

REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR: 8102180282 DOC. DATE: 81/02/15 NOTARIZED: NO DOCKET #  
 FACIL: 50-361 San Onofre Nuclear Station, Unit 2, Southern California 05000361  
 50-362 San Onofre Nuclear Station, Unit 3, Southern California 05000362  
 AUTH. NAME: BASKIN, K.P. AUTHOR AFFILIATION: Southern California Edison Co.  
 RECIP. NAME: MIRAGLIA, F. RECIPIENT AFFILIATION: Licensing Branch 3

SUBJECT: Forwards "Environ Qualification Rept Per Requirements of NUREG-0588."

DISTRIBUTION CODE: R001S COPIES RECEIVED: LTR 60 ENCL 60 SIZE: 251  
 TITLE: PSAR/FSAR AMDTS and Related Correspondence

NOTES: Send all FSAR & ER amends to L Chandler. 05000361  
 1 cy: J Hanchett (Region V), D Scaletti, 1 cy of all environ info  
 Send all FSAR & ER amends to L Chandler. 05000362  
 1 cy: J Hanchett (Region V), D Scaletti, 1 cy of all environ info

ACTION:	RECIPIENT ID CODE/NAME	COPIES		RECIPIENT ID CODE/NAME	COPIES	
		LT	TR ENCL		LT	TR ENCL
ACTION:	A/D LICENSING	1	0	MIRAGLIA, F.	1	0
	LEE, J.	1	0	ROOD, H. 04	1	1
INTERNAL:	ACCID EVAL BR26	1	1	AUX SYS BR 07	1	1
	CHEM ENG BR 06	1	1	CUNT SYS BR 09	1	1
	CORE PERF BR 10	1	1	EFF TR SYS BR12	1	1
	EMERG PREP 22	1	0	EQUIP QUAL BR13	3	3
	GEOSCIENCES 14	1	1	HUM FACT ENG BR	1	1
	HYD/GEO BR 15	2	2	I&C SYS BR 16	1	1
	I&E 06	3	3	LIC GUID BR	1	1
	LIC QUAL BR	1	1	MATL ENG BR 17	1	1
	MECH ENG BR 18	1	1	MPA	1	0
	MRC PDR 02	1	1	DELD	1	0
	OP LIC. BR	1	1	POWER SYS BR 19	1	1
	PRUC/TST REV 20	1	1	QA BR 21	1	1
	RAD ASSESS BR22	1	1	REAC SYS BR 23	1	1
	REG FILE 01	1	1	SIT ANAL BR 24	1	1
	STRUCT ENG BR25	1	1	SYS INTERAC BR	1	1
EXTERNAL:	ACRS 27	10	16	LPDR 03	1	1
	NSIC 05	1	1			

TOTAL NUMBER OF COPIES REQUIRED: LTR 58 51 ENCL 58 51

MT 4

JF

*Southern California Edison Company*

P O BOX 800  
2244 WALNUT GROVE AVENUE  
ROSEMEAD, CALIFORNIA 91770

K. P. BASKIN  
MANAGER OF NUCLEAR ENGINEERING,  
SAFETY, AND LICENSING

February 15, 1981

TELEPHONE  
(213) 572-1401

Director, Office of Nuclear Reactor Regulation  
Attention: Mr. Frank Miraglia, Branch Chief  
Licensing Branch No. 3  
U. S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Gentlemen:

Subject: Docket Nos. 50-361 and 50-362  
San Onofre Nuclear Generating Station  
Units 2 and 3

Enclosed are sixty-three (63) copies of responses to Equipment Qualification Branch questions and comments concerning the environmental qualification of equipment, Licensing Open Item No. 12. Enclosure 1 is a list of the responses which are included in Enclosure 2.

Please let me know if you have any questions or need any additional information.

Very truly yours,

*K P Baskin*

Enclosures

*Bos  
6/60*

5102180 *282*

SAN ONOFRE  
NUCLEAR GENERATING STATION

UNIT 2 AND 3

ENVIRONMENTAL QUALIFICATION REPORT  
PER REQUIREMENTS OF NUREG-0588

UNIT 2: DOCKET 50-361  
UNIT 3: DOCKET 50-362

2-15-81

SOUTHERN CALIFORNIA EDISON COMPANY  
SAN DIEGO GAS & ELECTRIC COMPANY

SAN ONOFRE  
NUCLEAR GENERATING STATION

UNIT 2 AND 3

ENVIRONMENTAL QUALIFICATION REPORT  
PER REQUIREMENTS OF NUREG-0588

UNIT 2: DOCKET 50-361  
UNIT 3: DOCKET 50-362

SOUTHERN CALIFORNIA EDISON COMPANY  
SAN DIEGO GAS & ELECTRIC COMPANY

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

SOUTHERN CALIFORNIA EDISON COMPANY  
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 AND 3  
DOCKET NO'S. 50-361 AND 50-362

ENVIRONMENTAL QUALIFICATION OF CLASS IE EQUIPMENT

RESPONSE TO NUREG 0588

## CONTENTS

	<u>Page</u>
1. INTRODUCTION	1-1
2. SAFETY-RELATED SYSTEMS REQUIRED TO FUNCTION FOR LOCA/HELBA SAFE SHUTDOWN	2-1
2.1 Safe Shutdown and Accident Mitigation	2-1
2.2 List of Systems Containing Class IE Electrical Equipment	2-1
2.3 TMI Equipment Requirements	2-4
2.4 FSAR Requirements for LOCA/HELBA	2-4
2.5 Post-Accident Monitoring Instrumentation (PAMI)	2-5
3. ENVIRONMENTAL CONDITIONS	3-1
3.1 Accident Profile	3-1
3.1.1 Environmental Conditions Inside Containment	3-1
3.1.2 Environmental Conditions Outside Containment	3-4
3.1.2.1 Main Steam and Feedwater Line Valve Rooms	3-5
3.1.2.2 Auxiliary Feedwater Pump Room	3-5
3.2 Margins-DBA	3-6
3.2.1 Temperature - Pressure Margin	3-6
3.2.2 Operating Time	3-7
3.3 High Radiation	3-7
3.3.1 Levels Inside Containment	3-7
3.3.1.1 Core Inventory	3-7
3.3.1.2 Reactor Coolant	3-7
3.3.1.3 Containment Airborne	3-8
3.3.1.4 Plateout Source Terms	3-8
3.3.1.5 Sump Sources	3-8
3.3.1.6 Methodology	3-11

## CONTENTS (cont)

		<u>Page</u>
3.3.2	Levels Outside Containment	3-14
3.3.2.1	Containment Direct Dose	3-14
3.3.2.2	Containment Leakage	3-14
3.3.2.3	Safety Injection System	3-15
3.3.2.4	Containment Spray System	3-15
3.3.2.5	Nuclear Plant Sampling System	3-15
3.3.2.6	Valve Leakage	3-15
3.3.2.7	Reactor Coolant Chemical and Volume Control System (CVCS)	3-16
3.3.2.8	Coolant Radwaste System	3-16
3.3.2.9	Waste Gas System	3-16
3.3.3	Calculational Methodology	3-17
3.3.3.1	Direct Dose from Containment	3-17
3.3.3.2	Airborne Sources	3-17
3.3.3.3	Direct Dose from Piping	3-17
3.3.3.4	Normal Operational Dose	3-17
3.4	Voltage and Frequency Fluctuations	3-19
3.4.1	Voltage	3-19
3.4.2	Frequency	3-20
3.5	Dust	3-20
3.6	Aging	3-20
3.7	Flooding and Submergence	3-21
4.	MASTER EQUIPMENT LIST AND QUALIFICATION REVIEW	4-1
4.1	Review Technique	4-1
4.1.1	Balance of Plant (BOP)	4-1
4.1.2	Nuclear Steam Supply System (NSSS)	4-2

## CONTENTS (Cont)

		<u>Page</u>
4.1.3	Qualification Status	4-4
4.1.3.1	Qualified for Plant Life	4-4
4.1.3.2	Relocate To	4-4
4.1.3.3	Interim Use	4-4
4.1.3.4	Replacement or Requalification Required	4-4
4.2	Equipment Qualification Tabulation Sheets	4-5
4.2.1	Balance of Plant (BOP) Equipment	4-5
5.	SUMMARY OF OUTSTANDING ITEMS	5-1
APPENDICES		
A.	Procedures for Maintaining Equipment Qualification	A-1
B.	Emergency Operating Procedures Review and Results	B-1
C.	Environmental Qualification Summary (Sample Form)	C-1
D.	NSSS Sample Evaluation Sheet	D-1
E.	NRC Inspection Items	E-1

# TABLES

		<u>Page</u>
2-1	List of Systems Containing Class IE Electrical Equipment	2-2
3-1	Core Inventory (Curies)	3-9
3-2	Reactor Coolant Concentrations (Curies/CC) (at Start of Accident)	3-9
3-3	Containment Spray Parameters	3-10
3-4	Containment Airborne Concentration (Curies/CC) (at Start of Accident)	3-10
3-5	Plateout Concentration (at Start of Accident)	3-12
3-6	Containment Sump Activities (Curies) (at Start of Accident)	3-13
3-7	Integrated 0-30 Day Post-Accident Doses Inside Containment	3-14
3-8	Integrated 0-30 Day Post-Accident Doses Outside Containment (Rads)	3-18
4-1	Environmental Qualification of IE Electrical Equipment	4-6
4-2	Equipment Qualification Tabulation (NSSS) Environmental Qualification of SONGS 2&3 Electrical Equipment	4-44
4-3	Normal, Accident, and Design Environmental Conditions	4-100
5-1	Outstanding Items - BOP Equipment	5-2
5-2	Outstanding Items - NSSS Equipment	5-6

## FIGURES

- 3-1            Containment Atmosphere - Temperature Vs. Time  
                 Loss-of-Coolant Accident (LOCA)
- 3-2            Containment Atmosphere - Pressure Vs. Time  
                 Loss-of-Coolant Accident (LOCA)
- 3-3            Beta Dose Reduction Factor

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

1. INTRODUCTION

In order to address the question of Environmental Qualification of Electrical Equipment for the San Onofre Nuclear Generating Station, Units 2 and 3, Southern California Edison Company has organized a task force to review the qualification of installed equipment. The equipment covered in this review includes Class IE equipment inside containment and Class IE equipment outside containment which is subjected to a harsh environment and required to mitigate a postulated accident or place the plant in a safe cold shutdown condition. Harsh environment is defined as: LOCA/MSLB inside the containment, MSLB outside the containment in the MSIV area or the auxiliary feedwater pump room, and any other area which could experience  $1 \times 10^5$  rads during a LOCA/MSLB or post-LOCA/MSLB event. This scope of review will assure that equipment necessary to protect the public health and safety is capable of performing its function when subjected to a harsh environment.

This review of environmental qualification was based on the guidelines outlined for Category II plants as defined by NUREG 0588, "Interim Staff Position on Environmental Qualification of Safety Related Electrical Equipment" issued to operating license applicants by NRC letter on February 5, 1980. The review was conducted by a task force composed of personnel experienced in reactor systems safety analysis and design, plant operations, emergency operating procedures, nuclear safety and licensing, and environmental qualification. A critical review of all documentation was conducted, using criteria established from NUREG 0588, resulting in an auditable record with appropriate documentation to identify the specific equipment, the criteria used in reviewing the report, the reviewer, and the specific report reference.

The San Onofre Nuclear Generating Station Units 2 and 3 environmental qualification review evaluate specific safety-related equipment for the worst environment and acceptability for use is then determined. Safety-related electrical equipment subject to a harsh environment is documented herein on qualification review summary sheets. Appropriate qualification-related requirements and results are recorded for each piece of equipment in accordance with the NRC guidelines. Documentation is also available upon NRC request for a comparison of the environmental qualification data

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

against the requirements set forth in NUREG 0588. These data are on report evaluation sheets for each type of equipment to identify the degree to which the qualification complies with the NRC staff position. Outstanding items are defined as those items for which discrepancies in meeting the guidelines of NUREG 0588 have been identified. A summary of these discrepancies is provided in Section 5 and includes corrective actions and schedules for implementation together with justification for interim operation or replacement as applicable.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

2. SAFETY-RELATED SYSTEMS REQUIRED TO FUNCTION FOR LOCA/HELBA/  
SAFE SHUTDOWN

2.1 SAFE SHUTDOWN AND ACCIDENT MITIGATION

As directed, Southern California Edison (SCE) has evaluated the environmental qualification of the safety-related electrical components which experience the harsh environment due to loss-of-coolant accident (LOCA) and high energy line break (HELB) accidents. This report includes equipment required for pressure and reactivity control, coolant inventory makeup, and removal of residual heat in order to bring the reactor to a subcritical cold shutdown condition. San Onofre Nuclear Plant Units 2&3 were designed for a safe shutdown condition of Hot Standby. Therefore, certain electrical components required to bring the plant to cold shutdown (i.e., pressurizer heater cable from the heater to IE junction box, charging pump flow sensor, and charging pump discharge pressure transmitters were not procured to IE specifications. SCE is continuing to evaluate the necessity for designing and procuring this equipment to IE qualified standards. Also included is equipment in this report that will experience the environmental conditions of design basis accidents which it must mitigate. Safety related equipment will be qualified to assure operability in the accident environment for the time required to mitigate a postulated accident. The LOCA accident evaluation also includes areas where equipment will be exposed to high radiation from piping systems containing recirculated containment sump fluids.

2.2 LIST OF SYSTEMS CONTAINING CLASS IE ELECTRICAL EQUIPMENT

Table 2-1 provides a list of all safety related systems. Those systems containing equipment exposed to harsh environments are identified on the table by an asterisk (\*).

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 2-1

LIST OF SYSTEMS CONTAINING CLASS IE ELECTRICAL EQUIPMENT

(Sheet 1 of 3)

1. Containment heat removal systems
  - a. Containment spray system<sup>(a)</sup>
  - b. Containment atmosphere emergency cooling system<sup>(a)</sup>
2. Containment isolation system (isolation devices)<sup>(a)</sup>
3. Combustible gas control system<sup>(a)</sup>
4. Safety injection system<sup>(a)</sup>
5. Fission product removal and control systems
  - a. Containment spray system<sup>(a)</sup>
  - b. Containment hydrogen purge system
  - c. Emergency operation control room ventilation system (not exposed to harsh environment)
  - d. Fuel handling building post-accident cleanup system (not required for LOCA/HELBA mitigation)
6. Fuel handling building isolation system (not required for LOCA/HELBA mitigation)
7. Onsite electrical power systems
  - a. AC power system (electrical penetrations and cable)<sup>(a)</sup>
  - b. DC power system (electrical penetrations and cable)<sup>(a)</sup>
8. Salt water cooling system (not exposed to harsh environment)
9. Component cooling water system<sup>(a)</sup>
10. Chemical and volume control system (charging and boric acid makeup systems not exposed to harsh environment)

a. Denotes exposure to harsh environment

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 2-1

LIST OF SYSTEMS CONTAINING CLASS IE ELECTRICAL EQUIPMENT

(Sheet 2 of 3)

11. Emergency operation containment building ventilation systems
  - a. Containment atmosphere emergency cooling system<sup>(a)</sup>
  - b. Containment hydrogen purge system
12. Emergency operation HVAC systems
  - a. Control room habitability system (not exposed to harsh environment)
  - b. ESF switchgear system (not exposed to harsh environment)
  - c. Charging and boric acid makeup pump room system (not exposed to harsh environment)
  - d. Battery room system (not exposed to harsh environment)
  - e. Chiller room system (not exposed to harsh environment)
  - f. Emergency chilled water system (not exposed to harsh environment)
  - g. Fuel handling building post accident cleanup system (not required for LOCA/HELBA mitigation)
  - h. Safety equipment pump room emergency cooling system<sup>(a)</sup>
  - i. Diesel generator building emergency ventilation system (not exposed to harsh environment)
  - j. Intake structure emergency ventilation system (not exposed to harsh environment)
13. Emergency evacuation alarm system (not classified as Class IE equipment)
14. Diesel generator systems (not exposed to harsh environment)
  - a. Diesel generator fuel oil storage and transfer system
  - b. Diesel generator cooling water system

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 2-1

LIST OF SYSTEMS CONTAINING CLASS IE ELECTRICAL EQUIPMENT  
(Sheet 3 of 3)

- c. Diesel generator starting system
- d. Diesel generator lubrication system
- e. Diesel generator combustion air intake and exhaust system
- 15. Auxiliary feedwater system<sup>(a)</sup>
- 16. Fuel pool cooling system (not required for LOCA/HELBA mitigation)
- 17. Reactor protection system (electronic equipment in control building not exposed to harsh environment)<sup>(a)</sup>
- 18. Engineered safety features actuation system (electronic equipment in control building exposed to harsh environment)<sup>(a)</sup>
- 19. Radiation monitors (airborne)<sup>(a)</sup>
- 20. Shutdown cooling system<sup>(a)</sup>
- 21. Post accident monitoring<sup>(a)</sup>
- 22. Reactor coolant gas system (new system to be added to FSAR)<sup>(a)</sup>
- 23. Main steam isolation system<sup>(a)</sup>

### 2.3 TMI EQUIPMENT REQUIREMENTS

Class IE electrical equipment presently installed to meet TMI requirements have been addressed with respect to their environmental qualification. The equipment presently installed to meet NUREG 0588/0737 requirements and located in harsh areas (as defined in this report) are addressed in the applicable sections of this report and are not considered separately.

### 2.4 FSAR REQUIREMENTS FOR LOCA/HELBA

FSAR section 3.11, Environmental Design of Mechanical and Electrical Equipment provides the detailed basis for the environmental qualification of

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Class IE electrical equipment for San Onofre Nuclear Generating Station Units 2 and 3. The normal, accident and design environmental conditions described by the pressure, temperature, humidity and chemical environment envelope inside containment after a loss-of-coolant accident (LOCA) are presented in FSAR table 3.11-1. These environmental conditions are consistent with the environmental qualification requirements as presented in IEEE Standard 323-1971 and NUREG-0588, Category II.

FSAR table 3.11-2 lists and categorizes systems required to mitigate a design basis accident (DBA) or to attain a safe shutdown. The systems listed in this table are designed for operation in the most severe temperature, pressure, humidity, and radiation environment that exists at the equipment location during normal operation, assuming proper routine preventive maintenance is performed. The design basis for equipment is to perform its required safety function with the combination of temperature, pressure, humidity, chemical spray environment, and maximum calculated integrated radiation exposure at the equipment location postulated for its DBA. In addition, steam and feedwater line breaks outside the containment are analytically checked to ensure that no additional qualifications need be applied to components that could be affected by these breaks.

For the purposes of this report, the main steam line break (MSLB) and high energy line break accident (HELBA) profiles are enveloped by the LOCA profile described in Chapter 3.

## 2.5 POST-ACCIDENT MONITORING INSTRUMENTATION (PAMI)

Several aspects of the PAMI qualification methodology for the specific instruments addressed in this report require further discussion.

In several cases, the PAMI function is performed by instruments which also have an accident mitigation function. These instruments will have been LOCA/MSLB qualified for the limiting event, but not necessarily tested for the operating duration associated with their PAMI function. Since temperatures are significantly reduced and radiation levels have decayed considerably in the period following the initial 30 days of the event, it would

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

appear that an analytical basis exists for providing confidence that such instruments will continue to operate for the event duration. This analysis would include parameters such as "as-tested" margins on radiation and temperature, method of long-term operation (intermittent or continuous), condition of vulnerable components following the qualification test, credit for diverse qualified instruments to provide information on the same parameter, etc. The PAMI presently addressed in this report have been tested for at most 30 days, consistent with the plant design basis.

Table 7.5-2 in the FSAR gives accuracy requirements for the subject PAMI. These accuracies are target values which have been established using:

- A. Engineering judgement based on an evaluation of what the operator will use the monitored parameter for and what the expected capability of the instrument is from its specifications.
- B. More stringent criteria imposed on the instrument because of its use for a mitigation function.

The acceptability of qualification test results is determined based on these target values in light of the above two criteria. If a PAMI does not meet its stated accuracy requirement during a test, the instrument may still be considered fully qualified for its intended service based on specific consideration of the use for the information that instrument provides. In addition, if diverse means are available for a cross-check on the same monitored parameter, this would reinforce acceptable qualification.

The same methodology as described above is applied in the cases of those PAMI that may have response time requirements.

A review of the overall PAMI design basis is presently being conducted using Reg. Guide 1.97 and when complete will incorporate the approximate bases for and qualification documentation of the PAMI equipment.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

3. ENVIRONMENTAL CONDITIONS

3.1 ACCIDENT PROFILE

The normal, accident and design environmental conditions for equipment used in the San Onofre Nuclear Generating Station, Units 2 and 3, are described in table 3.11-1 of the FSAR. IEEE Standard 323-1971 and NUREG-0588 Category II have been used to establish requirements for qualification tests and analysis performed on the electrical equipment exposed to these environmental conditions.

3.1.1 ENVIRONMENTAL CONDITIONS INSIDE CONTAINMENT

The environmental qualification and design condition envelope is based on an analysis of the containment response to a spectrum of hot and cold leg LOCAs. The analyses were performed using Bechtel's COPATTA containment response analysis program. The COPATTA program predicts pressures and temperatures within the containment building atmosphere and sump regions and the temperature profiles in various modeled structures. A condensed description of the COPATTA code appears in FSAR paragraph 6.2.1.1.3 and a complete description can be found in Bechtel Topical Report BN-TOP-3. The methodology used in the COPATTA program is consistent with that provided in NUREG-0588 as applied to LOCA analyses. The analyses used to define the qualification envelope (FSAR table 3.11-1) was developed from break mass/energy flow data provided by Combustion Engineering and are presented in FSAR section 6.2. The worst case LOCA is a double-ended suction leg slot break ( $9.82 \text{ ft}^2$ ) at 102% power with loss of off-site power and failure of one diesel generator. This postulated LOCA generates a calculated peak containment pressure of  $55.1 \text{ lb/in.}^2 \text{ g}$  and a peak containment vapor temperature of 287F. The post-accident design envelope for safety-related equipment as shown in FSAR table 3.11-1 and figures 3-1 and 3-2 in this report is as follows.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

<u>Time Following LOCA</u>	<u>Pressure (lb/in.<sup>2</sup>g)</u>	<u>Temperature (°F)</u>
0 to 15 minutes	60	300
15 to 60 minutes	50	250
1 to 24 hours	40	200
1 to 30 days	20	200

The evaluation of environmental conditions associated with a main steam line break (MSLB) in containment is discussed in the responses to NRC questions 022.18, 022.54, 022.55, 022.56, 022.57, 022.58, and 022.60.

This evaluation was performed utilizing the Bechtel COPATTA code modified to incorporate the modeling set forth in the NRC Containment Systems Branch Interim Evaluation Model consistent with the methodology presented in NUREG-0588, Appendix B. The most severe MSLB accident, 102% power with cooling train failure and off-site power available, has been analyzed and the results are shown in Responses to NRC Questions figure 22.54-1 and compared with earlier results. In addition to re-evaporation of up to 8% of heat sink condensate during the period of containment superheat, current start times for containment air coolers and sprays as shown in FSAR table 6.2-26 were used for the CSB-IEM analysis. These start times are 5-seconds earlier for both air coolers and sprays than the times used in the prior FSAR analysis. The current analysis using the NRC IEM yields a peak containment temperature of 405.6F and a peak containment pressure of 54.2 lb/in.<sup>2</sup>g. These values are lower than the peak values of 413.4F and 55.7 lb/in.<sup>2</sup>g for peak temperature and pressure, respectively, reported in FSAR table 6.2-9 for the 102% power MSLB with cooling train failure. The combined effect of the 5-second earlier start time for air coolers and spray is estimated to lower the peak temperature by 3F and lower the peak pressure by 0.25 lb/in.<sup>2</sup>g. The additional reduction in containment peak temperature and pressure is due to the condensate re-evaporation allowed in the CSB-IEM.

Previously reported MSLB containment response analyses in FSAR table 6.2-9 are conservative compared to the CSB-IEM and remain valid for the purpose of identifying the worst case MSLB to be used for the environmental qualification analysis. Responses to NRC Question 022.54-1 compares the entire spectrum of large and small MSLB accidents analyzed from the standpoint of

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

peak containment temperature and pressure and total time the vapor temperature exceeds 300F. On the basis of peak containment pressure and temperature, the 102% power MSLB with cooling train failure is the most severe. This MSLB exhibits peak containment conditions of 55.7 lb/in.<sup>2</sup>g and 413.4F. Several cases generate vapor temperatures above 300F for slightly greater lengths of time than the 85-seconds for the reference MSLB. However, they all exhibit lower peak temperatures, and the maximum increase time above 300F is only 5-seconds for the 25% power MSLB with cooling train failure accompanied by a peak temperature of only 394F. Consequently, the 102% power MSLB with cooling train failure is designated the design basis MSLB for safety-related component thermal analysis and environmental qualification.

Since the design basis MSLB generates a containment vapor temperature which exceeds the design envelope for 85-seconds during the first 90-seconds following the pipe break, the thermal response of a representative member of each type of safety-related component inside containment was determined.

The analysis performed using the Bechtel COPATTA code was modified to conform to NUREG-0588, Appendix B, as embodied in the earlier NRC CSB-IEM document. These analyses have been reported in the Response to NRC Questions 022.58 and 022.60. The analysis showed the surface temperature of all but three components remain below the qualification value. The three components are: (1) limitorque valve motor operator motor, (2) electrical cable and (3) solenoid valve switch casing. For these three components, with calculated surface temperatures above qualification, all show the internal temperatures in the vicinity of the sensitive constituents well below the qualification value.

Since the time the containment temperatures exceed the LOCA qualification value are extremely short, and calculated component internal temperatures do not exceed qualification parameters, the post MSLB environment is considered to be adequately enveloped by the post-LOCA environment.

The evaluation of environmental conditions associated with high energy line break (HELB) is presented in FSAR section 3.6. A listing of the lines that are considered capable of failure is given in FSAR tables 3.6-1 and 3.6-2. The effects of each postulated piping failure including pipe whip, jet impingement, and environmental analysis are examined in FSAR Appendix 3-6A.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

For each line break postulated, a zone of influence was generated and any safety-related equipment in that zone of influence identified. Specific design features used for protecting the safety-related equipment are identified in Appendix 3.6A. In general, design features such as physical separation, pipe supports, pipe restraints, and conduit supports are provided where proven that pipe whip or jet impingement effects could damage essential systems to an extent which would impair their design function or affect necessary component operability. In addition, where analysis shows that adverse effects could still result, physical barriers are provided to protect essential components. Finally, the ability of specific safety-related systems to withstand a single active failure concurrent with the postulated event is discussed in the failure modes and effects analyses provided in FSAR sections 5.4, 6.2, 6.3, 6.5, 7.2, 7.3, 8.3, 9.2, and 9.3. For the environmental analysis, the temperature, pressure, and humidity conditions resulting from a HELB are enveloped by the environmental conditions resulting from an MSLB or LOCA DBA.

### 3.1.2 ENVIRONMENTAL CONDITIONS OUTSIDE CONTAINMENT

Plant areas containing high energy lines considered were systematically identified in a review of piping layout and plant arrangement. These areas are separately addressed in FSAR section 3.6A.3. This systematic review verifies that the effects of postulated auxiliary system piping breaks (HELBA) are isolated, physically remote or restrained by plant design features from safety related systems or components. Where jet impingement due to HELBA breaks on safety-related equipment could occur, it has been demonstrated that insufficient impingement load was generated to damage the equipment. In three cases where this condition was not met, barriers have been erected to protect the equipment.

For each area previously identified, an environmental analysis is performed to verify that the safety-related systems and components exposed are qualified to operate in the maximum temperature, pressure, and humidity envelope generated by the piping break. The following plant areas are addressed as follows.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

3.1.2.1 Main Steam and Feedwater Line Valve Rooms

The main steam and feedwater line valve rooms located between the safety building and the containment building have been analyzed for environmental effects of single-area steam and feedwater line breaks. The results of the analysis are contained in the response to NRC question 010.47. The objective of the analysis was to define short-term peak pressure-temperature conditions in the valve rooms in response to single area pipe breaks. The analysis was performed using the Bechtel computer program, COPDA, a multi-node, thermal-hydraulic code described briefly in FSAR paragraph 6.2.1.2.3 and in detail in the Bechtel topical report BN-TOP-4. The COPDA code does not take credit for heat transfer to surrounding structures and provides a conservative calculation of short-term subcompartment pressures and temperatures as a function of time following pipe breaks consistent with the intent of NUREG-0588 for pipe breaks outside containment. The analysis showed the single area rupture of a main steam line outboard of the main steam restraint structure to be limiting. The results indicated equipment in the valve rooms will not receive significant exposure to temperatures exceeding the design value of 235F shown in FSAR table 3.11-1. Exposure of components to the MSLB environment would continue until the MSIV's close or one steam generator boils dry in event of MSIV failure. This condition will exist for a maximum of 16 minutes.

3.1.2.2 Auxiliary Feedwater Pump Room

The post-accident and design conditions originally specified in FSAR table 3.11-1 for the auxiliary feedwater pump room did not reflect the consequences of rupture of the 6-inch steam line supplying the turbine-driven auxiliary feedwater pump. An analysis of the room environmental response to rupture of the steam line consistent with NUREG-0588 was subsequently completed using the Bechtel COPATTA and COPDA programs and the post-accident and design conditions for the room upgraded to 302F, 2.76 lb/in.<sup>2</sup>g and 100% relative humidity (FSAR Amendment 21). The duration of exposure to the pipe break environment will not exceed 30-minutes at which time operator action is assumed to terminate steam flow to the pump room. Qualification of the turbine-driven auxiliary feedwater pump and associated controls to the revised pump room post-accident environment is not required

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

since the turbine driven pump will not be operable following the steam line break. The second motor-driven auxiliary feedwater pump to be added to the Units 2 (and 3) auxiliary feedwater pump room will be identical to the existing motor-driven pump and be qualified to the calculated environment, providing assurance that both motor-driven pumps will remain operable on a post steam-line break environment. The pump room ventilation system has already been qualified to 165C (329F) and will function to return the pump room environment to ambient conditions following termination of steam flow.

### 3.2 MARGINS DBA

#### 3.2.1 TEMPERATURE-PRESSURE MARGIN

The temperature-pressure margin as defined for environmental qualification includes the differences in temperature and pressure between the post-accident environmental design conditions specified in FSAR table 3.11-1 and the representative conditions which could conservatively be expected to occur in a DBA as given in paragraph 3.1.2.1. The conservatisms used in calculating the expected DBA environmental parameters are discussed in FSAR paragraph 6.2.1.1.3, Design Evaluation. These conservatisms provide additional separation between design parameters and those environmental parameters which could realistically be expected to occur under DBA conditions.

The margin discussed in NUREG-0588 Section 3(1) and 3(2) strongly imply that margin be quantified and applied across-the-board for all equipment. No such standard existed when the subject equipment was designed and built. However, good engineering practice was followed in each case and practically all levels in the design process contain margin to account for uncertainties (for example, one common practice is equipment derating).

The radiation margin specified for environmental qualification is the inherent differences between the calculated maximum radiation doses for the post-accident design basis accident (DBA) environment and those maximum radiation doses which could realistically be expected to occur under DBA conditions. These conservatisms are defined and outlined in NUREG-0588, Appendices.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

### 3.2.2 OPERATING TIME

Some devices perform their safety function (i.e., reactor trip) within the first 30-seconds following an accident. These devices have not been required to demonstrate an additional one hour qualification time because (1) their required action has been fulfilled and (2) no additional action is required.

### 3.3 HIGH RADIATION

#### 3.3.1 LEVELS INSIDE CONTAINMENT

A review of safety-related equipment which may be unduly degraded by radiation during post-accident operation has been conducted. The guidance provided by NUREG-0588 and NUREG-0737 has been used in determining radiation exposures.

A loss-of-coolant accident results in completely depressurizing the primary system and large releases of radioactive material to the containment atmosphere. The following sources of radiation are then available:

##### 3.3.1.1 Core Inventory

Table 3-1 presents the core inventory of radio isotopes. These sources are based on 105% of full power core conditions (3560 MWT).

##### 3.3.1.2 Reactor Coolant

The following fractions of core inventory are diluted in the reactor coolant volume of 82,000 gallons.

- A. 100% Noble Gas
- B. 50% Halogens (I, Br)
- C. 1% Solids

Table 3-2 presents reactor coolant concentrations at start of postulated accident.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

3.3.1.3 Containment Airborne

The following fractions of core inventory are diluted in the containment volume of  $2.3 \times 10^6 \text{ ft}^3$ .

- A. 100% Noble Gas
- B. 25% Halogens
- C. 1% Solids

As discussed below, 25% of the core inventory of iodines are considered to plateout on containment internal surfaces.

The iodine released to the containment is removed by the containment spray system. The spray removal constants, spray cutoff times, and iodine forms used are shown in table 3-3.

The model used considers first generation daughters. Table 3-4 shows concentrations of radioisotopes inside containment.

3.3.1.4 Plateout Source Terms

Iodine released from the core will plateout on surfaces within containment. The amount of iodine which is available for plateout is 25% of the core iodine inventory. Conservatively, no time dependency was assumed for the mechanism of plateout. All 25% of the core inventory was assumed to plateout immediately following a postulated accident.

The total available iodine plateout surface area taken into consideration was the concrete, stainless, galvanized, and carbon steel surfaces within containment. The total surface area available is  $3.6 \times 10^5 \text{ ft}^2$ .

The concentration of iodine available for plateout immediately following a postulated accident are presented in table 3-5.

3.3.1.5 Sump Sources

For the purpose of qualifying equipment which is located near the sump, a sump source was determined. The following fractions of core inventory are

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 3-1

CORE INVENTORY (CURIES)

Nuclide	Activity (Ci)	Nuclide	Activity (Ci)	Nuclide	Activity (Ci)
Br-84	2.85E-7	Mo-99	1.89E-8	I-135	1.89E-8
Br-85	3.99E-7	Tc-99m	2.27E-7	Xe-135m	5.51E-7
Kr-85m	3.98E-7	Ru-103	9.18E-7	Xe-135	4.62E-7
Kr-85	8.73E-5	Ru-106	8.23E-6	Cs-135	1.15E-1
Kr-87	7.44E-7	Te-129m	1.07E-7	Cs-136	1.78E-5
Kr-88	1.09E-8	Te-129	3.29E-7	Xe-137	1.80E-8
Rb-88	1.10E-8	I-129	2.08E-0	Cs-137	4.15E-6
Kr-89	1.41E-8	I-131	8.96E-7	Xe-138	1.79E-8
Rb-89	1.46E-8	Xe-131m	6.16E-5	Cs-138	2.04E-8
Sr-89	1.45E-8	Te-132	1.33E-8	Cs-140	1.81E-8
Sr-90	9.27E-6	I-132	1.33E-8	La-140	1.95E-8
Y-90	9.22E-6	Te-133m	1.07E-8	Ba-143	1.60E-8
Sr-91	1.78E-8	Te-133	1.13E-8	La-143	1.81E-8
Y-91m	1.05E-8	I-133	2.06E-8	Ce-143	1.81E-8
Y-91	1.79E-8	Xe-133	1.97E-8	Pr-143	1.81E-8
Y-95	1.87E-8	Cs-134	1.03E-6	Ce-144	1.26E-8
Zr-95	1.87E-8	Te-134	2.12E-8	Pr-144	1.26E-8
Nb-95	1.90E-8	I-134	2.39E-8		

Table 3-2

REACTOR COOLANT CONCENTRATIONS (CURIES/CC)  
(AT START OF ACCIDENT)

Nuclide		Nuclide		Nuclide	
Br-84	4.59E-02	Ru-106	2.64E-04	Xe-135	1.48E-01
Br-85	6.43E-02	Te-129M	3.44E-04	Cs-135	3.69E-10
Kr-85M	1.27E-01	Te-129	1.05E-03	Cs-136	5.72E-06
Kr-85	2.80E-03	Tc-99M	7.29E-04	Xe-137	5.78E-01
Kr-87	2.39E-01	I-129	3.34E-09	Cs-137	1.33E-04
Kr-88	3.50E-01	I-131	1.44E-01	Xe-138	5.75E-01
Rb-88	3.53E-03	Xe-131M	1.98E-03	Cs-138	6.55E-03
Kr-89	4.54E-01	Te-132	4.27E-03	Cs-140	5.81E-03
Rb-89	4.69E-03	I-132	2.14E-01	La-140	6.26E-03
Sr-89	4.66E-03	Te-133M	3.44E-03	Ba-143	5.14E-03
Sr-90	2.98E-04	Te-133	3.63E-03	La-143	5.81E-03
Y-90	2.96E-04	I-133	3.31E-01	Ce-143	5.81E-03
Sr-91	5.72E-03	Xe-133	6.33E-01	Pr-143	5.81E-03
Y-91M	3.37E-03	Cs-134	3.31E-05	Ce-144	4.05E-03
Y-91	5.75E-03	Te-134	6.81E-03	Pr-144	4.05E-03
Nb-95	6.10E-03	I-134	3.85E-01	Zr-95	6.01E-03
Mo-99	6.07E-03	I-135	3.03E-01		
Ru-103	2.95E-03	Xe-135m	1.77E-01		

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 3-3  
CONTAINMENT SPRAY PARAMETERS

Iodine Form	Removal Constant (hr-1)	Cutoff Time (hr)	Proportion of Total Iodine
Elemental	4.8	.96	91%
Particulate	.22	38.7	5%
Organic	0.0	0.0	4%

Table 3-4  
CONTAINMENT AIRBORNE CONCENTRATION (CURIES/CC)  
(AT START OF ACCIDENT)

Nuclide	Activity	Nuclide	Activity	Nuclide	Activity
Br-84	1.06E-04	Ru-106	1.23E-06	Xe-135	6.93E-04
Br-85	1.49E-04	Te-129m	1.60E-06	Cs-135	1.72E-12
Kr-85m	5.97E-04	Te-129	4.93E-06	Cs-136	2.67E-08
Kr-85	1.30E-05	I-129	7.80E-12	Xe-137	2.70E-03
Kr-87	1.11E-03	I-131	3.36E-04	Cs-137	6.22E-07
Kr-88	1.63E-03	Xe-131m	9.24E-06	Xe-138	2.68E-03
Kr-89	2.12E-03	Te-132	1.99E-05	Cs-138	3.06E-05
Rb-88	1.65E-05	I-132	4.99E-04	Cs-140	2.71E-05
Rb-89	2.19E-05	Te-133m	1.60E-05	La-140	2.92E-05
Sr-89	2.17E-05	Te-133	1.69E-05	Ba-143	2.40E-05
Sr-90	1.39E-06	I-133	7.72E-04	La-143	2.71E-05
Y-90	1.38E-06	Xe-133	2.95E-03	Ce-143	2.71E-05
Sr-91	2.67E-05	Cs-134	1.54E-07	Pr-143	2.71E-05
Y-91m	1.57E-05	Te-134	3.18E-05	Ce-144	1.89E-05
Y-91	2.68E-05	I-134	8.97E-04	Pr-144	1.89E-05
Nb-95	2.85E-05	I-135	7.09E-04	Zr-95	2.80E-05
Mo-99	2.83E-05	Xe-135m	8.26E-04	Tc-99m	3.40E-06
Ru-103	1.37E-05				

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

assumed to be diluted in the sump volume of 400,000 gallons immediately following the postulated accident.

- A. No Noble Gases
- B. 50% Halogens
- C. 1% Solids

Table 3-6 presents the isotopic concentration in the sump immediately following the postulated accident.

#### 3.3.1.6 Methodology

The following calculation methodology is utilized. Gamma and beta doses are determined for three types of radioactive source distribution: isotopes suspended in the containment atmosphere, plated-out on containment surfaces, or mixed in the containment sump water. A given piece of equipment may receive a dose contribution from any or all of these sources. The amount of dose contributed by each of these sources is determined by the location of the equipment and the effects of shielding.

##### A. Gamma Radiation:

##### 1. Containment Airborne

The finite cloud model is used to calculate the gamma dose to equipment from airborne sources. This model uses a sphere with the same volume as that of the containment.

##### 2. Plateout

The contribution to the gamma dose from iodine plateout is calculated using a cylindrical shell source of the same height and volume as that of the containment. No internal structures are modeled. Air attenuation is not considered.

##### 3. Sump

The gamma dose from the sump is calculated by modeling the sump as a cylinder with a radius equal to that of the containment and a height equal to that of the sump flood level of 7 ft. The dose is then calculated off the end of this cylinder.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 3-5  
PLATEOUT CONCENTRATION  
(AT START OF ACCIDENT)

Isotope	Concentration MicroCi/CC
I-129	8.0 E-6
I-131	3.43E+2
I-132	5.09E+2
I-133	7.89E+2
I-134	9.15E+2
I-135	7.24E+2
I-137	5.28E+2
I-138	3.65E+3

B. Beta Radiation:

1. Containment Airborne

The beta doses to equipment from airborne sources following a postulated accident are calculated using a semi-infinite cloud model. All the beta energy is assumed to be absorbed by the equipment.

2. Plateout

Beta doses to equipment due to plateout assume that the iodine plates out uniformly on all the plateout surfaces. An infinite plane source model is used to calculate the equipment dose.

3. Sump

The contribution to the beta dose from the sump is calculated by modeling the sump as an infinite cylindrical source of infinite thickness. Three distinct beta energy groups were used and appropriate considerations were given for beta attenuation in air above the sump.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 3-6  
CONTAINMENT SUMP ACTIVITIES (CURIES)  
(AT START OF ACCIDENT)

Nuclide	Activity	Nuclide	Activity
Br-84	$1.45 \times 10^7$	Te-133m	$1.07 \times 10^6$
Br-85	$2.04 \times 10^7$	Te-133	$2.18 \times 10^6$
Rb-88	$1.1 \times 10^6$	I-133	$1.03 \times 10^8$
Rb-89	$1.46 \times 10^6$	Cs-134	$1.03 \times 10^4$
Sr-89	$1.45 \times 10^6$	Te-134	$3.1 \times 10^6$
Sr-90	$5.55 \times 10^7$	I-134	$1.20 \times 10^8$
Y-90	$9.22 \times 10^4$	I-135	$9.58 \times 10^7$
Sr-91	$1.09 \times 10^8$	Cs-135	0.115
Y-91m	$1.05 \times 10^6$	Cs-136	$1.78 \times 10^3$
Y-91	$1.79 \times 10^6$	Cs-137	$4.15 \times 10^4$
Zr-95	$4.97 \times 10^6$	Ba-137m	$3.86 \times 10^4$
Nb-95	$1.90 \times 10^6$	Cs-138	$2.04 \times 10^6$
Mo-99	$5.14 \times 10^6$	Cs-140	$1.19 \times 10^8$
Tc-99m	$2.27 \times 10^5$	Ba-140	$1.93 \times 10^6$
Ru-103	$2.76 \times 10^6$	La-140	$1.95 \times 10^6$
Ru-106	$8.23 \times 10^4$	Ba-143	$3.65 \times 10^6$
Te-129m	$1.07 \times 10^5$	La-143	$1.81 \times 10^6$
Te-129	$7.74 \times 10^5$	Ce-143	$1.81 \times 10^6$
I-129	1.04	Pr-143	$1.81 \times 10^6$
I-131	$4.7 \times 10^7$	Ce-144	$4.49 \times 10^6$
Te-132	$2.54 \times 10^6$	Pr-144	$1.26 \times 10^6$
I-132	$6.65 \times 10^7$		

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

In addition to gamma and beta radiation, doses due to normal operation over a 40-year plant life are also considered. Contributions from neutrons and N-16 of reactor coolant with 1% failed fuel were included.

Table 3-7 presents the 0-30 day integrated accident doses. For each specific component, the appropriate normal operational dose is included along with the pertinent accident contributors. Credit for equipment and internal containment shielding is taken for various components. Figure 3-3 presents beta dose reduction factors versus size of component.

### 3.3.2 LEVELS OUTSIDE CONTAINMENT

The sources of radiation outside the containment are itemized below.

#### 3.3.2.1 Containment Direct Dose

The direct dose from containment is due to the sources presented in table 3-7. Of special concern are major containment penetrations such as the equipment hatch, personnel lock, and purge penetrations.

#### 3.3.2.2 Containment Leakage

It is assumed that the containment leaks at a rate of 0.1 volume % per day for the first 24-hours and 0.05 volume % thereafter. The source term for this leakage is based on the containment airborne sources and spray parameters provided.

Table 3-7  
INTEGRATED 0-30 DAY POST-ACCIDENT DOSES INSIDE CONTAINMENT

Source Contributor	Gamma (Rads)	Beta (Rads)
Airborne	1.3 E7	9.8 E7
Plateout	5.7 E5	8.6 E6
Sump	1.1 E7	4.1 E7

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

3.3.2.3 Safety Injection System

The low-pressure safety injection pumps are assumed to be operating in the shutdown cooling mode. The source terms for this operation are those given for the reactor coolant system described in paragraph 3.3.1.2.

The high-pressure safety injection pumps are assumed to be operating in the recirculation mode. Prior to start of recirculation, the high-pressure safety injection system will contain non-radioactive water from the refueling water storage tank. At the start of recirculation (30-minutes after start of accident), the source terms are those given for the sump in paragraph 3.3.1.5.

3.3.2.4 Containment Spray System

The containment spray system is assumed to be operating in the recirculation mode. Prior to the start of recirculation, the containment spray system will contain non-radioactive water from the refueling water storage tank. At the start of recirculation (30 minutes after start of accident), the source terms are those given for the sump in paragraph 3.3.1.5.

3.3.2.5 Nuclear Plant Sampling System

The lines to the post-accident sample lab are considered to contain sources discussed for inside containment consistent with the intended service. The portions of the sample lines between the post-accident and normal operation sample labs are not considered to contain highly radioactive material since automatic isolation prevents this condition.

3.3.2.6 Valve Leakage

For purposes of equipment qualification, it is assumed that the shutdown and recirculation cooling non-packless non-diaphragm valves leak at the rate of 10CC/hr per inch of valve stem diameter. This results in a radioactive cloud in the rooms where the valve leakage occurs.

The following systems were considered but determined not to be sources of radiation outside the containment.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

3.3.2.7 Reactor Coolant Chemical and Volume Control System (CVCS)

The CVCS is not considered to contain highly radioactive fluid following a postulated accident, except for piping used in the post-accident sampling system return line. The CVCS is not assumed to become highly radioactive because:

- A. The system is automatically isolated.
- B. The letdown system is not required for accident mitigation.
- C. Post-accident degassing capability of the primary system is provided by a remotely operated reactor coolant high point vent system.

3.3.2.8 Coolant Radwaste System

The coolant radwaste system is not assumed to contain highly radioactive fluid following a postulated accident, except for the piping used in the sample return line. This assumption is based on:

- A. The system is automatically isolated.
- B. The system is not required for accident mitigation.

The piping used in the sample liquid return line is considered to contain source terms as assumed for reactor coolant.

3.3.2.9 Waste Gas System

The waste gas surge and decay tanks are not considered to contain highly radioactive material generated following an accident, since:

- A. The waste gas system is automatically isolated.
- B. The waste gas system is not required for accident mitigation.
- C. Post-accident degassing capability of primary system is provided by a remotely operated reactor coolant high point vent system.
- D. Waste gas generated in the sample lab is returned to the containment.

The piping used in the sample gas return line is considered to contain highly radioactive material.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

### 3.3.3 CALCULATIONAL METHODOLOGY

The methodology used to calculate the individual dose contributions are listed below.

#### 3.3.3.1 Direct Dose From Containment

In order to calculate the direct dose from containment, the gamma dose is determined by using the QAD, point-kernel, shielding code. The concrete containment shell and interior concrete structures are modeled. The betas are attenuated by the containment structure.

#### 3.3.3.2 Airborne Sources

Leakage from containment and valves was considered. For areas outside buildings, the airborne isotopic concentrations are determined by using the control room  $x/q$  of  $3.1 \text{ E-3 sec/m}^3$ .

The entire containment leakage of paragraph 3.3.2.2 is assumed to be released into the penetration building along with the valve leakages. Credit is taken for ventilation systems within the building. For buildings not directly connected to the containment (e.g., safety equipment building), only the airborne contribution from the valves was considered. The gamma and beta doses from the airborne sources are based on a finite cloud model considering the dimensions of the room where the component is located.

#### 3.3.3.3 Direct Dose From Piping

Piping containing radioactive fluid is modeled as a cylindrical source. Credit is taken for concrete shielding as appropriate. Beta radiation from piping is negligible due to the steel thickness.

#### 3.3.3.4 Normal Operational Dose

Doses due to normal operation over a 40-year plant life are considered. Contributions from piping containing radioactive material are included.

The results of the radiation calculations are shown in table 3-8 which presents the 0-30 day integrated accident doses.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 3-8  
INTEGRATED 0-30 DAY POST-ACCIDENT DOSES  
OUTSIDE CONTAINMENT (RADS)

Location	Gamma (Rads)	Beta (Rads)	Total (Rads)
Auxiliary Feed Water Pump Room	3	24	27
Diesel Generator Building	2	24	26
Intake Structure	51	804	855
Safety Equipment Building			
Rooms for HPSI, LPSI and Containment Spray Pumps	$3.2 \times 10^7$	$3.1 \times 10^4$	$3.2 \times 10^7$
Shutdown Heat Exchanger Rooms	$2.6 \times 10^7$	$1.9 \times 10^6$	$2.8 \times 10^7$
Chemical Storage Tank Room	$3.6 \times 10^4$	$1.9 \times 10^6$	$2.0 \times 10^6$
Component Cooling Water Pump Rooms	$1.2 \times 10^5$	$3.1 \times 10^4$	$1.5 \times 10^5$
Penetration Areas			
Elev. 9' to 45'			
NW corner near shutdown cooling line	$1.4 \times 10^7$	$2.7 \times 10^3$	$1.4 \times 10^7$
North Central in pipe chase area	$5.4 \times 10^5$	$2.7 \times 10^3$	$5.4 \times 10^5$
Other Areas	$4.7 \times 10^5$	$2.7 \times 10^3$	$4.7 \times 10^5$
Elev. 45' to 63'6"	$2.9 \times 10^3$	$3.6 \times 10^3$	$6.5 \times 10^3$
Radwaste Building	$3.68 \times 10^3$	-	$3.68 \times 10^3$

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

3.4 VOLTAGE AND FREQUENCY FLUCTUATIONS

3.4.1 VOLTAGE

Sustained voltage variations at rated frequency specified for Class IE equipment operation are as follows:

4160 volts ac  $\pm 10\%$

480 volts ac  $\pm 10\%$

120 volts ac  $\pm 10\%$

120 volt ac vital bus system  $\pm 2\%$

125 volts dc (range 105 - 140V dc)

Voltage qualification is not required because, electrical motors are designed in accordance with NEMA Standard MG-1, which allows sustained fluctuations of  $\pm 10\%$  in supply voltage. Motors can also function during voltage dips to 75% of normal for 15 seconds.

Control devices are specified to withstand voltage deviations in accordance with NEMA Standard ICS. All control components are within the applicable voltage ranges except for dc relays. During 125V dc battery equalizing, the voltage is 140V dc which exceeds the  $+10\%$  (137.5V dc) upper limit allowed by ICS. Due to the small, 2.5V dc, deviation and the fact that equalizing is done infrequently, operation or life of control devices will not be significantly affected.

For equipment powered by the vital buses, voltage variations are not a common mode concern. Each of the four protective channels are electrically isolated (IEEE Std. 279-1971) from each other and are separately powered by a similarly isolated vital bus, with each bus having its own inverter and battery.

These power sources are designed specifically to provide stable, regulated power. The four channel protection system is designed to protect the plant with up to two of these four channels inoperative. In addition, the equipment powered from the vital buses are designed for voltage variations of  $\pm 10\%$ , whereas the vital buses are designed to regulate voltage to within  $\pm 2\%$ . Therefore, voltage variations will not affect the ability of these systems to perform their required safety functions.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

### 3.4.2 FREQUENCY

Frequency fluctuations which take place on the auxiliary power system are considered minor and will not affect equipment qualification. Stability studies outlined in FSAR paragraph 8.2.2.1.2 indicate that the loss of 1275 mW of generation in the western United States system will result in a frequency droop of only 0.1 Hz, and automatic load shedding to maintain frequency stability will begin at 59.1 Hz.

The diesel generator frequency is limited to 60 Hz  $\pm 2\%$  steady state and 55 Hz during transients. Vital bus power supply inverters are designed for 60 Hz  $\pm 0.5$  Hz output.

The frequency deviations described above will have only extremely limited consequences on the performance of induction motors and control components and have been specified to operate at 60 Hz  $\pm 5$  Hz.

For equipment powered by the vital buses, frequency variations are not a common mode concern for the same reasons as previously described in the discussion of voltage variations. The equipment is designed for frequency variations of  $\pm 5\%$ , whereas the vital buses are designed to regulate frequency to within  $\pm 0.5\%$ . Therefore, frequency variations will not affect the ability of these systems to perform their required safety functions.

### 3.5 DUST

Dust is not considered to be a degrading medium in the areas addressed by this report. This is partially due to the seacoast location of the plant where blowing dust is normally not a major factor. Additionally, ventilating units for the containment and auxiliary feedwater pump area are equipped with air filters. Good housekeeping practices within safety-related areas are also utilized by Southern California Edison to prevent large accumulations of dirt.

### 3.6 AGING

Accelerated aging was not performed for all items of equipment covered by this report. For those devices, an aging analysis will be developed to evaluate the stresses imposed on the equipment which degrade performance. The

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

objective of the analysis will be to determine a time period for which acceptable equipment performance is highly probable. This time period will be the basis for recommending a periodic replacement schedule. This analysis may be performed by an independent consultant who is experienced in this analysis for the nuclear industry.

### 3.7 FLOODING AND SUBMERGENCE

In response to NRC question 032.16 all instrumentation and circuits that may become submerged as a result of a LOCA were evaluated. The water surface elevation inside the containment after a LOCA will be a maximum of 25' - 0".

The result of the evaluation requires that all safety-related devices that must remain functional after a LOCA, will be located above the 25 foot level. The following safety-related devices will be submerged post LOCA, but are not required to function after submergence.

- A. The RC loop hot leg large drain (train 2) and reactor coolant to regenerative heat exchanger letdown (trains 1 and 2) valves are located below the post-LOCA flood level (25 ft-0 in.). The safety function of these valves is to close and remain closed in a post-LOCA condition. Short circuits or grounds that may occur at the terminals for the 3-way solenoid valves which control the instrument air to the pneumatic actuators do not reverse the position of the valves after they have closed. Shorts between the limit switches and solenoids do not generate enough current for the solenoids to pick up due to the circuit resistance.

If the valves are open prior to a LOCA, isolation will occur prior to post-LOCA flood level, submerging the valves operators. Since the valve remains closed in a flooded environment, the valve performs its required safety function.

- B. The containment emergency sump level transmitters are submerged in a post-LOCA condition. These transmitters and the respective control room indication are not required by the operator for any

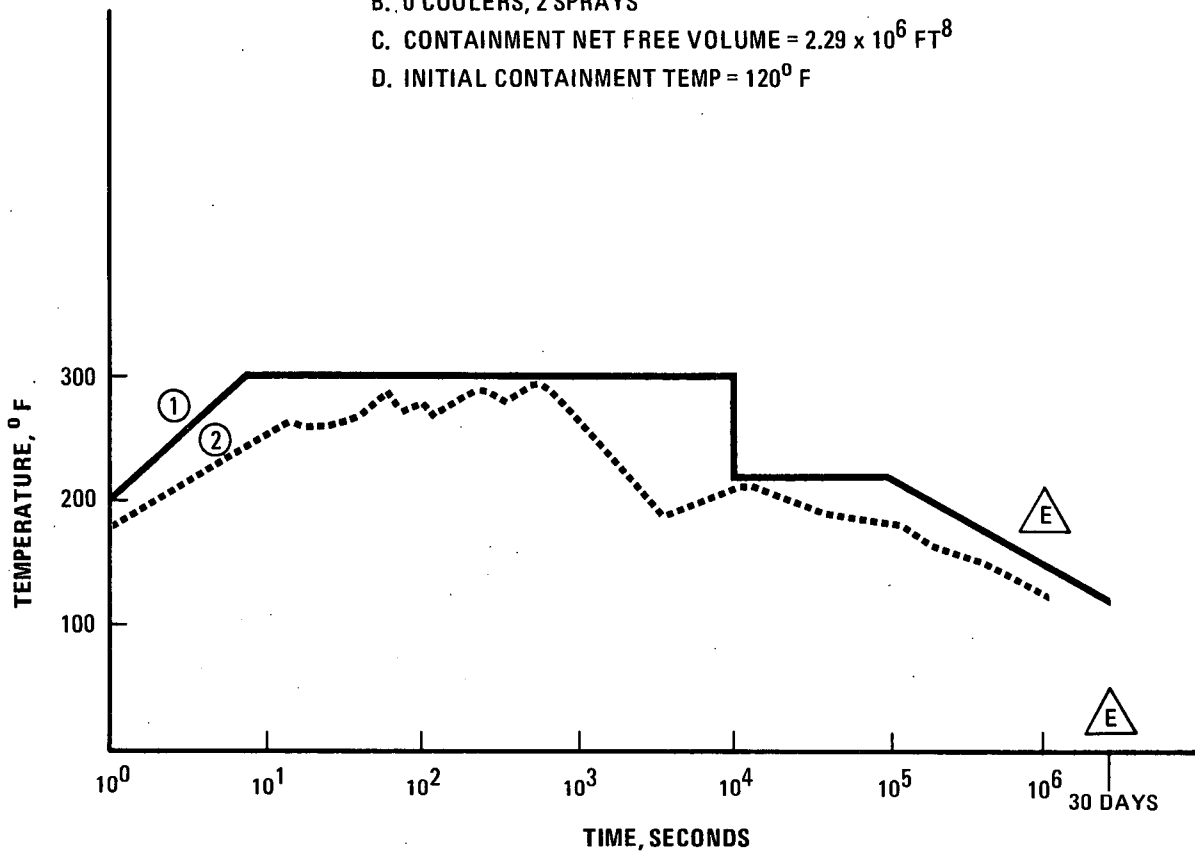
San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

of the design basis events. Short circuit of the terminals/wires is equivalent to a "no-signal" condition and accordingly does not degrade the IE instrumentation power supply system.

In addition, the occurrence of a short circuit is very unlikely since the transmitter terminals are located in a NEMA IV, watertight enclosure, and the device assembly is filled with silicone fluid to prevent water in leakage.

- C. The excore detectors, preamplifiers, and cables are submerged in a post-LOCA condition when the reactor cavity is flooded. However, the location of the excore detectors and cable is several feet above the bottom of the reactor vessel and would, therefore, not be submerged during the first 3- to 4-minutes after a postulated accident. The detectors would have fulfilled their required action within this time.

- ① DESIGN ENVELOPE CURVE  
 ② ACTUAL TEMPERATURE TRANSIENT FOR WORST  
 CASE LOCA BASED ON:  
 A. DOUBLE-EMBED SUCTION LINE BREAK (9.82 FT<sup>8</sup>)  
 B. 0 COOLERS, 2 SPRAYS  
 C. CONTAINMENT NET FREE VOLUME =  $2.29 \times 10^6$  FT<sup>3</sup>  
 D. INITIAL CONTAINMENT TEMP = 120° F

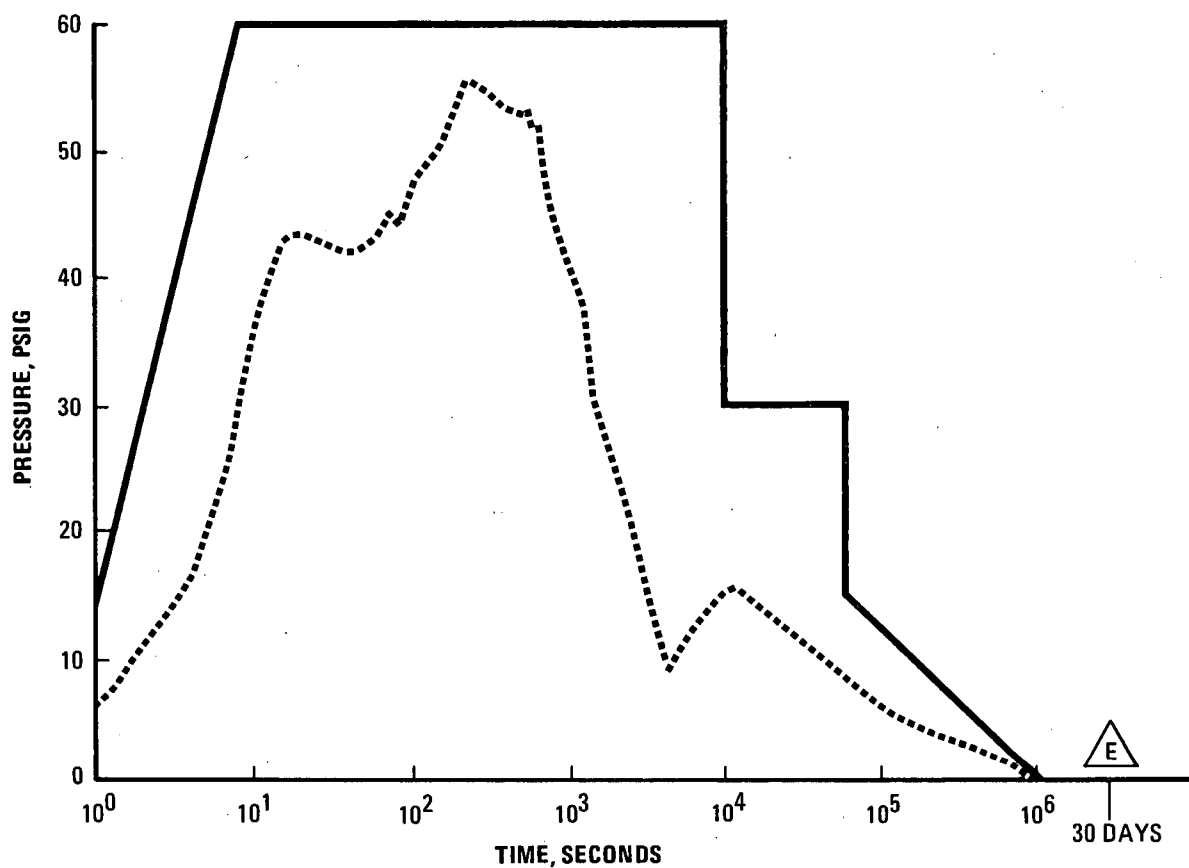


**SAN ONOFRE  
 NUCLEAR GENERATING STATION  
 Units 2 & 3**

CONTAINMENT ATMOSPHERE - TEMPERATURE  
 VS. TIME LOSS-OF-COOLANT  
 ACCIDENT (LOCA)

Figure 3-1

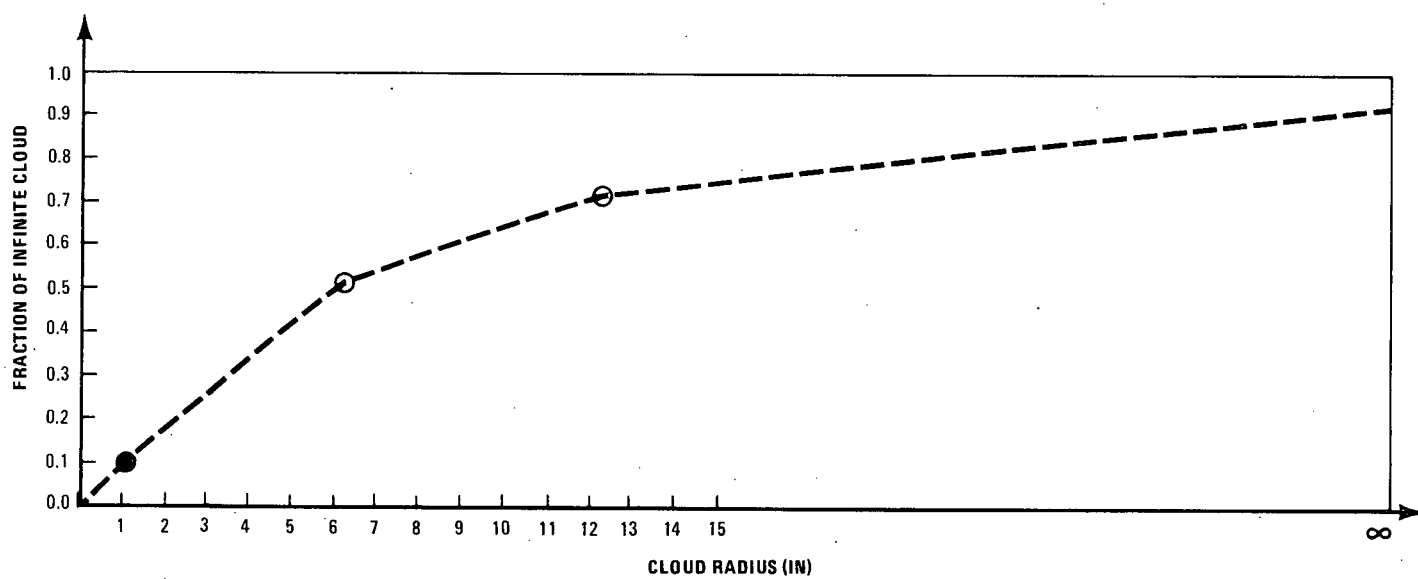
- ① DESIGN ENVELOPE CURVE  
 ② ACTUAL PRESSURE TRANSIENT FOR  
 WORSE CASE LOCA BASED ON:  
 A. DOUBLE-ENDED SECTION LIME BREAK (9.82A<sup>8</sup>)  
 B. 0 COOLERS, 2 SPRAYS  
 C. CONTAINMENT NET FREE VOLUME =  $2.29 \times 10^6$  FT<sup>3</sup>



**SAN ONOFRE  
 NUCLEAR GENERATING STATION  
 Units 2 & 3**

CONTAINMENT ATMOSPHERE - TEMPERATURE  
 VS. TIME LOSS-OF-COOLANT  
 ACCIDENT (LOCA)

Figure 3-2



**SAN ONOFRE  
NUCLEAR GENERATING STATION  
Units 2 & 3**

**BETA DOSE REDUCTION FACTOR**

**Figure 3-3**

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

4. MASTER EQUIPMENT LIST AND QUALIFICATION REVIEW

4.1 REVIEW TECHNIQUE

4.1.1 BALANCE OF PLANT (BOP)

The first step in conducting the review of the environmental qualification of Class IE equipment located in harsh environmental areas is to identify all the subject equipment. All electrical equipment in the plant is then categorized into either Non-Class IE or Class IE. The Class IE equipment is further sorted as to its location (harsh environment or benign environment). This is accomplished with a high degree of confidence for inclusion of all subject equipment by applying computer sorting techniques. A computer program, which is capable of sorting equipment by area location designation numbers, is used.

The format of the location number is alpha numeric with 13 positions. Each position identifies some feature of the equipment as follows:

(For explanation, the positions are designated as A B C D E F G H I J K L M)

<u>Position</u>	<u>Designates</u>
A.	Unit (2, 3, 0 is common)
B.	Safety Channel Class IE Circuit A, B, C, D (Non-Class IE is X)
C.,D.	Area Code Physical Location, the letter denotes structure, the numeral denotes elevation level for example:  B1 B6    Containment  J1        Refueling Water and Condensate Storage Tank Building. (The Auxiliary Feedwater Pump Room is in this building)  N1 - N5   Safety Equipment Building (The Main Steam Isolation Valve Room is an adjunct to this building)

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

<u>Position</u>	<u>Designates</u>
E.	Electrical System or Voltage Level Identifier
F,G,H,I,J,K.	Equipment or System Code Identifier
L,M.	Component Identifier

Class IE equipment, located in a harsh environment, is readily identified by the first four positions of its location number and the specific items can be identified by the last eight positions.

Supplementing the computer sorting techniques to identify the Class IE equipment in harsh environments is a thorough review of other project documents such as the instrument index, specifications, electrical drawings, etc. All identified equipment was then further analyzed, based upon verification with the FSAR and P&ID's to determine if it is actually required to mitigate or monitor the consequences of a postulated accident or place the plant in a cold shutdown condition.

To facilitate a uniform review of the environmental qualification of the above equipment, a review form entitled "Environmental Qualification Summary" was prepared. A copy of this form is included as Appendix C. The review form was prepared based upon the requirements of NUREG 0588 Category II. To be effective and useful, the form emphasizes the requirements of NUREG 0588 which need to be addressed on a case by case basis. Other requirements which can be addressed in a generic manner are included as part of this report. The review form is also designed to guide the reviewer in obtaining information from vendors which is in an auditable form.

The above information was developed in accordance with the applicable sections of the San Onofre Nuclear Generating Station Units 2 & 3 Project Internal Procedures Manual sections 15 and 38.

#### 4.1.2 NUCLEAR STEAM SUPPLY SYSTEM (NSSS)

The safety-related Class IE equipment for the NSSS scope of supply was identified from a review of Section 3.9, Chapters 6, 7 and 15 of the FSAR, procurement specifications, System Design Requirements, electrical drawings

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

and P&ID's. The safety related systems listed in section 2.2 have been systematically analyzed to identify and determine if components required to mitigate or monitor the consequences of an accident or place the plant in a cold shutdown condition are located in harsh environmental area per NUREG-0588 Appendix E paragraph 2.a. The individual device locations were defined using the computer listing techniques discussed in paragraph 4.1.1.

Once the safety-related Class IE equipment was identified for the NSSS scope of supply, a systematic review on a component level basis to determine the extent to which the component environmental qualification program complied with the requirements of NUREG-0588. The systematic review was conducted as follows:

- A. An evaluation sheet was developed to facilitate a line-by-line evaluation of the requirements of NUREG-0588, Category II, sections 2 through 5. The qualification test reports for each component were evaluated against these requirements and line-by-line notations were made on the evaluation sheets regarding the degree of compliance. A sample evaluation sheet is contained in Appendix D.
- B. The areas of non-compliance were summarized on a component basis on resolution sheets to facilitate evaluation of the overall status of the equipment's qualification. A sample resolution sheet is contained in Appendix D.
- C. The Equipment Qualification Tabulation Sheet depicts a component level evaluation of the equipment per NUREG-0588 which was compiled with an additional column added indicating qualification status in the last column.

The above information is being developed in accordance with the applicable sections of Combustion Engineering's Quality Assurance Design Manual, Section 5.9. This development will be completed prior to fuel load.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

#### 4.1.3 QUALIFICATION STATUS

Upon completing the review plan discussed in section IV.A.2, the qualification status and the recommended disposition for each component was established. The recommended disposition will fall into one of the four following categories:

##### 4.1.3.1 Qualified for Plant Life

This recommendation was based upon the review indicating that the equipment has been qualified and the existing qualification documentation does prove that it will be capable of performing its intended function at any time during plant life even though it may be subject to the most harsh environment postulated.

##### 4.1.3.2 Relocate To

This recommendation is based upon the review indicating that the equipment is not qualified as to its capability to perform its required function at any time during plant life because of its location. This recommendation was made only when relocation would result in complete qualification, i.e., relocating the equipment to a less stringent environment.

##### 4.1.3.3 Interim Use

This recommendation was based on an evaluation of the degree of compliance with the requirements of NUREG-0588 and an evaluation of the duration of use during which the equipment is capable of performing its intended safety function.

##### 4.1.3.4 Replacement or Regualification Required

This recommendation was based upon the review of the equipment qualification and evaluation of areas of non-compliance not providing assurance that the equipment will perform its intended safety function during an accident.

In addition the results of the review of each type of equipment were tabulated in section 4.3. Outstanding items which have not been resolved, are indicated in the last column under "Qualification Status" in tables 4-1 and 4-2.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

The environmental qualification summary sheets (Appendices C and D) and associated reference documents are not included in this report but are available for audit.

4.2 EQUIPMENT QUALIFICATION TABULATION SHEETS

4.2.1 BALANCE OF PLANT (BOP) EQUIPMENT

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 1 of 38)

[illegible]

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 2 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
Electrical Penetration Assemblies										
Containment Wall	Westinghouse Electric- Electronic Tube Div. (Spec 304-1)	Prototype modular low voltage power and control, low level signal and thermo- couple	LOCA Radia- tion $5 \times 10^7$ rads Humidity 100% Chem. spray	IEEE 323 -74 Rad. $8 \times 10^7$ Humidity 100% Caustic spray 24 hrs.	Continuous	30 days	Not Applicable	Not Applicable	Type Test aging 302F for 100 hrs.  Report No. PEN-TR-75-19 BPC Log No. S023-304-1- 48-4	Qualified for 40 years
		Prototype modular low voltage power - large conductor	LOCA Radia- tion $5 \times 10^7$ rads Humidity 100% Chem. spray	IEEE 323 -74 Rad. $8 \times 10^7$ Humidity 100% Caustic spray for 24 hrs.	Continuous	30 days	Not Applicable	Not Applicable	Type Test aging 302F for 100 hrs.  Report No. PEN-TR-76-29 BPC Log No. S023-304-1- 48-4	Qualified for 40 years

System: Various (Power, Control and Instrumentation Circuits)

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
 SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 3 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
Electrical Penetration Assemblies  Containment Wall	Westinghouse Electric- Electronic Tube Div. (Spec. 304-1)	Prototype modular coax and triax	LOCA Radia- tion 5x10 <sup>8</sup> rads Humidity 100% chemical spray	IEEE 323 -74 Rad. 1x10 <sup>8</sup> Humidity 100% Caustic spray for 24 hrs.	Continuous	30 days	Not Applicable	Not Applicable	Type Test aging 150C for 156 hrs.  Report No. PEN-TR-76-35 BPC No. S023-304-1- 48-4	Qualified for 40 years
	Amphenol	Type "N" Plug 34500- 1000 Jack 18250- 1000	(See above)	Tempera- ture 312F Pressure 68 lb/in <sup>2</sup> Radiation 2.2x10 <sup>8</sup> Humidity 100% Caustic Spray	Continuous	27 hour	Not Applicable	Not Applicable	Type Test Aging 134C for 100 hrs.  Report No. PEN-TR-79-29 BPC No. S023-304-1- 137	Interim Use per Table 5-1, A2
	Westinghouse Electric- Electronic Tube Div.	Prototype canister medium voltage	LOCA Radia- tion 5x10 <sup>8</sup> rads Humidity 100% Chem. spray	IEEE 323-74 Radiation 8x10 <sup>8</sup> Humidity 100% Caustic spray for 24 hrs.	Continuous	30 days	Not Applicable	Not Applicable	Type Test  Report No. PEN-ACD4- 72-03 BPC No. S023- 304-1-48-4	Qualified for 40 years

System: Various (Power, Control and Instrumentation Circuits)

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 4 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
600 Volt Control & Instrumen- tation Cable  Inside Containment	Raychem (Spec. No. 304-6)	N.A.	LOCA  Radiation 5x10 <sup>7</sup> rads  Humidity 100%  Chemical Spray	Generic Tests Exceed SONGS Re- quirements  Radiation 2.2x10 <sup>8</sup> rads  Chemical Spray 30 days	Continuous  Intermittent	30 days	Not Applicable	Not Applicable	Type Test  168 hours @ 150C  Report No.. F-C4033-1 BPC No. S023-304-6- 7-1	Qualified for 40 years

System: Various (Control and Instrumentation Circuit)

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 5 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
600 Volt Control & Instrumen- tation Cable  Inside Containment	Rockbestos Co. New Haven, CT (Spec. No. 304-6A)	Firewall III Class IE Electric Cable (Chemically cross- insulation) (Thermo.)	LOCA  Radiation 5x10 <sup>7</sup> Rads  Humidity 100% Chemical Spray	Generic Tests exceeds SONGS require- ments Radiation 2.0x10 <sup>8</sup> rads  Humidity 100%  Chemical Spray 24 hours	Continuous  Intermittent	30 days	Not Applicable	Not Applicable	Type Test  Aging: 850 hours @ 150C  Report No. (None) BPC Log No. S023-304-6A- 6-0	Interim Qualified per Table 5-1, A3

System: Various (Control and Instrumentation Circuit)

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 6 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
600 Volt Control & Instrumen- tation Cable  Inside Containment	Rockbestos Co. East Grandby, CT (Spec. No. 304-6A)	Firewall III Class IE Electric Cable (Irradiation Cross- Linked Insulation)  (Irradiated)	LOCA  Radiation 5x10 <sup>7</sup> Rads  Humidity 100%  Chemical Spray	Generic Tests exceed SONGS require- ments  Radiation 2.0x10 <sup>8</sup>  Humidity 100%  Chemical Spray 24 hours	Continuous  Intermittent	30 days	Not Applicable	Not Applicable	Type Test  Aging: 850 hours @ 150C  Report No. (None) BPC Log No. S023-304-6A- 7-0	Interim Qualified per Table 5-1, A3

System: Various (Control and Instrumentation Circuits)

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
 SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 7 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
8kV Power Cables Aux. Feedwater Pump Room	Anaconda (Spec. No. 304-8)	N.A.	Main steam line break  Radiation $1 \times 10^6$ Rads  Humidity 100%  No chemical spray	LOCA test exceed require- ments for main stm.  Radiation $2.2 \times 10^8$ Rads	Continuous  line break	30 days	Not Applicable	Not Applicable	Type Test  Aging 168 hours @ 150C  Report No. F-C4350-3 BPC Log No. S023-304-8- 18-0	Qualified for 40 years

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

System: Auxiliary Feedwater System

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 8 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
GE Vulkene Supreme 600 volt Power Cable w/ Factor Splices  Inside Containment	General Electric Co. (Spec. No. 304-11)	N.A.	LOCA  Radiation 5x10 <sup>7</sup> Rads  Humidity 100%  Chemical Spray	Generic Tests exceed SONGS require- ments  Radiation 2.2x10 <sup>8</sup> Rads  Chemical Spray 24 hours	Continuous  Intermittent	33 days	Not Applicable	Not Applicable	Type Test  Aging 248 hours @ 150C  Report No. F-C5285-1 BPC No. S023-304-11- 115-1	Qualified for 40 years
GE EPR Power Cable with Neoprene Jacket  Aux. Feedwater Pump Room	General Electric Co. (Spec. No. 304-11)	N.A.	Main Steam Line Break  Radiation 1x10 <sup>6</sup>  Humidity 100%  No chemical spray	LOCA Test exceed requirement for steam line break  Radiation 2.2x10 <sup>8</sup> Rads  Chemical spray 24 hours	Continuous  Intermittent	33 days	Not Applicable	Not Applicable	Type Test  Aging 130 hours @ 150C  Report No. F-C5285-2 BPC No. S023-304-11- 116-0	Qualified for 40 years

System: Various (480V Power Circuits)

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
 SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 9 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
Special Purpose Cable (RSPT Type II Cable Assembly)  Inside Containment	Bendix (Spec. No. 304-13)	N/A	Non- Accident 120F  Containment Pressure Test: 69 lb/in. <sup>2</sup> 122F 100% RH 24 hours  Radiation 1x10 <sup>8</sup> rads  Humidity 60%	Non- Accident 120F  Radiation 1x10 <sup>8</sup> rads  Humidity 60%	Continuous Duty Normal Operation Only	N/A Not needed During Accident	N/A	N/A	Type Test  Report No. 44892-1 BPC No. S023-304-13- 134-0	Qualified for 40 years

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

System: Reactor Protection System

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
 SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 10 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Identification	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
Cable and Wire Connector  Inside Containment	Amp Inc. (Spec. No. 304-14)	PVF Insulated Terminals	LOCA  Radiation 5x10 <sup>7</sup> Rads  Chemical Spray	Generic Tests exceed SONGS require- Humidity 100% Radiation 2x10 <sup>8</sup> Rads  Humidity 100%  Chemical Spray on 17.5 min. into test to 384 hrs.	Continuous	16 days	Not Applicable	Not Applicable	Type Test  Aging 1500 hours @ 150C  302940016 BPC No. S023-304-15-0	Qualified for 40 years  Report No.

System: Various (Power, Control and Instrumentation Cable Terminations)

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 11 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
8kV Cable Termination Kit  Aux. Feedwater Pump Room	Raychem (Spec. No. 304-18)	Type HVT	Main steam line break  Radiation $1 \times 10^6$ Rads  Humidity 80%  No chemical spray	Test Values exceeds SONGS require- ments  Radiation $2 \times 10^8$ Rads  Humidity 100%  Chemical spray 24 hours	Continuous	100 days	Not Applicable	Not Applicable	Type Test  Aging 168 hours @ 250F  Report No. 71100 BPC No. S023-304-18- 17-1	Qualified for 40 years
Motor Connection Kit (5kV)  Aux. Feedwater Pump Room	Raychem (Spec. No. 304-18)	Type HVMC-5	Main steam line break  Radiation $1 \times 10^6$ Rads  Humidity 80%  No chemical spray	Test values exceed SONGS require- ments  Radiation $2 \times 10^8$ Rads  Humidity 100%  Chemical spray 24 hours	Continuous	100 days	Not Applicable	Not Applicable	Type Test  Aging 168 hours @ 250F  Report No. 71100 BPC No. S023-304-18- 17-1	Qualified for 40 years

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

System: Auxiliary Feedwater System

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 12 of 38)

Type of Equipment/Location	Manufacturer	Model No. Or Identification	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demonstrated	Accuracy or Response Time Requirement	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Heat Shrinkage Connection Kits Inside Containment	Raychem (Spec. No. 304-18)	Type MCK	LOCA Radiation $5 \times 10^7$ Rads Humidity 100% Chemical Spray	Generic Tests exceed SONGS requirements Radiation $2.0$ to $2.9 \times 10^8$ Rads Humidity 100% Chemical Spray for 30 days	Continuous	30 days	Not Applicable	Not Applicable	Type Test Aging 1500 hours @ 150C  Report No. QP-S023 BPC No. S023-304-18-21-1	Qualified for 40 years
Heat Shrinkable Sleeves Inside Containment	Raychem (Spec. No. 304-18)	Type WCSF-N	LOCA Radiation $5 \times 10^7$ Rads Humidity 100% Chemical Spray	Generic Tests exceed SONGS requirements Radiation $2 \times 10^8$ Rads Humidity 100% Chemical spray for 24 hours	Continuous	30 days	Not Applicable	Not Applicable	Type Test Aging to 1500 hours @ 150C  Report No. EDR 5019 BPC No. S023-304-18-25-0	Qualified for 40 years

System: Various

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
 SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 13 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
Heat Trace System- Wire	Thermon (Spec. No. 308-5)	TEK	Temperature 104F Pres- sure 0 lb/ in. <sup>2</sup> g  Radiation 6.6x10 <sup>7</sup> Rads  Humidity 80%	Temperature 346F Pres- sure 1 <sup>1</sup> / <sub>3</sub> lb/in. <sup>2</sup> g  Radiation 2x10 <sup>8</sup> Rads  Humidity 100%	Continuous	Continuous	Not Applicable (Not used in plant safety analysis)	Not Applicable	Aging 180C for 7 days  Report No. (None) BPC No. S023-308-5- 645-0	Interim Qualified per Table 5-1, A4
Heat Trace System-RTD	Thermon (Spec. No. 308-5)	RTD with Kapton Insulated Leads	Temperature 104F Pres- sure 0 lb/ in. <sup>2</sup> g Radiation 6.6x10 <sup>7</sup> Rads Humidity 80%	Temperature in excess of 104F  Radiation 1x10 <sup>8</sup> Rads	Continuous	Continuous	Not Applicable (Not used in plant safety analysis)	Not Applicable	Analysis Thermon to Bechtel letter dated 1/27/81  Bechtel Log XB34405	Qualified for 40 years

System: Containment Heat Removal, Control Room Hability System

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
 SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 14 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
Environ- mental Seal Assemblies  Inside Containment	Conax (Spec. No. 308-18)	N.A.	LOCA  Radiation 5x10 <sup>7</sup> Rads  Humidity 100%  Chemical Spray  Submergence	Generic Tests exceed SONGS require- ments  Radiation 2.2x10 <sup>8</sup> Rads  Humidity 100%  Chemical Spray 24 hours water spray 28 days	Continuous	30 days	Not Applicable	Not Applicable	Type Test  Aging to 1500 hours @ 150C  Report No. IPS-409 BPC No. S023-308-18- 9-0	Qualified for 40 years

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

System: Containment Isolation and Safety Injection Systems

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
 SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 15 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
Containment Emergency Cooling Unit - Air Handling Electric Motor  Inside Containment	Reliance Elec. (Spec. No. 410-1)	447T Frame Class H, Type RN insulation, 460V, 100 hp, 1170 r/min TEAO, Induction Motor	LOCA  Radiation 5x10 <sup>7</sup> Rads  Humidity 100%  Chemical Spray	Test Values exceed SONGS require- ments  Radiation 1x10 <sup>7</sup> Rads  Humidity 100%  Chemical Spray 7 days	Continuous	1 year	Not Applicable	Not Applicable	Type Test  Aging 108 hours @ 415F  Report No. X-604 BPC No. S023-410- 628-1	Qualified for 40 years

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

System: Emergency Operation Containment Building Ventilation Systems

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 16 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
Dome Circulating Fan Motor  Inside Containment	Reliance Electric (Spec. No. 410-2)	44T Frame Class H Type RN insulation, 460V, 60 hp, 1170 r/min TEAO, Induction Motor	LOCA  Radiation 5x10 <sup>7</sup> Rads  Humidity 100%  Chemical Spray	Generic Tests exceed SONGS require- ments  Radiation 1x10 <sup>7</sup> Rads  Humidity 100%  Chemical Spray 7 days	Continuous	30 days	Not Applicable	Not Applicable	Type Test  Aging 108 hours @ 415F  Report No. X-604 BPC No. S023-410-1 628-1	Qualified for 40 years

System: Combustible Gas Control System

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
 SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 17 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
Aux. Feedwater Pump Motor  Aux. Feedwater Pump Room	Siemens Allis (Spec. No. 405-6)	Type AZ, 416V, 800 hp, 3600 r/min induction motor	Main steam line break  Radiation $1 \times 10^6$ Rads  Humidity 100%  No chemical spray	Test values exceed SONGS require- ments  Radiation $2 \times 10^8$ Rads  Humidity 100%  No chemical spray	Continuous	31 days	Not Applicable	Not Applicable	Type Test and Analysis  Report No. S023-405-6 -90	Qualification by Analysis is incomplete  Refer to Table 5-1, A5

System: Auxiliary Feedwater System

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
 SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 18 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
Component Cooling Water Pump Motor  Safety Equipment Bldg.	Westinghouse (Spec. No. 405-9)	Type 5810L 460V, 600 hp 1200 r/min Induction Motor	Temperature 104F Pres- sure 0 lb/ in. <sup>2</sup> g  Radiation 1x10 <sup>8</sup> Rads  Humidity 80%	Temperature 104F Pres- sure 0 lb/ in. <sup>2</sup> g  Radiation 2x10 <sup>8</sup> Rads  Humidity 80%	Continuous	Continuous	Not Applicable	Not Applicable	Type Test Method is based on Similarity of Materials and Design Aging to be determined  Report No. WCAP-8754 BPC No. S023- 405-9-119-0	Interim Use per Table 5-1, A6

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

System: Component Cooling Water System

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 19 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
Pump Room 015 A/C Unit Motor Safety Equip. Bldg. Elev. (-) 15'6"	Reliance (Spec. No. 410-6)	182T Frame, Class H Type RH Insulation 460V 1800 r/min TEFC, 1-1/2 HP, Squirrel Cage Induc- tion Motor E445, E517	Tempera- ture: 104F Pressure; 0 lb/in. <sup>2</sup> Humidity: 80% Radiation: 1x10 <sup>8</sup> Rads	Tempera- ture: 346F Pressure; 0 lb/in. <sup>2</sup> Humidity: 80% Radiation: >1x10 <sup>8</sup> Rads	Continuous (Following Loss of Normal A/C Unit)	Continuous	Not Applicable	Not Applicable	Combination Analysis & Motorette Test to IEEE-117 with temper- atures to 320C	Interim Use per Table 5-1, A7
Pump Rooms 006, 007 008 A/C Unit Motors  Safety Equip. Bldg. Elev. (-) 5'3"	Reliance (Spec. No. 410-6)	182T Frame, Class H Type RH Insulation 460V 1800 r/min TEFC, 1 hp, Squirrel Cage Induc- tion Motor E453,4,5 E518	Tempera- ture 104F Pressure; 0 lb/in. <sup>2</sup> Radiation 1x10 <sup>8</sup> Rads Humidity 80%	Tempera- ture 346F Pressure; 0 lb/in. <sup>2</sup> Radiation >1x10 <sup>8</sup> Rads Humidity 80%	Continuous (Following Loss of Normal A/C Unit)	Continuous	Not Applicable	Not Applicable	Combination Analysis & Motorette Test to IEEE-117 with temper- atures to 320C	Interim Use Qualified per Table 5-1, A7

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

System: Emergency Operation HVAC Systems

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 20 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
Pump Room 002 A/C Unit Motor  Safety Equip. Bldg. Elev. (-) 15'6"	Reliance (Spec. No. 410-6)	184T Frame, Class H Type RH Insulation 460V 1800 r/min TEFC, 5 hp. Squirrel Cage Induc- tion Motor E-416	Tempera- ture 104F  Pressure <sub>2</sub> 0 lb/in. <sup>2</sup> <sub>g</sub>  Radiation 1x10 <sup>8</sup> Rads  Humidity 80%	Tempera- ture 346F  Pressure <sub>2</sub> 0 lb/in. <sup>2</sup> <sub>g</sub>  Radiation >1x10 <sup>8</sup> Rads  Humidity 80%	Continuous (Following Loss of Normal A/C Unit)	Continuous	Not Applicable	Not Applicable	Combination Analysis & Motorette Test to IEEE-117 with tempera- tures to 320C	Interim Use per Table 5-1, A7
Pump Room 005 A/C Unit Motor  Safety Equip. Bldg. Elev. (-) 15'6"	Reliance (Spec. No. 410-6)	213T Frame Class H Type RH Insulation 460V 1800 r/min TEFC, 5 hp, Squirrel Cage Induc- tion Motor E-417	Tempera- ture 104F  Pressure <sub>2</sub> 0 lb/in. <sup>2</sup> <sub>g</sub>  Radiation 1x10 <sup>8</sup> Rads  Humidity 80%	Tempera- ture 346F  Pressure <sub>2</sub> 0 lb/in. <sup>2</sup> <sub>g</sub>  Radiation >1x10 <sup>8</sup> Rads  Humidity 80%	Continuous (Following Loss of Normal A/C Unit)	Continuous	Not Applicable	Not Applicable	Combination Analysis & Motorette Test to IEEE-117 with tempera- tures to 320C	Interim Use per Table 5-1, A7

System: Emergency Operation HVAC Systems.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
 SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 21 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
Aux. Feedwater Exhaust Fan Motor  Aux. Feedwater Pump Room	Reliance Elec. (Spec. No. 410-8)	213T Frame Class H, Type RH 150 hp TEAO 1800 r/min induction motor	Main steam line break  Radiation 1x10 <sup>6</sup> Rads  Humidity 100%  No chemical spray		Continuous	No	Not Applicable	Not Applicable	Analysis  Report No. NUC-9 BPC No. S023-410- 8-16-2	Qualified for 40 years.

System: Auxiliary Feedwater System.

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
 SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 22 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
Level Transmitter  Condensate Storage Tank	Foxboro (Spec. No. 504-1)	NE11GM	Outside Containment  Radiation $1 \times 10^6$ Rads	Later	Continuous Long Term	Later	PAMI $\pm 2\%$	Later	Later	Interim Use See Table 5-2, A10

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

System:

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 23 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
Level Trans- mitter  Containment Normal & Emergency Sumps	GEMS (DE Laval) (Spec. No. 504-1)	XM-36495	LOCA  Radiation 5 x 10 <sup>7</sup> Rads  Submergence  Humidity 100%  Chemical Spray	Test specimen was exposed to environ- ments of steam and chemical spray = Boric Acid (15,000 ppm in NaOH Solution pH - 10.5 4 hours  Steam 300°F/ 59 psig 4 hours  Steam 280°F/ 45 psig 1 hour 150°F/ 1.5 psig balance of 14 days  Radiation 2x10 <sup>8</sup> rads  Humidity due to steam. % not stated.	Continuous long term	Continuous during tests	Response time: N/A  Accuracy PAMI	Accuracy ±2%	Type Test generic qualification Log S023-504- 1-102 and 504-1-103	Interim Use per Table 5-1, A8

System: Post Accident Monitoring.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 24 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
Level Switch  Containment Bldg. 24'-6" Elev.	Magnetrol (Spec. No. 506-3)	FLS-X-MPX SIM4DC	LOCA  Radiation 5x10 <sup>7</sup> rads  Submergence  Humidity 100%  Chemical Spray Boric Acid & NaOH pH >9 110 mm max.	LOCA None  Radiation 1.25x10 <sup>8</sup> rads  Humidity 95-100% 480 hours Chemical Spray None	Intermittent long term	Intermittent	N/A	N/A	Type test, qualification  Report No. 43235-1  Log S023- 506-3-61-0  Thermal aging 300F for 160 hrs.  Mech. aging 6000 cycles	Qualified per Table 5-1, A9

System: Containment Heat Removal Safety Injection, Component Cooling Water, Emergency Operation HVAC, Auxiliary Feedwater.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 25 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
Solenoid Valve  In Contain- ment Mini- Purge Isolation Valve el. ~80'	Automatic Switch Co. (Spec. No. 507-2)	NP831664E	LOCA  Radiation 5x10 <sup>7</sup> rads  Humidity 100%  Chemical Spray Boric Acid & NaOH pH >9 110 min/max	LOCA 346 F/110 psig  profile peaks  30 day total test period  Radiation 2x10 <sup>8</sup> rads  Humidity all steam for temp >250°F >90° for all other conditions.  Chemical Spray Boric Acid 3000 ppm & NaOH pH = 10 30 days	Short term intermittent	intermittent throughout all test phases	N/A	N/A	Log 507-2-1- 545 Test Report No. AQS21678/TR  Thermal Aging 268°F for 288 hrs.  Wear Cycled 40,000 cycles	Qualified per Table 5-1, A10

System: Containment Isolation, Chemical and Volume Control, Component Cooling Water,  
Emergency Operation HVAC, Safety Injection, Main Steam Isolation

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
 SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 26 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
Limit Switch  In Contain- ment Purge Valve El. ~ 80'	Namco Controls Acme- Cleveland Company (Spec. No. 507-2)	EA-180	LOCA  Radiation 5x10 <sup>7</sup> rads  Humidity 100%  Chemical Spray Boric Acid and NaOH pH >9 110 min/max	LOCA 340 F at 70 psig profile peaks 30 day total test period.  Radiation 2x10 <sup>8</sup> rads  Humidity days 5-30, switch was continually sprayed w/water.  Chemical Spray Boric Acid & NaOH pH: 10-11 4 days	Short term intermittent	10 Actua- tions during peak level of second LOCA transient and other actuations.  Intermit- tently throughout test phases	N/A	N/A	Type Test  Log 507-2- 1-466-1 Report dated 9/5/78.  Thermal Aging 200°F for 200 hrs.  Mech. Aging 100,000 cycles	Interim use per Table 5-1, All

System: Containment Isolation, Chemical and Volume Control, Safety Injection, Emergency Operation HVAC, Component Cooling Water,  
 Emergency Operation Containment Building Ventilation, Main Steam Isolation.

Table 4-1.

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 27 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
Alternating Current Electric Motor Operators  inside the containment  Various locations	Limitorque Corporation  (Philadel- phia Gear Corp.)  Supplied on valves furnished by Fisher WKM Westinghouse Walworth (Spec. Nos. 507-2 507-5)	SMB-0-40 with Reliance Electric Co. Motors  2Y267074A1EZ  Class RH insulation	LOCA  Radiation 5x10 <sup>6</sup> rads  Humidity 100%  Chemical Spray	LOCA 300 F/ 70 psig profile peaks 30 day test  Radiation 2x10 <sup>6</sup> rads  Humidity 100%  Chemical Spray pH = 10.8 30 days	Intermittent long term	Intermit- tently during and after tests	N/A	N/A	Generic Type Test Class RH Insul.  Limitorque Project No. 600456, B0058 Log S023- 507-2-1-410 507-5-1-212 507-5-4-28 507-5-2-101  Thermal Aging 356°F for 100 hours  Wear 200 cycles during ther- mal aging + 1800 cycles ambient	Qualified for 40 years.

System: Safety Injection, Containment Isolation, Component Cooling Water, Chemical and Volume Control.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 4-1  
ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 28 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Identification	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demonstrated	Accuracy or Response Requirement	Accuracy or Response Demonstrated	Qualification Report & Method	Qualification Status
Solenoid Valve  Containment Isolation Valve Penetration Bldg. El. ~ 37'	Valcor Engineering Corporation (Spec. No. 507-4)	V52600-539	Outside Containment Radiation $7 \times 10^6$ rads	Radiation $2 \times 10^8$ rads	Short term intermittent	To be established upon review of report.	N/A	N/A	To be established.  Test report to be submitted by Vendor by March 1981.  Qualification Test Procedure Log S023-507-4-2-46-0	Interim use per Table 5-1, A12

System: Containment Isolation.

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 29 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
Solenoid Valve  In Contain- ment Various Locations	Target Rock Corporation (Spec 507-4)	77CC-001 Modified to include relays, rectifier and the latest TRC coil design and switch housing	LOCA:  Radiation 6 x 10 <sup>7</sup> rads  Humidity 100%  Chemical Spray	385°F 66 Psig Peaks 14 day profits  Radiation 10 x 10 <sup>7</sup> rads  Humidity 55 ± 5%  Chemical Spray Boron 6200 ppm 22 min. Hydrozine 55 ppm 14 days ph 8.6-10	Intermittent long term	Intermittent long term 1 cycle per day 14 days	Not Applicable	Not Applicable	Type Test generic quali- fication (Log 507-4-76 Report No. 2375)  Thermal Aging 350°F for 792 hrs.  Wear 18,000 cycles at 122°F 90% Humidity	Interim Use per Table 5-1, A13

System: Containment Isolation, Safety Injection, Reactor Coolant Gas Vent

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
 SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 30 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
Direct Cur- rent Elec- tric Motor Operators  Aux. Feedwater Pump Room	Limitorque Corporation  (Philadel- phia Gear Corp.)  Supplied on on Valves Furnished by WKM (Spec 507-5)	SMB-0/25 with H.K. Porter Co., Inc. Motor No. UCD2810  125 VDC. 5 minute duty  (Motor Model No. 176-18- 0026-0 Peer- less)	Main Stream Break  Temperature 302°F  Pressure 2.76 Psig  30 min. duration  Radiation 1 x 10 <sup>6</sup> rads  Humidity 100%	LOCA 340 F/atmos. pressure profile peak 1 hour; 25 hr. total test period  Radiation 1 x 10 <sup>7</sup> rads	Intermittent long term		Not Applicable	Not Applicable	Generic Type Test B0058 Class H insulation  Log S023-507- 5-1-355  Thermal Aging 180C for 100 hours	Qualified for 40 years

System: Auxiliary Feedwater

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 4-1  
ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 31 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Identification	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demonstrated	Accuracy or Response Time Requirement	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Aux. F.W. Pump MOV's (AC)	WKM Spec. No. 507-5			(LATER)						

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 32 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Identification	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demonstrated	Accuracy or Response Time Requirement	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
MOV's Alternating Current Electric Motor Operators  Various locations outside Containment	Limitorque Corporation (Philadelphia Gear Corp.)  Supplied on Valves furnished by Fisher WKM Westinghouse Walworth (Spec 507-2)	SMB-0-25 with Reliance Electric Co. Motors 447014-BZ 447014-JZ	Indoors 36-130 F  Radiation $8.7 \times 10^6$ rads max  Humidity up to 100%	Radiation $2 \times 10^7$ rads  Temperature 250F  Pressure $25 \text{ lb/in}^2$ g profile peaks	Intermittent long term	Intermittent during and after tests	Not Applicable	Not Applicable	Generic Type Test class B insulation  LOG S023-507-5-4-26 Limitorque Project No. 600461/Rept. No. 80003, B0058 Thermal Aging 180C for 200 cycles during thermal 1800 cycles at ambient	Qualified for 40 years

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

System: Component Cooling Water, Shutdown Cooling, Safety Injection

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 33 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
Main Steam Containment Isolation Valve (MSIV)	Marotta Scientific Controls	MV238C and MV233C	Steam Line Break	Temperature 300F	Intermittent Short Term	Functional test before, during and after each test phase	Not Appli- cable for individual components; applicable for complete MISV		Type Test Analysis for radiation document No. 15-0063-03 LOG 507-6-125) W-K-M document No. 15-0063-03	Interim Use per Table 5-1, A14
Solenoid Actuated Pneumatic Valve (Dump Valve)	Potter- Brumfield	Type MDR 5060 and Type MDR 137-8	271 F at 28 psig steam for 16 minutes	Pressure <sub>2</sub> 50 lb/in <sup>2</sup> g						
Relay	G.E. Wire & Cable Division	Vulkene Type SIS	Radiation 5 x 10 <sup>6</sup> rads	Radiation 5 x 10 <sup>6</sup> rads						
Wire	Supplied on valves fur- nished by WKM (Spec 507-6)		Humidity 100%	Humidity >95%					Thermal Aging 200°F for 200 hours	
MSIV Enclo- sure el 30'									Wear 200 cycles at ambient	

System: Main Steam Isolation

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 4-1  
ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 34 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Identification	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demonstrated	Accuracy or Response Requirement	Accuracy or Response Demonstrated	Qualification Report & Method	Qualification Status
Thermocouple  Inside Containment on outside of Secondary Shield El 68'	Weed Instrument (Spec 508-5)	DWG. No. 1000-512-0021 Rev 0	LOCA Radiation 5 x 10 <sup>7</sup> rads  Humidity 100%  Chemical Spray	SONGS 2&3 LOCA Total time 17.36 days  Radiation, 1.05 x 10 <sup>7</sup>  Humidity 100%  Chemical Spray  Boric Acid 2300 ppm and NaOH ph 9-9.5  17 days	Continuous long term	Continuous	I 1%	I 1%	Type Test Report No. 58547  Log S023-508-5-114-0  Thermal Aging 257°F for 7 days	Qualified for 40 years

System: Containment Heat Removal

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 35 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
Containment Post LOCA Hydrogen Monitors	General Electric (Spec. No. 508-17)	47E240609 (Complete System)	LOCA  Radiation 3.2 x 10 <sup>7</sup>	(1) 331F 55/lb/in. <sup>2</sup> 90 day profile	Continuous long term	Continuous long term	5% F.S.	5% F.S.	Type Test and and Analysis	Interim use per Table 5-1, A15
In Contain- ment el 75'			Humidity 100%	(2) 400F 85/lb/in. <sup>2</sup> peak 3 cycles					Report No. 80SDS4244	
(1) Press Transducer CEC 1000			Chem spray Boric Acid and NaOH ph >9 110 min max	(1) Radia- tion					Log S023- 508-17	
(2) H <sub>2</sub> Sen- sor 47E240610				(2) 3.2 x 10 <sup>7</sup> rads					(1) Thermal Aging 300F for 14 days	
				Humidity (1) 80%						
				(2) 30-100%						
				Chemical Spray (1)						
				(2) None						

System: Emergency Operation Containment Ventilation Systems

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
 SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 36 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Identification	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
Pressurizer PSV	(Spec. No. 508-18)		LOCA	To be estab- lished.	Continuous long term	To be estab- lished.				To be estab- lished.

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

System: Post-Accident Monitoring

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 4-1  
ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 37 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Identification	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demonstrated	Accuracy or Response Time Requirement	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Wide Range Radiation Monitor Instrumentation	General Atomics (Spec. No. 606-4)			(Later)						

Table 4-1

ENVIRONMENTAL QUALIFICATION OF IE ELECTRICAL EQUIPMENT  
 SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3 (Sheet 38 of 38)

Type of Equipment/ Location	Manufacturer	Model No. Or Ident- fication	Abnormal or Accident Environment	Environment To Which Qualified	Operability Requirement	Operability Demon- strated	Accuracy or Response Time Requirement	Accuracy or Response Time Demon- strated	Qualification Report & Method	Qualification Status
Electric Hydrogen Recombiner  Inside Contain- ment	Westinghouse Elect. (Spec. No. 607-1)	EHRS	LOCA  Radiation 5 x 10 <sup>7</sup> Rads  Humidity 100%  Chemical Spray	Generic Tests exceed SONGS requirements  Radiation 2 x 10 <sup>8</sup> Rads  Humidity 100%  Chemical Spray 10 days	Continuous	33 days	Not Applicable	Not Applicable	Type Test  Aging 100 hours @ 350F	Qualified for 40 years

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

System: Combustible Gas Control System

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 4-2  
EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 1 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Resistance Temperature Detector (RTD)	Rosemount	104 AFC-1	Legend A of table 4-3	See attached Data Sheet No. 216.	Accident Mitigation: 30 Minutes	See attached Data Sheet No. 216.	Total Accuracy: $\pm 1.308F$	Temperature: $+0.054F$ $-0.036F$	See attached Data Sheet No. 216.	Interim Use See table 5-2, All
Containment Building			Radiation: $5 \times 10^7$ rads		Post Accident Monitoring: See section 2.5 of the SONGS 2 and 3 submittal for NUREG-0588.		Response Time: 6.0 sec	Radiation: $+0.022F$ $-0.005F$ Response Time: See table 5-2, A7		

Component used in Plant Protection System.

**San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment**

**Table 4-2**

**EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2&3  
ELECTRICAL EQUIPMENT (Sheet 2 of 56)**

REFERENCE: IEEE STD 323-1971  
CENPD-212 SECTION(S) 3.3.1

ENVIRONMENTAL TEST DOCUMENTATION

DATA SHEET No. 216  
DATE \_\_\_\_\_  
REVISION No. \_\_\_\_\_

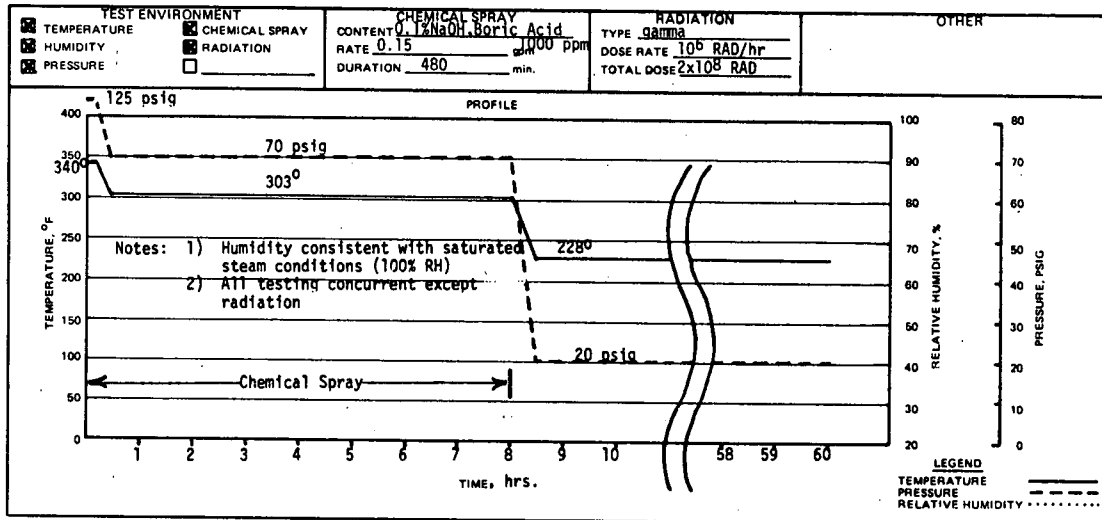
**I. EQUIPMENT DESCRIPTION**

ITEM <u>Resistance Temperature Detector</u>	MANUFACTURER <u>Rosemount</u>	MODEL <u>104APC + APV</u>
FUNCTION <u>Converts temperature to electrical signal</u>	SERVICE LOCATION <u>Containment</u>	

**II. TEST REPORT**

TITLE <u>Rosemount Report No. 67626</u>	DATE <u>June 1976</u>
-----------------------------------------	-----------------------

**III. TEST DESCRIPTION**



**IV. DESCRIPTION OF EQUIPMENT OPERATION DURING TESTING**

	YES	NO	NA	REMARKS
EQUIPMENT ENERGIZED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The RTD was operational with its output compared to that of an operating thermocouple in the test chamber; both were recorded. The output of the RTD was also monitored during radiation testing. After testing, the insulation resistance was checked.
ALL SAFETY FUNCTIONS TESTED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
FULL RANGE VERIFIED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
TRIP FUNCTIONS EXERCISED	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

**V. RESULTS AND DISCUSSION**

A post environmental calibration showed that the 0°C reading shifted only +0.016° (0.02°C), and the 100°C reading shifted only -0.023° (0.03°C). A visual inspection showed negligible change to the unit. The insulation resistance was 250 megohms.

A post radiation calibration showed the 0°C reading to increase of 0.002° (0.003°C) and a 0.01° (0.012°C) increase at 100°C. The insulation resistance remained greater than 100 megohms.

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 3 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Resistance Temperature Detector (RTD)	Rosemount	104 AFV-1	Legend A of table 4-3	See attached Data Sheet No. 216.	Post Acci- dent Monitoring:	See attached Data Sheet No. 216.	See section 2.5 of the SONGS 2 and 3 sub- mittal for NUREG-0588.	Temperature: +0.054F -0.036F	See attached Data Sheet No. 216.	Interim Use See table 5-2, All
Containment Building			Radiation: $5 \times 10^7$ rads		See section 2.5 of the SONGS 2 and 3 sub- mittal for NUREG-0588.			Radiation: +0.22F -0.005F		

Component used in Subcooled Margin Monitoring System.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class 1E Equipment

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2&3  
ELECTRICAL EQUIPMENT (Sheet 4 of 56)

REFERENCE: IEEE STD 323-1971  
CENPO-212 SECTION(S) 3.3.1

ENVIRONMENTAL TEST DOCUMENTATION

DATA SHEET No. 216  
DATE \_\_\_\_\_  
REVISION No. \_\_\_\_\_

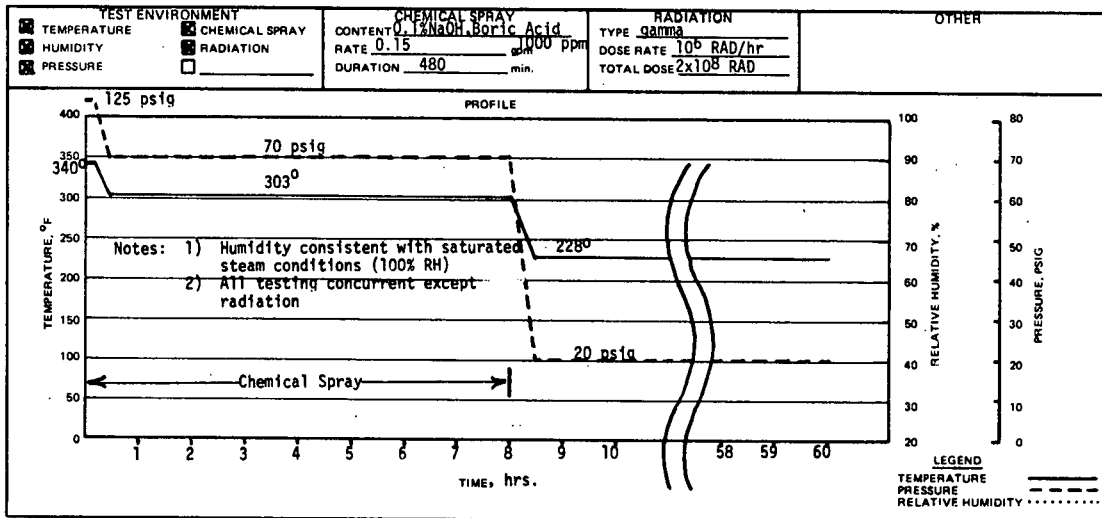
I. EQUIPMENT DESCRIPTION

ITEM <u>Resistance Temperature Detector</u>	MANUFACTURER <u>Rosemount</u>	MODEL <u>104 Afc + AFV</u>
FUNCTION <u>Converts temperature to electrical signal</u>		
SERVICE LOCATION <u>Containment</u>		

II. TEST REPORT

TITLE <u>Rosemount Report No. 67626</u>	DATE <u>June 1976</u>
-----------------------------------------	-----------------------

III. TEST DESCRIPTION



IV. DESCRIPTION OF EQUIPMENT OPERATION DURING TESTING

	YES	NO	NA	REMARKS
EQUIPMENT ENERGIZED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The RTD was operational with its output compared to that of an operating thermocouple in the test chamber; both were recorded. The output of the RTD was also monitored during radiation testing. After testing, the insulation resistance was checked.
ALL SAFETY FUNCTIONS TESTED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
FULL RANGE VERIFIED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
TRIP FUNCTIONS EXERCISED	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

V. RESULTS AND DISCUSSION

A post environmental calibration showed that the 0°C reading shifted only +0.016° (0.02°C), and the 100°C reading shifted only -0.023° (0.03°C). A visual inspection showed negligible change to the unit. The insulation resistance was 250 megohms.

A post radiation calibration showed the 0°C reading to increase of 0.002° (0.003°C) and a 0.01° (0.012°C) increase at 100°C. The insulation resistance remained greater than 100 megohms.

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
 ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 5 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
RCP Speed Signal Sensor and Trans- mitter  Containment Building	Bentley- Nevada Corporation	21956 (Trans.)  21956-01 (Sens.)	Legend A of table 4-3  Radiation: $5 \times 10^7$ rads	See attached Data Sheet No. 205	30 Minutes	See attached Data Sheet No. 205.	Total Accuracy:  $\pm 1.456$ rev/ min for 28" disc  $\pm 3.326$ rev/ min for 16.969" disc  Response Time:  None	Total Accuracy:  No degradation in accuracy occurred.  Response Time:  Not measured	See attached Data Sheet No. 205.	Interim Use See table 5-2, A9

Component used in Plant Protection System.

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

**San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment**

**Table 4-2**

**EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2&3  
ELECTRICAL EQUIPMENT (Sheet 6 of 56)**

REFERENCE  
IEEE STD 323-1971  
CENPO-212 SECTION(S) \_\_\_\_\_

**ENVIRONMENTAL TEST DOCUMENTATION**

DATA SHEET No. 205  
DATE \_\_\_\_\_  
REVISION No. \_\_\_\_\_

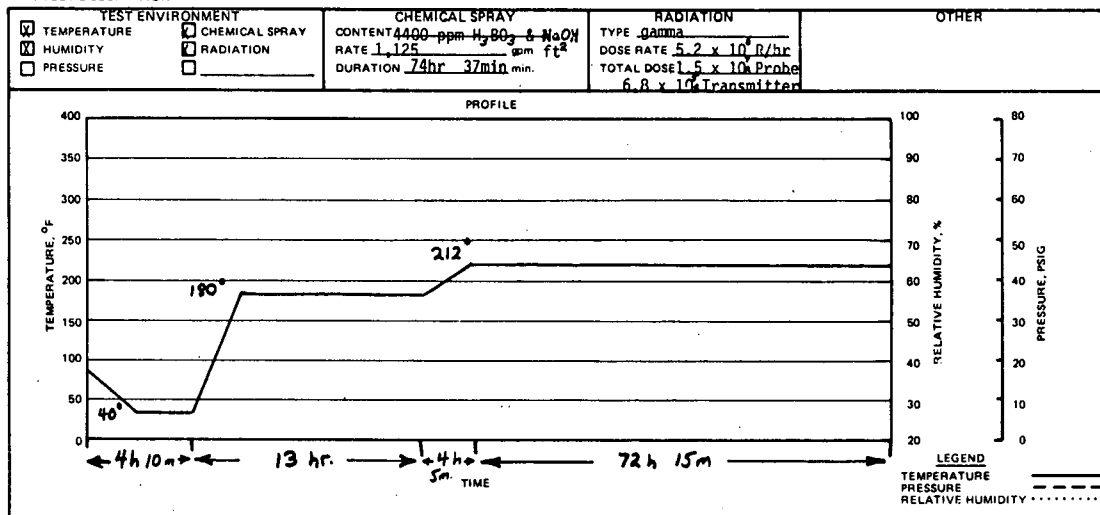
**I. EQUIPMENT DESCRIPTION**

ITEM Proximity Probe, Transmitter, Cable and Connector MANUFACTURER Bentley Nevada Corp. MODEL Probe: 21956-01  
FUNCTION Provide reactor coolant pump speed information to protection system SERVICE LOCATION Containment Transmitter: 21956

**II. TEST REPORT**

TITLE Wyle Report No. 54602 (Radiation, Environmental, and Seismic Tests) DATE March 16, 1977

**III. TEST DESCRIPTION**



**IV. DESCRIPTION OF EQUIPMENT OPERATION DURING TESTING**

	YES	NO	NA	REMARKS
EQUIPMENT ENERGIZED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The speed sensing system was operational with the probe monitoring a moving slotted disc. The probe and transmitter sent the speed signal to the processor (tested separately). The processor output was monitored by a pulse counter and oscilloscope. The pulse counter was used to find extra or missed pulses, if any. The oscilloscope was used to find irregular pulse shapes, if any. The slotted disc was independently monitored for proper speed.
ALL SAFETY FUNCTIONS TESTED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
FULL RANGE VERIFIED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
TRIP FUNCTIONS EXERCISED	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

**V. RESULTS AND DISCUSSION**

The processor output signal indicated no missed or extra pulses, and no variation in pulse shape for all tests indicated above. This demonstrates proper operation of the probe and transmitter.

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
 ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 7 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Pressure Transmitter	Foxboro	E11GM	Legend A of table 4-3	See attached Data Sheet No. 203.	30 Minutes	See attached Data Sheet No. 203.	Total Accuracy: -82 lb/in. <sup>2</sup> a	Total Accuracy: -63.8 lb/in. <sup>2</sup> a	See attached Data Sheet No. 203.	Requalify See table 5-2, A10
Containment Building			Radiation: 5x10 <sup>7</sup> rads				Response Time: 0.5 sec.	Response Time: See table 5-2, A5		

Component used in Plant Projection System.

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class 1E Equipment

**San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment**

**Table 4-2**

**EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2&3  
ELECTRICAL EQUIPMENT (Sheet 8 of 156)**

**REFERENCE**

IEEE STD 323-1971

CENPD-212 SECTION(S) 3.3.1

**ENVIRONMENTAL TEST DOCUMENTATION**

DATA SHEET No. 203

DATE \_\_\_\_\_

REVISION No. \_\_\_\_\_

**I. EQUIPMENT DESCRIPTION**

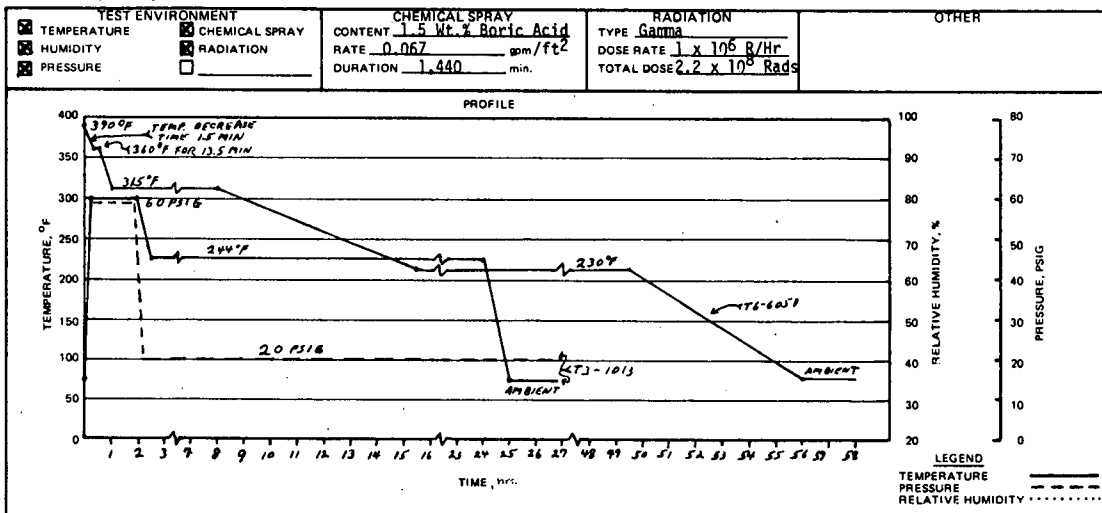
ITEM <u>Pressure Transmitter</u>	MANUFACTURER <u>The Foxboro Company</u>	MODEL <u>E11GM</u>
FUNCTION <u>Converts pressure to electrical signal</u>	SERVICE LOCATION <u>Containment</u>	

**II. TEST REPORT**

TITLE T3-1013 (Supplemental), March, 1973; T3-1068, Aug. 1973; T6-6051, Sept.-Oct., 1976  
Test Reports by Foxboro

DATE \_\_\_\_\_

**III. TEST DESCRIPTION**



**IV. DESCRIPTION OF EQUIPMENT OPERATION DURING TESTING**

	YES	NO	NA	REMARKS
EQUIPMENT ENERGIZED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
ALL SAFETY FUNCTIONS TESTED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
FULL RANGE VERIFIED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
TRIP FUNCTIONS EXERCISED	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
The transmitter was operational during all tests. Except during calibration checks the input pressures were maintained at 75% of span for the temperature and chemical spray tests and 80% of span for the radiation and high temperature tests. Outputs were continuously monitored. Calibration checks were done before and after each test on the test item.				

**V. RESULTS AND DISCUSSION**

Qualification testing was performed by 3 series of tests as follows:

- Temperature - steam pressure - chemical spray (Report No. T3-1013)
- High temperature (Report No. T6-6051)
- Radiation (Report No. T3-1068)

The first two hours of the chemical spray/temperature test produced maximum output shift of -6.70% of span. During the rest of the test the output shift remained negative within 0.5% of -3.30% of span. During the rest of the test the output shift remained negative within 0.5% of -3.30% of span.

During the initial phase of the high temperature test the maximum output shift was -1.7% and +1.8% of span. The subsequent phase of the test at 315°F produced a maximum output shift of -1.9% of span. During the final phase of the test, at 230°F, the output shift remained at a constant +0.4% of span.

The radiation test was started at a dose rate of  $1 \times 10^5$  R/Hr and increased to  $1 \times 10^6$  R/Hr at  $1 \times 10^6$  rads. The output shift was negative and increased to a maximum of 4.92% at  $1.68 \times 10^8$  rads and returned to 4.5% at  $2.2 \times 10^8$  rads. The shift progressed as follows: -0.15% at  $1 \times 10^5$  rads, -2.03% at  $1 \times 10^6$  rads, -3.35% at  $1 \times 10^7$  rads, -4.73% at  $1 \times 10^8$  rads, -4.92% at  $1.68 \times 10^8$  rads, and -4.50% at  $2.2 \times 10^8$  rads.

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
 ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 9 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Pressure Trans- mitter	Rosemount	1153GP	Legend A of table 4-3	See attached Data Sheet No. 209	Accident Mitigation:  30 Minutes	See attached Data Sheet No. 209.	Total Accuracy:  239.1 lb/in. <sup>2</sup>	Total Accuracy:  238.0 lb/in. <sup>2</sup>	See attached Data Sheet No. 209.	Interim Use See table 5-2, All
Containment Building			Radiation:  5x10 <sup>7</sup> rads		Post Accident Monitoring:  See section 2.5 of the SONGS 2 and 3 sub- mittal for NUREG-0588.		Response Time:  0.5 Sec.	Response Time:  0.11 Sec.		

Component used in Plant Protection System.

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class 1E Equipment

**San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment**

Table 4-2

**EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2&3  
ELECTRICAL EQUIPMENT (Sheet 10 of 56)**

REFERENCE: IEEE STD 323-1971  
CENPD-212 SECTION(S) 3.3.1

ENVIRONMENTAL TEST DOCUMENTATION

DATA SHEET No. 209  
DATE \_\_\_\_\_  
REVISION No. \_\_\_\_\_

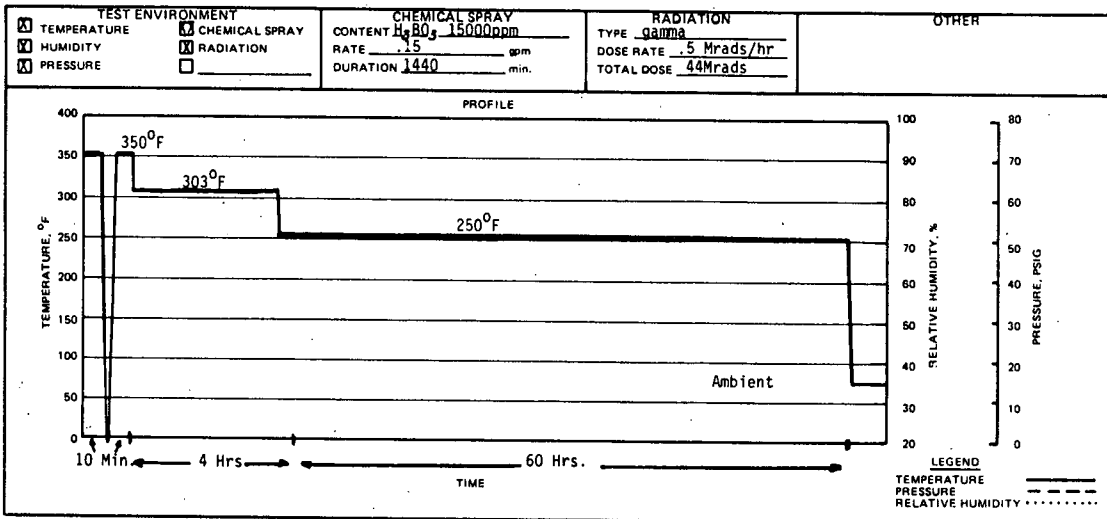
I. EQUIPMENT DESCRIPTION

ITEM <u>Pressure Transmitters</u>	MANUFACTURER <u>Rosemount</u>	MODEL <u>1153GP</u>
FUNCTION <u>Provides electrical output signal proportional to sensed pressure</u>		
		SERVICE LOCATION <u>in-containment</u>

II. TEST REPORT

TITLE <u>Qualification Test Report for Pressure Transmitters Rosemount No. 3788</u>	DATE <u>February 1977</u>
-------------------------------------------------------------------------------------	---------------------------

III. TEST DESCRIPTION



IV. DESCRIPTION OF EQUIPMENT OPERATION DURING TESTING

	YES	NO	NA	REMARKS
EQUIPMENT ENERGIZED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	During the radiation and steam/chemical tests the transmitters were to be continually powered and pressurized (see discussion below on exception during radiation testing). The transmitter outputs were also continuously monitored on strip charts. Calibration checks were run at specified check points to verify accuracy.
ALL SAFETY FUNCTIONS TESTED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
FULL RANGE VERIFIED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
TRIP FUNCTIONS EXERCISED	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

V. RESULTS AND DISCUSSION

DISCUSSION:

During the steam/chemical test, a deviation from procedure occurred in that the three transmitters were subjected to the chemical spray for different periods of time, however unit 106188 was subjected for the required 24 hour time period. The transmitters were tested in an autoclave, with the autoclave temperature and pressure, and the transmitter outputs continuously recorded on strip charts. Lift-off voltage, time constant and temperature coefficient values were checked before and after the test.

As with the steam/chemical test, lift-off voltage, time constant and temperature coefficient values were checked before and after the radiation test. After removal of the radiation source, the transmitters were cycled on and off three times to demonstrate start-up ability. There was some effect on the temperature coefficient during the test by the radiation, however the magnitude of the effect was small. There was a deviation from the test procedure in that the transmitters were to be powered and the process pressure at 100% throughout the duration of the test, however when a calibration test was made at 11 megarads, the pressure was found to be at 0% and stayed this way for the next 8.2 megarads until the setpoint was reset to 100% between calibration checks.

RESULTS:

The results of the steam/chemical test and the radiation test are acceptable as all measured parameters were within the specified limits. During the steam/chemical test, a maximum error of 6.95% full scale was noted at the second 10 minute heat-up @350°F and was within the acceptance criteria of + 8%. There was no evidence of moisture or corrosion within the housing during post-test examination. During the radiation exposure, the maximum deviation was +3.7% (transmitter 106187) Acceptable criteria is 5.0%.

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
 ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 11 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Differential Pressure Transmitter	Foxboro	E13DH	Legend A of table 4-3	See attached Data Sheet No. 210.	Post Accident Monitoring:	See attached Data Sheet No. 210.	Post Accident Monitoring:	Total Accuracy:  9.6 in.	See attached Data Sheet No. 210.	Requalify See table 5-2, A10
Containment Building			Radiation: $5 \times 10^7$ rads		See section 2.5 of the SONGS 2 and 3 sub- mittal for NUREG-0588.		See section 2.5 of the SONGS 2 and 3 submittal for NUREG-0588.			

Component used in Pressurizer Level Indication System

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

**San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment**

Table 4-2

**EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2&3  
ELECTRICAL EQUIPMENT (Sheet 12 of 56)**

REFERENCE: IEEE STD 323-1971  
CENPD-212 SECTION(S): 3.3.1

ENVIRONMENTAL TEST DOCUMENTATION

DATA SHEET No. 210  
DATE \_\_\_\_\_  
REVISION No. \_\_\_\_\_

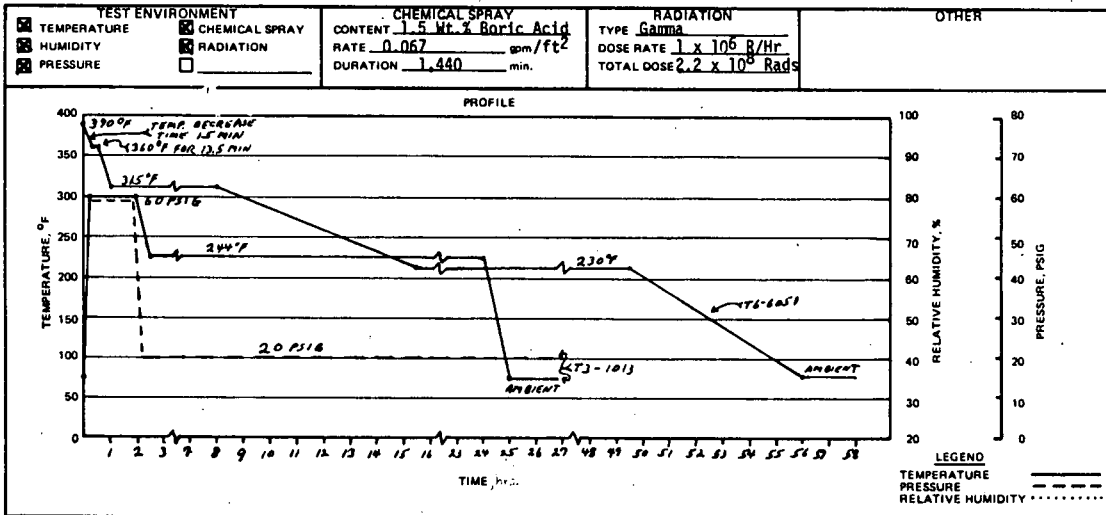
I. EQUIPMENT DESCRIPTION

ITEM: <u>Differential Pressure Transmitter</u>	MANUFACTURER: <u>The Foxboro Company</u>	MODEL: <u>E13DH</u>
FUNCTION: <u>Converts differential pressure to electrical signal</u>		SERVICE LOCATION: <u>Containment</u>

II. TEST REPORT

TITLE: <u>T3-1013 (Supplementary), March 1973; T3-1068, August 1973; T6-6051, Sept. - Oct. 1976</u>	DATE: _____
Test Reports by Foxboro	

III. TEST DESCRIPTION



IV. DESCRIPTION OF EQUIPMENT OPERATION DURING TESTING

EQUIPMENT OPERATED	YES	NO	NA	REMARKS
ALL SAFETY FUNCTIONS TESTED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The transmitter was operational during all tests. Except during calibration checks the input pressures were maintained at 75% of span for the temperature and chemical spray tests and 80% of span for the radiation and high temperature tests. Outputs were continuously monitored. Calibration checks were done before and after each test on the test item.
FULL RANGE VERIFIED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
TRIP FUNCTIONS EXERCISED	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
EQUIPMENT ENERGIZED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

V. RESULTS AND DISCUSSION

Qualification testing was performed by 3 series of tests as follows:

- Temperature - steam pressure - chemical spray (Report No. T3-1013)
- High temperature (Report No. T6-6051)
- Radiation (Report No. T3-1068)

The first two hours of the chemical spray/temperature test produced a maximum output shift of + 3.55% of span. During the rest of the test the output shift remained positive within 0.5% of + 0.65% of span.

During the initial phase of the high temperature test the maximum output shift was -1.7% and +1.8% of span. The subsequent phase of the test at 315°F produced a maximum output shift of -1.9% of span. During the final phase of the test, at 230°F, the output shift remained at a constant + 0.4 % of span.

The radiation test was started at a dose rate of  $1 \times 10^5$  R/Hr and increased to  $1 \times 10^6$  R/Hr. The output shift was negative and increased to a maximum of 4.92% at  $1.68 \times 10^6$  rads and returned to 4.5% at  $2.2 \times 10^8$  rads. The shift progressed as follows: -0.15% at  $1 \times 10^5$  rads, -2.03% at  $1 \times 10^6$  rads, -3.35% at  $1 \times 10^7$  rads, -4.73% at  $1 \times 10^8$  rads, -4.92% at  $1.68 \times 10^8$  rads, and -4.50% at  $2.2 \times 10^8$  rads.

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
 ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 13 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Pressure Transmitter	Foxboro	E11GM	Legend A of table 4-3	See attached Data Sheet No. 203.	Continuous, 6 Hours to 58 Hours	See attached Data Sheet No. 203.	Total Accuracy:  $\pm 16.0 \text{ lb/in.}^2$ at 6-36 Hours and a Maximum of $+300 \text{ lb/in.}^2$ at 6 Hours to 1 Year	Total Accuracy:  For 6-36 Hours. $36.7 \text{ lb/in.}^2$  For 6 Hours to 1 Year, $60.0 \text{ lb/in.}^2$	See attached Data Sheet No. 203.	Requalify See table 5-2 A10, A12
Containment Building			Radiation: $5 \times 10^7$ rads							

Component used in Shutdown Cooling System.

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class 1E Equipment

**San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment**

**Table 4-2**

**EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2&3  
ELECTRICAL EQUIPMENT (Sheet 14 of 56)**

REFERENCE: IEEE STD 323-1971  
CENPD-212 SECTION(S) 3.3.1

ENVIRONMENTAL TEST DOCUMENTATION

DATA SHEET No. 203  
DATE  
REVISION No.

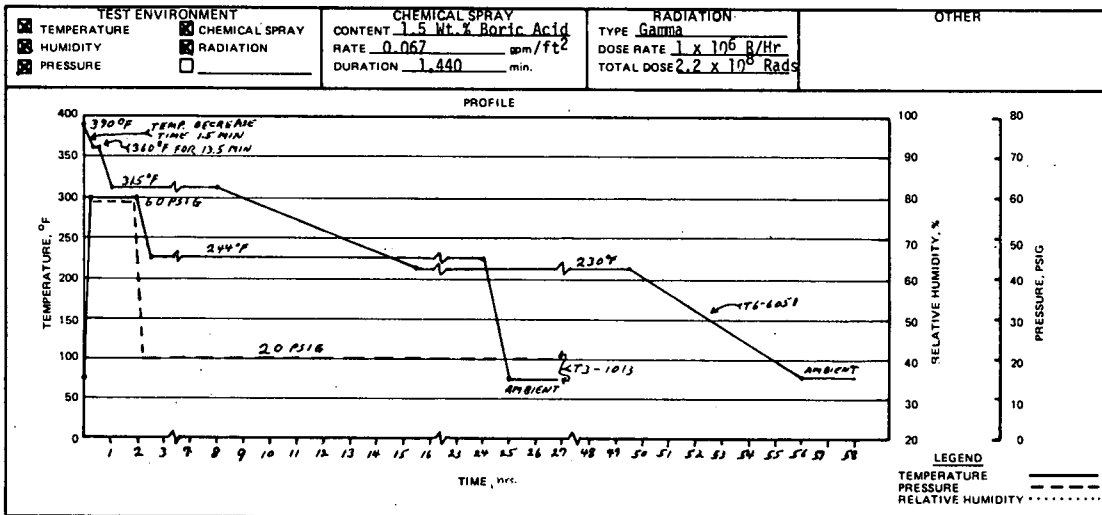
**I. EQUIPMENT DESCRIPTION**

ITEM <u>Pressure Transmitter</u>	MANUFACTURER <u>The Foxboro Company</u>	MODEL <u>E11GM</u>
FUNCTION <u>Converts pressure to electrical signal</u>	SERVICE LOCATION <u>Containment</u>	

**II. TEST REPORT**

TITLE <u>T3-1013 (Supplemental), March, 1973; T3-1068, Aug. 1973; T6-6051, Sept.-Oct., 1976</u>	DATE
<u>Test Reports by Foxboro</u>	

**III. TEST DESCRIPTION**



**IV. DESCRIPTION OF EQUIPMENT OPERATION DURING TESTING**

	YES	NO	NA	REMARKS
EQUIPMENT ENERGIZED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The transmitter was operational during all tests. Except during calibration checks the input pressures were maintained at 75% of span for the temperature and chemical spray tests and 80% of span for the radiation and high temperature tests. Outputs were continuously monitored. Calibration checks were done before and after each test on the test item.
ALL SAFETY FUNCTIONS TESTED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
FULL RANGE VERIFIED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
TRIP FUNCTIONS EXERCISED	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

**V. RESULTS AND DISCUSSION**

Qualification testing was performed by 3 series of tests as follows:

- Temperature - steam pressure - chemical spray (Report No. T3-1013)
- High temperature (Report No. T6-6051)
- Radiation (Report No. T3-1068)

The first two hours of the chemical spray/temperature test produced maximum output shift of -6.7% of span. During the rest of the test the output shift remained negative within 0.5% of -3.30% of span. During the rest of the test the output shift remained negative within 0.5% of -3.30% of span.

During the initial phase of the high temperature test the maximum output shift was -1.7% and +1/8% of span. The subsequent phase of the test at 315°F produced a maximum output shift of -1.9% of span. During the final phase of the test, at 230°F, the output shift remained at a constant +0.4% of span.

The radiation test was started at a dose rate of  $1 \times 10^5$  R/Hr and increased to  $1 \times 10^6$  R/Hr at  $1 \times 10^6$  rads. The output shift was negative and increased to a maximum of 4.92% at  $1.68 \times 10^8$  rads and returned to 4.5% at  $2.2 \times 10^8$  rads. The shift progressed as follows: -0.15% at  $1 \times 10^5$  rads, -2.03% at  $1 \times 10^6$  rads, -3.35% at  $1 \times 10^7$  rads, -4.73% at  $1 \times 10^8$  rads, -4.92% at  $1.68 \times 10^8$  rads, and -4.50% at  $2.2 \times 10^8$  rads.

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
 ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 15 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Pressure Transmitter	Rosemount	1153GP	Legend A of table 4-3	See attached Data Sheet No. 209.	Continuous, 6 Hours to 1 Year	See attached Data Sheet No. 209.	Total Accuracy:  $\pm 16.0 \text{ lb/in.}^2$ at 6-36 Hours and a Maximum $+300 \text{ lb/in.}^2$ at 6 Hours to 1 Year	Total Accuracy:  For 6-36 Hours, $22.8 \text{ lb/in.}^2$  For 6 Hours to 60 Hours $60.0 \text{ lb/in.}^2$	See attached Data Sheet No. 209.	Replace See table 5-2, A10, A12
Containment Building			Radiation:  $5 \times 10^7 \text{ rads}$							

Component used in Shutdown Cooling System.

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

**San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment**

**Table 4-2**

**EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2&3  
ELECTRICAL EQUIPMENT (Sheet 16 of 56)**

REFERENCE	ENVIRONMENTAL TEST DOCUMENTATION	DATA SHEET No. <u>209</u>
IEEE STD 323-1971		DATE _____
CENPD-212 SECTION(S) <u>3.3.1</u>		REVISION No. _____

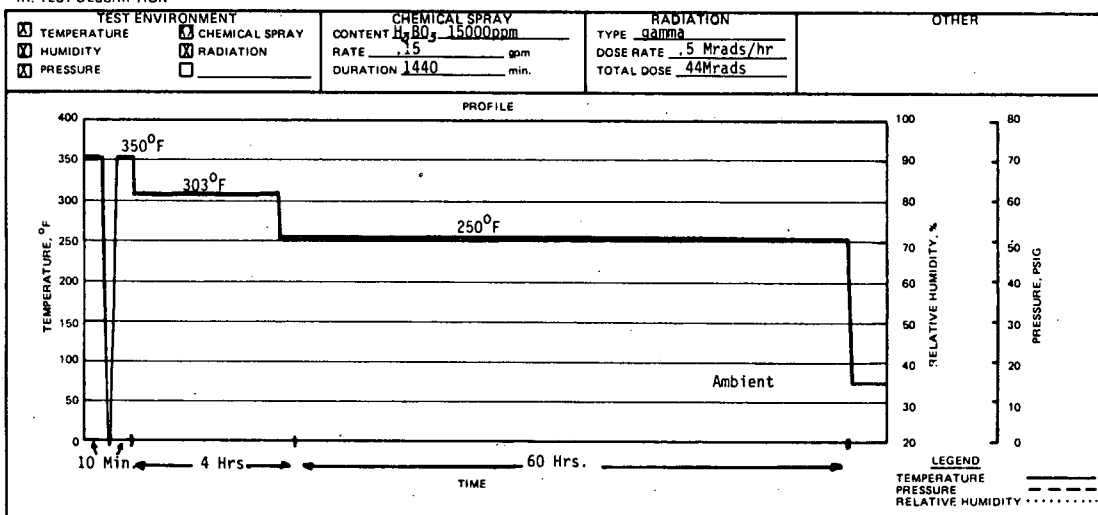
**I. EQUIPMENT DESCRIPTION**

ITEM <u>Pressure Transmitters</u>	MANUFACTURER <u>Rosemount</u>	MODEL <u>1153GP</u>
FUNCTION <u>Provides electrical output signal proportional to sensed pressure</u>		SERVICE LOCATION <u>in-containment</u>

**II. TEST REPORT**

TITLE <u>Qualification Test Report for Pressure Transmitters Rosemount No. 3788</u>	DATE <u>February 1977</u>
-------------------------------------------------------------------------------------	---------------------------

**III. TEST DESCRIPTION**



**IV. DESCRIPTION OF EQUIPMENT OPERATION DURING TESTING**

EQUIPMENT ENERGIZED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA ALL SAFETY FUNCTIONS TESTED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA FULL RANGE VERIFIED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA TRIP FUNCTIONS EXERCISED <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> NA	<b>REMARKS</b> During the radiation and steam/chemical tests the transmitters were to be continually powered and pressurized (see discussion below on exception during radiation testing). The transmitter outputs were also continuously monitored on strip charts. Calibration checks were run at specified check points to verify accuracy.
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

**V. RESULTS AND DISCUSSION**

DISCUSSION:

During the steam/chemical test, a deviation from procedure occurred in that the three transmitters were subjected to the chemical spray for different periods of time, however unit 106188 was subjected for the required 24 hour time period. The transmitters were tested in an autoclave, with the autoclave temperature and pressure, and the transmitter outputs continuously recorded on strip charts. Lift-off voltage, time constant and temperature coefficient values were checked before and after the test.

As with the steam/chemical test, lift-off voltage, time constant and temperature coefficient values were checked before and after the radiation test. After removal of the radiation source, the transmitters were cycled on and off three times to demonstrate start-up ability. There was some effect on the temperature coefficient during the test by the radiation, however the magnitude of the effect was small. There was a deviation from the test procedure in that the transmitters were to be powered and the process pressure at 100% throughout the duration of the test, however when a calibration test was made at 11 megarads, the pressure was found to be at 0% and stayed this way for the next 8.2 megarads until the setpoint was reset to 100% between calibration checks.

RESULTS:

The results of the steam/chemical test and the radiation test are acceptable as all measured parameters were within the specified limits. During the steam/chemical test, a maximum error of 6.95% full scale was noted at the second 10 minute heat-up @350°F and was within the acceptance criteria of  $\pm 8\%$ . There was no evidence of moisture or corrosion within the housing during post-test examination. During the radiation exposure, the maximum deviation was +3.7% (transmitter 106187) Acceptable criteria is 5.0%.

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 17 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Pressure Transmitter	Foxboro	E11GM	Legend A of table 4-3	See attached Data Sheet No. 203.	Accident Mitigation:  30 Minutes	See attached Data Sheet No. 203.	Total Accuracy:  26.95 lb/in. <sup>2</sup>	Total Accuracy:  Steam and radiation uncertainties in negative (conservative direction).	See attached Data Sheet No. 203.	Requalify See table 5-2, A10
Containment Building			Radiation:  5x10 <sup>7</sup> rads		Post Accident Monitoring:  See section 2.5 of the SONGS 2 and 3 sub- mittal for NUREG-0588.		Response Time:  0.5 sec.	Response Time:  See table 5-2, A5		

Component used in Plant Protection System.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

**San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment**

Table 4-2

**EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2&3  
ELECTRICAL EQUIPMENT (Sheet 18 of 56)**

REFERENCE

IEEE STD 323-1971

CENPD-212 SECTION(S) 3.3.1

ENVIRONMENTAL TEST DOCUMENTATION

DATA SHEET No. 203

DATE

REVISION No.

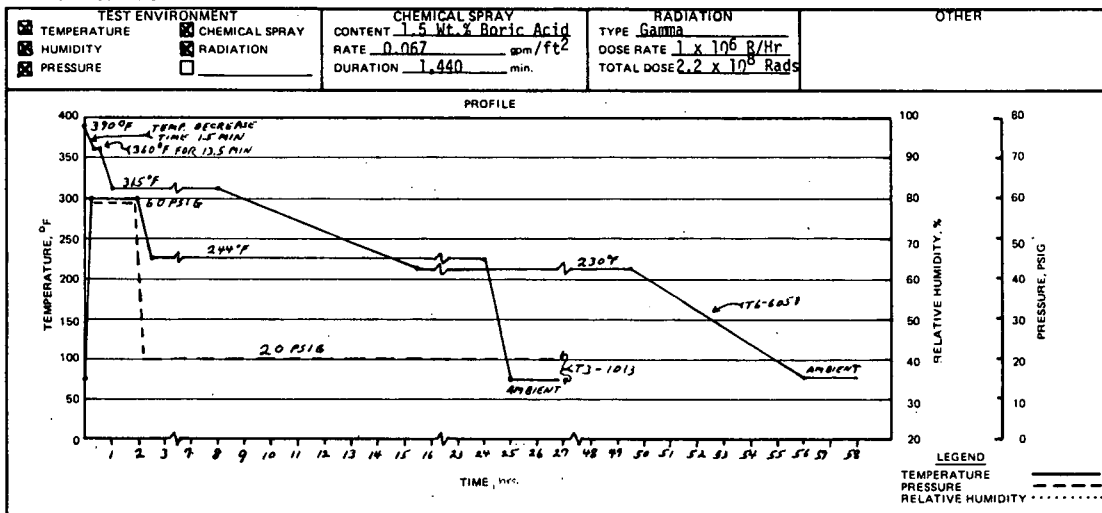
I. EQUIPMENT DESCRIPTION

ITEM <u>Pressure Transmitter</u>	MANUFACTURER <u>The Foxboro Company</u>	MODEL <u>E11GM</u>
FUNCTION <u>Converts pressure to electrical signal</u>	SERVICE LOCATION <u>Containment</u>	

II. TEST REPORT

TITLE <u>T3-1013 (Supplemental), March, 1973; T3-1068, Aug. 1973; T6-6051, Sept.-Oct., 1976</u>	DATE
Test Reports by Foxboro	

III. TEST DESCRIPTION



IV. DESCRIPTION OF EQUIPMENT OPERATION DURING TESTING

<p>EQUIPMENT ENERGIZED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA</p> <p>ALL SAFETY FUNCTIONS TESTED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA</p> <p>FULL RANGE VERIFIED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA</p> <p>TRIP FUNCTIONS EXERCISED <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> NA</p>	<p>REMARKS</p> <p>The transmitter was operational during all tests. Except during calibration checks the input pressures were maintained at 75% of span for the temperature and chemical spray tests and 80% of span for the radiation and high temperature tests. Outputs were continuously monitored. Calibration checks were done before and after each test on the test item.</p>
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

V. RESULTS AND DISCUSSION

Qualification testing was performed by 3 series of tests as follows:

- Temperature - steam pressure - chemical spray (Report No. T3-1013)
- High temperature (Report No. T6-6051)
- Radiation (Report No. T3-1068)

The first two hours of the chemical spray/temperature test produced maximum output shift of -6.70% of span. During the rest of the test the output shift remained negative within 0.5% of -3.30% of span. During the rest of the test the output shift remained negative within 0.5% of -3.30% of span.

During the initial phase of the high temperature test the maximum output shift was -1.7% and + 1/8% of span. The subsequent phase of the test at 315°F produced a maximum output shift of -1.9% of span. During the final phase of the test, at 230°F, the output shift remained at a constant + 0.4% of span.

The radiation test was started at a dose rate of 1 x 10<sup>5</sup> R/Hr and increased to 1 x 10<sup>6</sup> R/Hr at 1 x 10<sup>6</sup> rads. The output shift was negative and increased to a maximum of 4.92% at 1.68 x 10<sup>8</sup> rads and returned to 4.5% at 2.2 x 10<sup>8</sup> rads. The shift progressed as follows: -0.15% at 1 x 10<sup>5</sup> rads, -2.03% at 1 x 10<sup>6</sup> rads, -3.35% at 1 x 10<sup>7</sup> rads, -4.73% at 1 x 10<sup>8</sup> rads, -4.92% at 1.68 x 10<sup>8</sup> rads, and -4.50% at 2.2 x 10<sup>8</sup> rads.

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
 ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 19 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Differential Pressure Transmitter	Foxboro	E13DM	Legend A of table 4-3	See attached Data Sheet No. 211	Accident Mitigation:  30 Minutes	See attached Data Sheet No. 211.	Total Accuracy:  13.2 in.	Total Accuracy:  9.6 in.	See attached Data Sheet No. 211.	Requalify See table 5-2, A10
Containment Building			Radiation: $5 \times 10^7$ rads		Post Accident Monitoring:  See section 2.5 of the SONGS 2 and 3 sub- mittal for NUREG-0588.		Response Time:  0.5 sec.	Response Time:  See table 5-2, A5		

Component used in Plant Protection System.

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class 1E Equipment

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2&3  
ELECTRICAL EQUIPMENT (Sheet 20 of 56)

REFERENCE	ENVIRONMENTAL TEST DOCUMENTATION	DATA SHEET No. <u>211</u>
IEEE STD 323-1971		DATE _____
CENPD-212 SECTION(S) <u>3.3.1</u>		REVISION No. _____

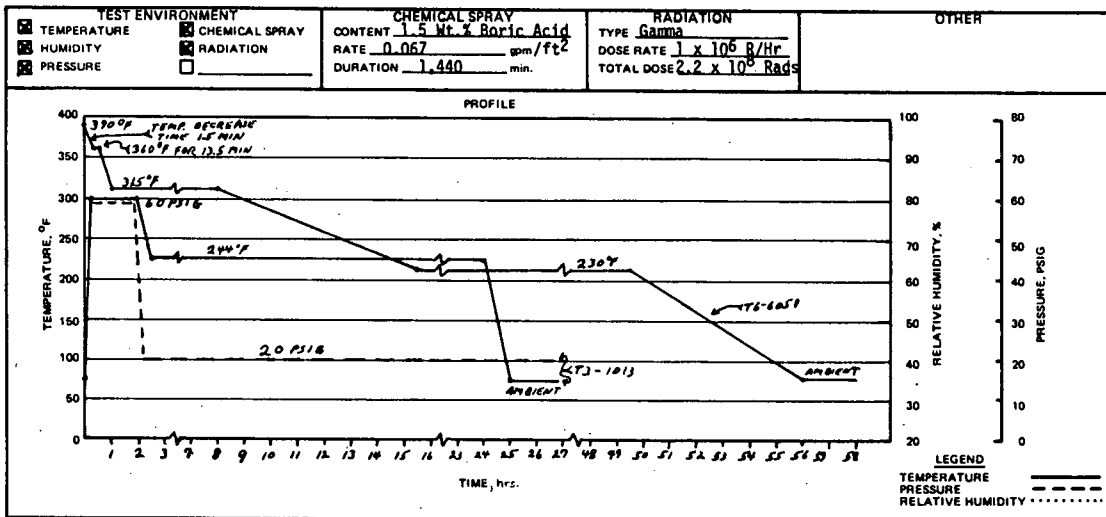
I. EQUIPMENT DESCRIPTION

ITEM <u>Differential Pressure Transmitter</u>	MANUFACTURER <u>The Foxboro Company</u>	MODEL <u>F13DM</u>
FUNCTION <u>Convert differential pressure to electrical signal</u>	SERVICE LOCATION _____	Containment

II. TEST REPORT

TITLE <u>T3-1013 (Supplementary), March 1973; T3-1068, August 1973; T6-6051, September-October 1976</u>	DATE _____
Test Reports by Foxboro	

III. TEST DESCRIPTION



IV. DESCRIPTION OF EQUIPMENT OPERATION DURING TESTING

<p>EQUIPMENT ENERGIZED    <input checked="" type="checkbox"/> YES    <input type="checkbox"/> NO    <input type="checkbox"/> NA</p> <p>ALL SAFETY FUNCTIONS TESTED    <input checked="" type="checkbox"/> YES    <input type="checkbox"/> NO    <input type="checkbox"/> NA</p> <p>FULL RANGE VERIFIED    <input checked="" type="checkbox"/> YES    <input type="checkbox"/> NO    <input type="checkbox"/> NA</p> <p>TRIP FUNCTIONS EXERCISED    <input type="checkbox"/> YES    <input type="checkbox"/> NO    <input checked="" type="checkbox"/> NA</p>	<p>REMARKS</p> <p>The transmitter was operational during all tests. Except during calibration checks the input pressures were maintained at 75% of span for the temperature and chemical spray tests and 80% of span for the radiation and high temperature tests. Outputs were continuously monitored. Calibration checks were done before and after each test on the test item.</p>
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

V. RESULTS AND DISCUSSION

Qualification testing was performed by 3 series of tests as follows:

- a) Temperature - steam pressure - chemical spray (Report No. T3-1013)
- b) High temperature (Report No. T6-6051)
- c) Radiation (Report No. T3-1068)

The first two hours of the chemical spray/temperature test produced maximum output shifts of + 1.50% and -2.05% of span. During the rest of the test the output shift remained negative within 0.5% of -1.20% of span.

During the initial phase of the high temperature test the maximum output shift was -1.7% and +1.8% of span. The subsequent phase of the test at 315°F produced a maximum output shift of -1.9% of span. During the final phase of the test, at 230°F, the output shift remained at a constant + 0.4% of span.

The radiation test was started as a dose rate of  $1 \times 10^5$  R/Hr and increased to  $1 \times 10^6$  R/Hr at  $1 \times 10^6$  rads. The output shift increased to a maximum of -4.92% at  $1.68 \times 10^8$  rads and returned to -4.5% at  $2.2 \times 10^8$  rads. The shift progressed as follows: -0.15% at  $1 \times 10^5$  rads, -2.03% at  $1 \times 10^6$  rads, -3.35% at  $1 \times 10^7$  rads, -4.73% at  $1 \times 10^8$  rads, -4.92% at  $1.68 \times 10^8$  rads, and -4.50% at  $2.2 \times 10^8$  rads.

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
 ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 21 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Differential Pressure Transmitter	Rosemount	1153 DA5	Legend A of table 4-3	See attached Data Sheet No. 209	Post Accident Monitoring:	See attached Data Sheet No. 209	Post Accident Monitoring:	Total Accuracy:	See attached Data Sheet No. 209.	Interim Use See table 5-2, All
Containment Building			Radiation: $5 \times 10^7$ rads		See section 2.5 of the SONGS 2 and 3 submittal for NUREG-0588.		See section 2.5 of the SONGS 2 and 3 submittal for NUREG-0588.	27.2 in.		

Component used in Steam Generator Level Monitoring System.

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class 1E Equipment

**San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment**

**Table 4-2**

**EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2&3  
ELECTRICAL EQUIPMENT (Sheet 22 of 56)**

**REFERENCE**

IEEE STD 323-1971

CENPD-212 SECTION(S) 3.3.1

**ENVIRONMENTAL TEST DOCUMENTATION**

DATA SHEET No. 209

DATE \_\_\_\_\_

REVISION No. \_\_\_\_\_

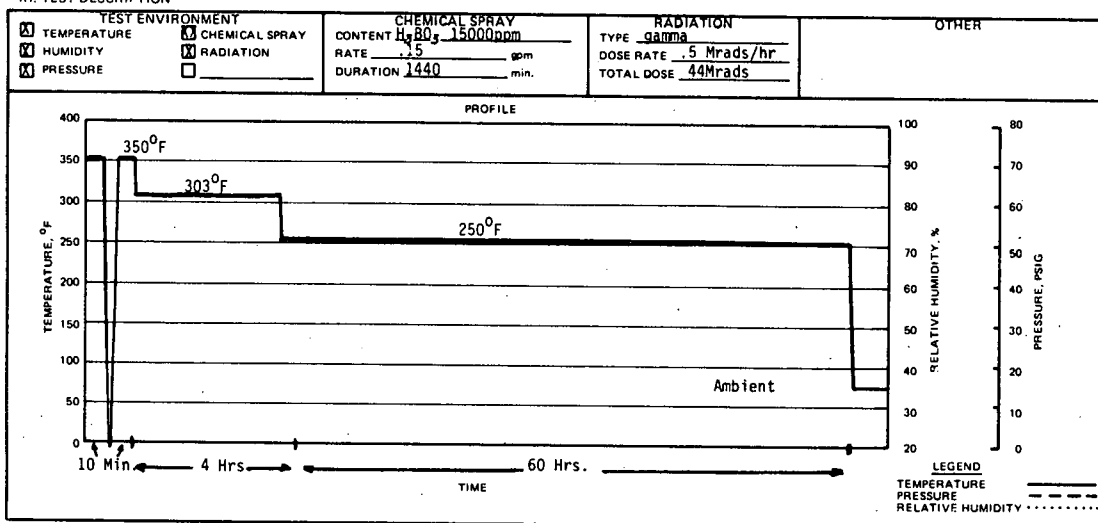
**I. EQUIPMENT DESCRIPTION**

ITEM <u>Pressure Transmitters</u>	MANUFACTURER <u>Rosemount</u>	MODEL <u>1153GP</u>
FUNCTION <u>Provides electrical output signal proportional to sensed pressure</u>		SERVICE LOCATION <u>in-containment</u>

**II. TEST REPORT**

TITLE <u>Qualification Test Report for Pressure Transmitters Rosemount No. 3788</u>	DATE <u>February 1977</u>
-------------------------------------------------------------------------------------	---------------------------

**III. TEST DESCRIPTION**



**IV. DESCRIPTION OF EQUIPMENT OPERATION DURING TESTING**

EQUIPMENT ENERGIZED    YES <input checked="" type="checkbox"/> NO <input type="checkbox"/> NA <input type="checkbox"/> ALL SAFETY FUNCTIONS TESTED <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> FULL RANGE VERIFIED <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> TRIP FUNCTIONS EXERCISED <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/>	<b>REMARKS</b> During the radiation and steam/chemical tests the transmitters were to be continually powered and pressurized (see discussion below on exception during radiation testing). The transmitter outputs were also continuously monitored on strip charts. Calibration checks were run at specified check points to verify accuracy.
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

**V. RESULTS AND DISCUSSION**

**DISCUSSION:**

During the steam/chemical test, a deviation from procedure occurred in that the three transmitters were subjected to the chemical spray for different periods of time, however unit 106188 was subjected for the required 24 hour time period. The transmitters were tested in an autoclave, with the autoclave temperature and pressure, and the transmitter outputs continuously recorded on strip charts. Lift-off voltage, time constant and temperature coefficient values were checked before and after the test.

As with the steam/chemical test, lift-off voltage, time constant and temperature coefficient values were checked before and after the radiation test. After removal of the radiation source, the transmitters were cycled on and off three times to demonstrate start-up ability. There was some effect on the temperature coefficient during the test by the radiation, however the magnitude of the effect was small. There was a deviation from the test procedure in that the transmitters were to be powered and the process pressure at 100% throughout the duration of the test, however when a calibration test was made at 11 megarads, the pressure was found to be at 0% and stayed this way for the next 8.2 megarads until the setpoint was reset to 100% between calibration checks.

**RESULTS:**

The results of the steam/chemical test and the radiation test are acceptable as all measured parameters were within the specified limits. During the steam/chemical test, a maximum error of 6.95% full scale was noted at the second 10 minute heat-up @350°F and was within the acceptance criteria of + 8%. There was no evidence of moisture or corrosion within the housing during post-test examination. During the radiation exposure, the maximum deviation was +3.7% (transmitter 106187) Acceptable criteria is 5.0%.

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
 ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 23 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Nuclear Instrument Detector Assembly	General Atoms/ Reuter Stokes	E1E304- 5000-1	Legend A table 4-3	See attached Data Sheet No. 206.	30 seconds for CEA ejection and 30 minutes for steam line break.	See attached Data Sheet No. 206.	See table 5-2, A1	Response Time: $3.0 \times 10^{-10}$ sec  See table 5-2, A1	See attached Data Sheet No. 206.	Interim Use See table 5-2, A1, A9, and A11
Containment Building			Radiation: $5 \times 10^7$ rads							

Component used in Plant Protection System.

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2&3  
ELECTRICAL EQUIPMENT (Sheet 24 of 56)

REFERENCE	ENVIRONMENTAL TEST DOCUMENTATION	DATA SHEET No. <u>206</u>
IEEE STD 323-1971		DATE <u>July</u> <u>1977</u>
CENPD-212 SECTION(S) <u>3.3.1</u>		REVISION No. <u>00</u>

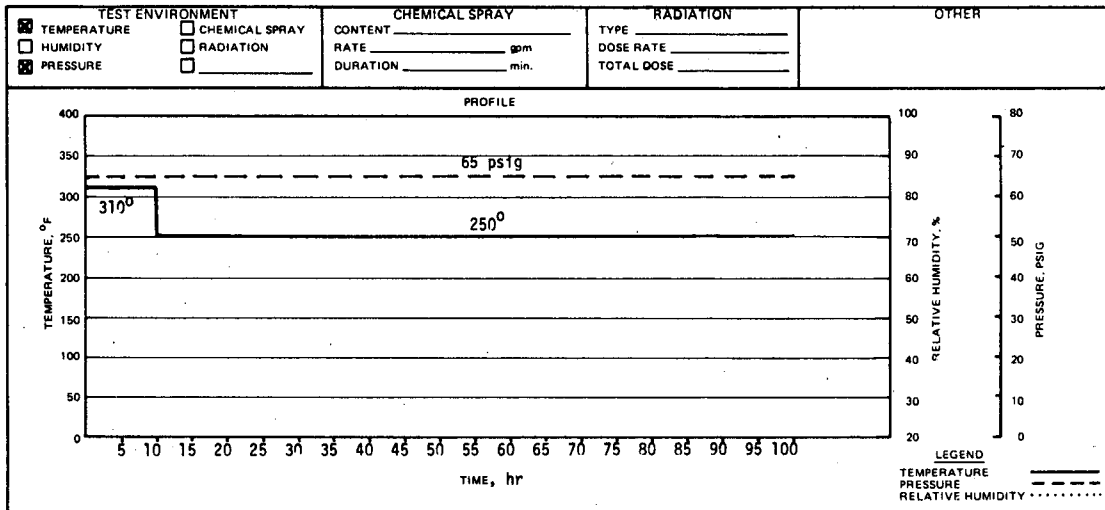
I. EQUIPMENT DESCRIPTION

ITEM <u>Nuclear Instrument Detector Assembly</u>	MANUFACTURER <u>General Atomic/Reuter Stokes</u>	MODEL _____
FUNCTION <u>Fission chamber neutron detector</u>	SERVICE LOCATION <u>Containment</u>	

II. TEST REPORT

TITLE <u>General Atomic Report No. E-115-496</u>	DATE <u>Aug. 20, 1975</u>
--------------------------------------------------	---------------------------

III. TEST DESCRIPTION



IV. DESCRIPTION OF EQUIPMENT OPERATION DURING TESTING

<table border="0"> <tr> <td>EQUIPMENT ENERGIZED</td> <td>YES <input type="checkbox"/></td> <td>NO <input checked="" type="checkbox"/></td> <td>NA <input type="checkbox"/></td> </tr> <tr> <td>ALL SAFETY FUNCTIONS TESTED</td> <td><input checked="" type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>FULL RANGE VERIFIED</td> <td><input type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>TRIP FUNCTIONS EXERCISED</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> </tr> </table>	EQUIPMENT ENERGIZED	YES <input type="checkbox"/>	NO <input checked="" type="checkbox"/>	NA <input type="checkbox"/>	ALL SAFETY FUNCTIONS TESTED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	FULL RANGE VERIFIED	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	TRIP FUNCTIONS EXERCISED	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<p style="text-align: center;">REMARKS</p> <p>Simulation of inservice conditions was not accomplished due to the impracticality of performing the environmental test in a radiation field. Proper operation of the detector was determined by making measurements with the detector before and after the environmental test. These measurements consisted of two detector resistance checks, and current output from the detector at high voltage values of 100, 500, and 100 DC. The output current is a function of the alpha (α) activity within the detector.</p>
EQUIPMENT ENERGIZED	YES <input type="checkbox"/>	NO <input checked="" type="checkbox"/>	NA <input type="checkbox"/>														
ALL SAFETY FUNCTIONS TESTED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>														
FULL RANGE VERIFIED	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>														
TRIP FUNCTIONS EXERCISED	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>														

V. RESULTS AND DISCUSSION

The detector resistance for the first check remained greater than  $2 \times 10^{13} \Omega$  ( $>10^{12} \Omega$  required) and for the second check greater than  $2 \times 10^9 \Omega$  ( $> 2 \times 10^8 \Omega$  required). The maximum deviation in alpha current for all thru voltages was less than 0.8%.

No humidity test was performed with the detector since they are of hermetically sealed construction, consisting of a welded aluminum can, integral aluminum sheathed cabling and connectors. Analysis has shown that if the detector is able to withstand the test pressure, then humidity will have no effect on operation.

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 25 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
CEDM Reed Switch Position Transmitter  Containment Building	Combustion Engineering and Electro- Mechanics	150 Inches Type	Legend A of table 4-3  Radiation: $5 \times 10^7$ rads	See attached Data Sheet No. 208.	30 Minutes	See attached Data Sheet No. 208.	Total Accuracy:  +4.993 in. -3.998 in.  Response Time:  None	Total Accuracy:  1.4 in. (two steps) uncertainty as a result of one inopera- tive reed switch  Response Time:  Not measured.	See attached Data Sheet No. 208.	Interim Use See table 5-2, A-9, All

Component used in Plant Protection System.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class 1E Equipment

**San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment**

**Table 4-2**

**EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2&3  
ELECTRICAL EQUIPMENT (Sheet 26 of 56)**

**REFERENCE**

IEEE STD 323-1971

CENPO-212 SECTION(S) 3.3.1 & 3.3.3

**ENVIRONMENTAL TEST DOCUMENTATION**

DATA SHEET No. 208

DATE \_\_\_\_\_

REVISION No. \_\_\_\_\_

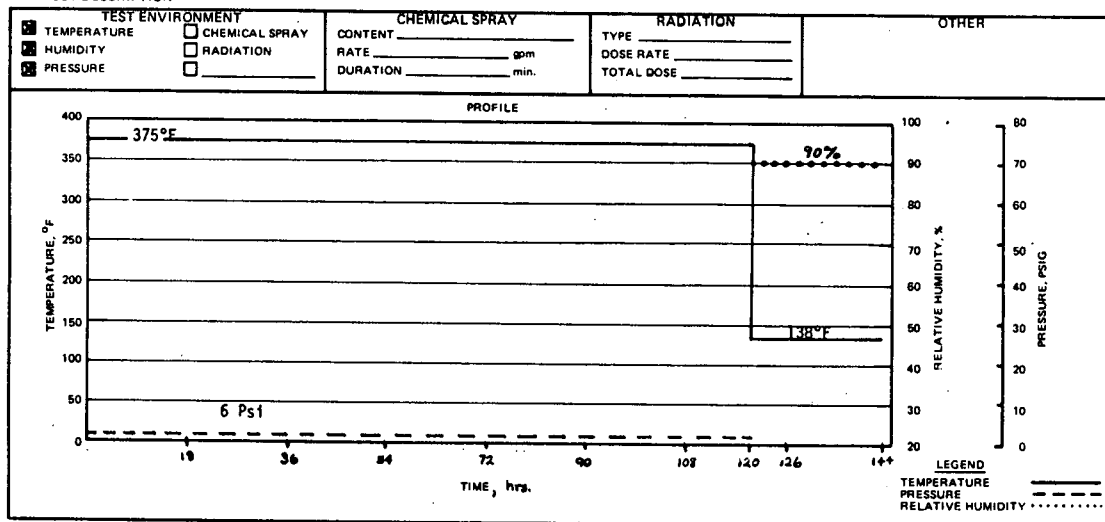
**I. EQUIPMENT DESCRIPTION**

ITEM <u>Reed Switch Position Transmitter</u>	MANUFACTURER <u>Electro-Mechanics</u>	MODEL <u>150 Inch</u>
FUNCTION <u>Provides Control Element Assembly Position Information</u>	SERVICE LOCATION <u>Containment</u>	

**II. TEST REPORT**

TITLE <u>Qualification of 150 Inch Reed Switch Position Transmitter and Bendix Electrical Connector, Environmental, Seismic and Radiation</u>	DATE <u>2-28-77</u>
TR-ESE-174	

**III. TEST DESCRIPTION**



**IV. DESCRIPTION OF EQUIPMENT OPERATION DURING TESTING**

EQUIPMENT ENERGIZED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA ALL SAFETY FUNCTIONS TESTED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA FULL RANGE VERIFIED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA TRIP FUNCTIONS EXERCISED <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> NA	<b>REMARKS</b> The R.S.P.T.'s output was recorded on a Honeywell Oscillograph Recorder. The R.S.P.T.'s output voltage was monitored on a digital voltmeter.
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------

**V. RESULTS AND DISCUSSION**

The RSPT successfully completed the environmental portion of the qualification test which consisted of a 120 hour temperature and pressure test and a 24 hour humidity test. The test showed that the RSPT analog circuitry and limit switches performed in accordance with para. 6.0 of Test Procedure No. 00000-ESE-066, Rev. 1 while the functional integrity of the RSPT remained unimpaired.

A material evaluation was completed to establish the design adequacy of the RSPT under the guidelines of Specification No. 00000-ESE-028 Rev. 1 manufacturing specification for Class IE reed switch position transmitter. An item by item examination of each RSPT component material revealed that they can sustain in excess of the required 30R/hr plant life time radiation dose ( $8.41 \times 10^6$  Rads total).

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 27 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Nuclear Instrument Preamplifier/Filter	General Atomics/ Reuter Stokes	PA5Q1	Legend A table 4-3	See attached Data Sheet No. 207.	30 seconds for CEA ejection and 30 minutes for steam line break.	See attached Data Sheet No. 207	See table 5-2, A1	See table 5-2, A1	See attached Data Sheet No. 207.	Interim Use See table 5-2, A9, A11
Containment Building			Radiation: $5 \times 10^7$ rads							

Component used in Plant Protection System.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2&3  
ELECTRICAL EQUIPMENT (Sheet 28 of 56)

REFERENCE  
IEEE STD 323-1971  
CENPD-212 SECTION/ISI 3.3.1

ENVIRONMENTAL TEST DOCUMENTATION

DATA SHEET No. 207  
DATE July 1977  
REVISION No. 00

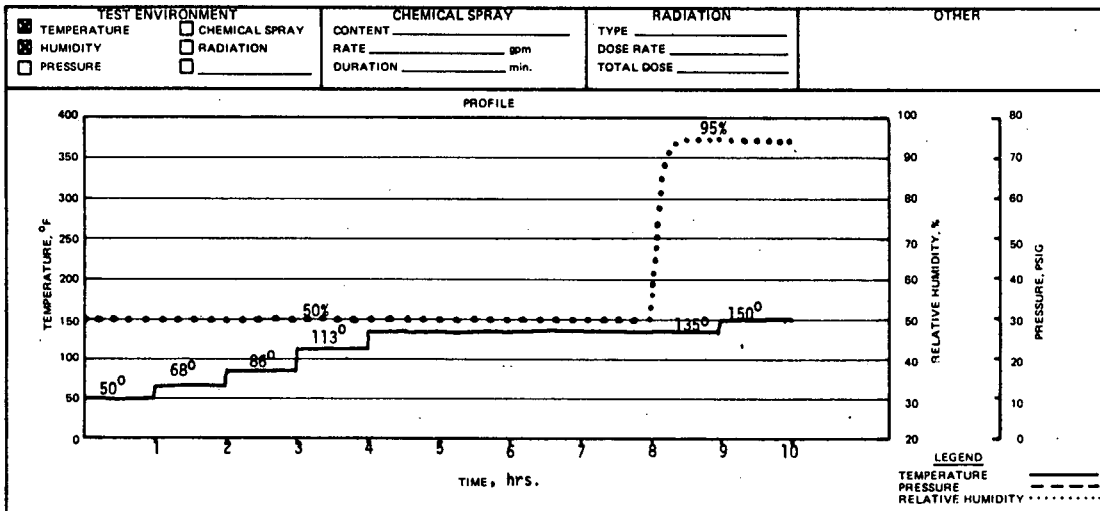
I. EQUIPMENT DESCRIPTION

ITEM <u>Nuclear Instrument Preamplifier/Filter</u>	MANUFACTURER <u>General Atomic</u>	MODEL <u>PA5Q1</u>
FUNCTION <u>Amplify nuclear detector signals</u>	SERVICE LOCATION <u>Containment</u>	

II. TEST REPORT

TITLE <u>General Atomic Report No. E-115-578 (Revised)</u>	DATE <u>June</u> 1976
------------------------------------------------------------	-----------------------

III. TEST DESCRIPTION



IV. DESCRIPTION OF EQUIPMENT OPERATION DURING TESTING

EQUIPMENT OPERATED DURING TESTING	REMARKS
EQUIPMENT ENERGIZED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA ALL SAFETY FUNCTIONS TESTED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA FULL RANGE VERIFIED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA TRIP FUNCTIONS EXERCISED <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> NA	See Section V Results and Discussion

V. RESULTS AND DISCUSSION

The preamplifier was tested simultaneously with the Nuclear Instrument Drawer (Data Sheet No. 1a).  
 See Data Sheet No. 1a for a description of the electrical operation.  
 The preamplifier performed well within specification throughout the environmental test.

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
 ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 29 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Excore Detector System Cable	ITT	3102-65- 4123	Legend A table 4-3	See table 5-2, A4	30 seconds for CEA ejection and 30 minutes for steam line break.	See table 5-2, A4	Not applicable.	Not measured.	See table 5-2, A4	Interim Use See table 5-2, A4, A9, and A11  See table 5-2, B1
Containment Building			Radiation: $5 \times 10^7$ rads							

Component used in Plant Protection System.

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class 1E Equipment

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
 ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 30 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
RSPT Cable	Anaconda	None	Legend A of table 4-3	See table 5-2, A3	30 Minutes	See table 5-2, A3	Not applicable.	Not measured.	See table 5-2, A3	Interim Use See table 5-2, A9, All
Containment Building			Radiation: $5 \times 10^7$ rads							

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

Component used in Plant Protection System.

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 31 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Temperature Sensors (RTD)	Rosemount	104A	Legend C3 of table 4-3 for Temperature and Humidity	See attached Data Sheet No. 201	Post Accident Monitoring:	See attached Data Sheet No. 201.	Post Accident Monitoring:	Steam/Chemical:	See attached Data Sheet No. 201.	Interim Use See table 5-2, All
Safety Equipment Building Elevation:			Radiation:		See section 2.5 of the SONGS 2 and 3 sub- mittal for NUREG-0588.		See section 2.5 of the SONGS 2 and 3 submittal for NUREG-0588.	+0.054F -0.036F		
8'-0" to 30'-6"			5.2x10 <sup>7</sup> Rads					Radiation: +0.022F -0.005F		

Component used in Shutdown Cooling System.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

**San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment**

**Table 4-2**

**EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2&3  
ELECTRICAL EQUIPMENT (Sheet 32 of 56)**

REFERENCE

IEEE STD 323-1971

CENPD-212 SECTION(S) 3.3.1

**ENVIRONMENTAL TEST DOCUMENTATION**

DATA SHEET No. 201

DATE \_\_\_\_\_

REVISION No. 00

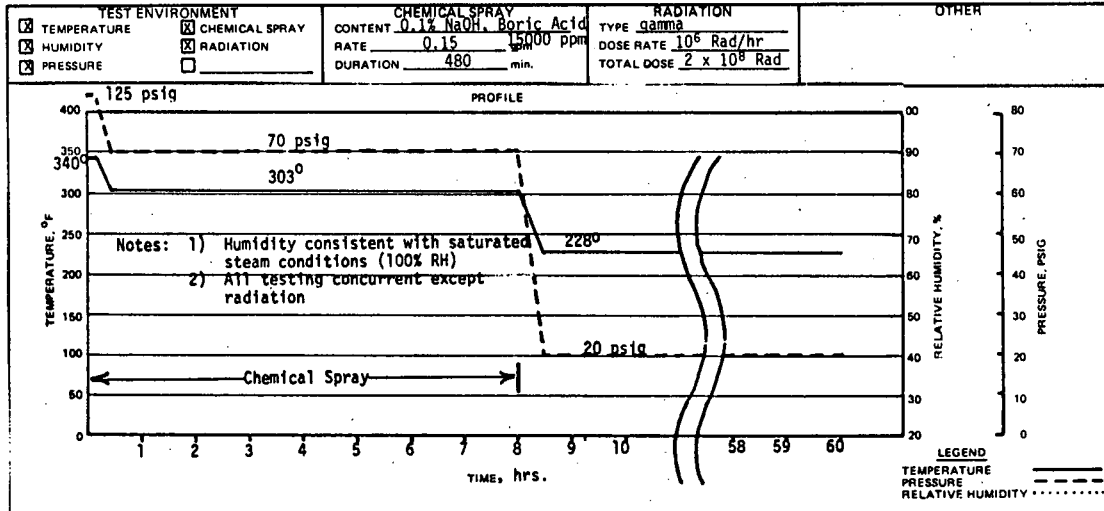
**I. EQUIPMENT DESCRIPTION**

ITEM <u>Resistance Temperature Detector</u>	MANUFACTURER <u>Rosemount</u>	MODEL <u>104</u>
FUNCTION <u>Converts temperature to electrical signal</u>		SERVICE LOCATION <u>Containment</u>

**II. TEST REPORT**

TITLE <u>Rosemount Report Number 1762, Revision A</u>	DATE <u>January 2, 1976</u>
-------------------------------------------------------	-----------------------------

**III. TEST DESCRIPTION**



**IV. DESCRIPTION OF EQUIPMENT OPERATION DURING TESTING**

EQUIPMENT ENERGIZED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA ALL SAFETY FUNCTIONS TESTED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA FULL RANGE VERIFIED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA TRIP FUNCTIONS EXERCISED <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> NA	<b>REMARKS</b> The RTD was operational with its output compared to that of an operating thermocouple in the test chamber; both were recorded. The output of the RTD was also monitored during radiation testing. After testing, the insulation resistance was checked.
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

**V. RESULTS AND DISCUSSION**

A post environmental calibration showed that the 0°C reading shifted only +0.016° (0.02°C), and the 100°C reading shifted only -0.023° (0.03°C). A visual inspection showed negligible change to the unit. The insulation resistance was 250 megohms.

A post radiation calibration showed the 0°C reading to increase of 0.002° (0.003°C) and a 0.01° (0.012°C) increase at 100°C. The insulation resistance remained greater than 100 megohms.

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 33 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Pressure Sensors	Foxboro	E11GM	Legend C3 of table 4-3 for Temperature and Humidity	See attached Data Sheet No. 203.	Post Accident Monitoring:	See attached Data Sheet No. 203.	Post Accident Monitoring	Total Accuracy:	See attached Data Sheet No. 203.	Requalify See table 5-2, A10
Safety Equipment Building Elevation:  8'-0" to 15'-0"			Radiation:  $5.2 \times 10^7$ Rads		See section 2.5 of the SONGS 2 and 3 sub- mittal for NUREG-0588.		See section 2.5 of the SONGS 2 and 3 sub- mittal for NUREG-0588.	$32.0 \text{ lb/in.}^2$		

Component used in Shutdown Cooling System.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class 1E Equipment

**San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment**

**Table 4-2**

**EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2&3  
ELECTRICAL EQUIPMENT (Sheet 34 of 56)**

**REFERENCE**

IEEE STD 323-1971

CENPD-212 SECTION(S) 3.3.1

**ENVIRONMENTAL TEST DOCUMENTATION**

DATA SHEET No. 203

DATE \_\_\_\_\_

REVISION No. \_\_\_\_\_

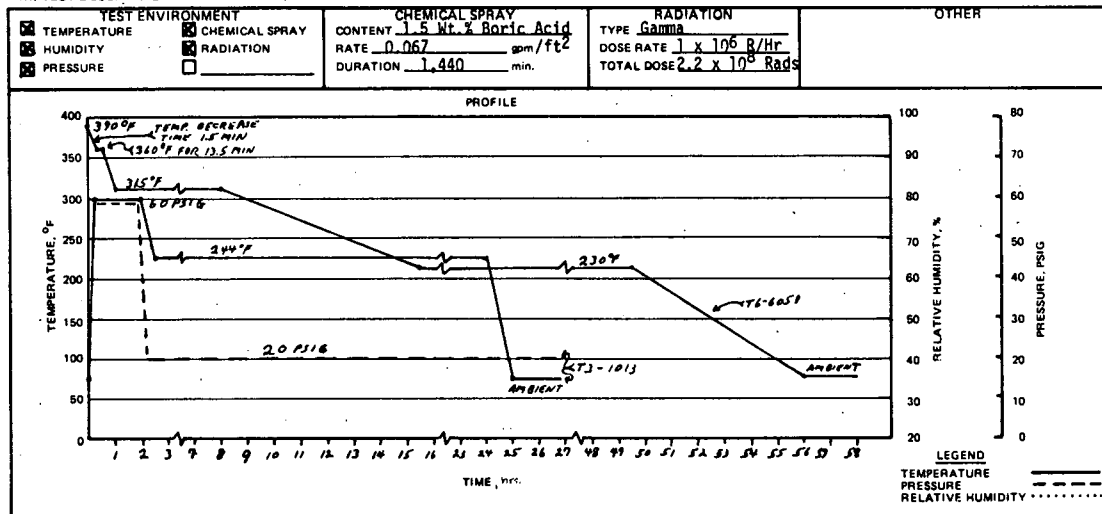
**I. EQUIPMENT DESCRIPTION**

ITEM <u>Pressure Transmitter</u>	MANUFACTURER <u>The Foxboro Company</u>	MODEL <u>E11GM</u>
FUNCTION <u>Converts pressure to electrical signal</u>	SERVICE LOCATION <u>Containment</u>	

**II. TEST REPORT**

TITLE <u>T3-1013 (Supplemental), March, 1973; T3-1068, Aug. 1973; T6-6051, Sept.-Oct., 1976</u>	DATE _____
<u>Test Reports by Foxboro</u>	

**III. TEST DESCRIPTION**



**IV. DESCRIPTION OF EQUIPMENT OPERATION DURING TESTING**

EQUIPMENT ENERGIZED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA ALL SAFETY FUNCTIONS TESTED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA FULL RANGE VERIFIED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA TRIP FUNCTIONS EXERCISED <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> NA	<b>REMARKS</b> The transmitter was operational during all tests. Except during calibration checks the input pressures were maintained at 75% of span for the temperature and chemical spray tests and 80% of span for the radiation and high temperature tests. Outputs were continuously monitored. Calibration checks were done before and after each test on the test item.
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

**V. RESULTS AND DISCUSSION**

Qualification testing was performed by 3 series of tests as follows:

- Temperature - steam pressure - chemical spray (Report No. T3-1013)
- High temperature (Report No. T6-6051)
- Radiation (Report No. T3-1068)

The first two hours of the chemical spray/temperature test produced maximum output shift of -6.79% of span. During the rest of the test the output shift remained negative within 0.5% of -3.30% of span. During the rest of the test the output shift remained negative within 0.5% of -3.30% of span.

During the initial phase of the high temperature test the maximum output shift was -1.7% and + 1/8% of span. The subsequent phase of the test at 315°F produced a maximum output shift of -1.9% of span. During the final phase of the test, at 230°F, the output shift remained at a constant + 0.4% of span.

The radiation test was started at a dose rate of 1 x 10<sup>5</sup> R/Hr and increased to 1 x 10<sup>6</sup> R/Hr at 1 x 10<sup>6</sup> rads. The output shift was negative and increased to a maximum of 4.92% at 1.68 x 10<sup>8</sup> rads and returned to 4.5% at 2.2 x 10<sup>8</sup> rads. The shift progressed as follows: -0.15% at 1 x 10<sup>5</sup> rads, -2.03% at 1 x 10<sup>6</sup> rads, -3.35% at 1 x 10<sup>7</sup> rads, -4.73% at 1 x 10<sup>8</sup> rads, -4.92% at 1.68 x 10<sup>8</sup> rads, and -4.50% at 2.2 x 10<sup>8</sup> rads.

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
 ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 35 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Pressure Sensor	Foxboro	E11GM	Legend E of table 4-3 for Temper- ture and Humidity	See attached Data Sheet No. 203.	Continuous	See attached Data Sheet No. 203.	Total Accuracy:  -1.01 lb/in. <sup>2</sup>	Total Accuracy:  -0.81 lb/in. <sup>2</sup>	See attached Data Sheet No. 203.	Requalify See table 5-2, A10
Penetration Area Elevation: 33'-0" to 45'-0"			Radiation:  6.6x10 <sup>7</sup> Rad.				Response Time:  0.6 sec.	See table 5-2, A5		

Component used in Plant Protection System.

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class 1E Equipment

**San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment**

Table 4-2

**EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2&3  
ELECTRICAL EQUIPMENT (Sheet 36 of 56)**

REFERENCE IEEE STD 323-1971 CENPD-212 SECTION(S) <u>3.3.1</u>	ENVIRONMENTAL TEST DOCUMENTATION	DATA SHEET No. <u>203</u> DATE _____ REVISION No. _____
---------------------------------------------------------------------	----------------------------------	---------------------------------------------------------------

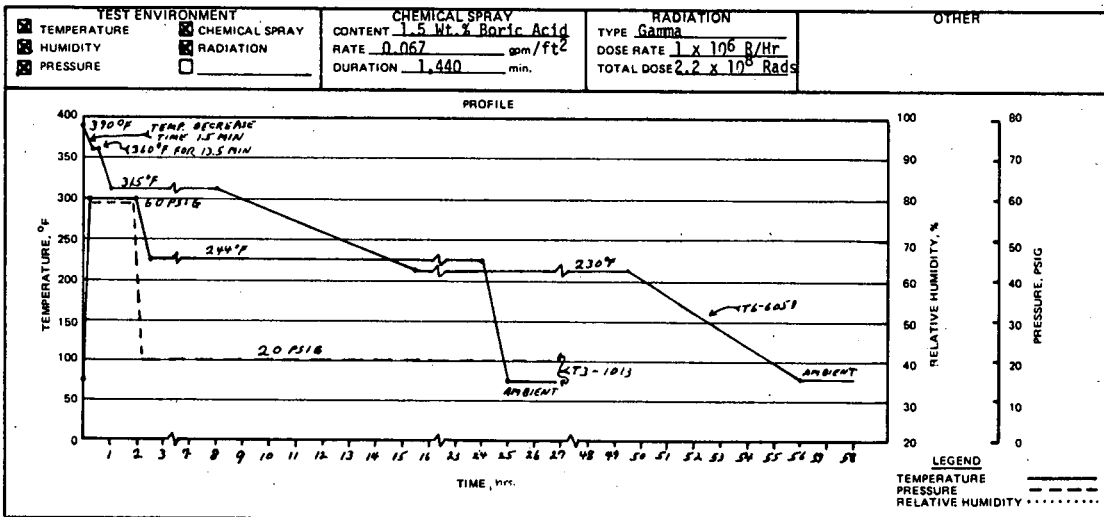
I. EQUIPMENT DESCRIPTION

ITEM <u>Pressure Transmitter</u>	MANUFACTURER <u>The Foxboro Company</u>	MODEL <u>E11GM</u>
FUNCTION <u>Converts pressure to electrical signal</u>	SERVICE LOCATION _____	Containment

II. TEST REPORT

TITLE <u>T3-1013 (Supplemental), March, 1973; T3-1068, Aug. 1973; T6-6051, Sept.-Oct., 1976</u> <u>Test Reports by Foxboro</u>	DATE _____
-----------------------------------------------------------------------------------------------------------------------------------	------------

III. TEST DESCRIPTION



IV. DESCRIPTION OF EQUIPMENT OPERATION DURING TESTING

	YES	NO	NA	REMARKS
EQUIPMENT ENERGIZED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The transmitter was operational during all tests. Except during calibration checks the input pressures were maintained at 75% of span for the temperature and chemical spray tests and 80% of span for the radiation and high temperature tests. Outputs were continuously monitored. Calibration checks were done before and after each test on the test item.
ALL SAFETY FUNCTIONS TESTED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
FULL RANGE VERIFIED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
TRIP FUNCTIONS EXERCISED	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

V. RESULTS AND DISCUSSION

Qualification testing was performed by 3 series of tests as follows:

- a) Temperature - steam pressure - chemical spray (Report No. T3-1013)
- b) High temperature (Report No. T6-6051)
- c) Radiation (Report No. T3-1068)

The first two hours of the chemical spray/temperature test produced maximum output shift of -6.70% of span. During the rest of the test the output shift remained negative within 0.5% of -3.30% of span. During the rest of the test the output shift remained negative within 0.5% of -3.30% of span.

During the initial phase of the high temperature test the maximum output shift was -1.7% and + 1/8% of span. The subsequent phase of the test at 315°F produced a maximum output shift of -1.9% of span. During the final phase of the test, at 230°F, the output shift remained at a constant + 0.4% of span.

The radiation test was started at a dose rate of 1 x 10<sup>5</sup> R/Hr and increased to 1 x 10<sup>6</sup> R/Hr at 1 x 10<sup>6</sup> rads. The output shift was negative and increased to a maximum of 4.92% at 1.68 x 10<sup>6</sup> rads and returned to 4.5% at 2.2 x 10<sup>8</sup> rads. The shift progressed as follows: -0.15% at 1 x 10<sup>5</sup> rads, -2.03% at 1 x 10<sup>6</sup> rads, -3.35% at 1 x 10<sup>7</sup> rads, -4.73% at 1 x 10<sup>8</sup> rads, -4.92% at 1.68 x 10<sup>6</sup> rads, and -4.50% at 2.2 x 10<sup>8</sup> rads.

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
 ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 37 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Pressure Sensor  Penetration Area Elevation: 33'-0" to 45'-0"	Foxboro	E11GM	Legend E of table 4-3 for Temper- ature and Humidity  Radiation:  $6.6 \times 10^7$ Rad.	See attached Data Sheet No. 203.	Accident Mitigation:  Continuous  Post Accident Monitoring:  See section 2.5 of the SONGS 2 and 3 submittal for NUREG-0588.	See attached Data Sheet No. 203.	Total Accuracy:  $-3.75 \text{ lb/in.}^2$  Response Time:  0.6 sec.	Total Accuracy:  $-3.0 \text{ lb/in.}^2$  Response Time:  See table 5-2, A5	See attached Data Sheet No. 203.	Requalify See table 5-2, A10

Component used in Plant Protection System.

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

**San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment**

Table 4-2

**EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2&3  
ELECTRICAL EQUIPMENT (Sheet 38 of 56)**

REFERENCE

IEEE STD 323-1971

CENPD-212 SECTION(S) 3.3.1

ENVIRONMENTAL TEST DOCUMENTATION

DATA SHEET No. 203

DATE \_\_\_\_\_

REVISION No. \_\_\_\_\_

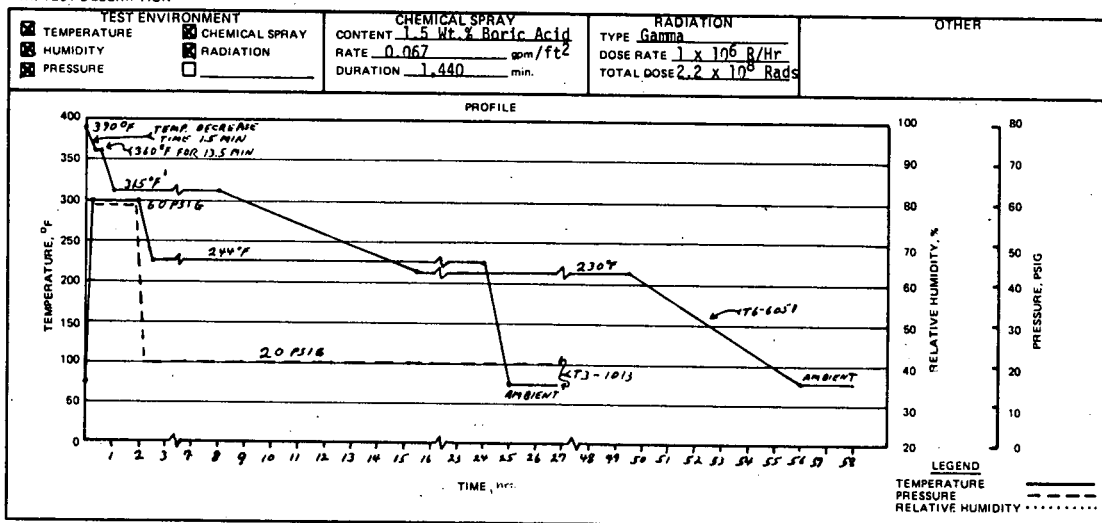
I. EQUIPMENT DESCRIPTION

ITEM <u>Pressure Transmitter</u>	MANUFACTURER <u>The Foxboro Company</u>	MODEL <u>E11GM</u>
FUNCTION <u>Converts pressure to electrical signal</u>	SERVICE LOCATION _____	Containment

II. TEST REPORT

TITLE <u>T3-1013 (Supplemental), March, 1973; T3-1068, Aug. 1973; T6-6051, Sept.-Oct., 1976</u>	DATE _____
Test Reports by Foxboro	

III. TEST DESCRIPTION



IV. DESCRIPTION OF EQUIPMENT OPERATION DURING TESTING

	YES	NO	NA	REMARKS
EQUIPMENT ENERGIZED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The transmitter was operational during all tests. Except during calibration checks the input pressures were maintained at 75% of span for the temperature and chemical spray tests and 80% of span for the radiation and high temperature tests. Outputs were continuously monitored. Calibration checks were done before and after each test on the test item.
ALL SAFETY FUNCTIONS TESTED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
FULL RANGE VERIFIED	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
TRIP FUNCTIONS EXERCISED	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

V. RESULTS AND DISCUSSION

Qualification testing was performed by 3 series of tests as follows:

- a) Temperature - steam pressure - chemical spray (Report No. T3-1013)
- b) High temperature (Report No. T6-6051)
- c) Radiation (Report No. T3-1068)

The first two hours of the chemical spray/temperature test produced maximum output shift of -6.70% of span. During the rest of the test the output shift remained negative within 0.5% of -3.30% of span. During the rest of the test the output shift remained negative within 0.5% of -3.30% of span.

During the initial phase of the high temperature test the maximum output shift was -1.7% and + 1/8% of span. The subsequent phase of the test at 315°F produced a maximum output shift of -1.9% of span. During the final phase of the test, at 220°F, the output shift remained at a constant + 0.4% of span.

The radiation test was started at a dose rate of 1 x 10<sup>5</sup> R/Hr and increased to 1 x 10<sup>6</sup> R/Hr at 1 x 10<sup>6</sup> rads. The output shift was negative and increased to a maximum of 4.92% at 1.68 x 10<sup>6</sup> rads and returned to 4.5% at 2.2 x 10<sup>6</sup> rads. The shift progressed as follows: -0.15% at 1 x 10<sup>5</sup> rads, -2.03% at 1 x 10<sup>6</sup> rads, -3.35% at 1 x 10<sup>7</sup> rads, -4.73% at 1 x 10<sup>8</sup> rads, -4.92% at 1.68 x 10<sup>6</sup> rads, and -4.50% at 2.2 x 10<sup>6</sup> rads.

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
 ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 39 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Differential Pressure Flow Sensors	Foxboro	E13DH	Legend E of table 4-3 for Temperature and Humidity.	See attached Data Sheet No. 210.	Post Accident Monitoring:  See section 2.5 of the SONGS 2&3 for NUREG-0588.	See attached Data Sheet No. 210.	Post Accident Monitoring:  See section 2.5 of the SONGS 2 & 3 for NUREG-0588.	Total Accuracy:  18.8 gal/min	See attached Data Sheet No. 210.	Requalify See table 5-2, A10
Penetration Area Elevation: 33'-0" to 45'-0"			Radiation:  $6.6 \times 10^7$ Rads							

Component used in High Pressure Safety Injection System.

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class 1E Equipment

**San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment**

**Table 4-2**

**EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2&3  
ELECTRICAL EQUIPMENT (Sheet 40 of 56)**

REFERENCE  
IEEE STD 323-1971  
CENPD-212 SECTION ISI 3.3.1

**ENVIRONMENTAL TEST DOCUMENTATION**

DATA SHEET No. 210  
DATE \_\_\_\_\_  
REVISION No. \_\_\_\_\_

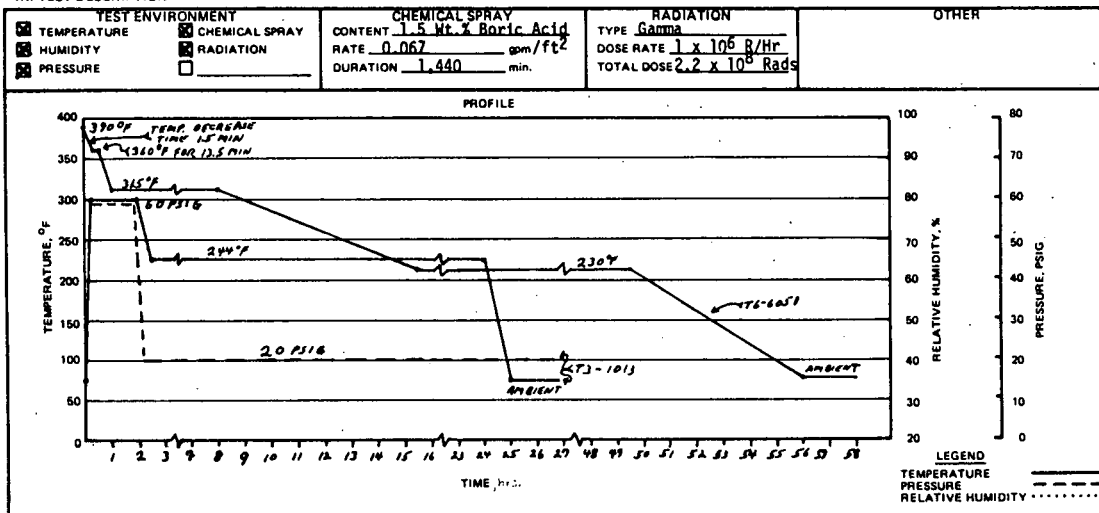
**I. EQUIPMENT DESCRIPTION**

ITEM <u>Differential Pressure Transmitter</u>	MANUFACTURER <u>The Foxboro Company</u>	MODEL <u>ET3DH</u>
FUNCTION <u>Converts differential pressure to electrical signal</u>	SERVICE LOCATION <u>Containment</u>	

**II. TEST REPORT**

TITLE <u>T3-1013 (Supplementary), March 1973; T3-1068, August 1973; T6-6051, Sept. - Oct. 1976</u>	DATE _____
<u>Test Reports by Foxboro</u>	

**III. TEST DESCRIPTION**



**IV. DESCRIPTION OF EQUIPMENT OPERATION DURING TESTING**

EQUIPMENT ENERGIZED	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/> NA <input type="checkbox"/>	REMARKS The transmitter was operational during all tests. Except during calibration checks the input pressures were maintained at 75% of span for the temperature and chemical spray tests and 80% of span for the radiation and high temperature tests. Outputs were continuously monitored. Calibration checks were done before and after each test on the test item.
ALL SAFETY FUNCTIONS TESTED	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/> NA <input type="checkbox"/>	
FULL RANGE VERIFIED	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/> NA <input type="checkbox"/>	
TRIP FUNCTIONS EXERCISED	YES <input type="checkbox"/> NO <input type="checkbox"/> NA <input checked="" type="checkbox"/>	

**V. RESULTS AND DISCUSSION**

Qualification testing was performed by 3 series of tests as follows:

- Temperature - steam pressure - chemical spray (Report No. T3-1013)
- High temperature (Report No. T6-6051)
- Radiation (Report No. T3-1068)

The first two hours of the chemical spray/temperature test produced a maximum output shift of + 3.55% of span. During the rest of the test the output shift remained positive within 0.5% of + 0.65% of span.

During the initial phase of the high temperature test the maximum output shift was -1.7% and +1.8% of span. The subsequent phase of the test at 315°F produced a maximum output shift of -1.9% of span. During the final phase of the test, at 230°F, the output shift remained at a constant + 0.4 % of span.

The radiation test was started at a dose rate of  $1 \times 10^5$  R/Hr and increased to  $1 \times 10^6$  R/Hr. The output shift was negative and increased to a maximum of 4.92% at  $1.68 \times 10^8$  rads and returned to 4.5% at  $2.2 \times 10^8$  rads. The shift progressed as follows: -0.15% at  $1 \times 10^5$  rads, -2.03% at  $1 \times 10^6$  rads, -3.35% at  $1 \times 10^7$  rads, -4.73% at  $1 \times 10^8$  rads, -4.92% at  $1.68 \times 10^8$  rads, and -4.50% at  $2.2 \times 10^8$  rads.

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
 ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 41 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Differential Pressure Flow Sensors	Foxboro	E13DM	Legend C3 of table 4-3 for Temperature and Humidity	See attached Data Sheet No. 211	Continuous	See attached Data Sheet No. 211.	Later	Total Accuracy:  172.2 gal/min	See attached Data Sheet No. 211.	Requalify See table 5-2, A10
Safety Equipment Building Elevation: 15'-0" to 8'-0"			Radiation:  $5.2 \times 10^7$ Rads					Response Time:  See table 5-2, A5		

Component used in Containment Spray System.

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

**San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment**

Table 4-2

**EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2&3  
ELECTRICAL EQUIPMENT (Sheet 42 of 56)**

REFERENCE	ENVIRONMENTAL TEST DOCUMENTATION	DATA SHEET No. <u>211</u>
IEEE STD 323-1971		DATE _____
CENPD-212 SECTION(S) <u>3.3.1</u>		REVISION No. _____

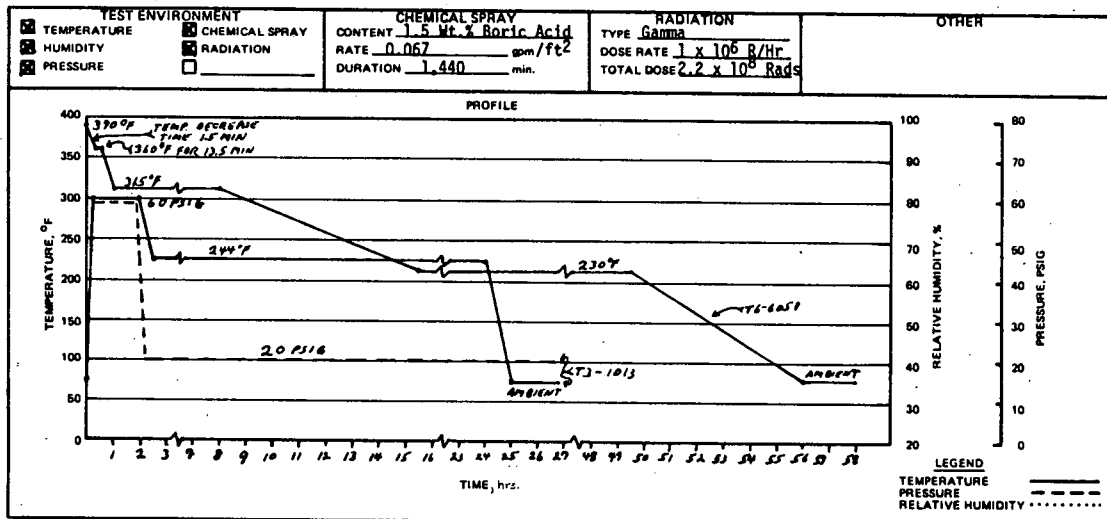
**I. EQUIPMENT DESCRIPTION**

ITEM <u>Differential Pressure Transmitter</u>	MANUFACTURER <u>The Foxboro Company</u>	MODEL <u>E130M</u>
FUNCTION <u>Convert differential pressure to electrical signal</u>	SERVICE LOCATION <u>Containment</u>	

**II. TEST REPORT**

TITLE <u>T3-1013 (Supplementary), March 1973; T3-1068, August 1973; T6-6051, September-October 1976</u>	DATE _____
Test Reports by Foxboro	

**III. TEST DESCRIPTION**



**IV. DESCRIPTION OF EQUIPMENT OPERATION DURING TESTING**

EQUIPMENT ENERGIZED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA ALL SAFETY FUNCTIONS TESTED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA FULL RANGE VERIFIED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA TRIP FUNCTIONS EXERCISED <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> NA	<b>REMARKS</b> The transmitter was operational during all tests. Except during calibration checks the input pressures were maintained at 75% of span for the temperature and chemical spray tests and 80% of span for the radiation and high temperature tests. Outputs were continuously monitored. Calibration checks were done before and after each test on the test item.
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

**V. RESULTS AND DISCUSSION**

Qualification testing was performed by 3 series of tests as follows:

- a) Temperature - steam pressure - chemical spray (Report No. T3-1013)
- b) High temperature (Report No. T6-6051)
- c) Radiation (Report No. T3-1068)

The first two hours of the chemical spray/temperature test produced maximum output shifts of + 1.50% and -2.05% of span. During the rest of the test the output shift remained negative within 0.5% of -1.20% of span.

During the initial phase of the high temperature test the maximum output shift was -1.7% and +1.8% of span. The subsequent phase of the test at 315°F produced a maximum output shift of -1.9% of span. During the final phase of the test, at 230°F, the output shift remained at a constant + 0.4% of span.

The radiation test was started as a dose rate of 1 x 10<sup>5</sup> R/Hr and increased to 1 x 10<sup>6</sup> R/Hr at 1 x 10<sup>6</sup> rads. The output shift increased to a maximum of -4.92% at 1.68 x 10<sup>8</sup> rads and returned to -4.5% at 2.2 x 10<sup>6</sup> rads. The shift progressed as follows: -0.15% at 1 x 10<sup>5</sup> rads, -2.03% at 1 x 10<sup>6</sup> rads, -3.35% at 1 x 10<sup>7</sup> rads, -4.73% at 1 x 10<sup>8</sup> rads, -4.92% at 1.68 x 10<sup>8</sup> rads, and -4.50% at 2.2 x 10<sup>6</sup> rads.

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 43 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Magnetic Flow Transmitter	Foxboro	E96	Legend C4 of table 4-3 for Temperature and Humidity.	See attached Data Sheet No. 213.	Continuous	See attached Data Sheet No. 213.	Total Accuracy: 0.5%	Total Accuracy: 0.4%	See attached Data Sheet No. 213.	Requalify See table 5-2, A13
Safety Equipment Building Elevation: 8'-0" to 30'-0"			Radiation: $1 \times 10^7$ Rads							

Component used in Containment Spray System.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class 1E Equipment

**San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment**

**Table 4-2**

**EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2&3  
ELECTRICAL EQUIPMENT (Sheet 44 of 56)**

REFERENCE IEEE STD 323-1971 CENPD-212 SECTION(S) <u>3.3.1</u>	ENVIRONMENTAL TEST DOCUMENTATION	DATA SHEET No. <u>213</u> DATE _____ REVISION No. _____
---------------------------------------------------------------------	----------------------------------	---------------------------------------------------------------

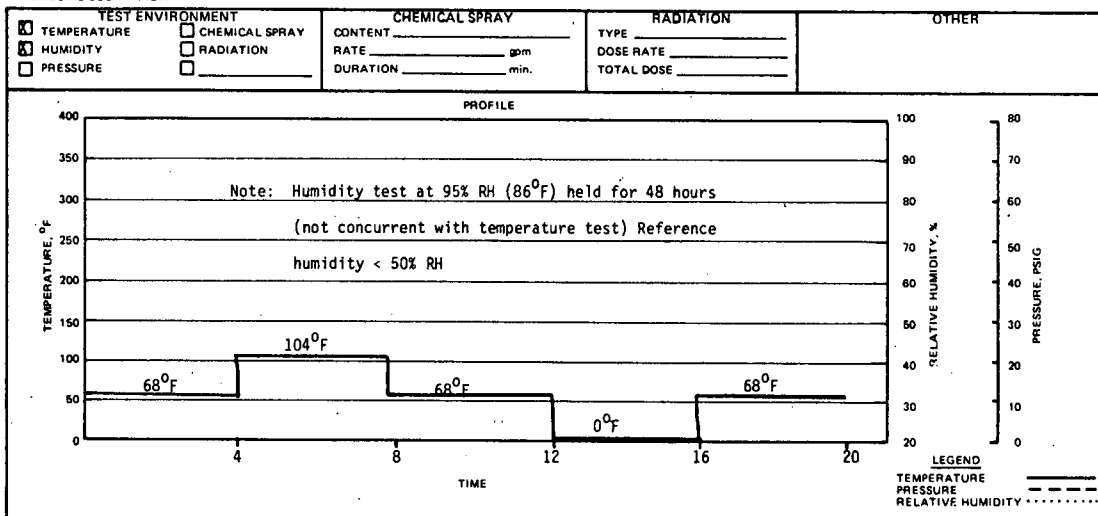
**I. EQUIPMENT DESCRIPTION**

ITEM <u>Magnetic Flow Transmitter</u>	MANUFACTURER <u>Foxboro</u>	MODEL <u>E96</u>
FUNCTION <u>Converts electrical output of magnetic flow tube to usable process signal (4 to 20 ma)</u>		
SERVICE LOCATION <u>Auxiliary Bldg.</u>		

**II. TEST REPORT**

TITLE <u>Foxboro Test Report T6-0307 CT</u>	DATE <u>Nov. 76</u>
---------------------------------------------	---------------------

**III. TEST DESCRIPTION**



**IV. DESCRIPTION OF EQUIPMENT OPERATION DURING TESTING**

EQUIPMENT ENERGIZED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA ALL SAFETY FUNCTIONS TESTED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA FULL RANGE VERIFIED <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NA TRIP FUNCTIONS EXERCISED <input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> NA	<p align="center"><b>REMARKS</b></p> <p>During the temperature and humidity test a magnetic flow transfer standard provided a variable input to the magnetic flow transmitter. Calibration characteristics were measured at the Reference temperature, 68°F, and at each level of temperature and humidity. The calibration characteristics that were measured were span error, hysteresis, linearity and reproducibility. Performance tests, including current and voltage shifts, and current and voltage output ripple, were performed.</p>
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

**V. RESULTS AND DISCUSSION**

The maximum output shift in % of span during the temperature test was a current output +.10% at 0% of span and -.35% at 100% of span.

The maximum output shift in % of span during the humidity test was for a current output +.03% at 0% of span and -.05% at 100% of span.

The maximum ripple of the current output as measured across a 250 ohm load with the output at 100% was .25% of span. The ripple of the voltage output with the output at 100% was 0.1% of span.

This unit was found to be within specification for all parameters tested. Therefore, the magnetic flow transmitter is deemed environmentally qualified.

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
 ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 45 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Magnetic Flow Detector	Foxboro	2801	Legend C4 of table 4-3 for Temperature and Humidity.	Ambient up to 122F and 95% RH.	Continuous	See table 5-2, A6	Total Accuracy:  0.5%	Total Accuracy:  0.5%	Qualified by test.	Requalify See table 5-2, A13
Safety Equipment Building Elevation: 8'-0" to 30'-0"			Radiation:  $1 \times 10^7$ Rads				See table 5-2, A2	Response Time:  Not measured.	Action Test Report Number 14988, Revision 2A.	

Component used in Containment Spray System.

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class 1E Equipment

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
 ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 46 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Differential Pressure Level Transmitter	Foxboro	E13DMP	To be Determined	Not Qualified	Continuous	Not Tested	Not Determined	Not Tested	None	Requalify See table 5-2, A10 and A13

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class 1E Equipment

Component Used in Chemical and Volume Control System.

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 47 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Solenoid pilot valve for pneu- matic valve Inside containment	Automatic Switch Co. (ASCO)	HT831665	300F 60 lb/in. <sup>2</sup> g 100% RH pH>9 boric acid & sodium hydroxide $6 \times 10^7$ Rads	Normal Environment	Actuate once after a DBA	Operation in normal environment	None	Not Applicable	Vendor has not sub- mitted sup- porting documentation	Replace See table 5-2, B.2
Solenoid pilot valve for pneu- matic valve Outside containment A) Heat Exchanger Room B) Safety Equipmt. Bldg. CCW Area C) Chemical Storage Tank Area	Automatic Switch Co. (ASCO)	HT831665	A) 130F 90% RH $10^8$ rads B) 104F 90% RH $10^8$ rads C) 104F 90% RH $10^7$ rads	Normal Environment	A) & B) Actuate on signal from control room after DBA  C) Actuate once after a DBA	Operation in normal environment	None	Not applicable	Vendor has not sub- mitted sup- porting documents	Replace See table 5-2, B.2

Component used in Chemical and Volume Control System and Safety Injection System.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
 ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 48 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Limit Switch for pneu- matic valves Inside containment	NAMCO Controls	EA-170- 11302	300°F 60 psig 100% RH spray pH>9, boric acid & sodium hydroxide.	194°F  Radiation $2 \times 10^8$ R	Actuate once after a DBA	Normal conditions only	None	Not applicable	Qualification of NAMCO con- trols limit switch Model EA 170-302 Rev. 1 dated 7/24/78	Replace See table 5-2, B.2
Limit Switch for pneu- matic valves Outside containment A) Heat Exchanger Room B) Safety Eqmt. Bldg. CCW Area C) Chemical Storage Tank Area	NAMCO Controls	EA-170- 11302	120°F Atmos. 100% RH Radiation  A) $10^8$ Rads B) $10^8$ Rads C) $10^7$ Rads	194°F  Radiation $2 \times 10^8$ R	Actuate once after a DBA	Normal conditions only	None	Not applicable	Qualification of NAMCO Controls Limit Switch Model EA- 170-302 Rev. 1 dated 7/24/78	Replace See table 5-2, B.2

Component used in Chemical and Volume Control System and Safety Injection System.

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
 ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 49 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Motor operator for Valve Location  Penetration Area	Limitorque Corporation (Philadel- phia Gear Corp.)	SMB-00-40	Temperature 104F; humidity 90% RH; Radiation  $6.6 \times 10^7$  Rads	LOCA: 300F/ 70 lb/in. <sup>2</sup> g profile peaks 30 day test  Radiation:  $2 \times 10^8$ rads  Humidity: 100%  Chemical Spray pH = 10.8 30 days	Intermittent, long term	Operation during and after a DBA	None	Not Applicable	Generic Type Test Class RH Insul.  Limitorque Project No. 600456,  Report No. B0058  Log S023- 507-2-1-410 507-5-1-212 507-5-4-28 507-5-2-101  Thermal Aging 356F for 100 hours  Wear 200 cycles during ther- mal aging + 1800 cycles ambient	Qualified for 40 Years

Component used in Safety Injection System.

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
 ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 50 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Motor operator for valve  <u>Location:</u>  Outside containment area	Limitorque Corporation (Philadelphia Gear Corp.)	SMB-00-10	Temperature 104F Humidity 90% RH Radiation $6.6 \times 10^7$ Rads	LOCA: 300 F/ 70 lb/in. <sup>2</sup> g profile peaks 30 day test  Radiation: $2 \times 10^8$ rads  Humidity: 100%  Chemical Spray pH = 10.8 30 days	Intermittent, long term	Operation during a DBA	None	Not applicable	Generic Type Test Class RH Insul.  Limitorque Project No. 600456,  Report No. B0058  Log S023-507-2-1-410 507-5-1-212 507-5-4-28 507-5-2-101  Thermal Aging 356F for 100 hours  Wear 200 cycles during thermal aging + 1800 cycles ambient	Qualified for 40 Years

Component used in Chemical and Volume Control System and in Safety Injection System.

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
 ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 51 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Solenoid Operator for Valves. Chemical Storage Equipment Building	Valcor Engineering Corp.	V52600 -573-1	Temperature 104F Humidity 90% RH  Radiation $1 \times 10^7$ Rads	Temperature 120°F Humidity 100%  Radiation $2 \times 10^8$ Rads	Close once after DBA	Post DBA Operation Demonstrated	None	Not Applicable	Valcor Report: 52600-515 dated Nov. 1977 IEEE 323-1974 Type Test	Qualified.  Interim Use See table 5-2, A11

Component used in Safety Injection System.

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class 1E Equipment

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
 ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 52 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Motor for low pressure safety injection pump  <u>Locations</u> Safety equipment building LPSI Area	Westinghouse	5808 P39 frame NA68690-L7	Temperature 104F  Humidity 90% RH  Radiation $1 \times 10^8$	Temperature 104F Humidity 100% RH Radiation $2 \times 10^8$ Rads	Continuous operation after a DBA.	Complete tests per IEEE 112A 1964 on motor type, and routine tests on subsequent motors	None	Not applicable	Westinghouse report W Cap 8754 Rev. 1 Analysis and testing of appropriate components were conducted to verify compliance with IEEE 323-1974.	Qualified

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

Component used in Safety Injection System.

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
 ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 53 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Motor for high pressure safety injection pump  <u>Location</u> Safety Equipment Building HPSI Area	Westinghouse	5809 H Type Lac. TEWC	Temperature 104F Humidity 90% RH Radiation $1 \times 10^8$ Rads	Temperature 104F Humidity 100% RH Radiation $2 \times 10^8$ Rads	Continuous Operation after a DBA	Complete tests per IEEE 112A, 1964 on motor type, and routine tests on subsequent motors.	None	Not applicable	Westinghouse report W CAP-8754 Rev. 1 Analysis and testing of appropriate components were conducted to verify compliance with IEEE 323-1974.	Qualified

Component used in Safety Injection System.

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
 ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 54 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Motor for containment spray pump  <u>Location</u> Safety equipment building CCW area	Westinghouse	5808 P39 Frame NA 68690-L7	Temperature 104F Humidity 100% RH Radiation $1 \times 10^8$ Rads	Temperature 104F Humidity 100% RH Radiation $2 \times 10^8$ Rads	Continuous Operation after a DBA.	Complete tests per IEEE 112A, 1964 on motor type, and routine tests on subsequent motors	None	Not applicable	Westinghouse report W CAP-8754, Rev. 1 Analysis and testing of appropriate components were con- ducted to verify com- pliance with IEEE 323-1974.	Qualified

Component used in Safety Injection System.

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
 ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 55 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Motor for spray chem. addition pump  <u>Location:</u> Chemical Storage tank #105 pump area	Allis Chalmers Mfg. Co.	SO-EL8- 90253-1	Temperature 104F Humidity 90% RH Radiation 10 <sup>7</sup> Rads	Motor Qualified to commer- cial standards	Continuous operation until chem- ical storage tank depleted.	Operability Performance has not been documented	None	Not applicable	Vendor has not submitted supporting documentation	Requalify See table 5-2, A13

Component used in Containment Spray System.

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

Table 4-2

EQUIPMENT QUALIFICATION TABULATION (NSSS)  
ENVIRONMENTAL QUALIFICATION OF SONGS 2 & 3 ELECTRICAL EQUIPMENT (Sheet 56 of 56)

Type of Equipment/ Location	Manufacturer	Model No. or Identification No.	Abnormal or Accident Environment	Environment to Which Qualified	Operability Requirements	Operability Demonstrated	Accuracy or Response Time Requirements	Accuracy or Response Time Demonstrated	Qualification Report & Method	Qualification Status
Solenoid operator for valve PS-230  <u>Location</u>  Suitable for LOCA Profile	Target Rock	80B-001-10	"Later"	385F 66 lb/in. <sup>2</sup> g Peaks 14 day profits  Radiation 10 x 10 <sup>7</sup> Rads  Humidity 55 ± 5%  Chemspray: Boron 6200 ppm 22 min. Hydrozine 55 ppm 14 days ph 8.6-10	Close once after a DBA	Post DBA operation demonstration	None	Not applicable	Type Test generic quali- fication (Log 507-4- 76 Report No. 2375 and 2948)  Thermal Aging 350F for 792 hrs.  Wear: 18,000 cycles at 122F 90% Humidity	Interim Use See table 5-1, A13

Component used in Post Accident Sampling System.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class 1E Equipment

Table 4-3

## NORMAL, ACCIDENT, AND DESIGN ENVIRONMENTAL CONDITIONS (Sheet 1 of 3)

Environmental Conditions													
Location		Temperature (°F)			Pressure (lb/in. <sup>2</sup> g)			Humidity (%)			Chemical Spray		
		Normal	Post-Accident	Design	Normal	Post-Accident	Design	Normal	Post-Accident	Design	Normal	Post-Accident	Design
Containment <sup>(a)</sup>	A	120	300	300 <sup>(b)</sup>	0	60	60 <sup>(b)</sup>	60	100	100	NA	(c)	(c)
Auxiliary Building	B												
Charging pump rooms	B1	104	104	104	0	0	0	80	80	90	NA	NA	NA
Boric acid makeup pump rooms	B2	104	104	104	0	0	0	80	80	90	NA	NA	NA
Chiller rooms	B3	95	95	95	0	0	0	80	80	100	NA	NA	NA
Control rooms	B4	75	75	75	0	0	0	50	50	50	NA	NA	NA
ESF switchgear room area	B5	95	95	95	0	0	0	80	80	100	NA	NA	NA
Cabinet area of control room	B6	75	85	85	0	0	0	50	50	50	NA	NA	NA
Battery system rooms	B7	95	95	95	0	0	0	80	80	100	NA	NA	NA
CEDM MC cabinet room	B8	104	104	104	0	0	0	80	80	90	NA	NA	NA
Cable spreading rooms	B9	98	98	98	0	0	0	80	80	100	NA	NA	NA
Gas sample labs	B10	90	90	90	0	0	0	80	80	100	NA	NA	NA

- a. Post-accident temperatures and pressures listed for the containment are short-term values applicable to the first 15 minutes after an accident. Other values are as follows: Next 45 minutes: temperature, 250F; pressure, 50 lb/in.<sup>2</sup>g  
 Next 23 hours: temperature, 200F; pressure, 40 lb/in.<sup>2</sup>g  
 Next 30 days: temperature, 200F; pressure, 20 lb/in.<sup>2</sup>g

In some cases, electrical equipment may be qualified to the more conservative values specified in IEEE 323-1974.

- b. Certain selective equipment is qualified to environmental conditions less severe than specified. However, the qualification environmental conditions are consistent with the time requirement for operability.
- c. Design maximum and post-accident spray conditions are a mixture of boric acid and sodium hydroxide with a Ph greater than 9.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 4-3  
NORMAL, ACCIDENT, AND DESIGN ENVIRONMENTAL CONDITIONS (Sheet 2 of 3)

Environmental Conditions													
Location		Temperature (°F)			Pressure (lb/in. <sup>2</sup> g)			Humidity (%)			Chemical Spray		
		Normal	Post-Accident	Design	Normal	Post-Accident	Design	Normal	Post-Accident	Design	Normal	Post-Accident	Design
Radio-chemical labs	B11	75	75	75	0	0	0	80	80	100	NA	NA	NA
	B12	104	104	104	0	0	0	80	80	90	NA	NA	NA
Safety Equipment Building	C												
Rooms for LPSI, HPSI, CCW and Containment Spray Pumps	C1	104	104	104	0	0	0	80	80	90	NA	NA	NA
Main steam valve rooms	C2	100	235	235	0	7	7	100	100	100	NA	NA	NA
Shutdown heat exchanger rooms	C3	104	130	130	0	0	0	80	80	90	NA	NA	NA
Chemical injection tank and pump room	C4	104	104	104	0	0	0	80	80	90	NA	NA	NA
Component cooling water surge tank rooms	C5	104	104	104	0	0	0	80	80	100	NA	NA	NA
Fuel Handling Building	D	104	150	150	0	0	0	80	80	100	NA	NA	NA
Fuel pool pump rooms	D1	104	104	104	0	0	0	80	80	100	NA	NA	NA
Penetration Area	E	100	104	104	0	0	0	80	80	90	NA	NA	NA

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 4-3  
NORMAL, ACCIDENT, AND DESIGN ENVIRONMENTAL CONDITIONS (Sheet 3 of 3)

Location		Environmental Conditions											
		Temperature (°F)			Pressure (lb/in. <sup>2</sup> g)			Humidity (%)			Chemical Spray		
		Normal	Post-Accident	Design	Normal	Post-Accident	Design	Normal	Post-Accident	Design	Normal	Post-Accident	Design
Diesel Generator Rooms	F	95	122	122	0	0	0	80	80	100	NA	NA	NA
	G	104	104	104	0	0	0	100	100	100	NA	NA	NA
Tankage Area	G1	104	302	302	0	2.76	2.76	80	100	100	NA	NA	NA
	H	100	100	100	0	0	0	80	80	100	NA	NA	NA
Intake Structure	H1	100	100	100	0	0	0	80	80	100	NA	NA	NA
	J	104	104	104	0	0	0	80	80	100	NA	NA	NA

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

5. SUMMARY OF OUTSTANDING ITEMS

A summary of outstanding items, those items for which discrepancies in meeting the guidelines have been identified, is provided in table 5-1 Outstanding Items - BOP Equipment and table 5-2 Outstanding Items - NSSS Equipment which follow. These tables include connective actions, schedules for implementation, and justification for interim operation or replacement as applicable.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 5-1

OUTSTANDING ITEMS - BOP EQUIPMENT

(Sheet 1 of 4)

A1. Electrical Penetration Backup Circuit Breaker Panels

The Class IE components to be qualified in the backup penetration circuit breaker panels are the circuit breakers themselves. Auditable qualification data has not yet been obtained from the supplier. Only a summary of qualification test results is now available. Until a detained report is furnished, the breakers are considered interim qualified for a period of 2 years. In 2 years, the breakers will not be significantly aged by the environment; and if they should fail to open, the primary breaker will protect electrical containment penetrations from damage.

A2. Amphenol Connector

The basis of heat aging data needs to be clarified by the vendor to substantiate a 40-year life. This information will not impact the interim operation of the plant.

A3. 600V Control and Instrumentation Cable

Material used for factory splices and repairs is compatible with original cable material. Qualification testing of cable with splices and repairs will be completed by April 1981.

A4. Heat Tracing Wire

Clarification is being sought on the material (TEFZEL) for the heat tracing wire. This information will be available prior to fuel load.

A5. Aux Feedwater Pump Motor

Qualification analysis of, and correction action resulting from, the analysis is proceeding. Equipment will be qualified prior to fuel load.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 5-1  
OUTSTANDING ITEMS - BOP EQUIPMENT  
(Sheet 2 of 4)

A6. CCW Pump Motor

The deficiency in aging data does not impact interim operation of the plant. The aging study will substantiate a 40-year life application of the motor.

A7. Pump Room A/C Unit Motors

The motor bearing replacement criteria is not yet available from the manufacturer. Since these motors are normally in standby, the bearing replacement schedule is not significant during the interim qualification period. The replacement criteria will be available prior to fuel load.

A8. Level Transmitter (Gems)

Requalification to IEEE 323-1974 is being performed by SNUPPS. Test plan is in review. Tests to be conducted end of 1981. SONGS instrument will be requalified based on test results or replaced with model identical to test specimen.

A9. Level Switch (Magnetrol)

Qualified for 5-years based on replacement of switch mechanism after 5-years and periodic (12 month) examination prescribed by vendor.

A10. Solenoid Valve (ASCO)

Qualified for 4-years with ongoing qualification aimed at 8-years.

A11. Limit Switch (NAMCO)

The vendor indicates a qualified life of 8 years. Present documentation is under review to substantiate this claim based on accelerated aging information supplied.

Table 5-1  
OUTSTANDING ITEMS - BOP EQUIPMENT  
(Sheet 3 of 4)

A12. Solenoid Valve (VALCOR)

Qualification plant indicates conformance with IEEE 323-1974 and identifies irradiation to  $2 \times 10^8$  Rads. Report will be submitted by March 1981. Actual qualified life to be determined.

A13. Solenoid Valve (Target Rock)

Thermal aging accomplished provides a 40-year life for an activation energy of 0.6. This valve is very low. IEEE 382 1980 recommends using 0.8 when uncertain. It can be seen that any increase in the activation energy value will provide an aged life in excess of 40-years. No identification of age sensitive materials has been provided. Additional information has been requested from the vendor to establish qualified life.

A14. Main Steam Isolation Valve

Potter-Brumfield relays failed to operate during post-thermal aging functional test until they were tapped and cycled 30 times. This anomaly occurred after 200 hours of 200F and 95% relative humidity. Vendor's review indicates that the aging environment far exceeds the actual conditions during an emergency. In addition, should a steam line break occur, the MSIV would receive a closure signal in approximately 4.3 seconds. The Vendor feels that within this time frame the relays would function.

Qualification of the Potter-Brumfield relays is being reviewed by the Vendor. It is anticipated that the relay will be requalified by test.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 5-1

OUTSTANDING ITEMS - BOP EQUIPMENT

(Sheet 4 of 4)

A15. Containment Post LOCA Hz Monitor (GE)

Analyses required from vendor to satisfy aging of hydrogen sensor.  
No accelerated thermal aging was performed. Vendor to identify  
materials and justify qualified life based on activation energies of  
materials used based on published information.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 5-2  
OUTSTANDING ITEMS - NSSS EQUIPMENT  
(Sheet 1 of 6)

- A1. The Nuclear Instrument Detector and Preamplifier do not have demonstrated nor required accuracies. A neutron detector is an uncalibrated instrument. Sensitivity is based on many things; such as distance from the core, neutrons attenuation due to intervening materials, etc. The accuracy of the ex-core flux measurement system is established by in-plant calibration by comparison to primary heat balance calculations. The response time of the Ex-core Neutron Detector is basically the detector Collection time which is in the order of  $10^{-10}$  seconds.
- A2. The principle of operation of the magnetic flow detector precludes a significant detector response time.
- A3. Similar cable (i.e. same insulation, jacket and type of construction) have been qualified by test to an environment of 110C and 120 megarads for a design life of 40 years. Test reports are to be provided by vendor no later than June 1981. No qualification data is to be provided for the 30 minutes accident environment qualification. Thirty minute operation of cable insulation into a high temperature steam/air environment can be shown by analysis. Accuracy and response time are not applicable.
- A4. Similar cable (i.e., same insulation, jacket and type of construction) have been qualified by test to an environment of 150F and  $1.03 \times 10^7$  Rads gamma for a design life of 40 years. Test reports are to be provided by vendor no later than June 1981. No qualification data is to be provided for the 30 minutes accident environment qualification. Thirty (30) minutes operation of cable insulation into a high temperature steam/air environment can be shown by analysis. Accuracy and response time are not applicable.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 5-2

OUTSTANDING ITEMS - NSSS EQUIPMENT

(Sheet 2 of 6)

- A5. Evaluation of response time is in progress; the data will be available and submitted in the near future prior to the fuel load.
- A6. Three tests of approximately 1-minute durations at three different environmental conditions (40F, 122F and ambient) have been performed. Each test precoded by one hour soak time at each condition.
- A7. The Rosemount RTD, Model 104 AFC-1, did not have response time demonstrated during environmental testing. However, this RTD consists of only wire whose response time is not affected by the severe conditions experienced during the DBA. The response of RTDS for normal environments, including its thermowell housing, is documented by test as part of the design and production process, and is the basis for the 6-second requirement. This precludes the need to demonstrate response time during extreme environments.
- A8. The qualification basis for the NSSS scope of supply was the guidelines provided by IEEE-323-1971. There were several areas where a comparison between the NSSS qualification progress and the requirements of NUREG 0588, Category II revealed generic areas of non-compliance applicable to all NSSS items. Each of these areas has been identified and a resolution provided in Chapter 3 above as follows:
1. Quantified Margin: Section 3.2
  2. Age Susceptible Material: Section 3.6
  3. Extremes of Voltage and frequency applied during testing.  
Section 3.4
  4. Post Accident Monitoring Requirements: Section 2.5

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 5-2  
OUTSTANDING ITEMS - NSSS EQUIPMENT  
(Sheet 3 of 6)

5. Dust Environment Impact on Qualification: Section 3.5

6. Operating Time: Subsection 3.2.2

A9. Several NSSS Items are providing inputs to the Core Protection Calculator (CPC) are not qualified for DBA environmental conditions which they are presently intended to mitigate. These components are:

RCPSSS Prove and Transmitter  
Reedswitch Position Transmitter (RSPT)  
RSPT Cable  
Ex-Core Detector Assembly  
Ex-Core Preamplifier  
Ex-Core Detector System Cable

Preliminary analyses indicate that credit could be taken for a combination of Loss of Load Turbines - Reactor trip, High Containment Pressure trip and Ex-Core Overpower (Hi Linear Power) trip in lieu of the present Lo DNBR CPC trip for protection in the event of inside containment MSLB events. Further analyses are underway to provide a basis for this change to the plant safety analyses.

Additionally, a transient thermal analysis will be performed to demonstrate that the ex-core detectors can provide a Hi Linear Power trip to mitigate selected MSLB events and a CEA ejection prior to exceeding the environmental conditions to which qualified.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 5-2  
OUTSTANDING ITEMS - NSSS EQUIPMENT  
(Sheet 4 of 6)

As a result of the above preliminary results and analyses in progress, the following equipment will most likely be removed from exposures to the "harsh" in-containment (DBA) environment:

RCPSSS Probe and  
Transmitter

Reedswitch Position Transmitter (RSPT)

RSPT Cable

Additionally, the following components of the ex-core detector system will most likely be shown qualified for their accident mitigation function:

Ex-Core Detector and Cable

Ex-Core Preamplifier

Ex-Core Detector System Cable

A final determination of the adequacy of the aforementioned equipment for interim operation will be made prior to fuel loading based upon results of the analyses described above.

A10. Foxboro and Rosemount Pressure, Level and Flow Transmitters

The IE pressure, level, and flow transmitters in San Onofre Nuclear Generating Station 2/3 harsh environment applications consist of both Foxboro and Rosemount units (to meet diversity).

Foxboro transmitters in such SONGS 2/3 applications are E11 and E13 models with LOCA and Radiation Withstand options. These transmitters are equivalent to the N-E11 and N-E13 units currently being type-qualified to IEEE 323-1974/344-1975 by the Utility Transmitter Qualification Program at Wyle Laboratories (in which SCE is a participant).

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 5-2  
OUTSTANDING ITEMS - NSSS EQUIPMENT  
(Sheet 5 of 6)

The Utility Program for Rosemount and Foxboro transmitters is being completed in two phases, with vendor support should design modifications be required. Phase I testing of Foxboro transmitters utilized inservice aged (3 years) N-E11 and N-E13 models. Results of Phase I testing indicate that the SONGS 2/3 Foxboro units are acceptable for interim use provided that two early production deficiencies are not present and that Locktite is used to secure two screws. These items will be verified or corrected prior to fuel load. Phase II testing of Foxboro transmitters will utilize artificial aging and is expected to result in full IEEE 323-1974/344-1975 qualification of these transmitters by January 1982. The present transmitter qualifications will be supplemented with the results of the tests described above.

Rosemount pressure, level and flow transmitters in SONGS 2/3 i.e., harsh environment applications are 1153 Series A models. These transmitters are currently qualified to IEEE 323-1971 including SONGS 2/3 seismic criteria and sequential testing, but aging was not considered. The presently installed Rosemount 1153 Series A transmitters are considered acceptable for interim use until they can be replaced with fully qualified transmitters. Phase II of the Utility Program described above is expected to result in full qualification of replacement design Rosemount 1153 Series D transmitters by January 1982. Replacement of the Rosemount transmitters will be made as soon as practical, but not later than first refueling.

A11. Interim use as per section III.F, installed life to be determined before fuel load.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Table 5-2

OUTSTANDING ITEMS - NSSS EQUIPMENT

(Sheet 6 of 6)

A12. Emergency operating procedures will be reviewed to verify acceptability for interim use.

A13. Device is to be requalified by a combination of analysis and testing prior to fuel loading.

B1. The following NSSS components were reviewed and found to be not qualified for the environment. These components will be removed and replaced with qualified components prior to fuel load.

Automatic Switch Co. (ASCO) HT831665 solenoid

NAMCO Controls EA-170-11302 limit switch

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

APPENDICES

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Appendix A

Procedure for Maintaining Equipment Qualification

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

PROCEDURES FOR MAINTAINING EQUIPMENT QUALIFICATION

To ensure that the qualification level of equipment identified in the master list of this submittal, is maintained throughout the life of the plant and that the corresponding environmental qualification records are maintained up-to-date and retrievable, the Southern California Edison Company provides the following:

1. Maintenance procedures assure that environmentally qualified parts subject to thermal and radiation aging are replaced or serviced at the intervals stipulated in the corresponding environmental qualification packages.
2. As required by ANSI N18.7, each procurement of a safety related replacement item will meet standards equivalent to or more stringent than those of the item being replaced, including any applicable part qualification requirements. Specifically, equipment that requires environmental qualification is identified in a controlled list which is utilized in the process of procuring identical or replacement items. Documentation verifying compliance with procurement requirements, including environmental qualification, is reviewed by appropriate personnel.
3. Southern California Edison Company design organizations utilize procedures established in accordance with ANSI N45.2.11 to ensure that all equipment requirements, including environmental qualification, are considered for new designs and for changes. In addition, once the plant is operating, a safety evaluation is performed to ensure compliance with 10CFR50.59. Once the design is transmitted to the plant for implementation, it is reviewed by the plant technical staff to verify that the proposed modification meets the design intent and that no plant operating requirements are adversely affected.
4. The Southern California Edison Company procedures assure that when environmentally qualified replacement parts are issued from stock and installed in the plant, the corresponding environmental qualification records are updated to reflect the as-built condition.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

5. The supporting environmental qualification records for currently installed items are retrievable by plant tag number, or other positive identifier, from the Engineering Data Management Center (EDMC) at the plant.
6. Quality Assurance procedures require QA surveillance of all plant procedures and activities important to safety to provide additional assurance that installed equipment qualification level is maintained in accordance with procedural requirements.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Appendix B

Emergency Operating Procedures Review and Results

(To be submitted by June 1981)

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Appendix C

Environmental Qualification Summary (Sample Forms)

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Sheet 1 of 10

ENVIRONMENTAL QUALIFICATION SUMMARY

I. EQUIPMENT DESCRIPTION AND REQUIREMENTS

A. Component Identification:

1. Name \_\_\_\_\_
2. Ref. Spec. No. \_\_\_\_\_ Rev. \_\_\_\_\_ Date: \_\_\_\_\_
3. Most Restrictive location in Plant \_\_\_\_\_
4. Manufacturer \_\_\_\_\_
5. Manufacturer's Model No. \_\_\_\_\_
6. Manufacturer's Cat. No. \_\_\_\_\_

B. Component used in \_\_\_\_\_ System

C. System Function:

1. Reactor Cooling \_\_\_\_\_
2. Emergency Reactor Shutdown \_\_\_\_\_
3. Containment Isolation \_\_\_\_\_
4. Containment and Reactor Heat Removal \_\_\_\_\_
5. Prevention of Significant Release of Radioactive material to the Environment \_\_\_\_\_

D. Component Operation is:

Continuous \_\_\_\_\_

Intermittent \_\_\_\_\_

E. Component must operate at:

(Indicate all "ON", "OFF", times for intermittent operations)

ON \_\_\_\_\_

OFF \_\_\_\_\_

(Time measured with T=0 at initiation of DBA)

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Sheet 2 of 10

F. The component's normal environment is:

Pressure \_\_\_\_\_ psig  
Temperature \_\_\_\_\_ °F  
Radiation \_\_\_\_\_ (integrated dosage)  
Humidity \_\_\_\_\_ %  
Other \_\_\_\_\_

G. Limiting environmental condition following DBA is:

1. LOCA profile \_\_\_\_\_ Attached \_\_\_\_\_

2. Other:

	0-15 Min	15-60 Min	1-24 Hrs	1-31 Days
Pressure (psig)	_____	_____	_____	_____
Temperature (°F)	_____	_____	_____	_____
Radiation (rad)	_____	_____	_____	_____
Humidity %	_____	_____	_____	_____
Caustic Spray (psig/temp/ph)	_____	_____	_____	_____
Other	_____	_____	_____	_____

H. In service equipment mounting and orientation requirements:

1. No special Requirements \_\_\_\_\_

2. Special requirements to  
be included in installation

spec: \_\_\_\_\_

Ref: \_\_\_\_\_

II. EQUIPMENT QUALIFICATION METHOD:

1. Type Test \_\_\_\_\_ (complete Section III)

2. Analysis or \_\_\_\_\_ (complete Section IV)  
other methods

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Sheet 3 of 10

III. EQUIPMENT WAS QUALIFIED BY TYPE TESTS

Yes \_\_\_\_\_ No \_\_\_\_\_

(If yes, complete this section)

A. Test Parameters:

1. Test profile attached \_\_\_\_\_

2. Other \_\_\_\_\_

	0-15 Min	15-60 Min	1-24 Hrs	1-31 Days
Pressure (psig)	_____	_____	_____	_____
Temperature (°F)	_____	_____	_____	_____
Radiation (rad)	_____	_____	_____	_____
Humidity (%)	_____	_____	_____	_____
Submergence (yes/no)	_____	_____	_____	_____
Caustic Spray (psig/temp/ph)	_____	_____	_____	_____
Other	_____	_____	_____	_____

B. The specimen tested was a representative of the component delivered:

Yes \_\_\_\_\_ No \_\_\_\_\_

Justification \_\_\_\_\_

C. All tests were performed on same sample

Yes \_\_\_\_\_ No \_\_\_\_\_

(If No, is justification adequate)

Yes \_\_\_\_\_ No \_\_\_\_\_

Remarks: \_\_\_\_\_

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Sheet 4 of 10

C. (continued)

Define Test Sequence: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Was Test Sequence justified by vendor

Yes \_\_\_\_\_ No \_\_\_\_\_

Justification \_\_\_\_\_  
\_\_\_\_\_

D. Margins applied during tests:

Pressure \_\_\_\_\_ (% of required)

Temp. \_\_\_\_\_ (% of required)

Radiation \_\_\_\_\_ (% of required)

Humidity \_\_\_\_\_ (% of required)

Caustic Spray:

Pressure \_\_\_\_\_ (% of required)

Temp. \_\_\_\_\_ (% of required)

$\frac{H}{P}$  \_\_\_\_\_

Time \_\_\_\_\_ (% of required)

E. Method of defining temperature of test specimen:

Direct Mounted Thermocouple \_\_\_\_\_

Heat Transfer Method \_\_\_\_\_

Other (define) \_\_\_\_\_

F. Radiation Source \_\_\_\_\_

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Sheet 5 of 10

G. Heat aging method used

Arrhenius Methodology \_\_\_\_\_

Operating History \_\_\_\_\_

Justify \_\_\_\_\_

H. Radiation aging method used:

Radiation Source \_\_\_\_\_

Integrated Dosage \_\_\_\_\_

I. Was review of materials susceptible to aging performed

Yes \_\_\_\_\_ No \_\_\_\_\_

(If Yes, identify materials) \_\_\_\_\_

J. Temp/Press Transient Rate

Time		Temp	Pressure
From	To	°F/Sec	Psi/Sec
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

(Describe all positive gradients)

K. Caustic spray was applied at max temp and pressure

Yes \_\_\_\_\_ No \_\_\_\_\_

Flow Rate \_\_\_\_\_

p<sup>H</sup> \_\_\_\_\_

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Sheet 6 of 10

L. Expected extremes of power supply voltage and frequency were applied

Yes _____	HIGHEST	LOWEST
VOLTAGE	_____	_____
FREQUENCY	_____	_____

No \_\_\_\_\_

Justify \_\_\_\_\_

M. Performance characteristics were monitored:

Accuracy

Continuously \_\_\_\_\_ Intermittently \_\_\_\_\_ Method \_\_\_\_\_

Repeatability

Continuously \_\_\_\_\_ Intermittently \_\_\_\_\_ Method \_\_\_\_\_

Operability

Continuously \_\_\_\_\_ Intermittently \_\_\_\_\_ Method \_\_\_\_\_

N. Describe qualification test interfaces:

Electrical Connections \_\_\_\_\_

Piping

Pneumatic \_\_\_\_\_

Gas \_\_\_\_\_

Hydraulic \_\_\_\_\_

Mechanical Supports \_\_\_\_\_

Other \_\_\_\_\_

Did these simulate installation condition

Yes \_\_\_\_\_ No \_\_\_\_\_

(If no, justify) \_\_\_\_\_

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Sheet 7 of 10

O. Environmental qualification tests were performed by:

\_\_\_\_\_  
(Name of Organization)

\_\_\_\_\_  
(Address of Organization)

\_\_\_\_\_  
(Report No.)

\_\_\_\_\_  
(Date)

\_\_\_\_\_  
(Bechtel Log No)

P. Proprietary documentation was included

Yes \_\_\_\_\_ No \_\_\_\_\_ Not Applicable \_\_\_\_\_

If, "No", proprietary documentation is available for audit at:

\_\_\_\_\_  
(Name of Organization)

\_\_\_\_\_  
(Address of Organization)

IV. EQUIPMENT WAS QUALIFIED BY ANALYSIS OR OTHER METHOD

Yes \_\_\_\_\_ No \_\_\_\_\_

(If Yes, complete this section)

A. Method of qualification was:

Analysis \_\_\_\_\_

Operating Experience \_\_\_\_\_

Combination \_\_\_\_\_

On-Going Qualification \_\_\_\_\_

B. Was completely assembled equipment analyzed:

Yes \_\_\_\_\_ No \_\_\_\_\_

C. What components were type tested

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Sheet 8 of 10

D. Parameters of equipment/components analyzed

Temp \_\_\_\_\_  
Radiation \_\_\_\_\_  
Press \_\_\_\_\_  
Stress \_\_\_\_\_ code applied \_\_\_\_\_  
Cycling \_\_\_\_\_

E. Methods of Analysis:

1. Temp. Arrhenius Method \_\_\_\_\_  
Time \_\_\_\_\_ Temp \_\_\_\_\_
2. Source of information  
Lit. Search \_\_\_\_\_ Source \_\_\_\_\_  
Other \_\_\_\_\_
3. Radiation \_\_\_\_\_ Data Source \_\_\_\_\_
4. Cycling \_\_\_\_\_
5. Stress \_\_\_\_\_
6. Chemical \_\_\_\_\_

F. What margins were applied

Temp \_\_\_\_\_  
Press \_\_\_\_\_  
Radiation \_\_\_\_\_  
Stress \_\_\_\_\_  
Cycling \_\_\_\_\_  
Chemical \_\_\_\_\_

G. Was expected extremes of power supply voltage and frequency  
included in the analysis

Yes \_\_\_\_\_ No \_\_\_\_\_

(If No, Justify) \_\_\_\_\_

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Sheet 9 of 10

- H. If equipment was qualified by operating experience what parameters were applied

Temp \_\_\_\_\_  
Press \_\_\_\_\_  
Radiation \_\_\_\_\_  
Stress \_\_\_\_\_  
Cycling \_\_\_\_\_  
Chemical \_\_\_\_\_

Source of Data \_\_\_\_\_

was environment equal to or more severe than that required for equipment type testing.

Yes \_\_\_\_\_ No \_\_\_\_\_

- I. Qualified life to be maintained by on-going qualification program:

Yes \_\_\_\_\_ No \_\_\_\_\_

1. Is criteria for satisfactory operation defined

Yes \_\_\_\_\_ No \_\_\_\_\_

2. Is the periodic evaluation interval defined Yes \_\_\_\_ No \_\_\_\_

3. Are the parameters to be evaluated defined Yes \_\_\_\_ No \_\_\_\_

4. Are the components/modules to be evaluated identified

Yes \_\_\_\_\_ No \_\_\_\_\_

Method of evaluation tests \_\_\_\_\_

Parameter Evaluation \_\_\_\_\_

5. Is vendor participation required

Yes \_\_\_\_\_ No \_\_\_\_\_

Available,

Yes \_\_\_\_\_ No \_\_\_\_\_

Describe participation \_\_\_\_\_

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Sheet 10 of 10

J. Environmental qualification was performed by:

\_\_\_\_\_  
(Name of Organization)

\_\_\_\_\_  
(Address of Organization)

\_\_\_\_\_  
(Report No.)

\_\_\_\_\_  
(Date)

\_\_\_\_\_  
(Bechtel Log No)

K. Proprietary documentation was included

Yes \_\_\_\_\_ No \_\_\_\_\_ Not Applicable \_\_\_\_\_

If, "No", proprietary documentation is available for audit at:

\_\_\_\_\_  
(Name of Organization)

\_\_\_\_\_  
(Address of Organization)

V. CONCLUSION

A. Equipment Qualified to NUREG 0588 Guideline \_\_\_\_\_

B. Equipment Qualified to Other Criteria \_\_\_\_\_

VI. RECOMMENDED DISPOSITION

A. Use as qualified for plant life \_\_\_\_\_

B. Relocate to \_\_\_\_\_

C. Interim use for \_\_\_\_\_ years

Justification \_\_\_\_\_

D. Requalification Required \_\_\_\_\_

VII. SIGN OFF's

Bechtel:

Reviewing Engineer \_\_\_\_\_

EGS \_\_\_\_\_

Project Engineer \_\_\_\_\_

9/17/80

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Appendix D

NSSS Sample Evaluation Sheet

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

EVALUATION OF ENVIRONMENTAL QUALIFICATION OF C-E SUPPLIED SONGS 2 AND 3 EQUIPMENT  
LOCATED IN HARSH ENVIRONMENT PER NUREG-0588.

NUREG-0588 REQUIREMENTS CATEGORY II	NSSS EQUIPMENT NUMBER																										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
2.1(1)  Qualification methods should conform to IEEE 323-1971.																											
2.1(2)  Analysis without test data is not adequate unless precluded by size or partial type test data is used to support analysis.																											
2.1(3)  The bases for the required time interval and the actual operability and failure criteria as well as the safety margin should be defined.																											
2.1(3) (a)  "Equipment that must function in order to mitigate any accident should be qualified by test to demonstrate its operability for the time required in the environmental conditions resulting from that accident."																											

EVALUATION OF ENVIRONMENTAL QUALIFICATION OF C-E SUPPLIED SONGS 2 AND 3 EQUIPMENT  
LOCATED IN HARSH ENVIRONMENT PER NUREG-0588.

NUREG-0588 REQUIREMENTS CATEGORY II	NSSS EQUIPMENT NUMBER																										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
2.1(3) (b)  "Any equipment (safety related or non-safety related) that need not function to mitigate any accident, but that must not fail in a manner detrimental to plant safety should be qualified by test to demonstrate its capability to withstand any accident environment for the time during which it must not fail."																											
2.1(3) (c)  "Equipment that need not function in order to mitigate any accident and whose failure in any accident environment is not detrimental to plant safety need only be qualified for its non-accident service environment."  Although actual type testing is preferred, other methods may be acceptable.																											

San Onofre Nuclear Units 2&3  
Environmental Qualification of Class IE Equipment

EVALUATION OF ENVIRONMENTAL QUALIFICATION OF C-E SUPPLIED SONGS 2 AND 3 EQUIPMENT  
LOCATED IN HARSH ENVIRONMENT PER NUREG-0588.

NUREG-0588 REQUIREMENTS CATEGORY II	NSSS EQUIPMENT NUMBER																											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
2.1(3) (c) Cont'd  The bases should be provided for concluding that such equipment is not required to function in order to mitigate any accident and that its failure in any mode in any accident environment is not detrimental to plant safety."																												
2.1(4)  For environmental qualification of equipment subject to events other than a DBA, which result in abnormal environmental conditions, actual type testing is preferred. However, analysis or operating history coupled with type test data may be acceptable.																												
2.2(1)  Failure criteria should be established prior to testing.																												

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class 1E Equipment

EVALUATION OF ENVIRONMENTAL QUALIFICATION OF C-E SUPPLIED SONGS 2 AND 3 EQUIPMENT  
LOCATED IN HARSH ENVIRONMENT PER NUREG-0588.

NUREG-0588 REQUIREMENTS CATEGORY II	NSSS EQUIPMENT NUMBER																											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
2.2(2)  Test results should demonstrate that equipment can perform its required function for all service conditions during its installed life.																												
2.2(3)  IEEE 323-1971 Section 5.2 provides acceptable guidelines for establishing test procedures, when supplemented by items (4) through (12) following.																												
2.2(4)  The preferred simulated environmental profile for qualifying in containment equipment is a single envelope covering all design basis events in all modes of plant operation.																												
2.2(5)  Locate equipment above flood level; or protect with water-tight enclosures and test.																												

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class 1E Equipment

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

EVALUATION OF ENVIRONMENTAL QUALIFICATION OF C-E SUPPLIED SONGS 2 AND 3 EQUIPMENT  
LOCATED IN HARSH ENVIRONMENT PER NUREG-0588.

NUREG-0588 REQUIREMENTS CATEGORY II	NSSS EQUIPMENT NUMBER																										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
2.2(6) The temperature to which equipment is qualified should be defined by thermocouple readings on or as close as practical to the surface of the component being tested. If no thermocouples are near equipment during test, heat transfer analysis should be done to determine component temperature.																											
2.2(7) Performance characteristics of equipment should be verified before, during, and after testing.																											
2.2(8) Caustic spray should be incorporated during simulated event testing at the maximum pressure and at the temperature conditions that would occur when the spray systems actuate.																											

EVALUATION OF ENVIRONMENTAL QUALIFICATION OF C-E SUPPLIED SONGS 2 AND 3 EQUIPMENT  
LOCATED IN HARSH ENVIRONMENT PER NUREG-0588.

NUREG-0588 REQUIREMENTS CATEGORY II	NSSS EQUIPMENT NUMBER																										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
2.2(9)  Operability status should be monitored continuously during testing. For long-term testing, however, monitoring at discrete intervals should be justified if used.																											
2.2(10)  Expected extremes in power supply voltage and frequency should be applied during simulated event environmental testing.																											
2.2(11)  Dust environments should be addressed when establishing qualification service conditions.																											
2.2(12)  Cobalt 60 is an acceptable gamma source for environmental qualification.																											

San Onofre Nuclear Units 2&3  
Environmental Qualification of Class IE Equipment

EVALUATION OF ENVIRONMENTAL QUALIFICATION OF C-E SUPPLIED SONGS 2 AND 3 EQUIPMENT  
LOCATED IN HARSH ENVIRONMENT PER NUREG-0588.

NUREG-0588 REQUIREMENTS CATEGORY II	NSSS EQUIPMENT NUMBER																										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
2.3(1)  Justification of the adequacy of the test sequence should be provided.																											
2.3(2)  The test should simulate as closely as possible the postulated environment.																											
2.3(3)  The test procedures should conform to Section 5, 323-1971.																											
2.3(4)  The staff considers that for equipment postulated to be subjected to hostile environ- ments (in or out of contain- ment), separate effects testing, for the most part, is not acceptable. The same piece of equipment should be tested sequentially to radiation and hostile steam environment.																											

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

EVALUATION OF ENVIRONMENTAL QUALIFICATION OF C-E SUPPLIED SONGS 2 AND 3 EQUIPMENT  
 LOCATED IN HARSH ENVIRONMENT PER NUREG-0588.

NUREG-0588 REQUIREMENTS CATEGORY II	NSSS EQUIPMENT NUMBER																										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
2.4  Qualification by analysis or operation may be acceptable based on NRC evaluation and some type testing.																											
3(1)  Quantified margins should be applied to design parameters in addition to margins applied during the derivation of specified plant parameters.																											
3(2)  Margin will be considered on a case basis. Factors to be considered for quantifying margin include (a) induced stress levels on environmental testing, (b) stress duration, (c) number of items tested and number of tests, (d) equipment performance and (e) specified equipment function.																											

San Onofre Nuclear Plant Units 2&3  
 Environmental Qualification of Class IE Equipment

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

EVALUATION OF ENVIRONMENTAL QUALIFICATION OF C-E SUPPLIED SONGS 2 AND 3 EQUIPMENT  
LOCATED IN HARSH ENVIRONMENT PER NUREG-0588.

NUREG-0588 REQUIREMENTS CATEGORY II	NSSS EQUIPMENT NUMBER																										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
3(4) Equipment required to function for only seconds or minutes is required to remain functional in the accident environment for a period of at least 1 hour in excess of the time assumed in the accident analysis.																											
4(1) Qualification committed to conform to IEEE Std. 382-72 and 334-71 should include the effects of aging regardless of equipment location in plant.																											
4(2) For equipment other than applicable to 4(1) above, qualification should address aging to the extent of identifying age-susceptible materials and a schedule for replacement of materials/components.																											

EVALUATION OF ENVIRONMENTAL QUALIFICATION OF C-E SUPPLIED SONGS 2 AND 3 EQUIPMENT  
LOCATED IN HARSH ENVIRONMENT PER NUREG-0588.

NUREG-0588 REQUIREMENTS CATEGORY II	NSSS EQUIPMENT NUMBER																											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
5(1)  The staff endorses the requirements for documentation in 323-71 that, "(see quote in 0588)".																												
5(2)  The guidelines for documentation in 323-71 when supplemented by Appendix E are acceptable.																												

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

EQUIPMENT	NON-COMPLIANCE TO NUREG-0588 CATEGORY II	RESOLUTION
APPLICATION		

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

Appendix E

NRC Inspection Items

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

The findings of an NRC inspection concerning docket Nos. 50-361 and 50-362 were reported in a letter from G. S. Spencer, Chief Reactor Construction and Engineering Support Branch, to Dr. L. T. Papay, Vice President Advanced Engineering dated January 9, 1981. The inspection was conducted by Messrs. J. H. Eckhardt and J. O. Elin on December 16-19, 1980 and examined activities authorized by NRC Construction Permit Nos. CPPR-97 and 98. Report Nos. 50-361/80-24 and 50-362/80-13 identified action will be taken to close four open items by providing environmental qualification in the response to NUREG-0588. The resolution of these items is as follows:

1. NRC item (50-361/79-10/02), Environmental Qualification of splice connections on containment electrical penetrations was investigated in order to respond to NRC IE Bulletin 77-07 and again during the review for NUREG-0588. It has been verified that the electrical penetrations have been successfully environmentally qualified and documented as shown on Equipment Qualification Tabulation table 4-1, sheet 11.
2. NRC item (50-361/79 - 10/01), Environmental Qualification of amphenol and cannon connectors was investigated in order to respond to NRC IE Bulletin 77-05, 77-05A and again during the review for NUREG-0588. It has been verified that the connectors have been successfully environmentally qualified and documented as shown on Equipment Qualification Tabulation table 4-1, sheet 3.
3. Action on 50.55(e) items concerning factory splices of some cable runs of GE and Rockbestos cable was included in NUREG-0588 Equipment Qualification Tabulation table 4-1, sheets 5, 6, and 8.

San Onofre Nuclear Plant Units 2&3  
Environmental Qualification of Class IE Equipment

4. During a site tour the possible submergence of valves 2HV 9204 and 2TV 0221 was questioned. The entire submergence issue was resolved in the response to NRC Question 032.16. The response for valves 2HV 9204 and 2TV 0221 was submitted as follows:

The safety function of these valves is to close and remain closed in a post-LOCA condition. Short circuits or grounds that may occur at the terminals for the 3-way solenoid valves which control the instrument air to the pneumatic actuators do not reverse the position of the valves after they have closed.

Shorts between the limit switches and solenoids do not generate enough current for the solenoids to pick up due to the circuit resistance.

If the valves are open prior to a LOCA, isolation will occur prior to post-LOCA flood level, submerging the valves operators. Since the valve remains closed in a flooded environment, the valve performs its required safety function.

FEB 23 1981

— NOTICE —

THE ATTACHED FILES ARE OFFICIAL RECORDS OF THE DIVISION OF DOCUMENT CONTROL. THEY HAVE BEEN CHARGED TO YOU FOR A LIMITED TIME PERIOD AND MUST BE RETURNED TO THE RECORDS FACILITY BRANCH 016. PLEASE DO NOT SEND DOCUMENTS CHARGED OUT THROUGH MAIL. REMOVAL OF ANY PAGE(S) FROM DOCUMENT FOR REPRODUCTION MUST BE REFERRED TO FILE PERSONNEL.

DEADLINE RETURN DATE

50-361

Control # 8102180282

Date - 2/15/81

RECORDS FACILITY BRANCH