1,3,3,4,6
d. Automatic Actuation Logic	N.A.	N.A.	R (3)	1,2,3,4,6

TABLE NOTATION

(1) Each train or logic channel shall be tested at least every 62 days on a STAGGERED TEST BASIS.

(2) Deleted.

(3) Testing of Automatic Actuation Logic shall include energization/de-energization of each initiation relay and verification of the OPERABILITY of each initiation relay.

(4) A subgroup relay test shall be performed which shall include the energization/de-energization of each subgroup relay and verification of the OPERABILITY of each subgroup relay. Relays exempt from testing during plant operation shall be limited to only those relays associated with plant equipment which cannot be operated during plant operation. Relays not testable during plant operation shall be tested during each COLD SHUTDOWN exceeding 24 hours unless tested during the previous 6 months.

(5) Actuated equipment only; does not result in CIAS.

* With irradiated fuel in the storage pool.

(6) At least once per Refueling Interval

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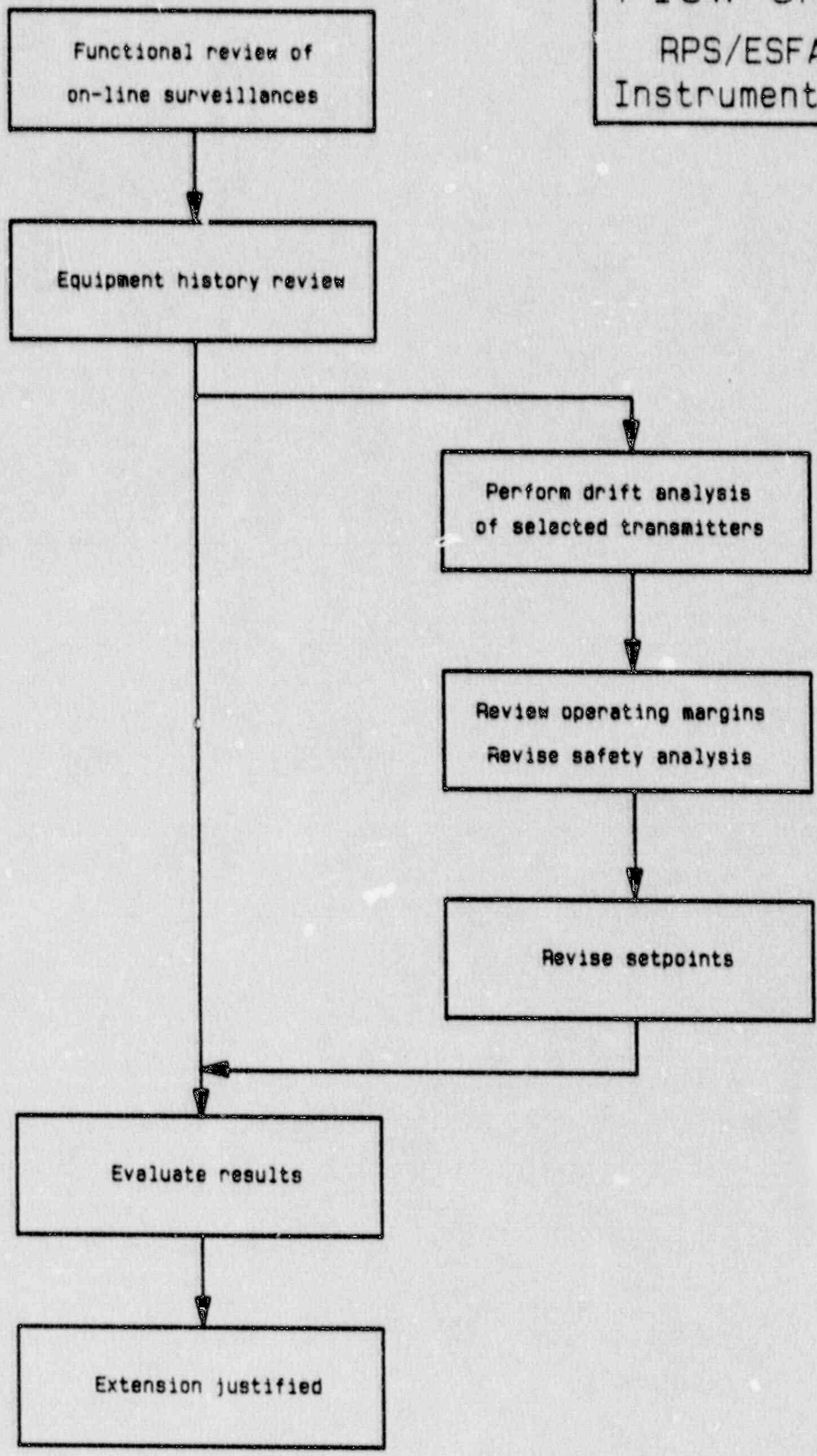
ATTACHMENT E

SONGS UNITS 2 AND 3

FIGURES

Figure 1 Methodology Flow Chart

RPS/ESFAS Instrumentation



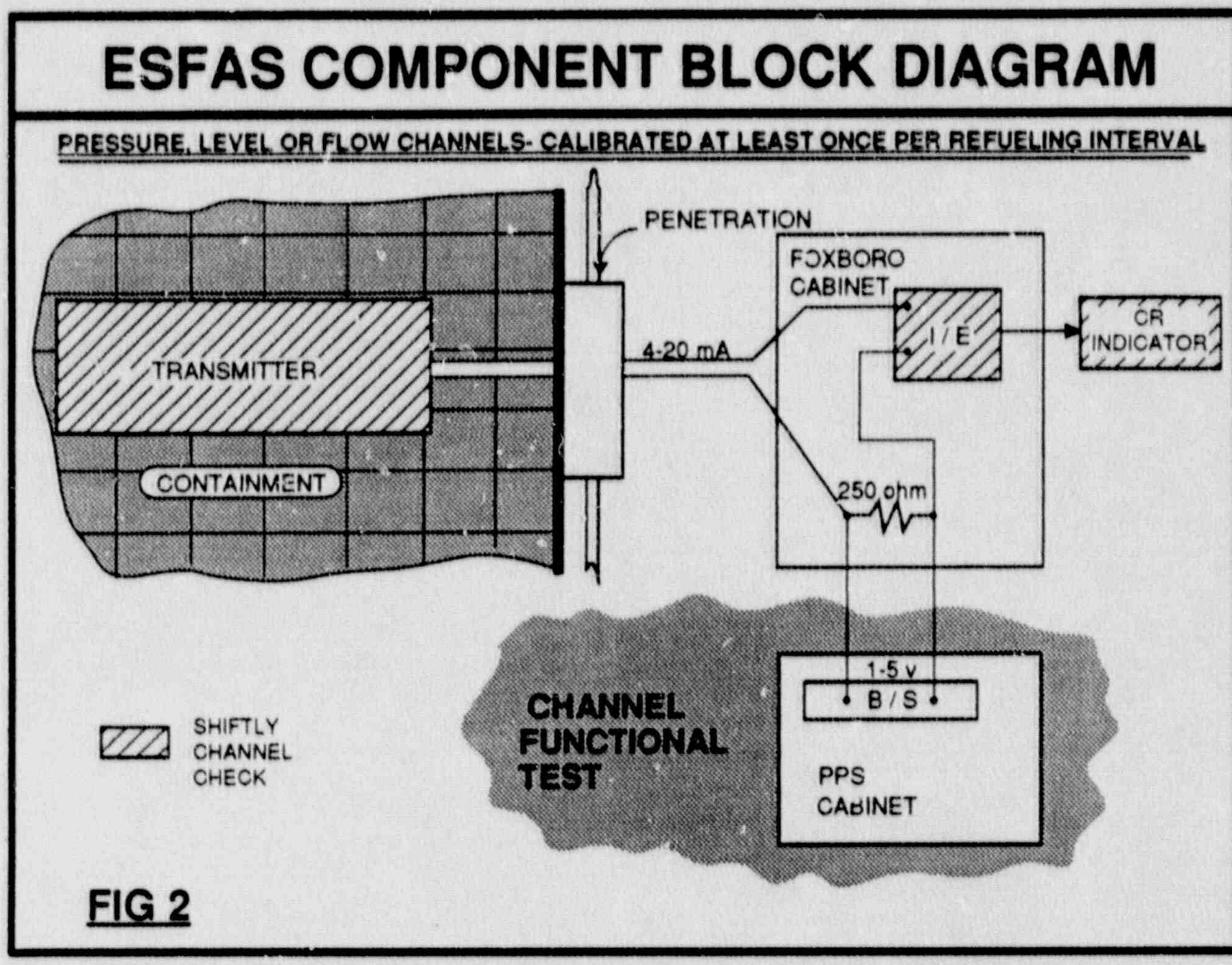


FIG 2

ABBREVIATIONS FOR FIGURES :

I/E -- CURRENT-TO-VOLTAGE CONVERTER

CR -- CONTROL ROOM

B/S -- BISTABLE

ESFAS COMPONENT BLOCK DIAGRAM

CONTAINMENT PRESSURE CHANNELS- CALIBRATED AT LEAST ONCE PER REFUELING INTERVAL

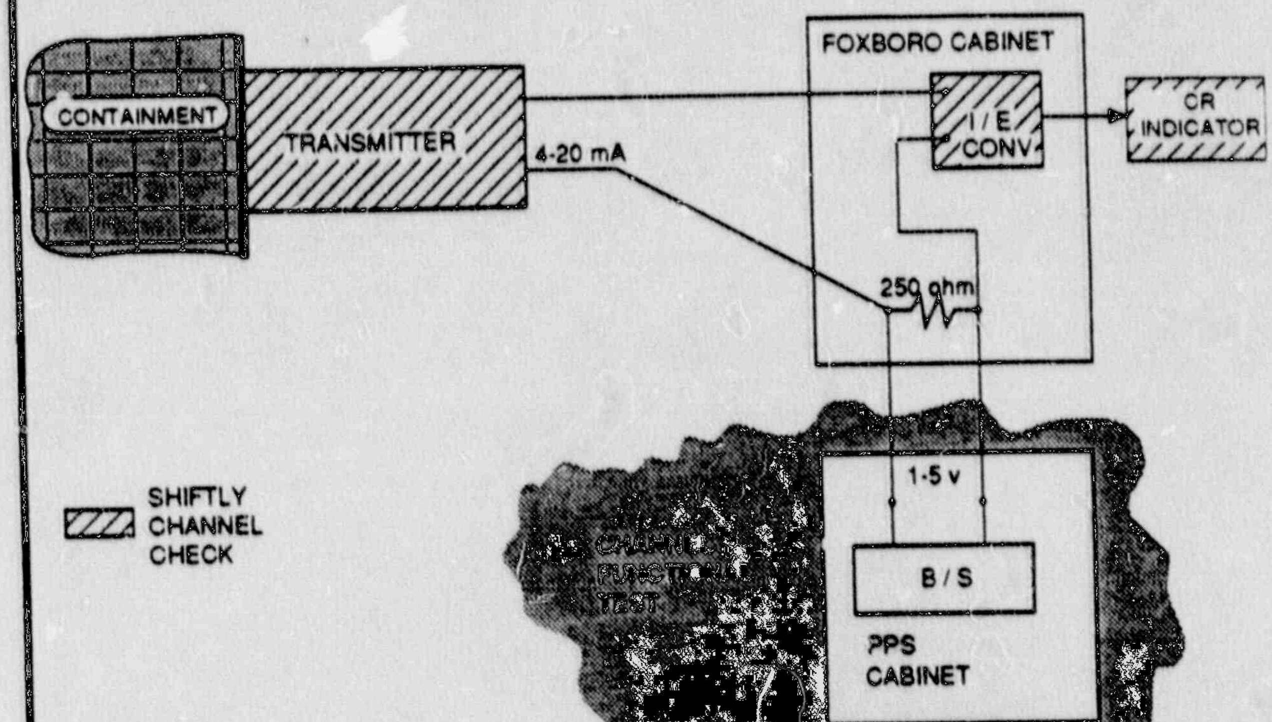


FIG 3

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 AND MAINTENANCE HISTORY REVIEW

Methodology

A Corrective Maintenance (CM) history review was conducted for all the instrumentation involved in supporting the Engineered Safety Features Actuation System (ESFAS) the refueling interval surveillance extension. The CM review was completed in two parts. 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 ESFAS system whose histories that were evaluated herein are listed on Table F-1. These components are pressure sensors, hand switches, differential pressure sensors, actuation logic channels, and relay circuitry. The Preventive Maintenance (PM) program for these instruments consists mainly of 18 month Channel Calibrations and shiftly operator checks. The shiftly checks include power supply, general failure and cross-channel comparison checks. Deficiencies detected during these checks 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 or 20 year intervals for the pressure and differential pressure transmitters. The actuation logic circuits are tested by a monthly Channel Functional Test (CFT), and subgroup relay tests are performed semi-annually.

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. No operability problems were found in the manual actuation circuits (handswitches). Few significant CMs were issued on the automatic actuation circuits. Those that were issued resulted from the monthly calibration tests.

Six CMs were identified as having been found during the performance of 18 month surveillance activities for the ESFAS loop components. Table F-2 summarizes the problems encountered, and provides an evaluation. Tables F-3 and F-4 are provided to summarize the Loss of Voltage (LOV) relay CMs and provide an evaluation of the 18 month surveillances performed.

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, and not during the refueling calibration. Five instruments were found to be noncalibratable during the refueling calibration, and were replaced. The review concluded that had these five instruments operated in the affected range or had the error increased even slightly, then the shiftly checks would have alerted the plant to the problem.

A comprehensive review of all CMs for the LOV channels determined that there were no CMs generated outside of the PM Program that presented an operability problem. Additionally, an evaluation of surveillance programs, Channel Calibrations and Channel Functional Tests, determined that no significant, time-dependent operability failures were being identified and corrected. Therefore, extension of the surveillance interval is supported by this evaluation.

For both process sensors and LOV relays, 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

ENGINEERED SAFETY FEATURES ACTUATION SYSTEM

INSTRUMENTATION LIST

T/S Func. Item	Loop Components	Description
1. Safety Injection		
	2(3)HS9135-1,-2,-3,-4	Actuation, manual
	2(3)PT0102-1,-2,-3,-4	Pressurizer pressure, low
	2(3)PT0351-1,-2,-3,-4	Containment pressure, high
	2(3)L032	Automatic actuation, logic
	2(3)L034	
	2(3)L035	
2. Containment Spray		
	2(3)HS9139-1,-2,-3,-4	Actuation, manual
	2(3)PT0352-1,-2,-3,-4	Containment pressure, high-high
	2(3)L032	Automatic actuation, logic
	2(3)L034	
	2(3)L035	
3. Containment Isolation		
	2(3)HS9136-1,-2,-3,-4	CIAS actuation, manual
	2(3)HS9135-1,-2,-3,-4	SIAS actuation, manual
	2(3)PT0351-1,-2,-3,-4	Containment pressure, high
4. Main Steam Isolation		
	2(3)HS9137-1,-2,-3,-4	Actuation, manual
	2(3)PT1013-1,-2,-3,-4	Steam generator pressure, low
	2(3)PT1023-1,-2,-3,-4	
	2(3)L032	Automatic actuation, logic
	2(3)L034	
	2(3)L035	

Table F-1 - continued

ENGINEERED SAFETY FEATURES ACTUATION SYSTEM

INSTRUMENTATION LIST

T/S Func. Item	Loop Components	Description
6. Containment Cooling		
	2(3)HS9138-1,-2,-3,-4	CCAS actuation, manual
	2(3)HS9135-1,-2,-3,-4	SIAS actuation, manual
	2(3)L032	Automatic actuation, logic
	2(3)L034	
	2(3)L035	
7. Loss of Offsite Power		
	LOV relays	Actuation circuits
8. Emergency Feedwater		
	2(3)HS9140-1,-2,-3,-4	Actuation, manual
	2(3)HS9141-1,-2,-3,-4	
	2(3)LT1113-1,-2,-3,-4	Steam generator level, low,
	2(3)LT1123-1,-2,-3,-4	and
	2(3)PT1013-1,-2,-3,-4	Steam generator pressure differential,
	2(3)PT1023-1,-2,-3,-4	high
	2(3)LT1113-1,-2,-3,-4	Steam generator level, low,
	2(3)LT1123-1,-2,-3,-4	and no
	2(3)PT1013-1,-2,-3,-4	Steam generator pressure, low trip
	2(3)PT1023-1,-2,-3,-4	

Table F-2

SURVEILLANCE AND MAINTENANCE HISTORY SUMMARY

Component	Date Completed	Problem Description
2LT1113-3	11/84	(1) Replaced after failing to calibrate
3LT1113-2	10/85	(1) Replaced after failing to calibrate
3LT1113-3	01/84	(1) Replaced after failing to calibrate
2PT0351-1	02/85	(2) Replaced after failing to calibrate
2PT0351-2	02/85	(2) Replaced after failing to calibrate
3PT0352-4	05/88	(3) Replaced after amplifier failed during response time testing

EVALUATIONS

(1) The subject transmitters were not able meet the five point span accuracy specifications, 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 ESFAS operability.

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

Table F-2 - continued

SURVEILLANCE AND MAINTENANCE HISTORY SUMMARY

(3) This transmitter had been successfully calibrated and was having its loop response time tested when the failure occurred. This failure would have been detected in the control room during normal operations. At that time the limiting condition of operation for one channel inoperable would have been entered until repairs could be made.

(4) CM History Summary - 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 showed 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.

(5) The functional units with manual actuation use trip buttons. These functional units do not require Channel Checks or Channel Calibrations but do require Channel Functional Testing on an 18 month interval. No credit is taken in the accident analysis for the manual actuations.

Manual trip instrumentation is not subject to drift. Channel functional checks serve to provide operability assurance. The surveillance test results, were reviewed to determine the history of the manual trip actuations from a reliability perspective. This surveillance review determined that there has never been a failure of a manual trip to properly function.

Table F-3

CALIBRATION AND CM HISTORY SUMMARY
FOR
LOSS OF VOLTAGE RELAYS

Date Completed	Operability Affected?	Problem Description
Bus 2A04		
10/26/87	No	(1) 162 out of tolerance
Bus 2A06		
09/17/87	No	(2) Voltages out of tolerance
12/25/84	No	(3) 127DC6 replaced
Bus 3A04		
07/11/88	No	(4) 162 erratic time observed
Bus 3A06		
02/09/84	No	(5) 162F4X2 open coil 127L reset contact loose

EVALUATIONS

(1) Time delay relay (162) for sequencing the emergency chiller on could not be brought into specified time and was replaced. The as found deficiency would have resulted in delayed loading of the chiller, but not an inoperable condition.

(2) Several drop out voltages were found to be slightly out of tolerance. Because some of the relays affected were under voltage, while others were above voltage, and most were input to a "any 2 of 4" logic circuit the net effect is minimal. The evaluation concludes that if a Channel Functional Test had been conducted with the as found conditions, no deficiencies would have been detected due to the minimal voltage variations.

Table F-3 - continued

CALIBRATION AND CM HISTORY SUMMARY
FOR
LOSS OF VOLTAGE RELAYS

(3) The 127DC6 relay is a supervisory relay installed to detect and annunciate a loss of 125 DC control power to LOV relay circuits. While the relay was found not to meet its specified drop out range and was replaced, it did not affect operability of any portion of the LOV channel.

(4) Erratic time adjustment was found when calibrating the time delay relay that sequences an emergency chiller onto the vital bus. As in item (1) this Unit 3 breaker would have been delayed in closing, but would not have resulted in an inoperable condition.

(5) Relay 162F4X2 was found with an open coil. This failure would have prevented one set of contacts in an "any 2 of 4" logic circuit from actuating. This particular relay is in the circuit to load shed 2 salt water cooling pumps and one chiller. Since 3 of 4 relays remained functional, this failure would not have affected operability of the LOV circuit. This condition meets the "minimum channels operable" requirement of technical specification 4.3.2.3.
The 127L relay annunciates to the control room the LOV condition on the affected bus. The loose reset contact would not affect the initial annunciation, but could have resulted in premature clearing of the LOV indication. This would not affect LOV operability.

(6) CM History Summary - A comprehensive review of corrective maintenance history for maintenance actions discovered outside of planned surveillances was conducted. It found only one corrective maintenance order that presented a potential operability problem. This maintenance order, 83306265, identified that a 127F2 residual voltage relay did not drop out when an associated fuse blew. Investigation revealed that the design did not have the associated alarm relay monitoring both supply fuses. A design change was initiated to correct the problem. This occurred at the time of beginning commercial operation, and did not represent an operability problem.

Table F-4

CHANNEL FUNCTIONAL TEST SUMMARY
FOR
LOSS OF VOLTAGE RELAYS

Refueling Cycle	Date Completed	Operability Affected?	Problem Description
Unit 2			
1	03/10/85	**	6 load sequencing relays were out of their timed tolerance band. 1 relay failed to reset, and was replaced.
2	05/18/86	**	8 load sequencing relays were out of their timed tolerance band.
3	11/04/87	**	12 load sequencing relays were out of their timed tolerance band.
Unit 3			
1	12/09/85	**	9 load sequencing relays were out of their timed tolerance band.
2	02/27/87	**	5 load sequencing relays were out of their timed tolerance band.
3	07/25/88	**	1 load sequencing relay was out of its timed tolerance band.

** As discussed below, the observed tolerance violations are considered too insignificant to result in an ESF operability problem, however all relays are restored to within their specified allowances prior to declaring the channels operable.

Evaluation

The Channel Functional Tests have to date not detected any failures in the voltage failure, residual voltage, auxiliary, alarm or time delay relays. All deficiencies have been associated with the timing of the load sequencing relays being out-of-tolerance. A typical example is the five deficiencies observed during cycle 2 on Unit 3. These are shown below:

1. Salt Water Cooling pump started 0.15 sec too early.

Table F-4 - continued

CHANNEL FUNCTIONAL TEST SUMMARY
FOR
LOSS OF VOLTAGE RELAYS

2. Salt Water Cooling pump started 0.25 sec too early.

3. D/G Bldg. HVAC Fan started 0.30 sec too early.

4. D/G Radiator Fan started 0.25 sec too early.

5. D/G Radiator Fan started 0.25 sec too early.

These values are typical of other observed out-of-tolerance readings in magnitude. It is more usual, however, to have some late out-of-tolerance times. As in other cases, the minor magnitude would not be expected to interfere with other loads coming on line which are separated by approximately 4 seconds assuming the deficient condition. This consideration is important for large loads such as the salt water cooling pumps. For the fans, the minor deviation will have even less impact.

The out-of-tolerance conditions experienced above resulted after only a two week post-calibration period. Calibration records show approximately the same out-of-tolerance conditions after a nominal 16 month period. Therefore, once reset and returned to service, the findings indicate that the observed drift is not time dependent, and that no operability problems are likely to be promoted by interval extension.

Furthermore, in all CFTs, the diesels were successfully loaded. The loss of voltage circuit has not been responsible for the failure of any of the required loads to operate.

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 (Figure G-1). 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 22 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 PPS 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 13 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[1]	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

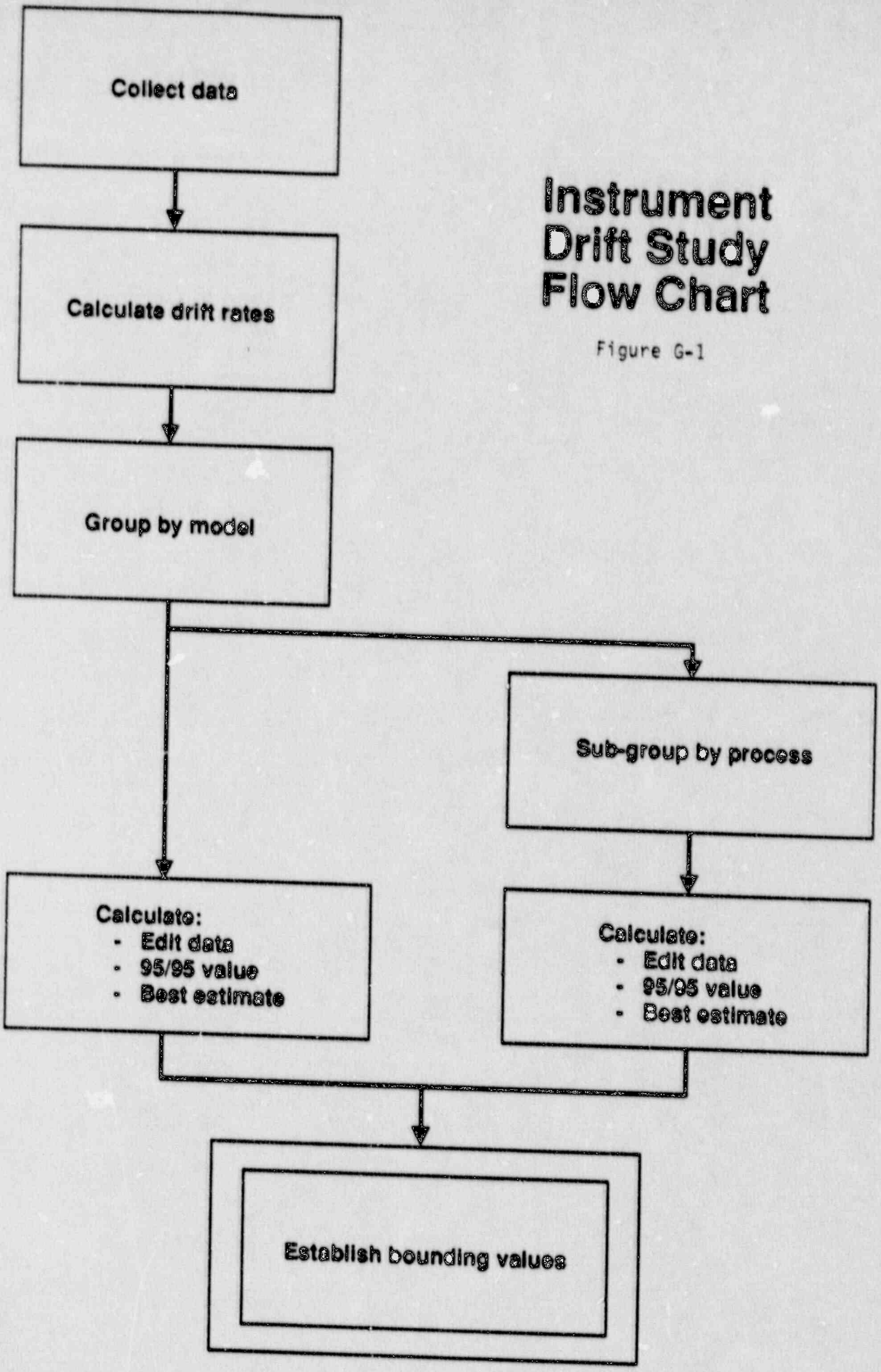
5.1 Instrument Drift Study, CDM Document Number M-89047, R. M. Bockhorst, Southern California Edison Company, May, 1989

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

ESFAS 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 Engineered Safety Features Actuation System (ESFAS) 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. Engineered Safety Features Actuation System (ESFAS) 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 safety system actuations, during normal cycle operations. As part of the process of revising the ESFAS setpoints, an assessment of the change was made after accounting for the increased values for drift. In instances where the revised actuation setpoint was judged to result in a potential increase in the number of unnecessary safety system actuations, a review of the SONGS Units 2 and 3 actuation setpoint calculations and Safety Analysis Setpoints was performed. The actuation setpoint calculation assumptions for certain ESF actuation functions were revised. The pressurizer pressure trip setpoint calculations were also revised to reflect more realistic containment enviornmental conditions for pressure and tempterature. 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 Reactor Protection System (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 ESFAS 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 3.3.2 (Table 3.3-4) Functional Units 1,2,3,4,6 & 8. These functional units include sensors which are calibrated only at the refueling interval and are affected by the increased surveillance interval.

3. ESFAS INSTRUMENT LOOPS

Two basic configurations of instrument loops were included in the Engineered Safety Features Actuation System (ESFAS) instrumentation (See Attachment E Figures 2 & 3)as follows:

TECH. SPEC.	FUNCTIONAL UNIT	APPLICABLE Figure
3.3.2	1	2 (Pressurizer Pressure Low)
		3 (Containment Pressure High)
	2	3 (Containment Pressure High High, only if an SIAS signal is present)
	3	3 (Containment Pressure High)
	4	2 (Steam Generator Pressure Low)
	6	2 (Pressurizer Pressure Low)
		3 (Containment Pressure High, with SIAS)
	8	2 (Steam Generator Level and Pressure)

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

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 Appendix 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 w/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.

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. All of 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 ESFAS 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 use 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 ESFAS 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 actuation setpoint calculations. The calibration tolerance is the acceptable tolerance band for each bistable actuation function in the periodic surveillance procedure. If the bistable actuation occurs within this tolerance band, no adjustment is required, and the "as-Found" and "As-Left" values are recorded without adjustment. If the bistable actuation 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 ESFAS setpoints. A number of the new setpoint values provide more operating margin than the existing values while still based on the same accident analysis limits. 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 ESF actuation, while still based on the same accident analysis limits.

A discussion of each of the setpoint calculations performed by C-E is included in the following:

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

   The Low Pressurizer Pressure actuation setpoint 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 setpoint calculations, were revised from 60 psig and 350 degrees F to 5 psig and 250 degrees F, respectively. High Containment Pressure ESFAS trip and SIAS functions are credited in limiting containment temperature to less than 250 degrees F and containment pressure to less than 5 PSIG in considering the worst case environmental errors for Low Pressurizer Pressure SIAS initiation. The calculation for Low Pressurizer Pressure resulted in a lower actuation setpoint of 1740 psia in place of the existing 1806 psia.

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

   The High Containment Pressure actuation setpoint was revised from 2.95 psig to 3.4 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. High containment pressure trip is credited in limiting containment temperature to less than 250 degrees F prior to initiation of a SIAS function. 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 a) above.

   The increase in the High Containment Pressure trip setpoint causes a slight increase in the time to initiation of the Containment Isolation

TABLE H-1

ESFAS INSTRUMENTATION TRIP SETPOINT LIMITS

FUNCTIONAL UNIT	EXISTING T.S. 3.3.2 TRIP SETPOINT	EXISTING T.S. 3.3.2 ALLOWABLE VALUE	PROPOSED T.S. 3.3.2 TRIP SETPOINT	PROPOSED T.S. 3.3.2 ALLOWABLE VALUE
1. SIAS				
-Cont. Press-Hi	≤ 2.95 psig	≤ 3.14 psig	≤ 3.4 psig	≤ 3.7 psig
-Pzr. Press-Lo	≥ 1806 psia	≥ 1763 psia	≥ 1740 psia	≥ 1700 psia
2. CSAS				
-Cont. Press-Hi	≤ 2.95 psig	≤ 3.14 psig	≤ 3.4 psig	≤ 3.7 psig
-Pzr. Press-Lo	≥ 1806 psia	≥ 1763 psia	≥ 1740 psia	≥ 1700 psia
-Cont. Press-Hi-Hi	≤ 16.14 psig	≤ 16.83 psig	≤ 14.0 psig	≤ 15.0 psig
3.) CIAS				
-Cont. Press-Hi	≤ 2.95 psig	≤ 3.14 psig	≤ 3.4 psig	≤ 3.7 psig
4.) MSIS				
-S/G Press-Lo	≥ 729 psia	≥ 711 psia	≥ 741 psia	≥ 729 psia

TABLE H-1
(Continued)

ESFAS INSTRUMENTATION TRIP SETPOINT LIMITS

FUNCTIONAL UNIT	EXISTING T.S. 3.3.2 TRIP SETPOINT	EXISTING T.S. 3.3.2 ALLOWABLE VALUE	PROPOSED T.S. 3.3.2 TRIP SETPOINT	PROPOSED T.S. 3.3.2 ALLOWABLE VALUE
6.) CCAS				
-Cont. Press-Hi	≤ 2.95 psig	≤ 3.14 psig	≤ 3.4 psig	≤ 3.7 psig
-Pzr. Press-Lo	≥ 1806 psia	≥ 1763 psia	≥ 1740 psia	≥ 1700 psia
8.) EFAS				
-S/G (A&B) Level-Lo	≥ 25%	≥ 24.23%	≥ 21%	≥ 20%
-S/G Delta P-Hi				
(SG-A > SG-B)	≤ 50 psid	≤ 66.25 psid	≤ 125 psid	≤ 140 psid
(SG-B > SG-A)	≤ 50 psid	≤ 66.25 psid	≤ 125 psid	≤ 140 psid
-S/G (A&B) Press-Lo	≥ 729 psia	≥ 711 psia	≥ 741 psia	≥ 729 psia

Actuation System (CIAS) and the Containment Cooling Actuation System (CCAS). Credit is taken for CIAS in limiting the amount of steam released through containment and 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 mass releases through the valves are bounded by the present analyses. The slight increase in time to initiation of CIAS results in a minor reduction in the 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 existing analyses.

c) The Low Steam Generator Water Level actuation setpoint recalculation 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 actuation setpoint was reduced from 25% to 21%.

The associated Safety Analysis Setpoint for EFAS was reduced from 5.0% to 2.0%. LOCA events do not credit the Low Steam Generator Water Level for the reactor trip function, but do credit EFAS on Low Steam Generator Water 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.

d) The Low Steam Generator Pressure actuation setpoint was calculated based on the increased sensor drift and an increased tolerance for PPS bistable functional testing. No change to the existing Safety Analysis Setpoint was required.

e) The Containment Pressure Hi-Hi actuation setpoint was calculated based on the increased sensor drift and an increased tolerance for PPS bistable functional testing. No change to the Safety Analysis Setpoint was required.

f) The High Steam Generator Delta Pressure actuation setpoint was calculated based on the revised sensor drift and an increased tolerance for PPS bistable functional testing. The actuation setpoint was revised from 50 psid to 125 psid. The associated Safety Analysis Setpoint was increased from 100 psid to 250 psid to allow for more room between the equipment setpoint and the normal variation in delta pressure. C-E reanalyzed the limiting decreased heat removal event (feedwater line break) to demonstrate that the pressurizer will not be filled solid due to the revised setpoint and that the feedwater line break results are bounded by the analysis presented in FSAR Section 15.2.

4.5 Summary

The SONGS Units 2 & 3 ESFAS actuation setpoints were revised based on changes to the Safety Analysis Setpoints and changes in the actuation setpoint calculations. The Safety Analysis Setpoints were revised for Low Steam Generator Level, High Containment Pressure and High Steam Generator Delta Pressure actuation functions. These evaluations demonstrate acceptable results when compared to the existing safety analysis limits. The actuation setpoint calculations for Low Pressurizer Pressure, Low Steam Generator Level, High Containment Pressure and High Steam Generator Delta Pressure were revised to improve operating margins while accounting for increased transmitter drift and an increase in the allowed tolerance for actuation bistable functional testing. The actuation setpoint calculations for Low Steam Generator Pressure and High-High Containment Pressure were revised to account for increased transmitter drift and an increase in the allowed tolerance for actuation bistable functional testing. These changes to the actuation setpoint calculations preserve the margin of safety while maintaining adequate operating margins.

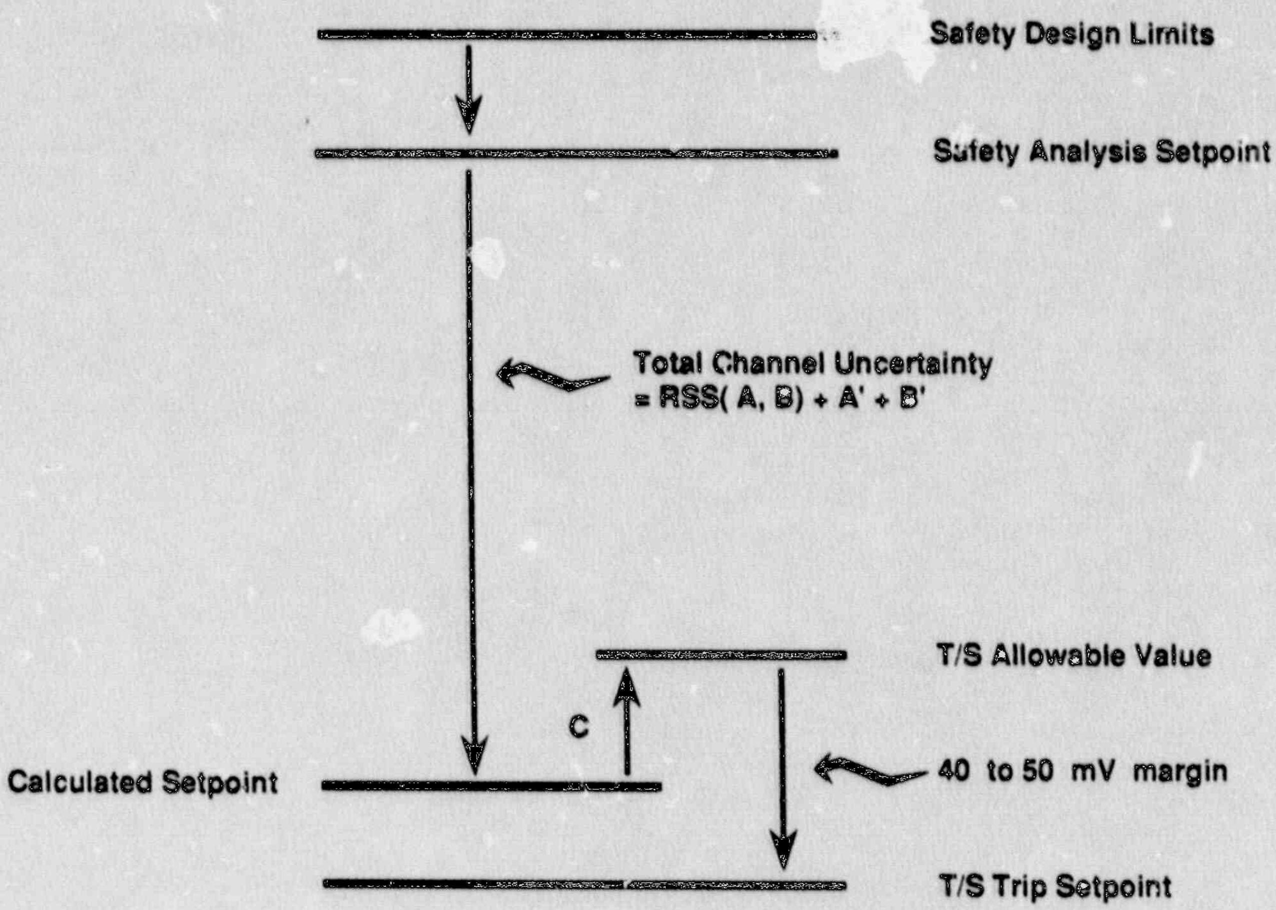
This reanalysis has met all of the objectives which are: adequate protection for design transients; nominal 24 month calibration intervals; and sufficient operating margins.

5. RESPONSE TIME TESTING LIMITS

All of the Safety Analysis response times were confirmed by C-E to remain acceptable, without any changes required. No technical specification response time changes were required because the response times used in the safety evaluation were not changed.

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

REDUNDANT INSTRUMENT MONITORING SYSTEM (RIMS) DESCRIPTION

ATTACHMENT I

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.

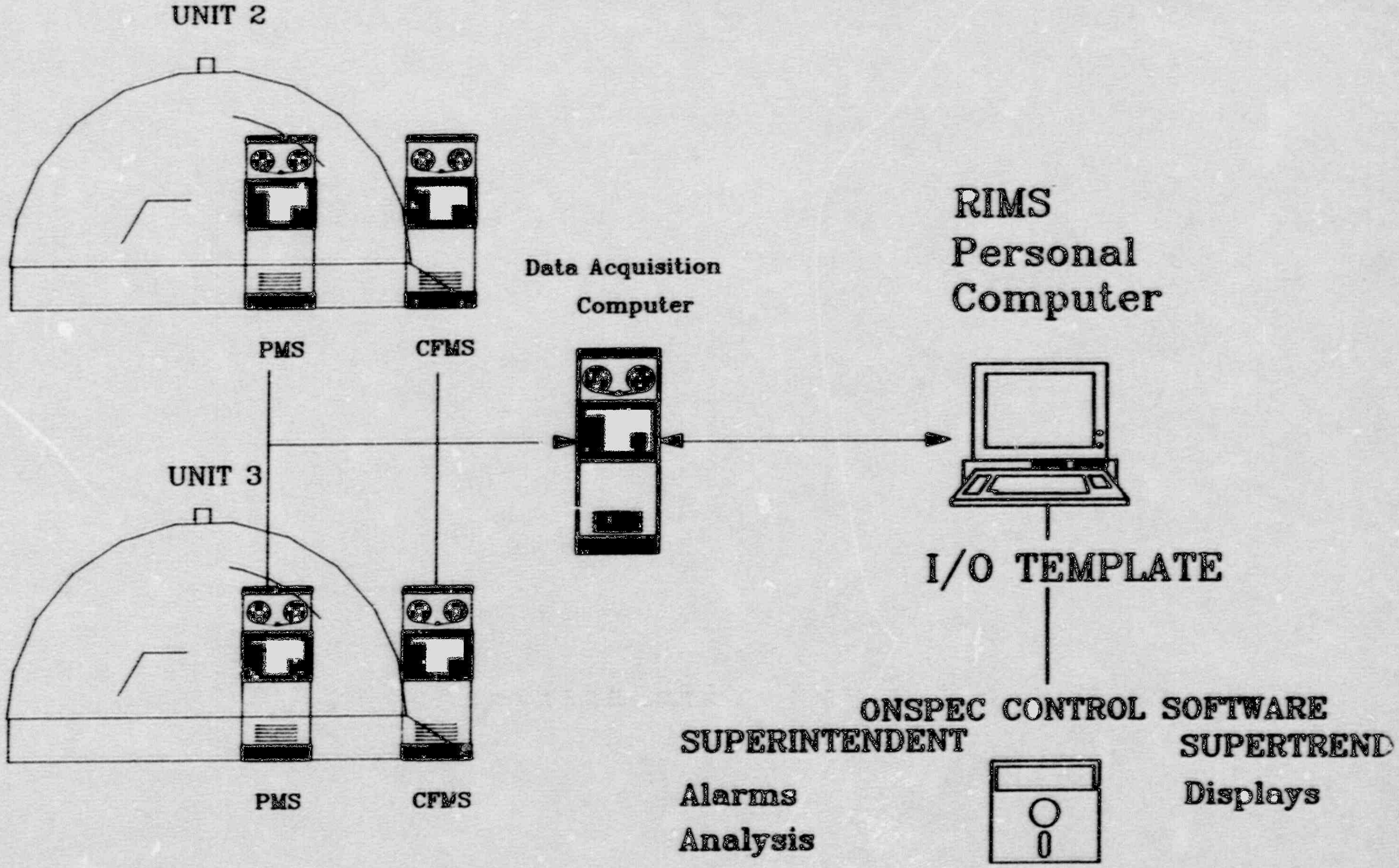
- Contribution of the system to the station operating goals of reducing overall radiation exposure (ALARA) and reducing the frequency of surveillances that result in needless cycling of instruments and can accelerate equipment aging.

- 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.

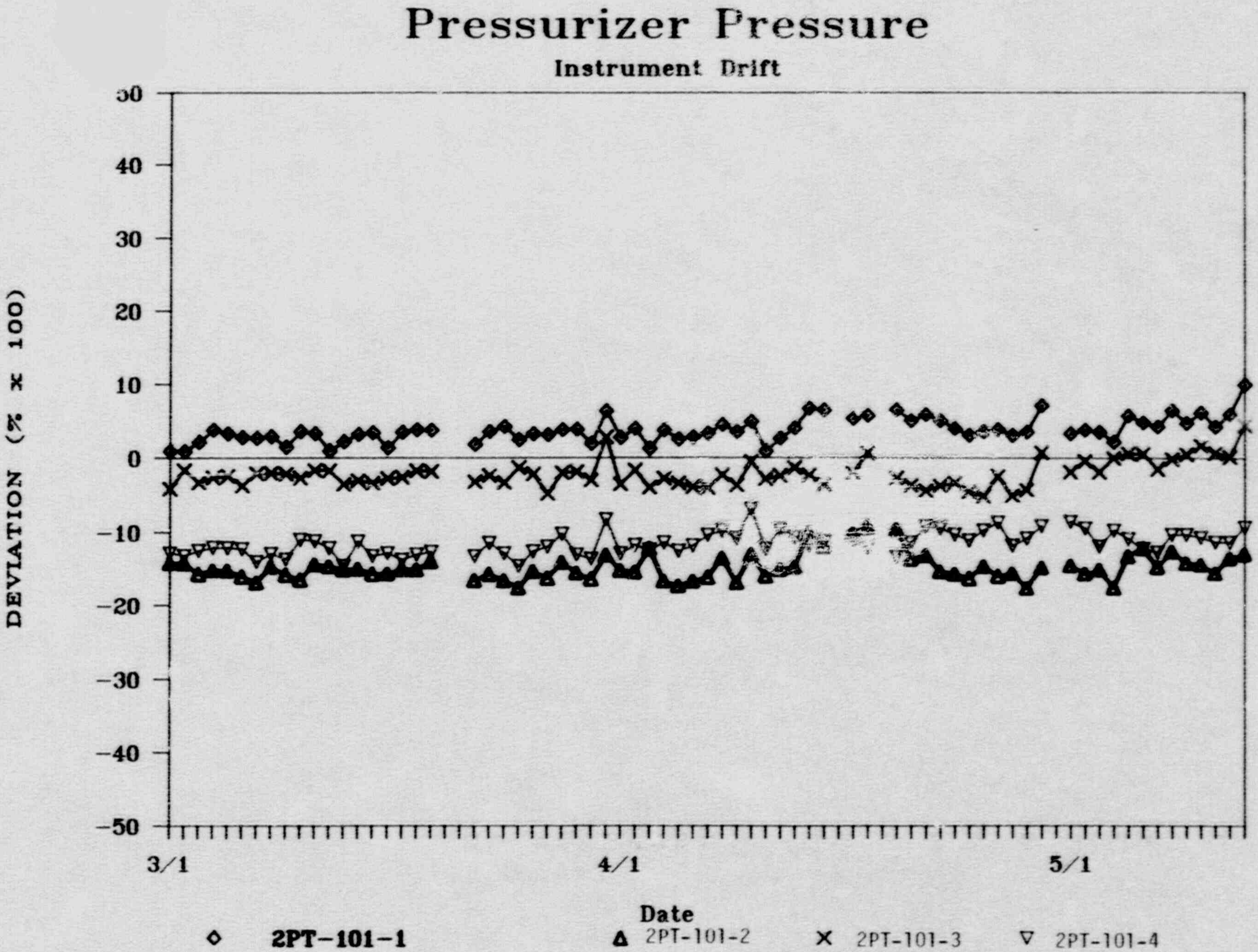
Figure I-1

REDUNDANT INSTRUMENT MONITORING SYSTEM



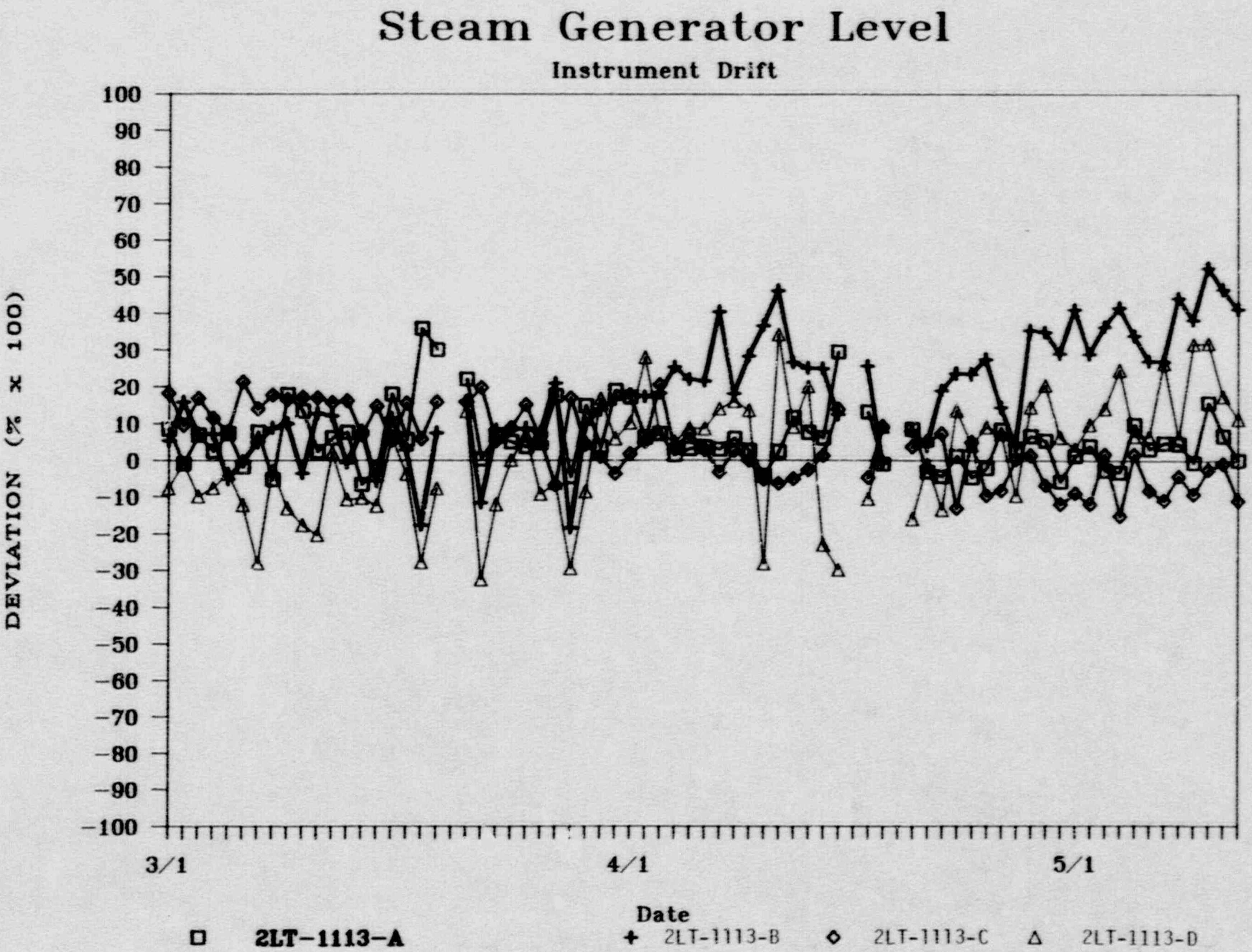
6/02/88

Figure I-2



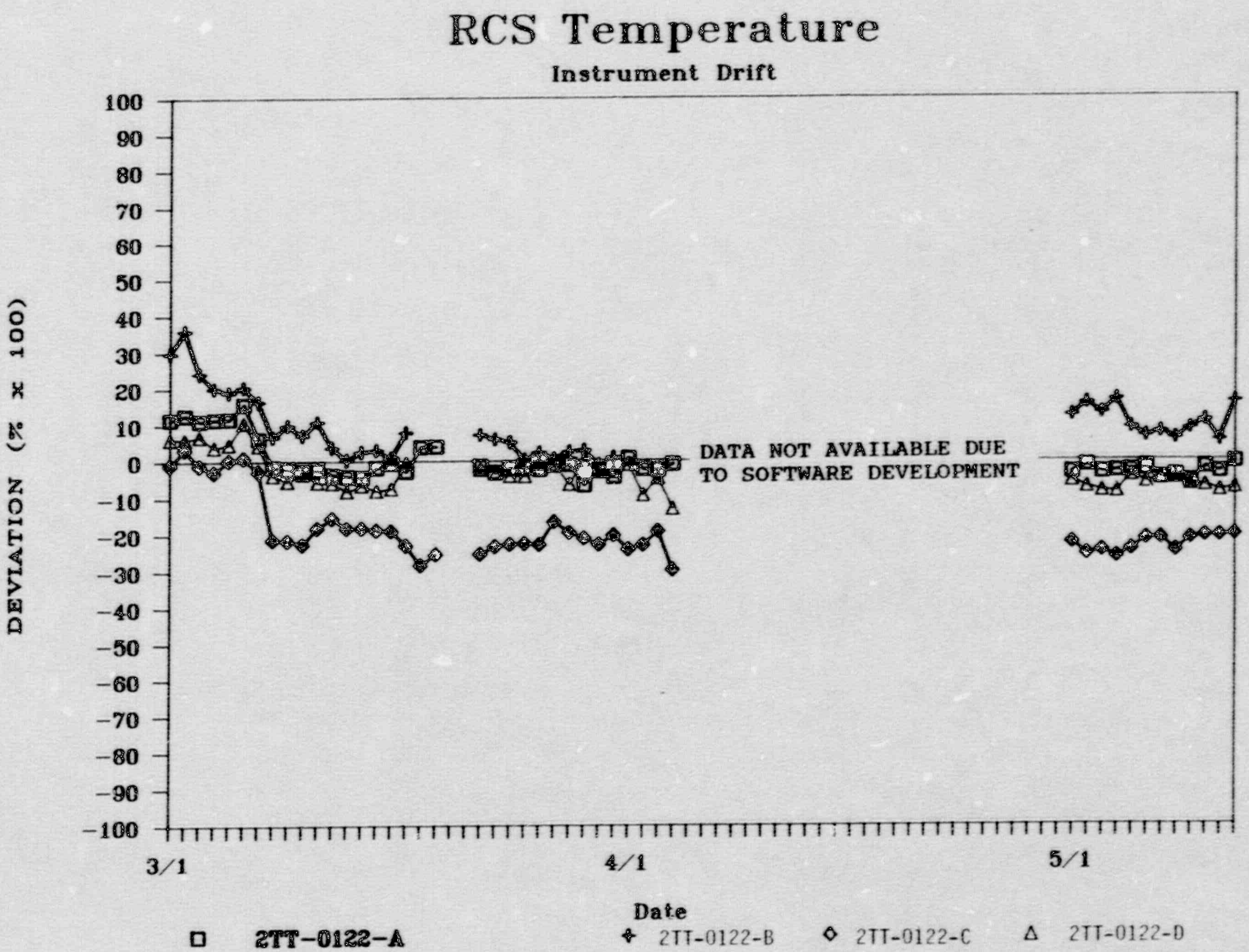
Pressurizer Pressure
Instrument Drift
50
40
30
20
10
0
−10
−20
−30
−40
−50
DEVIATION (% x 100)
3/1
4/1
5/1
Date
2PT−101−1
2PT-101-2
2PT-101-3
2PT-101-4

Figure I-3



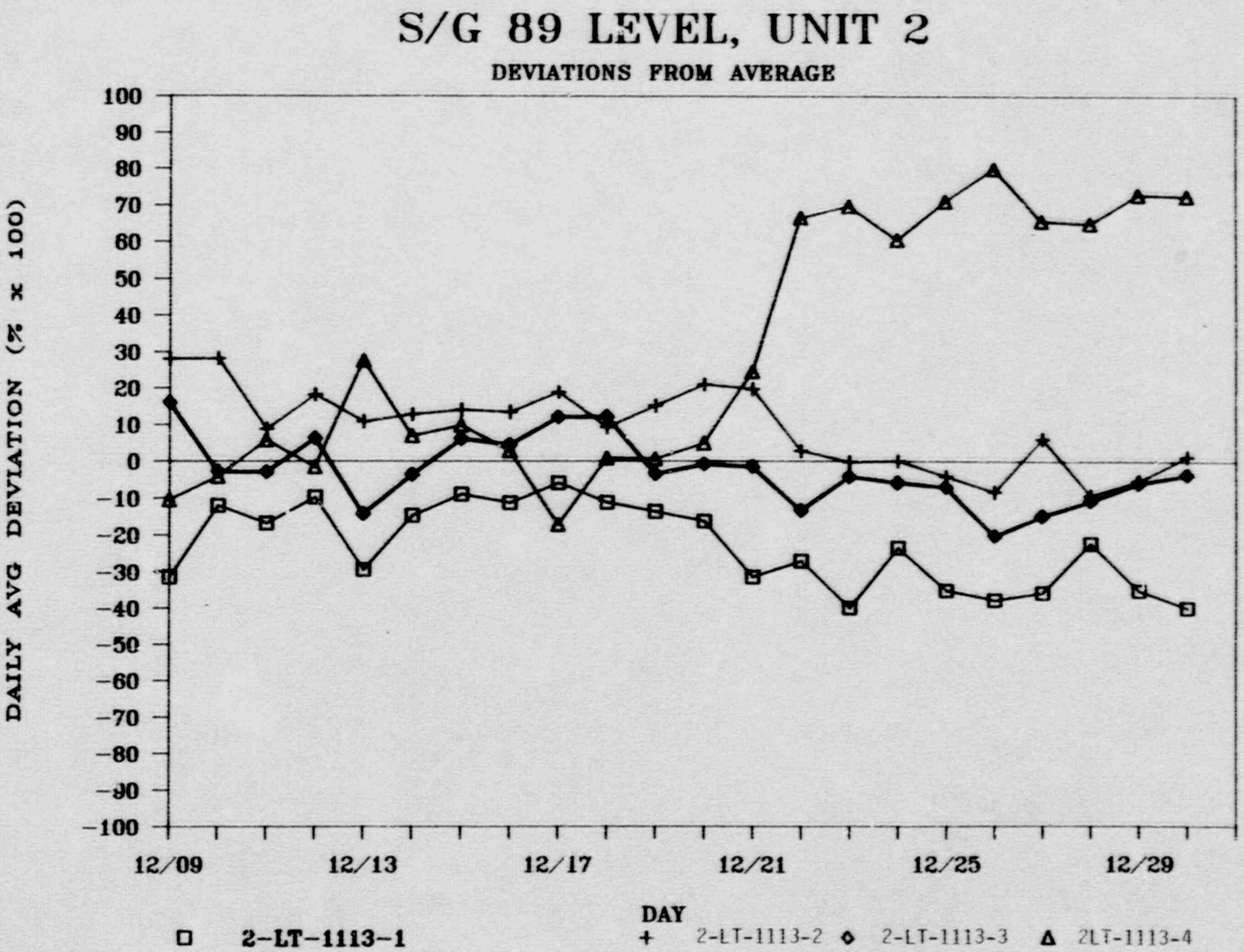
Steam Generator Level
Instrument Drift
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
DEVIATION (% x 100)
3/1
4/1
5/1
Date
2LT-1113-A
2LT-1113-B
2LT-1113-C
2LT-1113-D

Figure I-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 I-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
2LT-1113-4