INSTRUMENTATION

REMOTE SHUTDOWN INSTRUMENTATION

LIMITING CONDITION FOR OPERATION

3.3.3.5 The remote shutdown monitoring instrumentation channels shown in Table 3.3-9 shall be OPERABLE with readouts displayed external to the control room.

APPLICABILITY: MODES 1, 2 and 3.

ACTION:

a. With the number of OPERABLE remote shutdown monitoring channels less than required by Table 3.3-9, either restore the inoperable channel to OPERABLE status within 7 days, or be in HOT SHUTDOWN within the next 12 hours.

b. The provisions of Specification 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.3.3.5 Each remote shutdown monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK and CHANNEL CALIBRATION operations at the frequencies shown in Table 4.3-6.

9001160427 900108
PDR ADOCK 05000361
P PNU

TABLE 4.3-6

REMOTE SHUTDOWN MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	CHANNEL CALIBRATION
1. Log Power Level	M	R
2. Reactor Coolant Cold Leg Temperature	M	R
3. Pressurizer Pressure	M	R
4. Pressurizer Level	M	R
5. Steam Generator Level	M	R
6. Steam Generator Pressure	M	R
7. Source Range Neutron Flux	M	R
8. Condenser Vacuum	M	R
9. Volume Control Tank Level	M	R
10. Letdown Heat Exchanger Pressure	M	R
11. Letdown Heat Exchanger Temperature	M	R
12 Boric Acid Makeup Tank Level	M	R
13. Condensate Storage Tank Level	M	R
14. Reactor Coolant Hot Leg Temperature	M	R
15. Pressurizer Pressure - Low Range	M	R
16. Pressurizer Pressure - High Range	M	R
17. Pressurizer Level	M	R
18. Steam Generator Pressure	M	R
19. Steam Generator Level	M	R

ATTACHMENT B

SONGS UNITS 3

EXISTING TECHNICAL SPECIFICATIONS

INSTRUMENTATION

REMOTE SHUTDOWN INSTRUMENTATION

LIMITING CONDITION FOR OPERATION

3.3.3.5 The remote shutdown monitoring instrumentation channels shown in Table 3.3-9 shall be OPERABLE with readouts displayed external to the control room.

APPLICABILITY: MODES 1, 2 and 3.

ACTION:

a. With the number of OPERABLE remote shutdown monitoring channels less than required by Table 3.3-9, either restore the inoperable channel to OPERABLE status within 7 days, or be in HOT SHUTDOWN within the next 12 hours.

b. The provisions of Specification 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.3.3.5 Each remote shutdown monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK and CHANNEL CALIBRATION operations at the frequencies shown in Table 4.3-6.

NOV 1 5

TABLE 4.3-6

REMOTE SHUTDOWN MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	CHANNEL CALIBRATION
1. Log Power Level	M	R
2. Reactor Coolant Cold Leg Temperature *	M	R
3. Pressurizer Pressure	M	R
4. Pressurizer Level	M	R
5. Steam Generator Level	M	R
6. Steam Generator Pressure	M	R
7. Source Range Neutron Flux	M	R
8. Condenser Vacuum	M	R
9. Volume Control Tank Level	M	R
10. Letdown Heat Exchanger Pressure	M	R
11. Letdown Heat Exchanger Temperature	M	R
12. Boric Acid Makeup Tank Level	M	R
13. Condensate Storage Tank Level	M	R
14. Reactor Coolant Hot Leg Temperature	M	R
15. Pressurizer Pressure - Low Range	M	R
16. Pressurizer Pressure - High Range	M	R
17. Pressurizer Level	M	R
18. Steam Generator Pressure	M	R
19. Steam Generator Level	M	R

ATTACHMENT C

SONGS UNIT 2

PROPOSED TECHNICAL SPECIFICATIONS

REMOTE SHUTDOWN INSTRUMENTATION

LIMITING CONDITION FOR OPERATION

3.3.3.5 The remote shutdown monitoring instrumentation channels shown in Table 3.3-9 shall be OPERABLE with readouts displayed external to the control room.

APPLICABILITY: MODES 1, 2 and 3.

ACTION:

a. With the number of OPERABLE remote shutdown monitoring channels less than required by Table 3.3-9, either restore the inoperable channel to OPERABLE status within 7 days, or be in HOT SHUTDOWN within the next 12 hours.

b. The provisions of Specification 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.3.3.5 Each remote shutdown monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK and CHANNEL CALIBRATION operations at the frequencies shown in Table 4.3-6.

TABLE 4.3-6

REMOTE SHUTDOWN MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	CHANNEL CALIBRATION
1. Log Power Level	M	R (1)
2. Reactor Coolant Cold Leg Temperature	M	R (1)
3. Pressurizer Pressure	M	R (1)
4. Pressurizer Level	M	R (1)
5. Steam Generator Level	M	R (1)
6. Steam Generator Pressure	M	R (1)
7. Source Range Neutron Flux	M	R (1)
8. Condenser Vacuum	M	R (1)
9. Volume Control Tank Level	M	R (1)
10. Letdown Heat Exchanger Pressure	M	R (1)
11. Letdown Heat Exchanger Temperature	M	R (1)
12. Boric Acid Makeup Tank Level	M	R (1)
13. Condensate Storage Tank Level	M	R (1)
14. Reactor Coolant Hot Leg Temperature	M	R (1)
15. Pressurizer Pressure - Low Range	M	R (1)
16. Pressurizer Pressure - High Range	M	R (1)
17. Pressurizer Level	M	R (1)
18. Steam Generator Pressure	M	R (1)
19. Steam Generator Level	M	R (1)

TABLE NOTATION

(1) At least once per Refueling Interval

1

ATTACHMENT D

SONGS UNIT 3

PROPOSED TECHNICAL SPECIFICATIONS

REMOTE SHUTDOWN INSTRUMENTATION

LIMITING CONDITION FOR OPERATION

3.3.3.5 The remote shutdown monitoring instrumentation channels shown in Table 3.3-9 shall be OPERABLE with readouts displayed external to the control room.

APPLICABILITY: MODES 1, 2 and 3.

ACTION:

a. With the number of OPERABLE remote shutdown monitoring channels less than required by Table 3.3-9, either restore the inoperable channel to OPERABLE status within 7 days, or be in HOT SHUTDOWN within the next 12 hours.

b. The provisions of Specification 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.3.3.5 Each remote shutdown monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK and CHANNEL CALIBRATION operations at the frequencies shown in Table 4.3-6.

NOV 1 5

TABLE 4.3-6

REMOTE SHUTDOWN MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	CHANNEL CALIBRATION
1. Log Power Level	M	R (1)
2. Reactor Coolant Cold Leg Temperature	M	R (1)
3. Pressurizer Pressure	M	R (1)
4. Pressurizer Level	M	R (1)
5. Steam Generator Level	M	R (1)
6. Steam Generator Pressure	M	R (1)
7. Source Range Neutron Flux	M	R (1)
8. Condenser Vacuum	M	R (1)
9. Volume Control Tank Level	M	R (1)
10. Letdown Heat Exchanger Pressure	M	R (1)
11. Letdown Heat Exchanger Temperature	M	R (1)
12. Boric Acid Makeup Tank Level	M	R (1)
13. Condensate Storage Tank Level	M	R (1)
14. Reactor Coolant Hot Leg Temperature	M	R (1)
15. Pressurizer Pressure - Low Range	M	R (1)
16. Pressurizer Pressure - High Range	M	R (1)
17. Pressurizer Level	M	R (1)
18. Steam Generator Pressure	M	R (1)
19. Steam Generator Level	M	R (1)

TABLE NOTATION

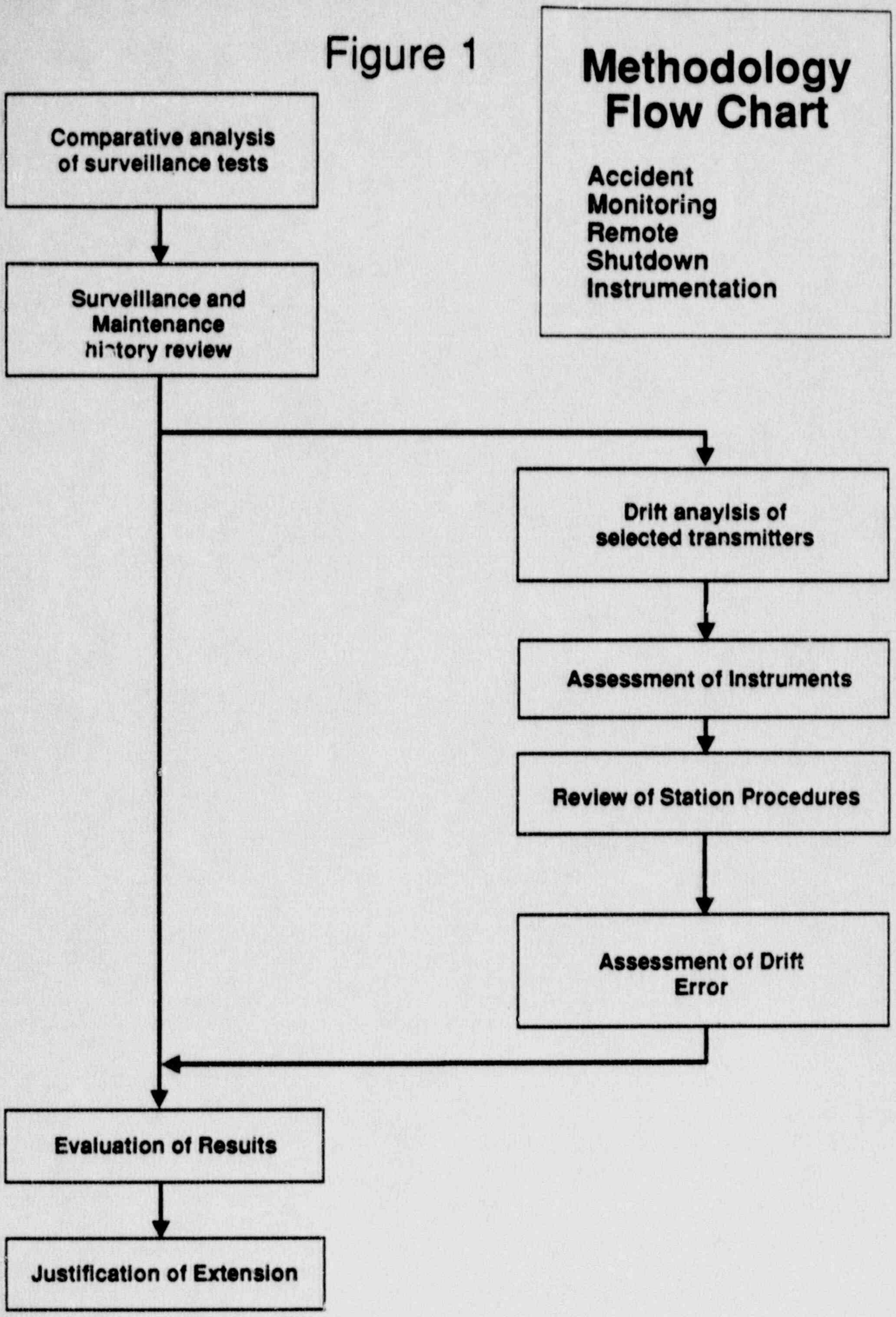
(1) At least once per Refueling Interval

ATTACHMENT E

SONGS UNITS 2 AND 3

FIGURES

Figure 1


Methodology Flow Chart
Accident
Monitoring
Remote
Shutdown
Instrumentation
Comparative analysis of surveillance tests
Surveillance and Maintenance history review
Drift anaylsis of selected transmitters
Assessment of Instruments
Review of Station Procedures
Assessment of Drift Error
Evaluation of Results
Justification of Extension

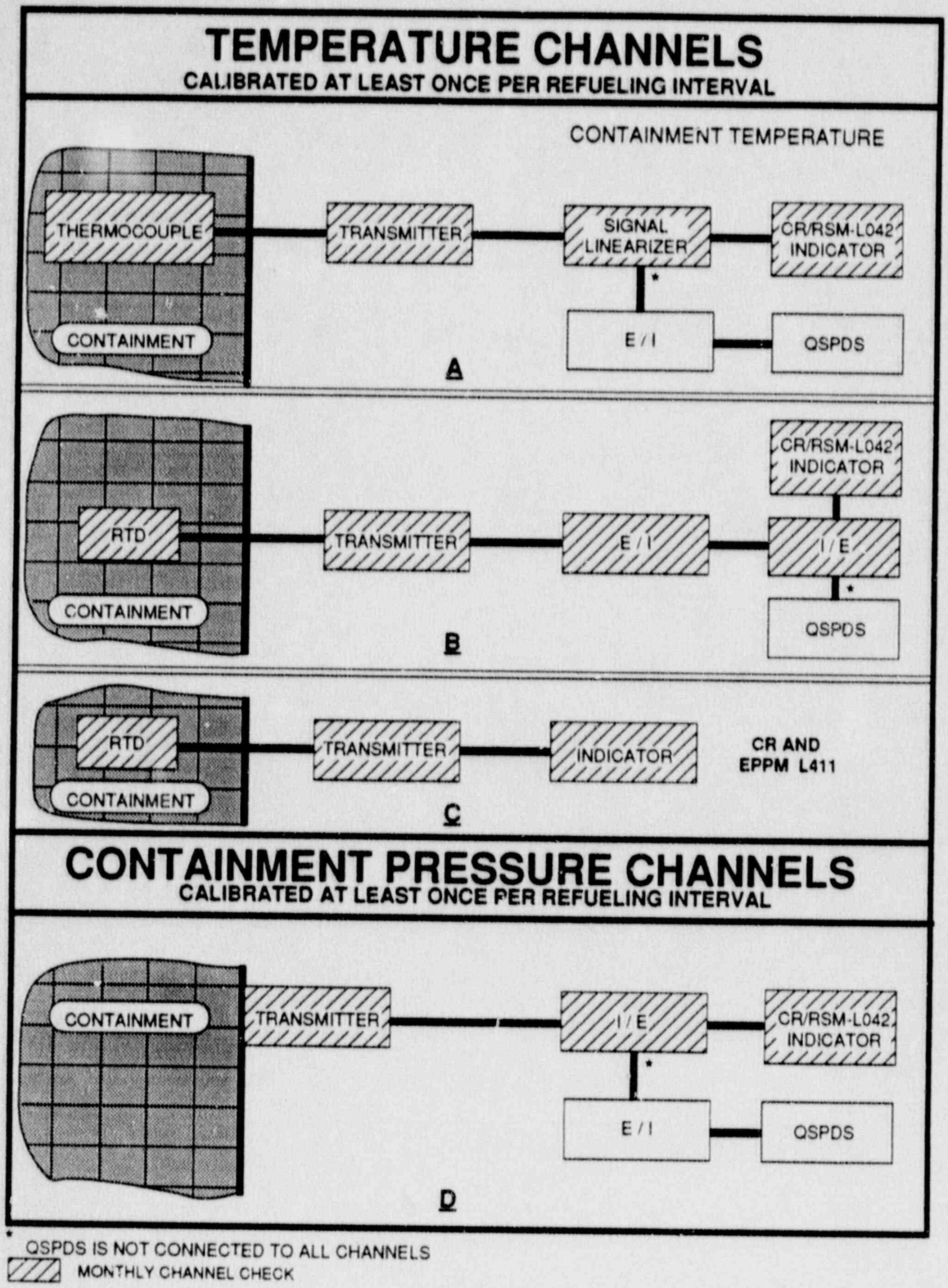
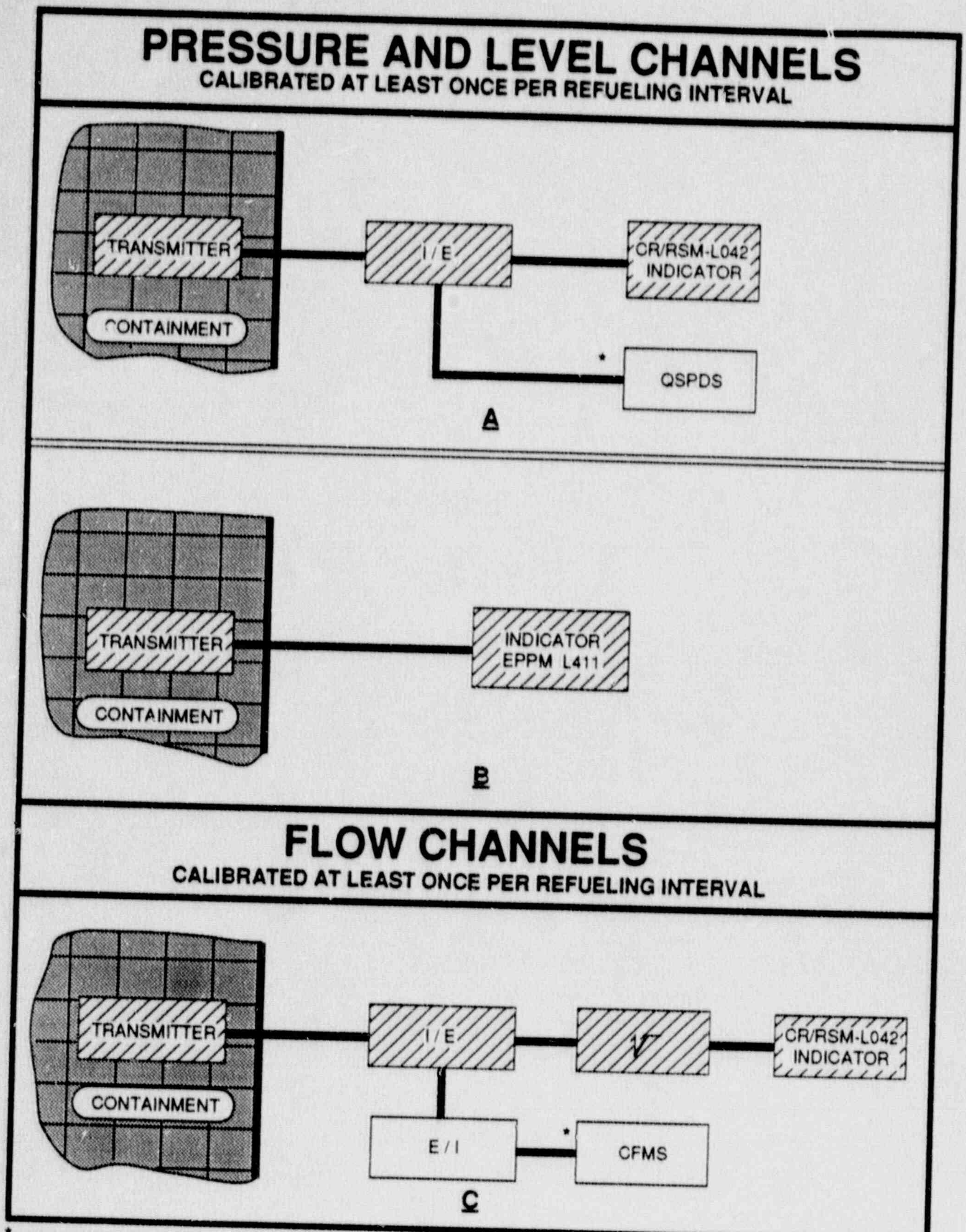

TEMPERATURE CHANNELS
CALIBRATED AT LEAST ONCE PER REFUELING INTERVAL
CONTAINMENT TEMPERATURE
THERMOCOUPLE
TRANSMITTER
SIGNAL LINEARIZER
CR/RSM-L042 INDICATOR
*
CONTAINMENT
E / I
QSPDS
A
CR/RSM-L042 INDICATOR
RTD
TRANSMITTER
E / I
I / E
*
CONTAINMENT
QSPDS
B
RTD
TRANSMITTER
INDICATOR
CR AND EPPM L411
CONTAINMENT
C
CONTAINMENT PRESSURE CHANNELS
CALIBRATED AT LEAST ONCE PER REFUELING INTERVAL
CONTAINMENT
TRANSMITTER
I / E
CR/RSM-L042 INDICATOR
*
E / I
QSPDS
D
* QSPDS IS NOT CONNECTED TO ALL CHANNELS
MONTHLY CHANNEL CHECK

Figure 2



* QSPDS/CFMS ARE NOT CONNECTED TO ALL CHANNELS

MONTHLY CHANNEL CHECK

Figure 3

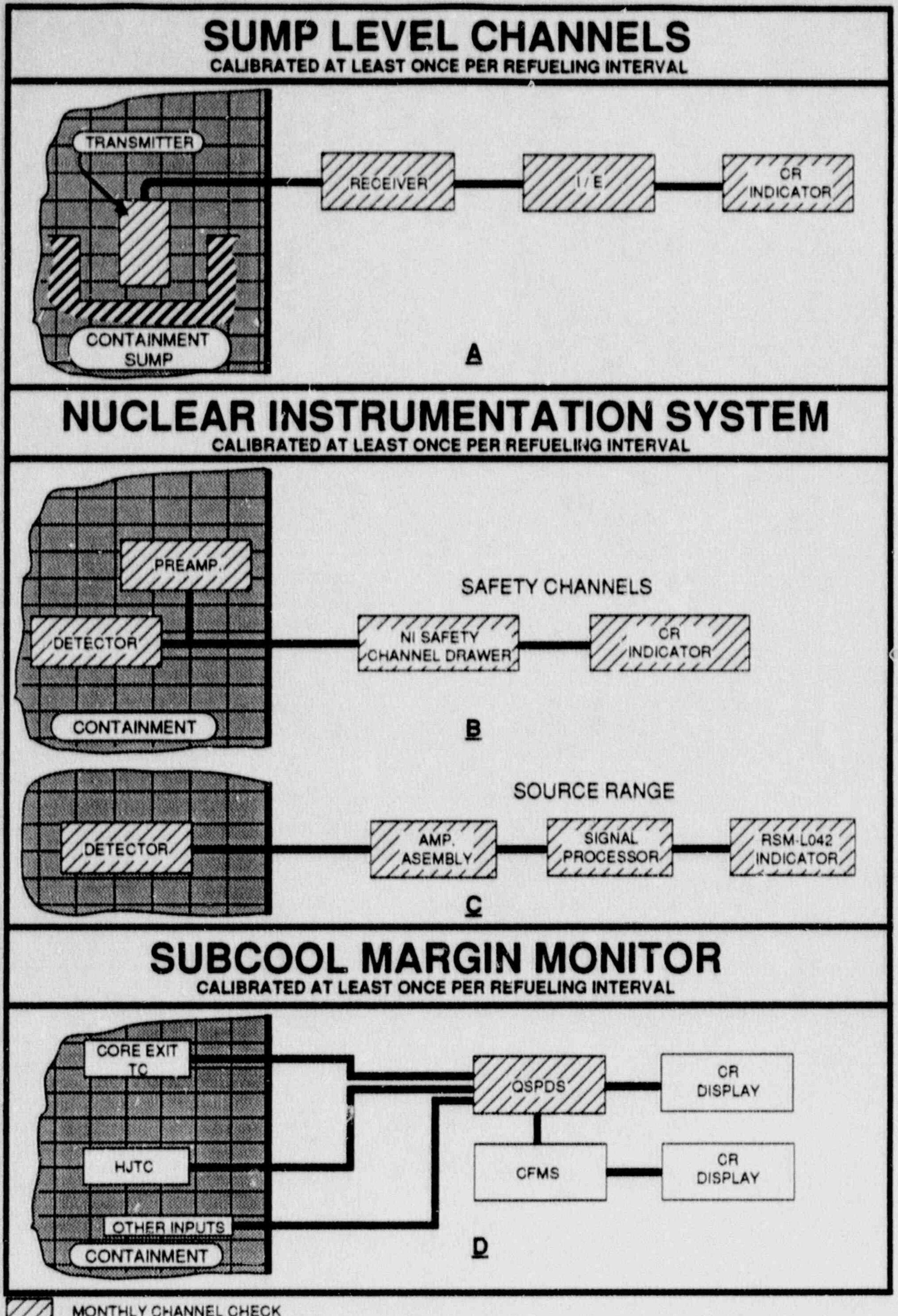

SUMP LEVEL CHANNELS
CALIBRATED AT LEAST ONCE PER REFUELING INTERVAL
TRANSMITTER
RECEIVER
I / E
CR INDICATOR
CONTAINMENT SUMP
A
NUCLEAR INSTRUMENTATION SYSTEM
CALIBRATED AT LEAST ONCE PER REFUELING INTERVAL
PREAMP.
SAFETY CHANNELS
DETECTOR
NI SAFETY CHANNEL DRAWER
CR INDICATOR
CONTAINMENT
B
SOURCE RANGE
DETECTOR
AMP. ASEMBLY
SIGNAL PROCESSOR
RSM-L042 INDICATOR
C
SUBCOOL MARGIN MONITOR
CALIBRATED AT LEAST ONCE PER REFUELING INTERVAL
CORE EXIT TC
QSPDS
CR DISPLAY
HJTC
CFMS
CR DISPLAY
OTHER INPUTS
CONTAINMENT
D
MONTHLY CHANNEL CHECK

Figure 4

Attachment E

FIGURE ABBREVIATIONS

CFMS -	Critical Function Monitoring System
CR -	Control Room
E/I -	Voltage to Current Converter
EPPM -	Essential Plant Parameter Monitoring Panel
EVSD -	Evacuation Shutdown Panel
HJTC -	Heated Junction Thermocouple
I/E -	Current to Voltage Converter
NI -	Nuclear Instrumentation
QSPDS -	Qualified Safety Parameter Display System
RSM -	Remote Shutdown Panel
RTD -	Resistor Time Detector
TC -	Thermocouple
$\sqrt{\ }$ -	Square Root Extractor

Table E-2

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 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 subject Technical Specification for the Remote Shutdown Monitoring (RSM). 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 assure 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 RSM system that were evaluated herein are listed on Table F-1. These components are the loop elements supporting the following process parameters: pressure, differential pressure, temperature, and nuclear flux. They normally consist of sensors, transmitters, converters, and indicators. The Preventive Maintenance (PM) program for these instruments consists mainly of 18 month Channel Calibrations, monthly cross-channel checks and operator monitoring. The monthly cross-channel comparison is a control room to remote shutdown panel instrument indication check for consistent indications. 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 or 20 year intervals for the pressure and differential pressure transmitters. Nuclear instrument channels receive a monthly calibration.

Results

The CM history review determined that almost all of the problems associated with operability are found by operations personnel during the monthly 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.

Eleven (11) CMs were identified that were 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 instruments have not been experiencing substantial calibration problems. When calibration problems were identified, they were normally found during the cross-channel checks. The eleven calibration failures 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 cross-channel 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

REMOTE SHUTDOWN MONITORING

INSTRUMENT LIST

Loop Components	Description
2(3)JE0001-3 2(3)JE0001-4 2(3)JI0001-B3 2(3)JI0001-B4	Excore Safety Channel
2(3)TE0111-BY 2(3)TT0111-BY 2(3)TY0111-BY 2(3)TI0111-BY 2(3)TE0115-2 2(3)TT0115-2 2(3)TY0115-2 2(3)TI0115-2 2(3)TE0125 2(3)TT0125-1 2(3)TY0125-A1 2(3)TI0125	Reactor Coolant Cold Leg Temperature
2(3)TE0111-BX 2(3)TT0111-BX 2(3)TY0111-BX 2(3)TI0111-BX 2(3)TI0111X	Reactor Coolant Hot Leg Temperature
2(3)PT0102-3,-4 2(3)PY0102-B3,-B4 2(3)PI0102-C3,-C4 2(3)PT0104-A 2(3)PY0104-A 2(3)PI0104-A 2(3)PT0100-X 2(3)PY0100-A 2(3)PI0100-A	Pressurizer Pressure
2(3)LT0110-1,-2 2(3)LY0110-1,-2 2(3)LI0110-B1,-B2 2(3)LT0103 2(3)LY0103-A 2(3)LI0103-A	Pressurizer Level

Table F-1 - continued

REMOTE SHUTDOWN MONITORING

INSTRUMENTATION LIST

Loop Components	Description
2(3)PT1013-3 2(3)PY1013-B3 2(3)PI1013-C3 2(3)PT1023-4 2(3)PY1023-B4 2(3)PI1023-C4 2(3)PT8300 2(3)PY8300 2(3)PI8300 2(3)PT8301 2(3)PY8301 2(3)PI8301	Steam Generator Pressure
2(3)LT1113-3 2(3)LY1113-B3 2(3)LI1113-B3 2(3)LT1123-4 2(3)LY1123-B4 2(3)LI1123-B4 2(3)LT1105 2(3)LI1105 2(3)LT1106 2(3)LI1106	Steam Generator Level
2(3)JE0005-2 2(3)JI0005-C2	Source Range Monitor
2(3)L539 2(3)L540	Neutron Monitoring Channel
2(3)PT3202 2(3)PY3202 2(3)PI3202-B 2(3)PT3383 2(3)PY3383 2(3)PI3383-B 2(3)PT3395 2(3)PY3395 2(3)PI3395-B	Condenser Vacuum

Table F-1 - continued

REMOTE SHUTDOWN MONITORING

INSTRUMENTATION LIST

Loop Components	Description
2(3)LT0226 2(3)LY0226 2(3)LI0226-B	Volume Control Tank Level
2(3)PT0201 2(3)PY0201 2(3)PI0201	Letdown Heat Exchanger Pressure
2(3)TT0223 2(3)TY0223 2(3)TI0223	Letdown Heat Exchanger Temperature
2(3)LT0206-1 2(3)LY0206 2(3)LI0206-C 2(3)LT0208-2 2(3)LY0208 2(3)LI0208-C	Boric Acid Makeup Tank Level
2(3)LT4356 2(3)LI4356-C 2(3)LT4357 2(3)LI4357-C	Condensate Storage Tank Level

Table F-2

SURVEILLANCE AND MAINTENANCE HISTORY SUMMARY

Component	Date Completed	Problem Description
2LT1113-3	11/84	(1) Replaced after failing to calibrate
3LT1113-3	01/84	(1) Replaced after failing to calibrate
2TI0111-AY	09/87	(3) Failed to calibrate, replaced display board
2PI3202-B	03/89	(3) Failed to calibrate, repaired board
2LI1123-B4	05/89	(2) Failed to calibrate, cleaned terminals
2LI1123-B4	09/87	(3) Failed to calibrate, replaced IC chip
2LI1106	09/87	(4) Failed to calibrate, replaced meter
2JI0001-B3	11/84	(5) Lumigraph failing, replaced
3JI0001-B4	10/85	(4) Failed to calibrate full scale, replaced
2L540	09/87	(6) Negative voltage out o, tolerance, card replaced
2L540	10/87	(6) Voltage out of tolerance, card replaced

EVALUATION

(1) The subject transmitters were not able to meet the stringent five point span accuracy specifications uti!ized 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 RSM operability.

(2) Erratic behavior was found during calibration. The problem was isolated to dirty terminal connections, which were cleaned. Erratic indications are routinely reported by operators and repaired. The occasional degradation of terminal boards, terminal lugs and connections, while routinely surveyed for gross visual deficiencies, is not a normal occurrence during Channel Calibrations.

SURVEILLANCE AND MAINTENANCE HISTORY SUMMARY

(3) 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 reported during mode 1 through 4 operations.

(4) The meter failures found during calibration are not gross failures, but ones characterized by meter nonlinearity. Nonlinearity in this context is the inability for the meter to meet its calibration requirements in all ranges. Often these failures result from missing the tight calibration requirements slightly in one or two ranges. These failures, while cause for meter replacement, would still provide operators with reasonable plant information for the parameters and actions required post-accident.

(5) Lumigraph (a Neon display meter) degradation is the most frequent classification of corrective maintenance order generated in this system. As the performance of the illumination degrades, operations and instrumentation and controls, identify and correct the problems.

(6) Voltage checks are a requirement of the Channel Calibrations, however, unlike other portions of the calibration, the voltage regulator card is not adjustable, and requires replacement for any out of tolerance condition. These out of tolerance findings are minor and have negligible effect on the loop, but as part of the more stringent calibration specifications, are considered a failure. As above, a gross failure would be detected by the operators.

(7) CM History Summary - The maintenance history for these instruments was reviewed. This review showed that the usual problems encountered during plant operations were lumigraph failures, deviations between redundant channel readings, erratic indications, indicator failures, 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 (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 spreaosheets. 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 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.

- o 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.

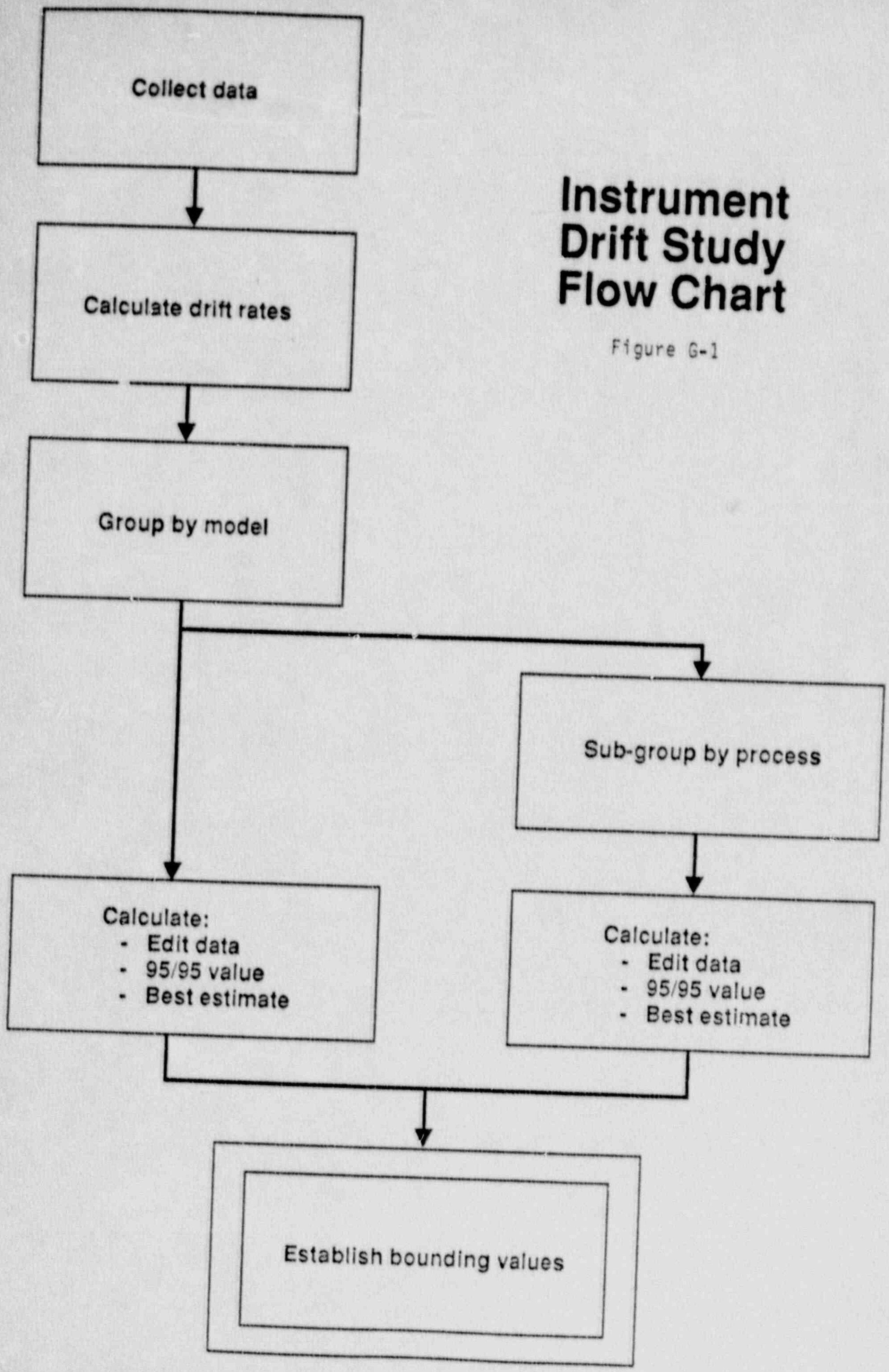
This analysis provides a conservative assessment of transmitter performance for those transmitters addressed within the scope of this summary. Utilization of the revised allowances for long term drift in setpoint and uncertainty calculations, and in evaluations of instrument performance with respect 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

FUNCTIONAL ANALYSIS

ATTACHMENT H

FUNCTIONAL ANALYSIS SUMMARY

REMOTE SHUTDOWN INSTRUMENTATION

1.0 Introduction

The purpose of this summary is to provide a discussion of instrumentation used in the unlikely event that it becomes necessary to evacuate the Main Control Room. Specifically, this discussion is presented to provide justification for extending the calibration interval of this instrumentation from the current nominal interval of 18 months to an extended nominal interval of 24 months.

The evaluation assumes that a maximum calibration interval of 30 months would routinely occur through the application of the 25% grace period permitted by Technical Specification 4.0.2. It is planned that these calibrations will be done concurrently with refueling outages. The actual interval, then, will be a function of the unit capacity factor, which is expected to result in an interval of between 21 and 26 months.

The evaluation was conducted to investigate extending the calibration interval of the instrumentation addressed in Technical Specification 3.3.3.5, Remote Shutdown Instrumentation. This evaluation consisted of the following:

- Review of the surveillances that are performed with the unit on-line.
- A review of the 18 month surveillance test history of this instrumentation.
- A review of the corrective maintenance activities associated with instrumentation.
- An assessment of the instrument quality classification.
- An evaluation of the impact of increased uncertainties related to transmitter drift with respect to the use of this instrumentation in the applicable operating procedure.

This summary focuses on the Functional Analysis that was performed and on use of these instruments in the Abnormal Operating Instruction (AOI), SO23-13.2, "Shutdown From Outside The Control Room." The results of the reviews of surveillance test history and corrective maintenance activities, as well as the determination of transmitter drift over the longer interval, are discussed in other attachments. A description of the operating procedure, the use of instrumentation by the operators and a specific discussion of each technical specification instrument channel is presented.

2.0 Technical Specification

The proposed change would revise Technical Specification (TS) 3/4.3.3.5, "Remote Shutdown Instrumentation" to increase the interval for surveillance tests, which are currently performed every 18 months to 24 months with a maximum interval of 30 months. TS 3/4.3.3.5 defines the number of channels required to be operable for each instrument, periodic surveillance tests to verify operability, and action to be taken if the minimum operability requirements are not met. The testing required by TS 3/4.3.3.5 assures that the various remote shutdown monitoring instruments will be operational in the unlikely event that it is necessary to evacuate the Control Room. The instruments located on Panel L411 are installed to be able to conduct a plant shutdown to cold shutdown conditions in the event of a fire in the cable spreading room, control room, or in panel L042. The instruments installed in Panel L042 are adequate to conduct a shutdown to hot shutdown conditions and to maintain the unit in that mode.

Surveillance Requirement 4.3.3.5 states that each remote shutdown monitoring instrumentation channel shall be demonstrated operable by the performance of the Channel Check, and Channel Calibration operations for the modes and at the frequencies shown in Table 4.3-6. This table lists the following instruments for remote shutdown monitoring instrumentation.

1. Log Power Level
2. Reactor Coolant Cold Leg Temperature(2)
3. Pressurizer Pressure
4. Pressurizer Level
5. Steam Generator Level
6. Steam Generator Pressure
7. Source Range Nuclear Instrumentation
8. Condenser Vacuum(1)
9. Volume Control Tank Level(1)
10. Letdown Heat Exchanger Pressure(1)
11. Letdown Heat Exchanger Temperature(1)
12. Boric Acid Makeup Tank Level(1)
13. Condensate Storage Tank Level(1)
14. Reactor Coolant Hot Leg Temperature (2)
15. Pressurizer Pressure - Low Range(2)
16. Pressurizer Pressure - High Range(2)
17. Pressurizer Level(2)
18. Steam Generator Pressure(2)
19. Steam Generator Level(2)

Notes:

(1) Located outside Containment.
(2) Located on Panel L411. Others are located on Panel L042.

The table designates a frequency for a Channel Check and a Channel Calibration. Technical Specification Definition 1.13, "Frequency Notation", defines the notation used in Table 4.3-6 by referencing Table 1.2. Table 1.2 defines "R" as "At least once per 18 months." Channel Calibrations are required for each remote shutdown instrumentation channel at least once every 18 months. This specification includes requirements to calibrate transmitters located in areas which are not readily accessible during power operation. The proposed change would revise the requirement for this testing from the current 18 month interval to an interval at least once per refueling (nominally 24 months).

3.0 Methodology

Figure H-1 provides a pictorial representation of the process followed in evaluating the Remote Shutdown Monitoring Instrumentation with respect to extending the calibration interval to a maximum of 30 months. The Functional Analysis was basically broken into three parts which were as follows.

3.1 Assessment of Instruments - The specific instruments used to comply with the AMS and RSD Technical Specification were identified. The applicable regulatory documents were reviewed for content. The results of the first step was used to obtain 30 month drift data. The instrument loops were reviewed to determine the components that would add error over time. For each instrument loop, the total instrument uncertainty was calculated, by Root-Sum-Square (RSS), using the revised values for drift over a 30 month interval, values for instrument accuracy, calibration equipment error, and environmental effects, as applicable.

3.2 Review of Station Procedures - Only one SONGS Station Procedure is used for Remote Shutdown Monitoring. Abnormal Operating Instruction (AOI), SO23-13.2 was reviewed and broken down step by step. This breakdown identified the instruments that were used by the operator at each step, the purpose related to the reference by the AOI to the particular instrument at that step, and the allowable error for that instrument associated with each AOI step. Table H-1 lists the calculated uncertainty and the allowable uncertainty for each Remote Shutdown Monitoring Instrument channel.

3.3 Assessment of Drift Error - The allowable error of each step was compared to the calculated 30 month RSS value. The comparison determined the ability of the instrument with its 30 month drift error to still perform its intended function.

The Functional Analysis is a detailed analysis that systematically provides the basis to extend the Remote Shutdown Monitoring System instrument calibration interval.

4.0 General Discussion of Instrumentation

These instruments generally consist of a sensor or transmitter located in the Containment, and signal conditioning electronics located in the Control Room which provides the input to the PPS bistables and other indicating devices. The signal conditioning electronics are generally located in the control room and consist of a power supply and devices which isolate the loop from remote indicators, computers, etc. A typical loop consists of a transmitter, power supply, several signal isolation devices and indicators. Since the transmitter regulates the current to all of the isolators for a particular loop, comparisons of their output provides a relatively accurate validation of their calibration. Channel Checks, that are performed each month compare the channel indication with other indications from independent channels measuring the same parameter. Significant changes in the calibration of an individual channel are detected as a result of this surveillance.

In many procedural applications, the absolute value of an indication is not as significant as the trend of the parameter. Any problem of sufficient magnitude to significantly affect the indicated trend would likely be noted and corrected as a result of the monthly cross Channel Checks. The monthly Channel Checks generally compare the indication on the Remote Shutdown Panel to the Main Control indication for the same loop and to other instrument channels for the same process.

The Remote Shutdown Instrumentation incorporates one or two channels of each monitored parameter. Drift is random in nature, and therefore, is not likely to affect both channels in the same direction and at the same time and rate. This means that a significant amount of drift is likely to result in a difference in readings between the two channels, which would alert the operator to use local or diverse means to make decisions.

5.0 Remote Shutdown Instrumentation Evaluations

This section provides a specific evaluation of each instrument channel addressed by Technical Specification 3/4.3.3.5, Remote Shutdown Instrumentation.

5.1 Log Power Level

The Log Power Channel consists of a neutron detector, a preamplifier, signal processing electronics, signal isolation devices, and indicators. Figure 4B, of Attachment E, shows a block diagram of this instrument loop. The signal processing electronics include installed test circuits which are utilized on a monthly basis to perform a calibration check of each channel. These test circuits generate a known pulse rate that is applied to the input of the preamplifier. The surveillance test compares the output of the signal processing electronics to expected values. As part of a separate surveillance test, a cross channel comparison is done on the indication at the Remote Shutdown Panel. These two surveillance tests provide a reasonable level of assurance that the instrumentation is operating within design requirements.

In the unlikely event that evacuation of the Main Control Room is required, SO23-13.2 requires that the reactor be tripped and a decreasing neutron flux level be observed. These actions confirm that the reactor is shutdown. The Log Power Level indication on the Remote Shutdown Panel is used to monitor the neutron flux level to provide added assurance that the reactor remains shutdown.

1. Maintaining the required shutdown margin as required by the procedure provides the primary assurance that the reactor remains shutdown.
2. Two channels of this indication are provided.
3. This parameter is used on a trend basis by the operator.
4. Source Range Nuclear Instrumentation is also provided, which can be used as a diverse means of confirming that the reactor is shutdown.
5. Monthly cross Channel Checks provide a level of assurance that the instrumentation has not significantly degraded.
6. The instruments' Quality Classification (QC 2) provides assurance that the instruments will perform the intended safety function.

Collectively, these factors demonstrate that increasing the calibration interval to a maximum of 30 months will have no impact on conducting a shutdown from outside the Main Control Room.

5.2 Reactor Coolant Cold Leg Temperature

The Cold Leg Temperature channels consist of a resistance temperature detector (RTD), temperature transmitter, power supply, signal isolators, and indicators. Figure 2B, of Attachment E, shows a block diagram of this instrument loop. This indication is used to maintain subcooled conditions in the RCS, maintaining the unit within reactor vessel pressure and temperature limits, maintaining a net positive suction head for the reactor coolant pumps, verification that natural circulation exists and determining when to initiate shutdown cooling.

The RTD is a passive device which is not subject to drift. An analysis of long term drift of the temperature transmitters was conducted (Reference 7.2) and the resulting allowable drift value was used in assessing the impact of this drift on operator decisions in implementing a shutdown from outside the control room (Reference 7.1). Table H-1 provides a comparison of the RSS value for the uncertainty as well as the allowable uncertainty. It was concluded that the allowable long term drift did not have a significant impact. The monthly cross Channel Checks provide a reasonable level of assurance that the signal isolators and indicators have not degraded significantly.

The following points summarize the basis for extending the calibration interval of this instrumentation.

1. Reference 7.1 documents a detailed evaluation of this instrumentation as it is used in SO23-13.2. The impact of drift was assessed for all loop instruments. It concludes that drift allowance documented in Reference 7.2 does not significantly impact the use of this instrument by an operator in implementing this procedure.
2. Monthly cross Channel Checks provide a reasonable level of assurance that the instrumentation has not significantly degraded.
3. Two channels of this indication are provided.
4. RCS Hot Leg Temperature indication is available (on Panel 2(3)L-411) to provide a backup means of temperature indication which assists in most manual control except verification of natural circulation.

5. Steam Generator Pressure is available to provide a backup means of determining RCS temperature which assists in most manual control except verification of natural circulation.
6. Trending of RCS parameters provides a backup method of assessing the effectiveness of natural circulation.
7. Pressurizer level provides a diverse means of assessing subcooled margin in combination with other indications.
8. The instruments' Quality Classification (QC 2 & 4) provides assurance that the instruments will perform the intended safety function.

Based on these factors it is concluded that extending the calibration interval of this instrumentation to 30 months is acceptable.

5.3 Pressurizer Pressure

The Pressurizer Pressure channels consist of a pressure transmitter, power supply, signal isolators, and indicators. Figure 3A, of Attachment E, shows a block diagram of this instrument loop. This indication is used to maintain subcooled conditions in the RCS, maintaining the unit within reactor vessel pressure and temperature limits, maintaining a net positive suction head for the reactor coolant pumps and determining when to initiate shutdown cooling.

An analysis of long term drift of the pressure transmitters was conducted (Reference 7.2) and the resulting allowable drift value was used in assessing the impact of this drift on operator decisions in implementing a shutdown from outside the control room (Reference 7.1). Table H-1 provides a comparison of the RSS value for the uncertainty as well as the allowable uncertainty. It was concluded that the allowable long term drift did not have a significant impact. The monthly cross channel checks provide a reasonable level of assurance that the signal isolators and indicators have not degraded significantly.

The following points summarize the basis for extending the calibration interval of this instrumentation.

1. Reference 7.1 documents a detailed evaluation of this instrumentation as it is used in SO23-13.2. The impact of drift was assessed for all loop instruments. It concludes that drift allowance documented in Reference 7.2 does not significantly impact the use of this instrument by an operator in implementing this procedure.
2. Monthly cross channel checks provide a reasonable level of assurance that the instrumentation has not significantly degraded.
3. Two channels of this indication is provided.
4. Low range pressurizer pressure indication is provided outside the control room to assist in establishing shutdown cooling at the proper pressure.
5. The instruments' Quality Classification (QC 1) provides assurance that the instruments will perform the intended safety function.

Based on these factors it is concluded that extending the calibration interval of this instrumentation to 30 months is acceptable.

5.4 Pressurizer Level

The Pressurizer Level channels consist of a differential pressure transmitter, power supply, signal isolators, and indicators. Figure 3A, of Attachment E, shows a block diagram of this instrument loop. This instrument channel is used to maintain a water inventory in the pressurizer to simplify pressure control of the RCS. A nominal level between 30 and 40% is suggested by SO23-13.2. This provides a substantial margin between emptying the pressurizer, establishing a water solid condition, and lifting the Shutdown Cooling relief valve. Pressure response to RCS volume changes provides a diverse means of determining that a water solid condition exists. Maintaining a subcooled condition in the RCS provides a diverse means of determining that a sufficient water inventory exists.

An analysis of long term drift of the differential pressure transmitters was conducted (Reference 7.2) and the resulting allowable drift value was used in assessing the impact of this drift on operator decisions in implementing a shutdown from outside the control room (Reference 7.1). Table H-1 provides a comparison of the RSS value for the uncertainty as well as the allowable uncertainty. It was concluded that the allowable long term drift did not have a significant impact. The monthly cross channel checks provide a reasonable level of assurance that the signal isolators and indicators have not degraded significantly.

The following points summarize the basis for extending the calibration interval of this instrumentation.

1. Reference 7.1 documents a detailed evaluation of this instrumentation as it is used in SO23-13.2. The impact of drift was assessed for all loop components. It concludes that drift allowance documented in Reference 7.2 does not significantly impact the use of this instrument by an operator in implementing this procedure.
2. Monthly cross channel checks provide a reasonable level of assurance that the instrumentation has not significantly degraded.
3. Two channels of this indication is provided.
4. Pressure response to RCS volume changes provides a diverse means of determining that a water solid condition exists.
5. Maintaining a subcooled condition in the RCS provides a diverse means of determining that a sufficient water inventory exists.
6. The instruments' Quality Classification (QC 2) provides assurance that the instruments will perform the intended safety function.

Based on these factors it is concluded that extending the calibration interval of this instrumentation to 30 months is acceptable.

5.5 Steam Generator Level

The Steam Generator Level channels consist of a differential pressure transmitter, power supply, signal isolators, and indicators. Figure 3A, of Attachment E, shows a block diagram of this instrument loop. This instrument channel is used to maintain a water inventory in the steam generators so that a heat sink remains available for removal of decay heat. The nominal control band specified by the procedure, 40 to 80%, provides ample margin to the limit conditions of overfilling the S/Gs or losing level indication to accommodate the instrument uncertainty.

An analysis of long term drift of the differential pressure transmitters was conducted (Reference 7.2) and the resulting allowable drift value was used in assessing the impact of this drift on operator decisions in implementing a shutdown from outside the control room (Reference 7.1). Table H-1 provides a comparison of the RSS value for the uncertainty as well as the allowable uncertainty. It was concluded that the allowable long term drift did not have a significant impact. The monthly cross channel checks provide a reasonable level of assurance that the signal isolators and indicators have not degraded significantly.

The following points summarize the basis for extending the calibration interval of this instrumentation.

1. Reference 7.1 documents a detailed evaluation of this instrumentation as it is used in SO23-13.2. The impact of drift was assessed for all loop components. It concludes that drift allowance documented in Reference 7.2 does not significantly impact the use of this instrument by an operator in implementing this procedure.
2. Monthly cross channel checks provide a reasonable level of assurance that the instrumentation has not significantly degraded.
3. One channel of indication is provided per steam generator. Only one steam generator is required to conduct a cooldown.
4. Steam generator pressure provides a diverse means for determining that a water inventory exists in the S/G.
5. The instruments' Quality Classification (QC 1) provides assurance that the instruments will perform the intended safety function.

Based on these factors it is concluded that extending the calibration interval of this instrumentation to 30 months is acceptable.

5.6 Steam Generator Pressure

The Steam Generator Pressure channels consist of a pressure transmitter, power supply, signal isolators, and indicators. Figure 3A, of Attachment E, shows a block diagram of this instrument loop. This indication is used to verify that the S/G pressure is being controlled. RCS temperature provides a diverse means of determining S/G pressure.

An analysis of long term drift of the pressure transmitters was conducted (Reference 7.2) and the resulting allowable drift value was used in assessing the impact of this drift on operator decisions in implementing a shutdown from outside the control room (Reference 7.1). Table H-1 provides a comparison of the RSS value for the uncertainty as well as the allowable uncertainty. It was concluded that the allowable long term drift did not have a significant impact. The monthly cross channel checks provide a reasonable level of assurance that the signal isolators and indicators have not degraded significantly.

The following points summarize the basis for extending the calibration interval of this instrumentation.

1. Reference 7.1 documents a detailed evaluation of this instrumentation as it is used in SO23-13.2. The impact of drift was assessed for all loop components. It concludes that drift allowance documented in Reference 7.2 does not significantly impact the use of this instrument by an operator in implementing this procedure.
2. Monthly cross channel checks provide a reasonable level of assurance that the instrumentation has not significantly degraded.
3. One channel of indication is provided per steam generator. Only one steam generator is required to conduct a cooldown.
4. RCS temperature indication provides a diverse means of determining S/G pressure.
5. The instruments' Quality Classification (QC 1) provides assurance that the instruments will perform the intended safety function.

Based on these factors it is concluded that extending the calibration interval of this instrumentation to 30 months is acceptable.

5.7 Source Range Nuclear Instrumentation

The Source Range Nuclear Instrumentation consists of neutron detector, preamplifier, signal processing electronics, signal isolation devices, and indicators. Figure 4C, of Attachment E, shows a block diagram of this instrument loop. During power operation, the neutron flux is substantial greater than the upper limit of the range of these instrument channels.

In the unlikely event that evacuation of the Main Control Room is required, SO23-13.2 requires that the reactor be tripped and a decreasing neutron flux level be observed. These actions confirm that the reactor is shutdown. In addition to the Source Range Nuclear Instrumentation, the Log Power Level indication on the Remote Shutdown Panel provides a diverse indication of the neutron flux level.

1. Maintaining the required shutdown margin as required by the procedure provides the primary assurance that the reactor remains shutdown.
2. This parameter is used on a trend basis by the operator.
3. Log Power Level Instrumentation is also provided, which can be used as a diverse means of confirming that the reactor is shutdown.
4. The instruments' Quality Classification (QC 2) provides assurance that the instruments will perform the intended safety function.

Collectively, these factors demonstrate that increasing the calibration interval to a maximum of 30 months will have no impact on conducting a shutdown from outside the Main Control Room.

5.8 Condenser Vacuum

The Condenser Vacuum channels consist of a pressure transmitter, power supply, signal isolators, and indicators. Figure 3A, of Attachment E provides an instrument loop block diagram. The Condenser Vacuum transmitter is located outside of containment, in the Turbine Building. Other than this, this block diagram is representative of the Condenser Vacuum instrumentation loop. This indication is not used in implementing SONGS Procedure SO23-13.2, Shutdown From Outside The Control Room. Local and diverse indications are available to confirm the condenser vacuum status, if that information became necessary.

It was concluded that this instrumentation does not have any impact on conducting a shutdown from outside the control room. The monthly cross channel checks provide a reasonable level of assurance that the signal isolators and indicators have not degraded significantly.

The following points summarize the basis for extending the calibration interval of this instrumentation.

1. Reference 7.1 documents a detailed evaluation of this instrumentation. The impact of drift was assessed for all loop components. It concludes that this instrumentation does not impact an operator in implementing this procedure.
2. Monthly cross channel checks provide a reasonable level of assurance that the instrumentation has not significantly degraded.
3. Three channels of this indication is provided.

Based on these factors it is concluded that extending the calibration interval of this instrumentation to 30 months is acceptable.

5.9 Volume Control Tank Level

The Volume Control Tank Level channel consists of a differential pressure transmitter, power supply, signal isolators, and indicators. Figure 3A, of Attachment E, provides an instrument loop block diagram. The Volume Control Tank transmitter is located outside of containment, in the Radwaste Building. Other than this, this block diagram is representative of the Volume Control Tank instrumentation loop. This indication is not used in implementing SONGS Procedure SO23-13.2, Shutdown From Outside the Control Room.

Table H-1 provides a comparison of the RSS value for the uncertainty as well as the allowable uncertainty. It was concluded that the allowable long term drift did not have a significant impact. The monthly cross channel checks provide a reasonable level of assurance that the signal isolators and indicators have not degraded significantly.

The following points summarize the basis for extending the calibration interval of this instrumentation.

1. Reference 7.1 documents a detailed evaluation of this instrumentation. It concludes that this instrumentation does not impact an operator in implementing this procedure.
2. Monthly cross channel checks provide a reasonable level of assurance that the instrumentation has not significantly degraded.

Based on these factors it is concluded that extending the calibration interval of this instrumentation to 30 months is acceptable.

5.10 Letdown Heat Exchanger Pressure

The Letdown Heat Exchanger Pressure channel consists of a pressure transmitter, power supply, signal isolators, and indicators. Figure 3A, of Attachment E, shows a block diagram of this instrument loop. This indication is not used in implementing SONGS Procedure SO23-13.2, Shutdown From Outside The Control Room.

Table H-1 provides a comparison of the RSS value for the uncertainty as well as the allowable uncertainty. It was concluded that this instrumentation does not have any impact on conducting a shutdown from outside the control room. The monthly Channel Check provide a reasonable level of assurance that the signal isolators and indicators have not degraded significantly.

The following points summarize the basis for extending the calibration interval of this instrumentation.

1. Reference 7.1 documents a detailed evaluation of this instrumentation. It concludes that this instrumentation does not impact an operator in implementing this procedure.
2. Monthly Channel Check provide a reasonable level of assurance that the instrumentation has not significantly degraded.

Based on these factors it is concluded that extending the calibration interval of this instrumentation to 30 months is acceptable.

5.11 Letdown Heat Exchanger Temperature

The Letdown Heat Exchanger Temperature channel consists of a temperature transmitter, power supply, signal isolators, and indicators. Figure 2B, of Attachment E, provides an instrument loop block diagram. The Letdown Heat Exchanger Temperature transmitter is located outside of containment, in the Radwaste Building. Other than this, this block diagram is representative of the Letdown Heat Exchanger Temperature instrumentation loop. This indication is not used in implementing SONGS Procedure SO23-13.2, Shutdown From Outside The Control Room.

Table H-1 provides a comparison of the RSS value for the uncertainty as well as the allowable uncertainty. It was concluded that this instrumentation does not have any impact on conducting a shutdown from outside the control room. The monthly Channel Check provide a reasonable level of assurance that the signal isolators and indicators have not degraded significantly.

The following points summarize the basis for extending the calibration interval of this instrumentation.

1. Reference 7.1 documents a detailed evaluation of this instrumentation. It concludes that this instrumentation does not impact an operator in implementing this procedure.
2. Monthly Channel Check provide a reasonable level of assurance that the instrumentation has not significantly degraded.

Based on these factors it is concluded that extending the calibration interval of this instrumentation to 30 months is acceptable.

5.12 Boric Acid Makeup Tank Level

The Boric Acid Makeup Tank Level channels consist of a differential pressure transmitter, power supply, signal isolators, and indicators. Figure 3A, of Attachment E provides an instrument loop block diagram. The Boric Acid Makeup Tank level transmitter is located outside of containment, in the Radwaste Building. Other than this, this block diagram is representative of the Boric Acid Makeup Tank Level instrumentation loop. This instrument channel is used to trend the water inventory in the Boric Acid Makeup Tanks so that a source of borated water remains available for makeup to the primary system.

An analysis of long term drift of the differential pressure transmitters was conducted (Reference 7.2) and the resulting allowable drift value was used in assessing the impact of this drift on operator decisions in implementing a shutdown from outside the control room (Reference 7.1). Table H-1 provides a comparison of the RSS value for the uncertainty as well as the allowable uncertainty. It was concluded that the allowable long term drift did not have a significant impact. The monthly Channel Check provides a reasonable level of assurance that the signal isolators and indicators have not degraded significantly.

The following points summarize the basis for extending the calibration interval of this instrumentation.

1. Reference 7.1 documents a detailed evaluation of this instrumentation as it is used in SO23-13.2. It was concluded that this instrumentation does not have any impact on conducting a shutdown from outside the control room.
2. Monthly cross Channel Check provides a reasonable level of assurance that the instrumentation has not significantly degraded.
3. One channel of indication is provided per Boric Acid Makeup Tank. Only one Boric Acid Makeup Tank is required to conduct a cooldown.
4. The Refueling Water Tank provides a diverse source of borated makeup water for the primary system.
5. The Boric Acid Makeup pump suction pressure is available locally for determining Boric Acid Makeup tank level.
6. The instruments' Quality Classification (QC 2) provides assurance that the instruments will perform the intended safety function.

Based on these factors it is concluded that extending the calibration interval of this instrumentation to 30 months is acceptable.

5.13 Condensate Storage Tank Level

The Condensate Storage Tank Level channels consist of a differential pressure transmitter, power supply, signal isolators, and indicators. Figure 3A, of Attachment E provides an instrument loop block diagram. The Condensate Storage Tank Level transmitter is located outside of containment, in the Radwaste Building. Other than this, this block diagram is representative of the Condensate Storage Tank Level instrumentation loop. This instrument channel is used to trend the water inventory available for makeup to the steam generators.

An analysis of long term drift of the differential pressure transmitters was conducted (Reference 7.2) and the resulting allowable drift value was used in assessing the impact of this drift on operator decisions in implementing a shutdown from outside the control room (Reference 7.1). Table H-1 provides a comparison of the RSS value for the uncertainty as well as the allowable uncertainty. It was concluded that the allowable long term drift did not have a significant impact. The monthly cross channel checks provide a reasonable level of assurance that the signal isolators and indicators have not degraded significantly.

The following points summarize the basis for extending the calibration interval of this instrumentation.

1. Reference 7.1 documents a detailed evaluation of this instrumentation as it is used in SO23-13.2. It was concluded that this instrumentation does not have any impact on conducting a shutdown from outside the control room.
2. Monthly cross channel checks provide a reasonable level of assurance that the instrumentation has not significantly degraded.
3. Two channels of this indication is provided.
4. Condensate transfer pump suction pressure is used to determine condensate storage tank level.
5. The instruments' Quality Classification (QC 2 & 3) provides assurance that the instruments will perform the intended safety function.

Based on these factors it is concluded that extending the calibration interval of this instrumentation to 30 months is acceptable.

5.14 Reactor Coolant Hot Leg Temperature

The Reactor Coolant Hold Leg Temperature channel consists of a resistance temperature detector (RTD), temperature transmitter, power supply, signal isolators, and indicators. Figure 2C, of Attachment E, shows a block diagram of this instrument loop. This indication is used to maintain subcooled conditions in the RCS, maintaining the unit within reactor vessel pressure and temperature limits, maintaining a net positive suction head for the reactor coolant pumps, verification that natural circulation exists and determining when to initiate shutdown cooling.
The RTD is a passive device which is not subject to drift. An analysis of

long term drift of the temperature transmitters was conducted (Reference 7.2) and the resulting allowable drift value was used in assessing the impact of this drift on operator decisions in implementing a shutdown from outside the control room (Reference 7.1). Table H-1 provides a comparison of the RSS value for the uncertainty as well as the allowable uncertainty. It was concluded that the allowable long term drift did not have a significant impact. The monthly cross channel check provides a reasonable level of assurance that the signal isolators and indicators have not degraded significantly.

The following points summarize the basis for extending the calibration interval of this instrumentation.

1. Reference 7.1 documents a detailed evaluation of this instrumentation as it is used in SO23-13.2. The impact of drift was assessed for all loop components. It concludes that drift allowance documented in Reference 7.2 does not significantly impact the use of this instrument by an operator in implementing this procedure.
2. Monthly cross channel checks provide a reasonable level of assurance that the instrumentation has not significantly degraded.
3. RCS Cold Leg Temperature indication is available (on Panel 2(3)L-042) to provide a backup means of temperature indication which assists in most manual control except verification of natural circulation.
4. Steam Generator Pressure is available to provide a backup means of determining RCS temperature which assists in most manual control except verification of natural circulation.
5. Trending of RCS parameters provides a backup method of assessing the effectiveness of natural circulation.
6. Pressurizer level provides a diverse means of assessing subcooled margin.

Based on these factors it is concluded that extending the calibration interval of this instrumentation to 30 months is acceptable.

5.15 Pressurizer Pressure - Low Range

The Low Range Pressurizer Pressure channel consists of a pressure transmitter, power supply, signal isolators, and indicators. Figure 3B, of Attachment E, shows a block diagram of this instrument loop. The Low Range Pressurizer Pressure transmitter is located outside of containment, in the Main Steam Isolation Valve (MISV) area. Other than this, this block diagram is representative of the Low Range Pressurizer Pressure instrumentation loop. This indication is used to maintain subcooled conditions in the RCS, maintaining the unit within reactor vessel pressure and temperature limits, maintaining a net positive suction head for the reactor coolant pumps and determining when to initiate shutdown cooling.

An analysis of long term drift of the pressure transmitters was conducted (Reference 7.2) and the resulting allowable drift value was used in assessing the impact of this drift on operator decisions in implementing a shutdown from outside the control room (Reference 7.1). Table H-1 provides a comparison of the RSS value for the uncertainty as well as the allowable uncertainty. It was concluded that the allowable long term drift did not have a significant impact. The monthly cross channel checks provide a reasonable level of assurance that the signal isolators and indicators have not degraded significantly.

The following points summarize the basis for extending the calibration interval of this instrumentation.

1. Reference 7.1 documents a detailed evaluation of this instrumentation as it is used in SO23-13.2. The impact of drift was assessed for all loop components. It concludes that drift allowance documented in Reference 7.2 does not significantly impact the use of this instrument by an operator in implementing this procedure.
2. Monthly cross channel check provides a reasonable level of assurance that the instrumentation has not significantly degraded.
3. Two channels of Wide Range Pressurizer Pressure indication is provided on Panel 2(3)L-042 for redundancy.
4. The instruments' Quality Classification (QC 2) provides assurance that the instruments will perform the intended safety function.

Based on these factors it is concluded that extending the calibration interval of this instrumentation to 30 months is acceptable.

5.16 Pressurizer Pressure - High Range

The High Range Pressurizer Pressure channel consists of a pressure transmitter, power supply, signal isolators, and indicators. Figure 3B, of Attachment E, shows a block diagram of this instrument loop. This indication is used to maintain subcooled conditions in the RCS, maintaining the unit within reactor vessel pressure and temperature limits, maintaining a net positive suction head for the reactor coolant pumps and determining when to initiate shutdown cooling.

An analysis of long term drift of the pressure transmitters was conducted (Reference 7.2) and the resulting allowable drift value was used in assessing the impact of this drift on operator decisions in implementing a shutdown from outside the control room (Reference 7.1). Table H-1 provides a comparison of the RSS value for the uncertainty as well as the allowable uncertainty. It was concluded that the allowable long term drift did not have a significant impact. The monthly cross channel checks provide a reasonable level of assurance that the signal isolators and indicators have not degraded significantly.

The following points summarize the basis for extending the calibration interval of this instrumentation.

1. Reference 7.1 documents a detailed evaluation of this instrumentation as it is used in SO23-13.2. The impact of drift was assessed for all loop components. It concludes that drift allowance documented in Reference 7.2 does not significantly impact the use of this instrument by an operator in implementing this procedure.
2. Monthly cross channel checks provide a reasonable level of assurance that the instrumentation has not significantly degraded.
3. Two channels of this Wide Range Pressurizer Pressure indication is provided on Panel 2(3)L-042 for diversity.
4. The instruments' Quality Classification (QC 2) provides assurance that the instruments will perform the intended safety function.

Based on these factors it is concluded that extending the calibration interval of this instrumentation to 30 months is acceptable.

5.17 Pressurizer Level

The Pressurizer Level channel consists of a differential pressure transmitter, power supply, signal isolators, and indicators. Figure 3B, of Attachment E, shows a block diagram of this instrument loop. This instrument channel is used to maintain a water inventory in the pressurizer to simplify pressure control of the RCS. A nominal level between 30 and 40% is suggested by SO23-13.2. This provides a substantial margin between emptying the pressurizer and establishing a water solid condition. Pressure response to RCS volume changes provides a diverse means of determining that a water solid condition exists. Maintaining a subcooled condition in the RCS provides a diverse means of determining that a sufficient water inventory exists.

An analysis of long term drift of the differential pressure transmitters was conducted (Reference 7.2) and the resulting allowable drift value was used in assessing the impact of this drift on operator decisions in implementing a shutdown from outside the control room (Reference 7.1). Table H-1 provides a comparison of the RSS value for the uncertainty as well as the allowable uncertainty. It was concluded that the allowable long term drift did not have a significant impact. The monthly cross channel checks provide a reasonable level of assurance that the signal isolators and indicators have not degraded significantly.
The following points summarize the basis for extending the calibration interval of this instrumentation.

1. Reference 7.1 documents a detailed evaluation of this instrumentation as it is used in SO23-13.2. The impact of drift was assessed for all loop components. It concludes that drift allowance documented in Reference 7.2 does not significantly impact the use of this instrument by an operator in implementing this procedure.
2. Monthly cross channel checks provide a reasonable level of assurance that the instrumentation has not significantly degraded.
3. Two channels of Pressurizer Level indication is provided on Panel 2(3)L-042.
4. Pressure response to RCS volume changes provides a diverse means of determining that a water solid condition exists.

5. Maintaining a subcooled condition in the RCS provides a diverse means of determining that a sufficient water inventory exists.

Based on these factors it is concluded that extending the calibration interval of this instrumentation to 30 months is acceptable.

5.18 Steam Generator Pressure

The Steam Generator Pressure channels consist of a pressure transmitter, power supply, signal isolators, and indicators. Figure 3B, of Attachment E provides an instrument loop block diagram. The Steam Generator Pressure transmitter is located outside of containment, in the MSIV area. Other than this, this block diagram is representative of the Steam Generator Pressure instrumentation loop. This indication is used to verify that the S/G pressure is being controlled and providing an adequate heat sink for natural circulation. RCS temperature provides a diverse means of determining S/G pressure.

An analysis of long term drift of the pressure transmitters was conducted (Reference 7.2) and the resulting allowable drift value was used in assessing the impact of this drift on operator decisions in implementing a shutdown from outside the control room (Reference 7.1). Table H-1 provides a comparison of the RSS value for the uncertainty as well as the allowable uncertainty. It was concluded that the allowable long term drift did not have a significant impact. The monthly cross channel checks provide a reasonable level of assurance that the signal isolators and indicators have not degraded significantly.

The following points summarize the basis for extending the calibration interval of this instrumentation.

1. Reference 7.1 documents a detailed evaluation of this instrumentation as it is used in SO23-13.2. The impact of drift was assessed for all loop components. It concludes that drift allowance documented in Reference 7.2 does not significantly impact the use of this instrument by an operator in implementing this procedure.
2. Monthly cross channel checks provide a reasonable level of assurance that the instrumentation has not significantly degraded.
3. One channel of indication is provided per steam generator. Only one steam generator is required to conduct a cooldown.
4. One channel of indication per steam generator is provided on Panel 2(3)L-042.
5. RCS temperature indication provides a diverse means of determining S/G pressure.
6. The instruments' Quality Classification (QC 2) provides assurance that the instruments will perform the intended safety function.

Based on these factors it is concluded that extending the calibration interval of this instrumentation to 30 months is acceptable.

5.19 Steam Generator Level

The Wide Range Steam Generator Level channels consist of a differential pressure transmitter, power supply, signal isolators, and indicators. Figure 3B, of Attachment E, shows a block diagram of this instrument loop. This instrument channel is used to maintain a water inventory in the steam generators so that a heat sink remains available for removal of decay heat. The nominal control band specified by the procedure, 40 to 80%, provides ample margin to the limit conditions of overfilling the S/Gs or losing level indication to accommodate the instrument uncertainty.

An analysis of long term drift of the differential pressure transmitters was conducted (Reference 7.2) and the resulting allowable drift value was used in assessing the impact of this drift on operator decisions in implementing a shutdown from outside the control room (Reference 7.1). Table H-1 provides a comparison of the RSS value for the uncertainty as well as the allowable uncertainty. It was concluded that the allowable long term drift did not have a significant impact. The monthly cross channel checks provide a reasonable level of assurance that the signal isolators and indicators have not degraded significantly.

The following points summarize the basis for extending the calibration interval of this instrumentation.

1. Reference 7.1 documents a detailed evaluation of this instrumentation as it is used in SO23-13.2. The impact of drift was assessed for all loop components. It concludes that drift allowance documented in Reference 7.2 does not significantly impact the use of this instrument by an operator in implementing this procedure.
2. Monthly cross channel checks provide a reasonable level of assurance that the instrumentation has not significantly degraded.
3. One channel of indication is provided per steam generator. Only one steam generator is required to conduct a cooldown.
4. One channel of narrow range indication per steam generator is provided on Panel 2(3)L-042. Only one steam generator is required to conduct a cooldown.
5. Steam generator pressure provides a diverse means for determining that a water inventory exists in the S/G.

Based on these factors it is concluded that extending the calibration interval of this instrumentation to 30 months is acceptable.

6.0 Conclusions

This proposed change only affects the frequency of performing calibrations of certain instruments which are utilized to maintain the unit in a hot shutdown condition or to conduct a plant cooldown in the event that the control room is not available. Other surveillances performed on a more frequent basis provides a high degree of assurance that the instruments are performing properly.
An analysis of the allowable uncertainties of instrumentation used in SONGS Procedure SO23-13.2, Shutdown From Outside the Control Room, was performed. The instrument uncertainties, considering the long term drift experienced at SONGS Units 2&3, were calculated. Comparisons of the calculated uncertainties

An analysis of the allowable uncertainties of instrumentation used in SONGS Procedure SO23-13.2, Shutdown From Outside the Control Room, was performed. The instrument uncertainties, considering the long term drift experienced at SONGS Units 2&3, were calculated. Comparisons of the calculated uncertainties to the allowable uncertainties demonstrates that the operator has sufficiently accurate information to maintain the unit in a hot shutdown condition, or to conduct a plant cooldown, from outside the control room.

In general, redundant and diverse indication of important process parameters are available on the Remote Shutdown Panels. This provides a backup source of information to the operators to confirm the primary indication.

An added level of assurance is provided by the classification of these components as Quality Class II. For Quality Class II components, the applicable requirements of 10CFR50, Appendix B, Quality Assurance Criteria for Nuclear Power Plants have been met to ensure the highest quality standards. This provides assurance that the instruments will perform the intended function.

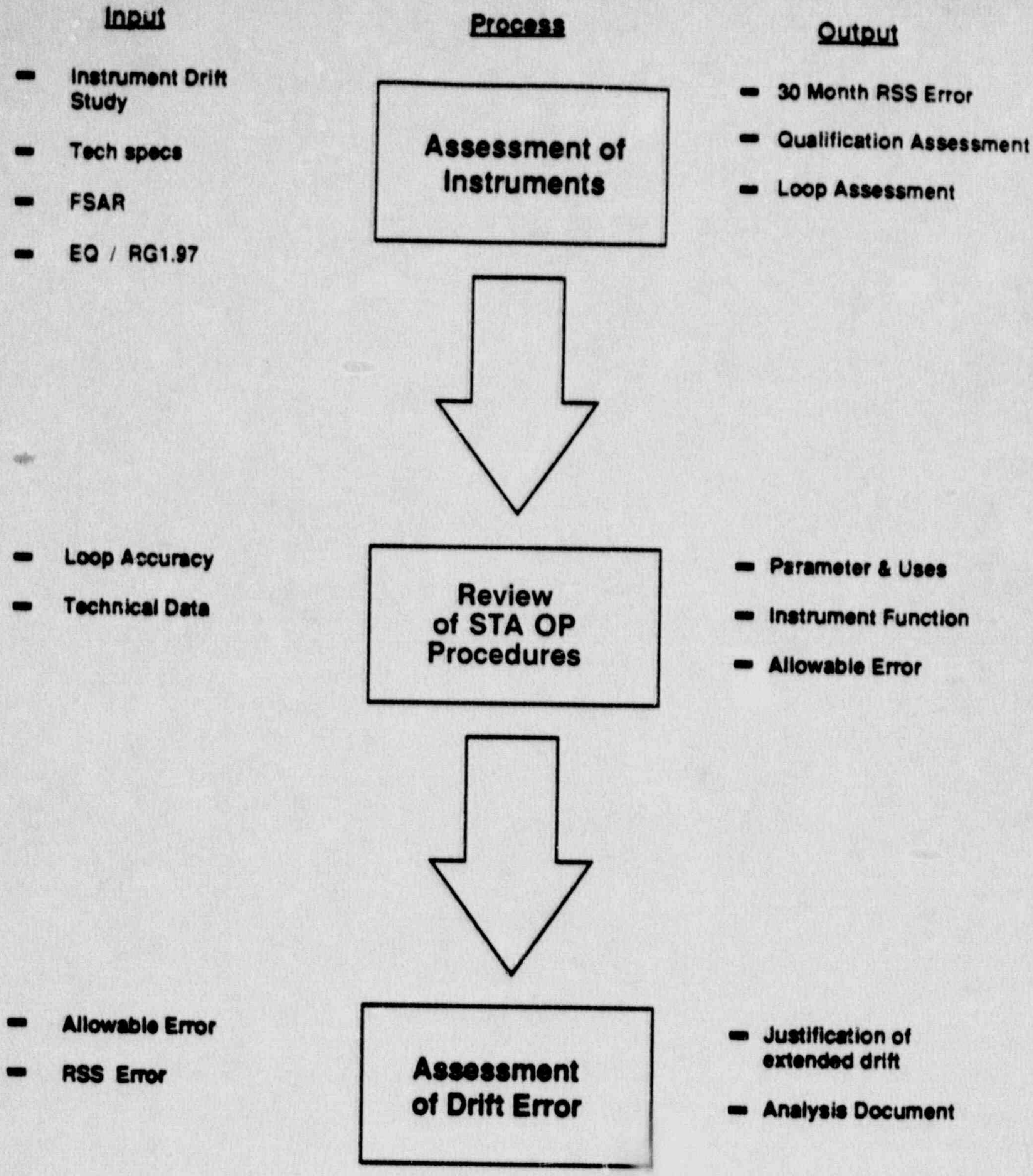
It is concluded that extending the surveillance interval of Remote Shutdown Instrumentation to a maximum interval of 30 months is acceptable.

7.0 References

7.1 Draft Functional Analysis, Evaluation to Support AMS/RSM instrumentation Calibration Extension From 18 to 24 Month Interval, Southern California Edison, Nuclear Engineering Design Organization, Controls Engineering, December, 1989

7.2 Instrument Drift Study, M-89047, Revision 0, San Onofre Nuclear Generating Station Units 2&3, R. M. Bockhorst, May, 1989

7.3 San Onofre Nuclear Generating Station (SONGS), Units 2 & 3, Procedure SO23-13.2, Shutdown From Outside The Control Room



Methodology to provide bases for AMS & RSD Technical Spcelfication Changes to extend Instrument Calibration interval.

Functional Analysis Process Flow Diagram

Figure H-1

TABLE H-1

REMOTE SHUTDOWN INSTRUMENTATION
PARAMETER SUMMARY

PANEL L042[1]

Functional Unit	RSS Value[2,3]	EOI/FSAR Allowable Value[4]
1. Log Power	Trending	
3. Pzr. Press	58 psi	67 psi
4. Pzr. Level	6.6%	10%
	Trending	
5. SG Level	6.6%	20%
	6.6%	15%
6. SG Pressure	Trending	
	22.7 psi[5]	35 psi
7. Source Range	Not Used in AOI	
8. Condenser Vacuum	Not Used in AOI	
9. Volume Control Tank Level	Not Used In AOI	
10. Letdown Heat Exch. Pres.	Not Used in AOI	
11. Letdown Heat Exch. Temp.	Not Used in AOI	
12. Boric Acid MV Tank Level	Level Measured by BAMU pump suction pressure. Drift not impacted.	
13. Condensate Tank Level	Trending	

TABLE H-1
(Continued)

REMOTE SHUTDOWN INSTRUMENTATION
PARAMETER SUMMARY

PANEL L411[6]

	Functional Unit	RSS Value		EOI/FSAR Allowable Value
2.	Cold Leg Temp	20°F		29°F
			Trending	
		13.9°F		60°F
		13.9°F		35°F
14.	Hot Leg		Trending	
		20°F		25°F
		13.9°F		35°F
		13.9°F		60°F
15.	Pzr. Pressure (LR)	32 psi[5]		50 psi
			Trending	
		42.2 psi		50 psi
		32 psi[5]		35 psi
16.	Pzr. Pressure (HR)	42.2 psi		50 psi
			Trending	
17.	Pzr. Level	6.66%		8%
		6.66%		10%
			Trending	
		6.66%		40%
18.	SG Pressure		Not Used in AOI	
19.	SG Level	6.6%		20%
		6.6%		30%
		6.6%		15%
		6.6%		10%

TABLE H-1
(Continued)

REMOTE SHUTDOWN INSTRUMENTATION
TABLE NOTES

(1) Panel L042 is the Evacuation Shutdown Panel. This is identified in the Technical Specification as Remote Shutdown Instrumentation.

(2) The Root-Sum-Square (RSS) Value is the total instrument uncertainty for each instrument loop. This instrument uncertainty was calculated, by RSS, using the revised values for drift over a 30 month interval, values for instrument accuracy, calibration equipment error, and environmental effects, as applicable.

(3) Unless otherwise noted, the drift factor included in the RSS is based on the Instrument Drift Study (Reference 7.2) Drift Allowance. Refer to Attachment G for a summary of the Instrument Drift Study.

(4) The Allowable Value is derived from the Functional Analysis performed for Remote Shutdown Instrumentation (Reference 7.1)

(5) The drift factor included in the RSS is based on the Best Estimate Value, rather than the 95/95 value reported in the Instrument Drift Study (Reference 7.2).

(6) Panel L411 is the Essential Plant Parameter Monitoring Panel. This is identified in the Technical Specification as Remote Shutdown Instrumentation.

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 in the analysis process. 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 twenty four (24) month 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 J-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 cooldowns (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 J-2, J-3, and J-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 J-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.

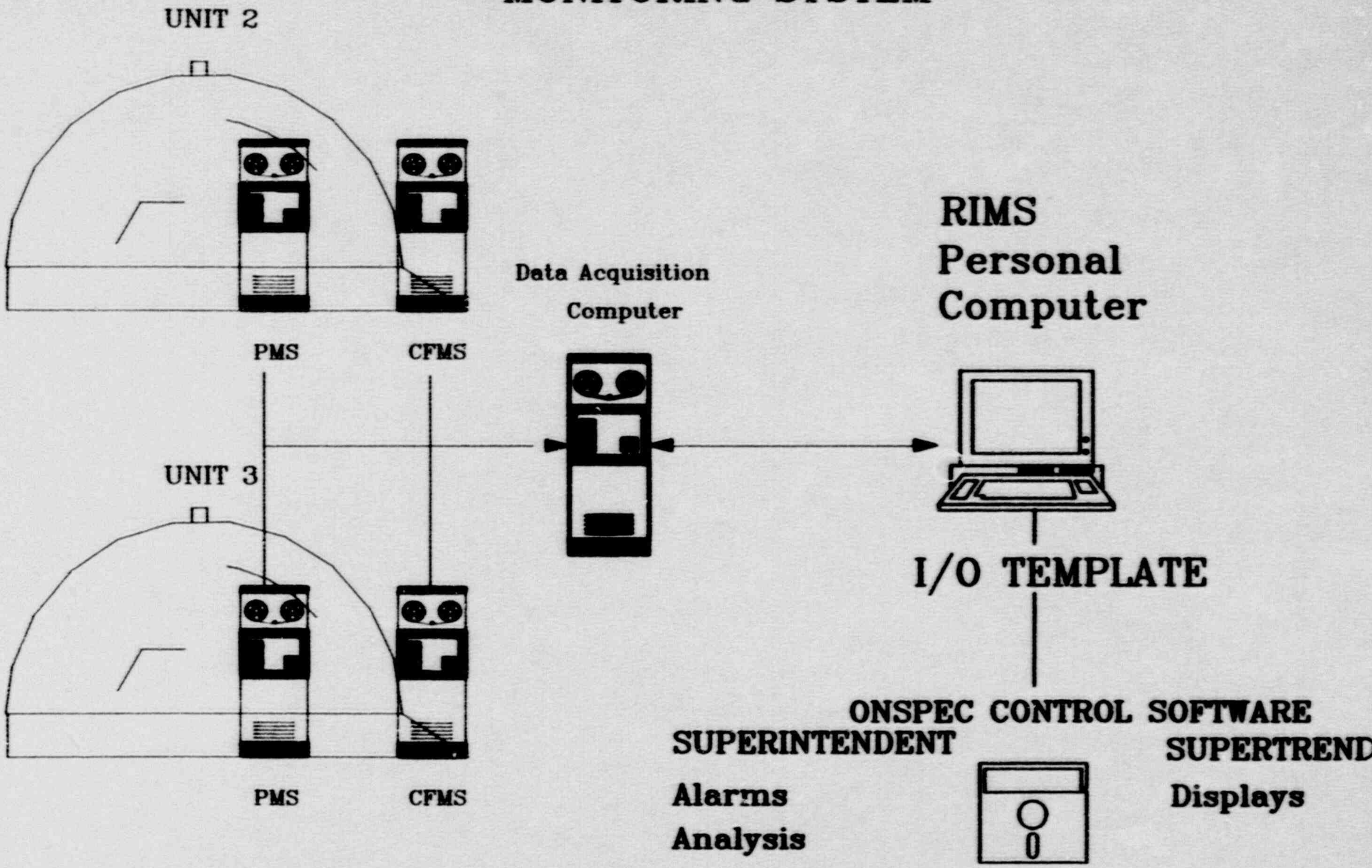
The benefits derived from operation of the system are as follows:

- o 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.
- o 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.
- o 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.

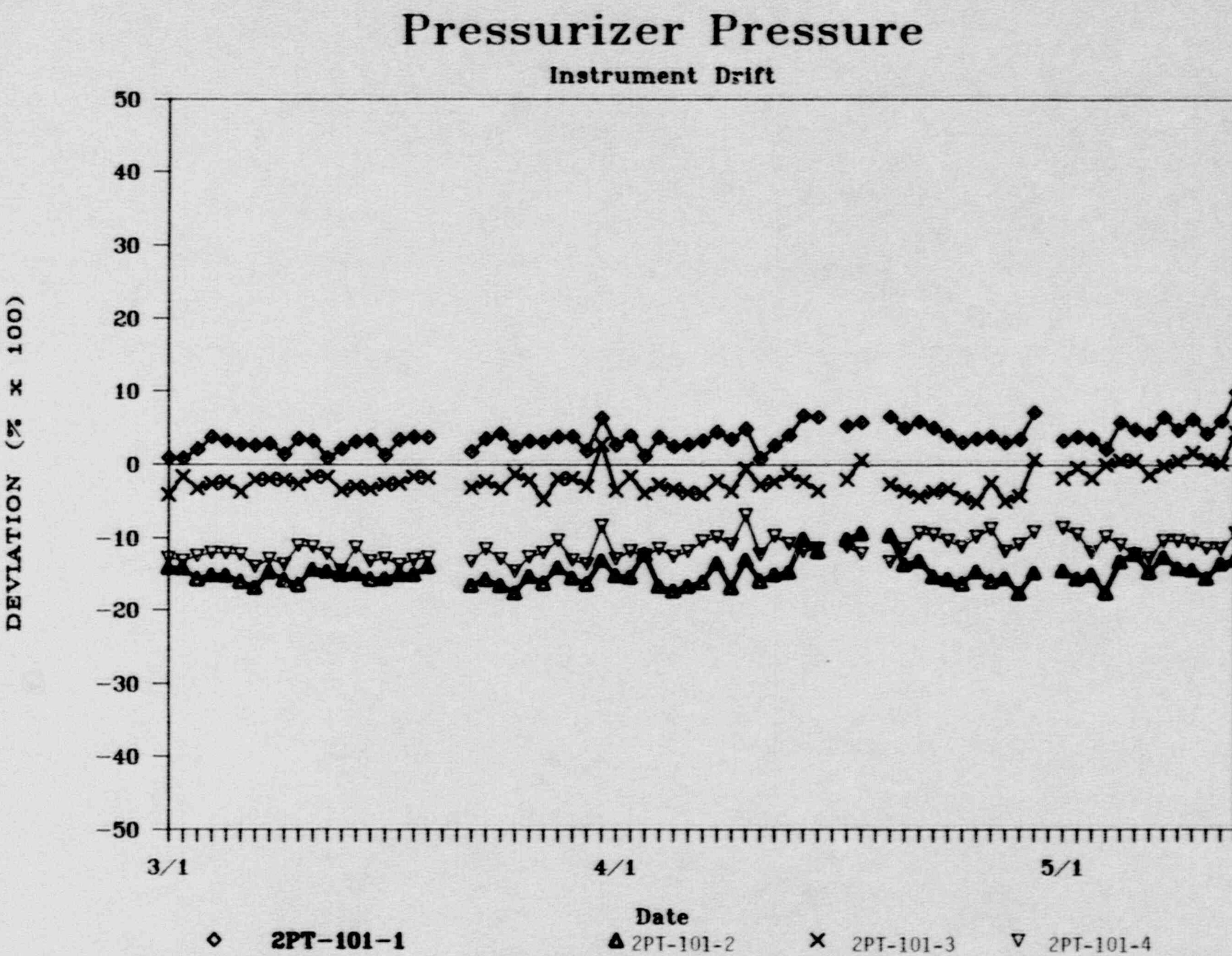
Figure I-1

REDUNDANT INSTRUMENT MONITORING SYSTEM



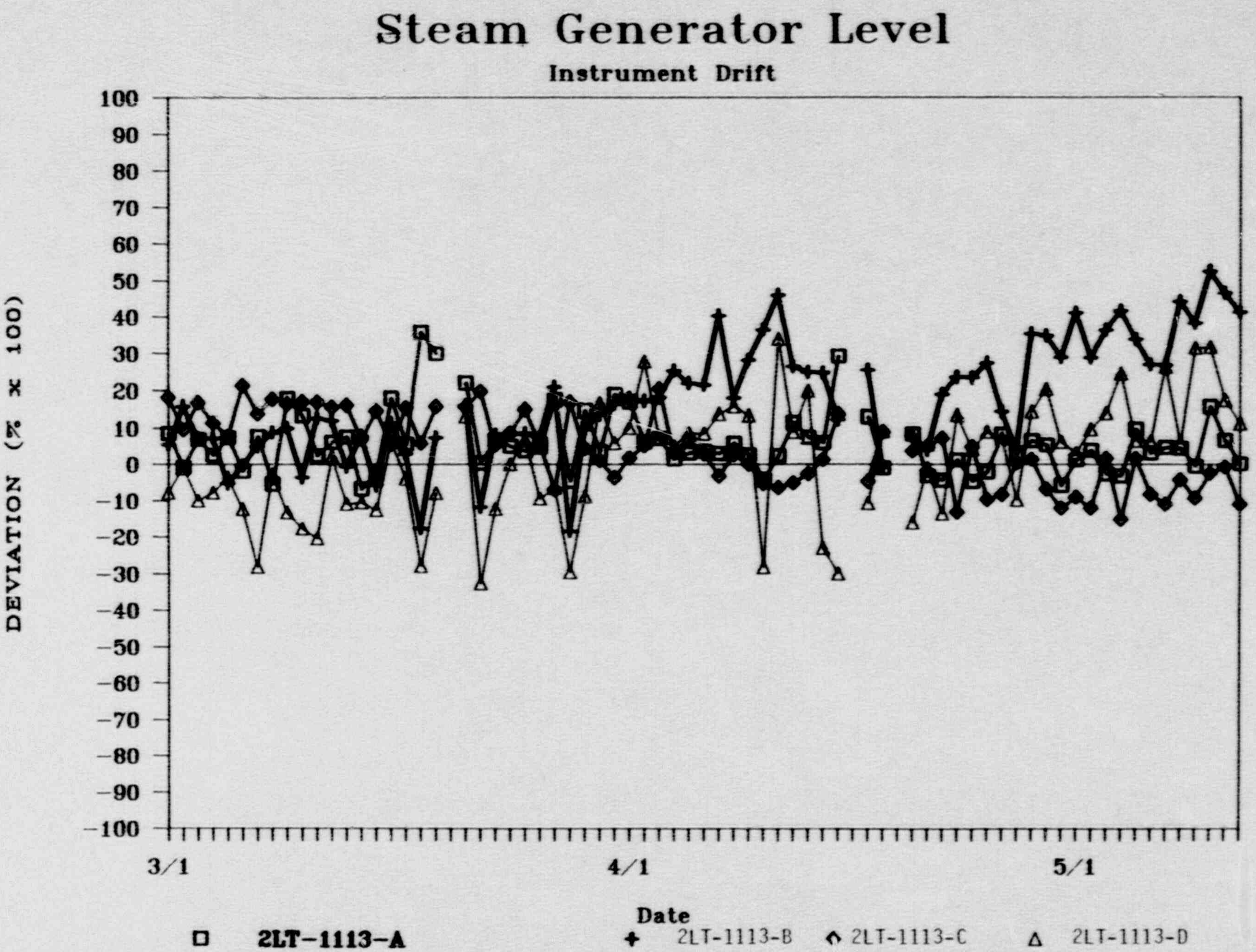
6/02/88

Figure I-2



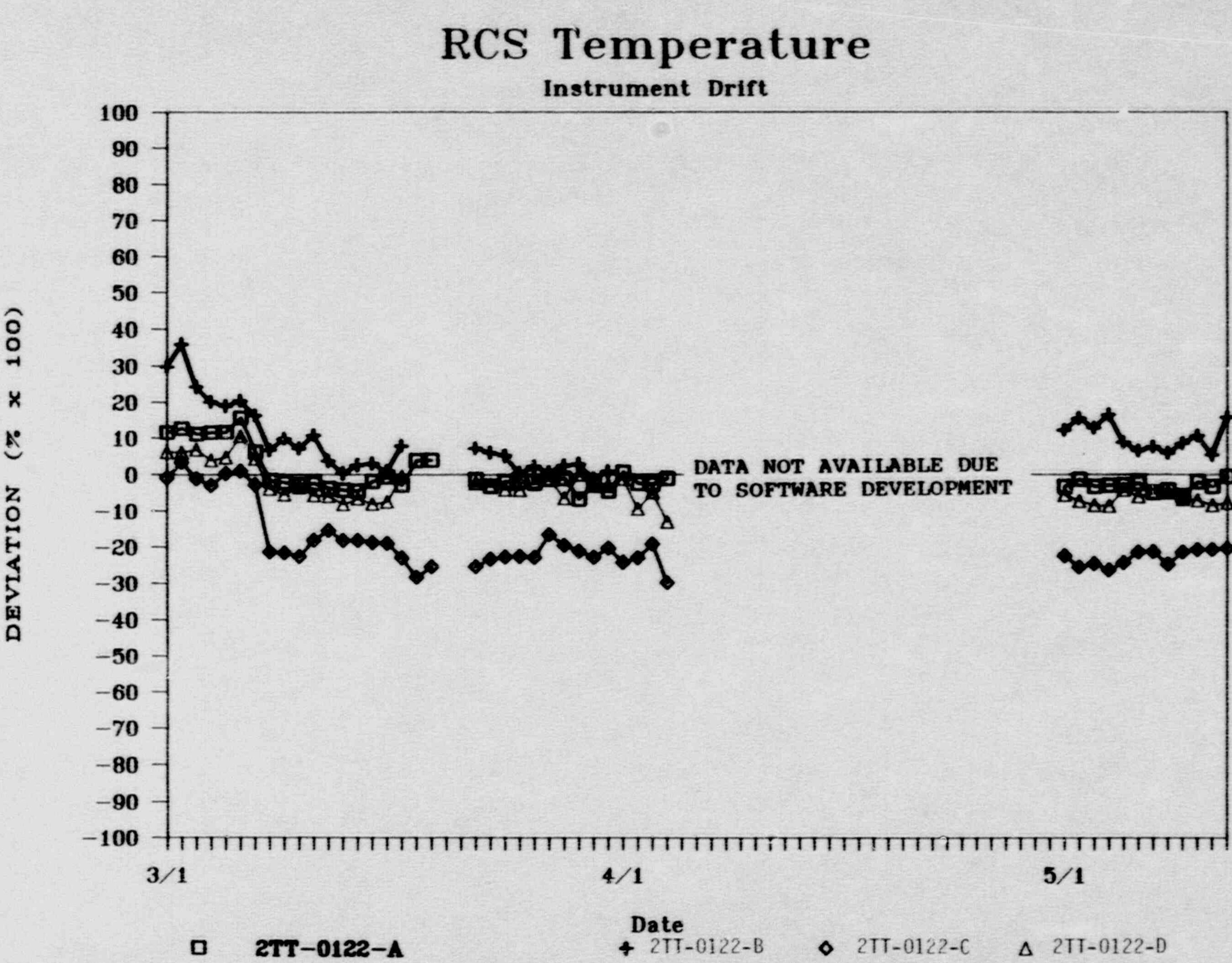
Pressurizer Pressure
Instrument Drift
50
40
30
20
10
0
-10
-20
-30
-40
-50
DEVIATION (% x 100)
3/1
4/1
5/1
Date
2PT-101-1
2PT-101-2
2PT-101-3
2PT-101-4

Figure I-3



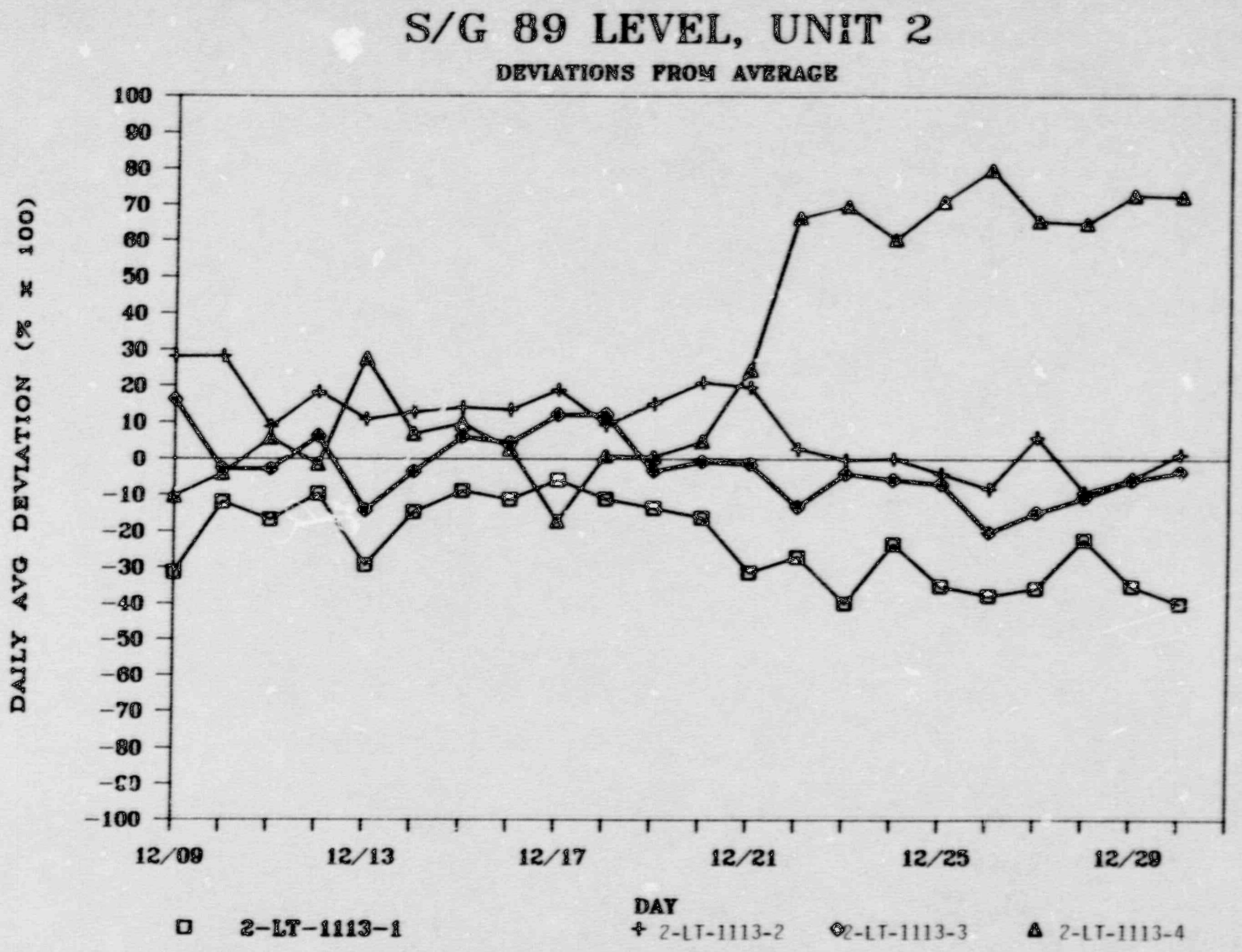
Steam Generator Level
Instrument Drift
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
DEVIATION (% x 100)
3/1
4/1
5/1
Date
2LT-1113-A
2LT-1113-B
2LT-1113-C
2LT-1113-D

Figure I-4



RCS Temperature
Instrument Drift
DEVIATION (% x 100)
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-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
-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