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WASHINGTON PUBLIC POWER SUPPLY SYSTEM EQUIPMENT QUALIFICATION PROGRAM FOR CLASS 1E INSTRUMENTATION AND ELECTRICAL EQUIPMENT FOR WNP-1/4 AND 3/5 PROJECTS

Washington Public Power Supply System
3000 George Washington Way
Richland, Washington 99352

ENGINEERING REPORT

QUALIFICATION PROGRAM FOR CLASS 1E INSTRUMENTATION

AND ELECTRICAL EQUIPMENT FOR WNP-1/4 AND WNP-3/5

COPY NUMBER 005

PREPARED BY: RL Abbott 12-1-80
R. L. Abbott, Corporate Engineering

APPROVED BY: J.E. Rhoads
J. E. Rhoads, Corporate Engineering

N. Porter
N. [illegible]rter, WNP-1/4

Jack E. Werle
J. E. Werle, WNP-3/5

DISTRIBUTION:

COPY NUMBER:	001	N.S. Porter, WNP-1/4
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	004	K.W. Cook, WNP-3/5
	005	J.E. Rhoads, Corporate Engineering
	006	A.N. Joshi, Corporate Engineering
	007	R.L. Abbott, Corporate Engineering
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	009	M. Sharma, UE&C
	010	R.B. Rock, UE&C
	011	D.L. Quamme, Ebasco
	012	M. Yates, Ebasco
	013	L.B. Tiscione, Ebasco
	014	E.G. Ward, Babcock & Wilcox
	015	A.A. Tuzes, Combustion Engineering
	016	C.F. Miller, Consultant
	017	
	018	
	019	
	020	

ABSTRACT

Qualification of Class 1E equipment for WPPSS WNP-1/4 and 3/5 Nuclear Project is a complex process composed of relatively simple steps. These steps consist of:

- o Determining which equipment must be qualified
- o Establishing criteria which qualification programs must meet
- o Establishing the most effective qualification methods
- o Performance of the qualification progrm
- o Providing adequate documentation to establish qualification
- o Following up with procedures designed to insure that the qualification program is maintained during the operational phase.

This report describes the WPPSS Qualification Program and the methods used to implement the step mentioned above. It also provides sample program summaries which are used to document equipment qualification

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
EQUIPMENT QUALIFICATION PROGRAM FOR
CLASS 1E INSTRUMENTATION AND ELECTRICAL EQUIPMENT

TABLE OF CONTENTS

1.0 INTRODUCTION

This section presents the background, bases and objectives for the Supply System Equipment Qualification Program to satisfy the requirements of IEEE 323-1974, or its daughter standards that are supported by regulatory guides and/or U.S. NRC documentation. This information report is applicable to Supply System Nuclear Project Nos. 1 and 4 (WNP-1/4) and Supply System Nuclear Project Nos. 3 and 5 (WNP-3/5), Docket Nos. 50-460, 513, 508, and 509.

The sections in this report are identified as follows. Section 2.0 describes the fundamental requirements utilized by the Supply System in the equipment qualification program. Section 3.0 identifies the types of Class 1E equipment to be qualified, and the plant specific service conditions under which this equipment must perform. Section 4.0 describes the qualification methods used to demonstrate the required equipment safety function. Section 5.0 describes the program implementation and necessary documentation Section 6.0 presents the information report conclusions.

1.1 Background

On January 16, 1979, Supply System representatives met with the NRC staff to present the Supply System equipment qualification program and the schedule for qualification of Class 1E electrical and I&C equipment on WNP-1/4 and 3/5 projects. In that meeting, the Supply System stated that they would submit an information report describing the methodology for qualification of I&C/electrical equipment on WNP-1/4 and 3/5 projects. This report would also provide a sample Class 1E equipment list and summaries of equipment qualification programs for various types of equipment. The staff agreed, in this meeting, to review the report and provide comments on the technical content and format of information contained within. Any comments generated as a result of a review of the report would then be resolved at that time.

1.2 Scope

The qualification requirements, methodology and documentation described in this report apply to balance-of-plant Class 1E equipment for the WNP-1/4 and WNP-3/5 projects. Although this report uses methods employed by the NSSS vendors, the report does not include the Class 1E equipment supplied by Babcock & Wilcox for WNP-1/4 or Combustion Engineering for WNP-3/5.

The NSSS equipment qualification program for WNP-1/4 is described in Babcock & Wilcox' Topical report, BAW-10082. This topical report will contain equipment qualification reports as appendices, which the Supply System intends to reference for the qualification of the NSSS and BOP equipment for WNP-1/4.

The qualification of NSSS equipment for WNP-3/5 will be based upon individual equipment qualification reports supplied by Combustion Engineering. The Supply System intends to reference these qualification reports for NSSS and BOP equipment on WNP-3/5.

1.3 Purpose

The purpose of this information report is to describe the requirements, identify the equipment to be qualified, and present the methodology to be used in the Supply System equipment qualification program.

The intent of the Supply System program is to satisfy the qualification requirements of IEEE 323-1974, or its daughter standards that are supported by regulatory guides and/or NRC documentation.

2.0 SUPPLY SYSTEM EQUIPMENT QUALIFICATION PROGRAM REQUIREMENTS

. :s section identifies the qualification requirements to which this information report was developed. The documents listed below, along with the plant specific service conditions of Section 3.0, form the bases for the Supply System Equipment Qualification Program. The Supply System program conforms with the objectives of the regulatory guides, standards and other criteria listed below.

Regulatory Guides:

- R.G. 1.89, Revision 0, "Qualification of Class 1E Equipment for Nuclear Power Plants"
- R.G. 1.100, Revision 1, "Seismic Qualification of Electrical Equipment for Nuclear Power Plants"
- R.G. 1.40, Revision 0, "Qualification Tests of Continuous-Duty Motors Installed Inside the Containment of Water-Cooled Nuclear Power Plants"
- R.G. 1.63, Revision 1, "Electric Penetration Assemblies in Containment Structures for Light-Water-Cooled Nuclear Power Plants:
- R.G. 1.73, Revision 0, "Qualification Tests of Electric Valve Operators Installed Inside the Containment of Nuclear Power Plants"
- R.G. 1.131, Revision 0, "Qualification Tests of Electric Cable, Field Splices and Connections for Light-Water-Cooled Nuclear Power Plants"

IEEE Standards:

- IEEE 101-1972, "Guide for the Statistical Analysis of Thermal Life Test Data"
- IEEE 279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations"
- IEEE 387-1977, "Standard Criteria for Diesel-Generator Units Applied as Standby Power Supplies for Nuclear Power Generating Stations"

- IEEE 650-1979, "IEEE Standard for Qualification of Class 1E Static Battery Chargers and Inverters for Nuclear Power Stations".
- IEEE 501-1978, "IEEE Standard for Seismic Testing of Relays"
- IEEE 535-1979, "IEEE Standard for Qualification of Class 1E Lead Storage Battery Chargers and Inverters for Nuclear Power Generating Stations"

FSAR Requirements:

- Regulatory Guide 1.70, Revision 3
- Standard Review Plan, Section 3.10
- Standard Review Plan, Section 3.11

General Design Criteria:

- 1, 2, 4 and 23 of Appendix A, 10CFR50
- III and XI of Appendix B, 10CFR50

IE Circulars/Bulletins:

- IE Circular 78-08, "Environmental Qualification of Safety-Related Electrical Equipment at Nuclear Power Plants"
- IE Bulletin 79-01, "Environmental Qualification of Class 1E Equipment"
- NUREG-0588, "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment"

2.1 Conformance with Regulatory Guide 1.89, "Qualification of Class 1E Equipment for Nuclear Power Plants"

This regulatory guides references IEEE 323-1974. (A basic purpose of the Supply System qualification program is to provide compliance with the objectives of NUREG-0588.) The equipment qualification program contained in this document exceeds this position presented during the PSAR review. The source term as defined by Regulatory Guide 1.89 and the Interim Staff Position NUREG-0588 is being applied to determine the radiation dose levels in specific equipment spaces. These levels, then, will be used in the equipment qualification program.

2.2 Conformance with Regulatory Guide 1.100, "Seismic Qualification of Electric Equipment for Nuclear Power Plants"

This regulatory guide references IEEE 344-1975. The qualification methods and procedures of IEEE 344-1975 are utilized by the Supply System according to equipment type and size. The summaries contained in Appendix A provide details of the Supply System's conformance to this IEEE standard and R.G. 1.100.

The Supply Systen preferred method of seismic qualification is random, multi-frequency input testing, simultaneously to the principal vertical and one principal horizontal axis. This configuration is rotated 90 degrees about the principal vertical axis with the excitation then repeated. Five OBE and one SSE tests are performed that envelope the required response spectra for each Supply System nuclear project.

Single frequency tests are accepted if one of the following criteria are satisfied:

- The characteristics of the seismic input motion indicate that the motion is dominated by one frequency (e.g., by structural filtering effects).
- The anticipated response of the equipment is adequately represented by one mode.
- The test input motion has sufficient intensity and duration to excite all modes to the required amplitudes such that the test response spectra will envelope the corresponding response spectra of the individual modes.

2.3 Conformance with Regulatory Guide 1.40, "Qualification Test of Continuous Duty Motors Installed Inside the Containment of Water-Cooled Nuclear Power Plants"

This regulatory guide references IEEE 334-1971. The Supply System also conforms with the 1974 revision of IEEE 334. The qualification procedure of IEEE 334-1974 is used with the parameters contained in the Supply System Technical Specifications to demonstrate adequacy of aged motor and auxiliary equipment under normal and postulated DBE conditions.

A qualification summary contained in Appendix A illustrates the Supply System methodology in conforming with IEEE 334 and R.G. 1.40.

2.4 Conformance with Regulatory Guide 1.63, Revision 1, "Electric Penetration Assemblies in Containment Structures for Light-Water Cooled Nuclear Power Plants"

This regulatory guide references IEEE 317-1976. The Supply System combines the qualification test sequence of this standard with the plant environmental and seismic parameters of the Supply System Technical Specifications to demonstrate aged penetration assemblies' adequacy to perform their safety function during normal and DBE conditions.

A qualification summary contained in Appendix A illustrates the Supply System methodology in complying with Regulatory Guide 1.63 and IEEE 317-1976.

2.5 Conformance with Regulatory Guide 1.73, "Qualification Tests of Electric Valve Operators Installed Inside the Containment of Nuclear Power Plants"

This regulatory guide references IEEE 382-1972. The Supply System conforms with this qualification standard by combining the standard's qualification test sequence with the environmental and seismic parameters of the Technical Specifications to demonstrate adequacy of aged motor operator and auxiliary equipment under normal and DBE conditions.

A qualification summary contained in Appendix A illustrates the Supply System methodology in conforming to IEEE 382 and R.G. 1.73.

2.6 Conformance with Regulatory Guide 1.131, "Qualification Tests of Electric Cables, Field Splices, and Connections for Light-Water-Cooled Nuclear Power Plants"

This regulatory guide references IEEE 383-1974. The Supply System conforms with the objectives of Revision 0 of the regulatory guide and the reference IEEE standard.

The IEEE 383 qualification test sequence is used with the Supply System Technical Specification parameters to demonstrate adequacy for Supply System applications. Flame testing of aged cables is based upon the thermal aging properties of the fire-retardant jacket materials to demonstrate fire resistance capability. Qualification summaries contained in Appendix A illustrate the Supply System methodology in conforming to IEEE 383 and R.G. 1.131.

2.7 Conformance with IEEE 101-1972, "Guide for the Statistical Analysis of Thermal Life Test Data"

The Supply System employs the methods described in this standard when using Arrhenius methodology to address accelerated aging.

2.8 Conformance with IEEE 279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations"

The Supply System Technical Specifications for safety-related equipment require conformance to the design basis and functional requirements of IEEE 279.

2.9 Conformance with IEEE 378-1977, "Standard Criteria for Diesel-Generator Units Applied as Standby Power Supplies for Nuclear Power Generating Stations"

The Supply System employs the methods described in the qualification section, Section 5.4, of this standard.

2.10 Conformance with IEEE 501-1978, "IEEE Standard for Seismic Testing of Relays'

The Supply System employs the fragility test guidelines of IEEE 501 whenever discrete relay qualification is performed.

2.11 Conformance with IEEE 535-1979, "IEEE Standard for Qualification of Class 1E Lead Storage Batteries for Nuclear Power Generating Stations"

The Supply System Qualification Program for Class 1E batteries employs the type-test methods described in this standard.

2.12 Conformance with IEEE 650-1979, "IEEE Standard for Qualification of Class 1E Static Battery Chargers and Inverters for Nuclear Power Stations"

The Supply System employs the methods of IEEE 650 in the qualification of battery chargers, static inverters, and other safety-related electronic equipment.

2.13 Conformance with Regulatory Guide 1.70, Revision 3, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants"

The Supply System conforms with the objectives of Regulatory Guide 1.70. Sections 3.10 and 3.11 of this regulatory guide specifically require seismic and environmental qualification of safety-related equipment. These sections are addressed in Section 2.14 and 2.15 of this document.

2.14 Conformance with the Standard Review Plan, Section 3.10, "Seismic Qualification of Category I Instrumentation & Electrical Equipment"

The Supply System conforms with the objectives of this Standard Review Plan. Appendix B illustrates in detail the methodology the Supply System intends to employ to satisfy the seismic criteria of the Standard Review Plan, Section 3.10.

2.15 Conformance with the Standard Review Plan, Section 3.11, "Environmental Design of Mechanical and Electrical Equipment"

The Supply System conforms with the objectives of this Standard Review Plan. The Supply System combines the qualification test sequence of the IEEE qualification standards with the plant environmental and seismic parameters of the Technical Specification to demonstrate equipment adequacy to perform required safety functions under normal and DBE conditions. Appendix B identifies the methodology used in qualification of each piece of equipment. The qualification summaries in Appendix A provide additional details of the qualification program.

The submittal of test results which demonstrate that the equipment meets the worst case environmental conditons (e.g., loss of air conditioning) required by Section 3.11.4 will be met by inclusion of such data in the summaries of those tests/analysis. These will be referenced in the FSAR to satisfy requirements of Standard FSAR Format Section 3.11.4.

2.16 Conformance with General Design Criteria

The Supply System is in conformance with the objectives of the General Design Criteria 1, 2, 4, and 23 of Appendix A, and III and XI of Appendix B to 10CFR Part 50. This is accomplished through conformance with

NUREG-0588, IEEE 323-1974, its ancilliary standards, and IEEE 344-1975, as discussed in Section 2.0 of this document.

2.17 Conformance with IE Circular 78-08, "Environmental Qualification of Safety-Related Electrical Equipment at Nuclear Power Plants"

This circular requires documentation that demonstrates Class 1E equipment will function under postulated worst case accident conditions. Specific items were identified in the circular as examples of inadequate documentation. These include connectors, penetrations, terminal blocks, limit switches and cable splices.

The Supply System interprets the circular to emphasize certain specific items mentioned above. The Supply System Equipment Qualification Program provides methods for meeting IEC 78-08 by conforming to the objectives of NUREG-0588, described by Section 2.19 of this document.

2.18 Conformance with IE Bulletin 79-01, "Environmental Qualification of Class 1E Equipment"

IEB 79-01 re-emphasizes IEC 78-08 and identifies specific unqualified limit switches.

The Supply System Equipment Qualification Program provides methods for meeting IEB 79-01 by conforming to the objectives of NUREG-0588, described by Section 2.19 of this document.

2.19 Conformance with NUREG-0588, "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment"

The NRC Commissioner's Order, CLI-80-21, establishes NUREG-0588 as the bases for environmental qualification of safety-related equipment. The Supply System is in the process of complying with this order. Review of this NUREG document has been completed at the Supply System. The Supply System and the respective Architectural Engineers have included the NUREG document in the equipment qualification review effort. This review effort provides for equipment vendor contact, which will establish conformance to the objectives of the NUREG document.

NUREG-0588 has incorporated Standard Question Number 4 as Appendix E. The Supply System intends conformance to Appendix E. The categorizing will be performed as indicated below and in Figure 1.

Appendix E of NUREG-0588, "Standard Question on Environmental Qualification of Class 1E Equipment", consists of several parts. Figure 1 represents the Supply System interpretation of the Standard Question. The three major parts represent categories of Class 1E equipment. Within these categories lie subparts requiring detailed information dependent on equipment function and location.

The major categories are:

- All Class 1E Equipment (Part I)
- Class 1E Equipment Subject to Design Basis Accident Environments (Part II)

- Class 1E Equipment Not Subject to Design Basis Accident Environments

2.19.1 Part I

For all Class 1E equipment, the Supply System will provide:

- Identification of Equipment

    1. Type (functional designation)
    2. Manufacturer
    3. Manufacturer's type and model numbers

- Qualification Envelope Simulated During Environmental Testing

    1. The duration of the hostile environment and the margin in excess of design requirements.

- Methods Used for Environmental Qualification Other Than Type Testing.

- Summary of Test Results

    1. The summary which demonstrates the adequacy of the qualification program.
    2. Justifications for all analyses and assumptions made.

- Qualification Documents

    1. All qualification documents which contain detailed supporting information including test data will be referenced in the summary of test results.

2.19.2 Part II

All Class 1E equipment, which, when subjected to a Design Basis Accident environment must function or not fail, is provided with documentation. For this type of equipment, the Supply System provides the following information:

- Equipment safety function requirements derived from the system safety function. The Supply System also substantiates that components will perform their safety function during postulated service conditions.

- An environmental envelope as a function of time which includes all extreme parameters, both maximum and minimum values, which are expected to occur during plant shutdown, normal operation, abnormal operation, design basis accidents (including LOCA and SLB), and post accident conditions.

- Time required for the equipment to fulfill its safety function (period of operability).

Appendix E of NUREG-0588 requires identification of the system safety function. The Supply System interprets this to mean the equipment safety function. The Supply System Technical Specification identifies the equipment safety function required, along with the environmental and seismic service conditions. The equipment is then qualified to satisfy the safety function under postulated service conditions.

If any method other than type testing was used for qualification, the method is described in sufficient detail to permit evaluation of its adequacy.

The qualification test plan, test setup, test procedures and acceptance criteria for at least one of each type of equipment listed below is provided:

Switchgear	Motor Control Centers
Logic Equipment	Cable
Valve Operators	Motors
Diesel Generator Control Equipment	Sensors
	Heaters
Limit Switches	Control Boards
Fans	Electrical Penetrations
Instrument Racks & Panels	Terminal Blocks
Splices	Connectors

2.19.3 Part III

For representative safety class equipment not subject to a design basis accident environment, the following information is provided:

- Equipment safety function requirements derived from the system safety function. The Supply System also substantiates that components will perform their safety function during postulated service conditions.

- All environmental envelope as a function of time which includes all extreme parameters, both maximum and minimum values, expected to occur during plant shutdown, normal operation, abnormal operation, design basis events (excluding LOCA and SLB), and post DBE conditions.

- Time required for the equipment to fulfill its safety function (period of operability).

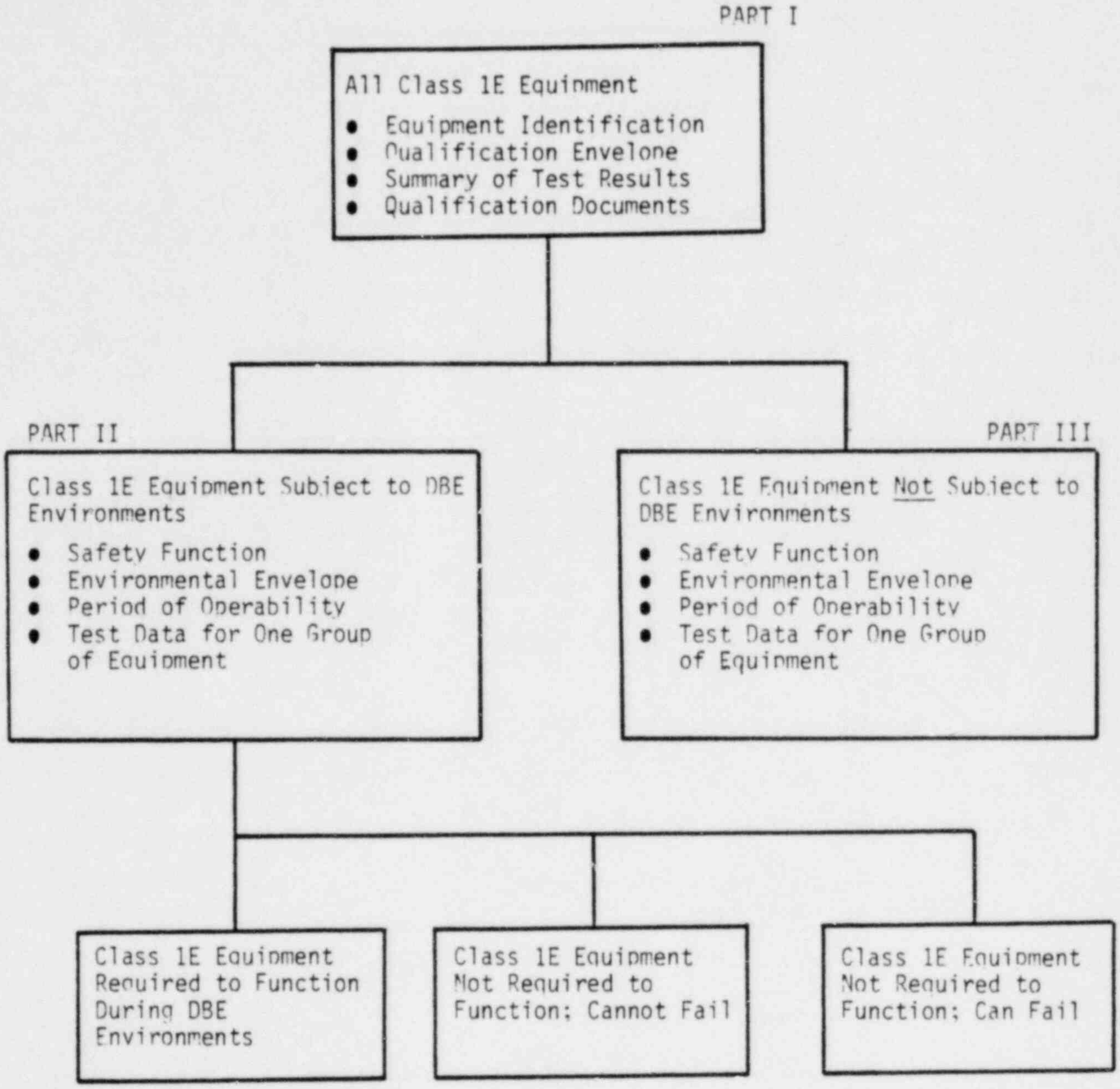
- The qualification test plan, test setup, test procedures, and acceptance criteria for at least one of each group of representative equipment.

  1. If any method other than type testing was used for qualification, that method is described in sufficient detail to permit evaluation of its adequacy.

  2. The representative equipment for which this data is provided consists of the list described in Section 2.19.2 Part II, of this document.

FIGURE 1

STANDARD QUESTION REQUIREMENTS
(NUREG-0588, APPENDIX E)



3.0 CLASS 1E EQUIPMENT TYPES AND SERVICE CONDITIONS

This section addresses the equipment types which are qualified by the Supply System Equipment Qualification Program. The service conditions applicable to WNP-1/4 and WNP-3/5, respectively, are also discussed. In addition, the acceptance criteria used by the Supply System in the review and evaluation of supplier qualification programs are identified.

3.1 Equipment Types

The Supply System Equipment Qualification Program involves all Class 1 electrical, instrumentation, and control equipment not included in the NSSS scope of supply. The qualification programs for NSSS equipment are contained in separate documents.

3.2 Service Conditions

The equipment types are located in diverse areas within the plant. Because of this, the service conditions affecting the operation of some equipment may be different from those conditions affecting the operation of other equipment. This section discusses service conditions consisting of environmental (temperature, radiation, pressure, chemical and humidity) and vibrational (operational and seismic) stresses.

3.2.1 Environmental Service Conditions

Each project, due to different geographical locations and separate NSSS vendors, has different service conditions. The methods used in the development of those conditions (i.e., temperature, pressure, radiation, humidity, etc.) will be contained in the respective projects FSARs, Section 3.11.

3.2.1.1 WNP-1/4 Environmental Service Conditions

- Control and Auxiliary Equipment Rooms

  This area, designated "Environmental Condition Code B8" in Table 3.11.1-2, is supplied by a redundant Class 1E, Seismic Category I heating, ventilating, and air conditioning system. This system (HCL) is designed to operate under normal and all emergency modes. During an ESFAS condition, the system is automatically connected to the appropriate emergency bus. During Loss-of-Offsite-Power, this system is manually loaded by the operator under administrative controls. No single failure of an active component will result in loss of service.

  During normal, abnormal (emergency mode powered by the emergency bus), and accident conditions, the HCL system provides heating, cooling, humidity control, static pressure control, normal filtration, and atmosphere clean-up service while maintaining the area ambient temperature at nominally 75^{O}F; therefore, no loss of air conditioning is postulated for this space.

The ability of this Class 1E equipment to perform its safety function under the environmental service conditions is demonstrated in the equipment qualification program.

- Fuel Handling Area

This area, designated "Environmental Condition Code B3" in Table 3.11.1-2, is supplied by a redundant Class 1E, Seismic Category I heating, ventilating, and air conditioning system. This system (HSF) is designed to operate under normal and all emergency modes. No single failure of an active component will result in loss of service. During normal, abnormal, and accident conditions, the HSF system provides heating, cooling, humidity control, normal filtration, and atmospheric clean up while maintaining the area ambient at a nominal 80°F. The system is automatically loaded on receipt of an ESFAS signal and is administratively loaded upon a Loss-Of-Offsite-Power condition by administrative procedures. No loss of air conditioning is postulated for this space. The ability of the Class 1E equipment to perform its safety function under the environmental service conditions is demonstrated in the equipment qualification program.

- Safeguards Area

This area, designated "Environmental Condition Code B4" in Table 3.11.1-2, is supplied by a redundant Class 1E, Seismic Category I heating, ventilating, and air conditioning system. This system (HSG) is designed to operate under normal and all emergency modes. A single failure of an active component will not offset the environmental conditions of the area. Evaporative coolers are provided for cooling; however, the normal supply of chilled water is not postulated to be available during Loss-Of-Offsite-Power. During an emergency, if the temperature of the space exceeds 130°F, a temperature controller opens the chilled-water valves allowing chilled water supplied from the HSF system to circulate through emergency chilled-water coils located in the HSG air-handling units. This maintains air conditioning to this area and therefore, loss of air conditioning is not postulated for this area. The partial loss of air conditioning will not result in extreme temperatures as the maximum condition of 130°F is within the design limits of the equipment and will be of short duration.

Accelerated thermal aging of equipment or components subject to thermal degradation during the qualification program includes temperatures well above 130°F and establishes the ability of the equipment or component to survive the abnormal condition of 130°F. The equipment qualification program demonstrates the equipment's ability to perform its safety function under the environmental service conditions.

- Containment

This area, designated "Environmental Condition Code A1 and A2" in Table 3.11.1-2, is supplied by a recirculation system (CFC), a purge system (CPP), and a heating system (HSS). The only parts of these systems designated Class 1E are the hydrogen-pocket removal fans and associated instrumentation and controls.

The CFC system, however, has four 100% capacity air-handling units--any one of which can maintain the containment temperature below 135°F. These air-handling units are powered by the emergency buses and are manually loaded by administrative controls upon Loss-Of-Offsite-Power. During LOCA conditions, temperature conditions are maintained by containment spray. Loss of air conditioning to the containment is highly unlikely and therefore, the maximum abnormal condition will not result in extreme temperatures and will not exceed 135°F.

Class 1E equipment located in containment which mitigate the effects of a LOCA or MSLB events are qualified to these conditions. Other Class 1E equipment required to mitigate the effects of other events are qualified to the service conditions produced by those events.

- Diesel Generator Area

Each diesel generator area, designated "Environmental Condition Code B5" in Table 3.11.1-2, is supplied by an independent Class 1E, Seismic Category I heating, ventilating and air conditioning system (HDG). Each of the HDG systems is separate, independent and powered from the emergency power bus of its respective diesel generator. Upon LOOP or ESFAS conditions each HDG system is automatically loaded on to its respective diesel source by the emergency power load sequencer. Each of the HDG ventilation systems has 100% capacity in both normal and emergency modes, thus the postulated single failure in the HDG does not prevent performance of the redundant diesel systems safety function.

The ability of the Class 1E equipment to perform its safety function under the environmental service conditions is demonstrated in the equipment qualification program. Accelerated thermal aging of components and equipment susceptible to thermal degradation is performed during the aging portion of the qualification program at substantially higher temperatures and establishes the adequacy of the equipment to survive the abnormal condition.

- Switchgear, Battery and Cable-Spreading Area

This area, designated "Environmental Condition Code B12" in Table 3.11.1-2, is supplied by a redundant Class 1E heating, ventilating, and air conditioning system (HSC) and is designed to operate under normal and all emergency modes. A single failure of an active component will not affect the environmental condition of the area. During an ESFAS condition, the system is automatically loaded on to the emergency buses. During Loss-Of-Offsite-Power (LOOP), operator action under administrative control re-establishes the HSC system. Therefore, no loss of air conditioning is postulated for this area. The maximum extreme temperature for the switchgear area is 104°F--with the battery and cable-spreading areas maintained at a maximum of 85°F during normal and LOOP conditions and 90°F during ESFAS. The ability of the Class 1E equipment to perform its safety function under the environmental service conditions is demonstrated in the equipment qualification program.

- <u>Electrical Piping Tunnels</u>

  This area, designated "Environmental Condition Code B10" in Table 3.11.1-2, is supplied by a redundant Class 1E, Seismic Category I heating, ventilating, and air conditioning system. This system (HPT) is designed to operate under normal and all emergency modes. A single failure of an active component will not affect the environmental conditions of the area.

  Evaporative coolers are provided for cooling during normal power conditions; however, during LOOP, the normal supply of chilled water is not postulated to be available. Calculations have been performed that establish the maximum ambient conditions to be 130°F with the outside environmental conditions at maximum. This is accomplished through ventilating the area with outside air. This maintains ventilation to this area and therefore, loss of air conditioning is not postulated. The partial degradation of the system will not result in extreme temperatures as the maximum condition of 130°F is within the design limits of the equipment and will be of short duration. The Class 1E equipment qualification program demonstrates the ability of this equipment to perform its safety function under the environmental service conditions.

- <u>Component Cooling and Makeup Pump Areas</u>

  This area, designated "Environmental Condition Code B11" in Table 3.11.1-2, is supplied by a redundant Class 1E, Seismic Category I heating, ventilating and air conditioning system. This system (HCA) is designed to operate under normal and all emergency modes. Single failure of an active component will not affect the environmental conditions of this area.

  System startup, or the transfer of operation from one train to the other, is accomplished by manual control during normal plant operation or following a LOOP. The system is automatically loaded on the emergency bus in the event of an ESFAS signal. The evaporative coolers are not available during Loss-Of-Offsite-Power conditions. Calculations have been performed that establish the maximum ambient conditions to be 130°F with outside environmental conditions at maximum. This is accomplished through ventilating of the area with outside air. This maintains air conditioning to this area; therefore, loss of air conditioning is not postulated. The partial degradation of the system will not result in extreme temperature as the maximum condition of 130°F is within the design limits of the equipment and will be of short duration. Accelerated thermal aging of the equipment and components susceptible to thermal degradation during the qualification program includes temperature exposures well above 130°F and establishes the ability of the equipment or component to survive the abnormal condition.

- Main Steam and Feedwater Isolation Areas

  This area, designated "Environmental Condition Code D1" in Table 3.11.1-2, is supplied by a non-Class 1E heating, ventilating, and air conditioning system. The system (HIA) is not vital to the safe operation or shutdown of the plant. The system has been designed such that failure of any component will not affect the operation of any safety-related system.

  The design basis for qualification of safety-related equipment in this area is a HELB in the main steam lines. In order to mitigate the consequences of this accident, the main steam-valve actuator and other required control equipment located in the area of influence are qualified to the more limiting environment of the HELB.

- Spary-Pond Pump House Area

  The spray-pond pump house is divided into two separate and identical areas. Each is served by an independent Class 1E, Seismic Category I heating, ventilating and air conditioning system (VAB). Each system is separate, independent, and powered from the emergency bus of the pump house it serves. They are automatically loaded on ESFAS conditions. Loss of one of the air-handling units will require operation of the redundant spray pump system. As each HVAC system and pump house constitutes an integral, separate unit, the single failure of any HVAC system component cannot prevent the safe shutdown of the plant. During a LOOP condition, manual restarting of the VAB systems ensure continued environmental control. During emergency conditions with the pumps running, the peak inside ambient will not exceed 121°F with a 24-hour average of 108°F maximum.

  FSAR Tables 3.11.1 and 3.11.5 and Figures 3.2.1-1 and 3.2.1-2 are included as reference to provide details of the environmental conditions of WNP-1/4 equipment spaces discussion above.

TABLE 11.1-1
(Sheet 1 of 8)

EQUIPMENT REQUIRED TO PERFORM SAFETY FUNCTIONS
DURING AND SUBSEQUENT TO A DESIGN BASIS ACCIDENT

SYSTEM	EQUIPMENT	LOCATION	Required Duration of Operation For DBA (1) LOCA	Required Duration of Operation For DBA (2) MSLB	Normal/Abnormal DBA (3) ENVIRONMENTAL CONDITION	FSAR SECTION
REACTOR COOLANT SYSTEM	Reactor Vessel	Containment Inside Crane Wall	Continuous	Continuous	A1	5.3, 5.4
	Steam Generators	"	Continuous	The unaffected S.G. is required	"	"
	Pressurizer	"	Continuous	Not Required	"	"
	Reactor Coolant Pumps	"	Continuous	Conditionally Required	"	"
	RCS Piping	"	Continuously Required(5)	Continuously Required(5)	"	"
	Instrumentation & Controls	Inside Containment Outside Containment	Short Term Long Term(7)	Short Term Long Term(7)		
	RC Pump Motor Monitoring Cabinets	Outside Containment	Short Duration	Conditionally Required	B, D-2	8.3
CONTAINMENT HEAT REMOVAL SYSTEMS:	Spray Additive Tank 2 Eductors	"	Short Term(6)	Not Required	B4	6.2.2, 6.5.2
CONTAINMENT SPRAY SYSTEM	Spray Pumps & Drivers	"	Continuous	Continuous	"	"
	Spray Heat Exchangers	"	Re-Cir Mode	Re-Cir Mode	"	"
	Valves & Piping	"	Continuous	Continuous	"	"
	Spray Nozzles Manifolds & Piping	Inside Containment Outside Crane Wall	Continuous	Continuous	A2	"
	Emergency Sumps	"	Continuous	Continuous	"	"
	Instrumentation & Controls	Inside Containment Outside Containment	Continuous	Continuous (Fission Product removal portion is not required for MSLB)	A2, B4	"

TABLE 3.11.1-1
(Sheet 2 of 8)

SYSTEM	EQUIPMENT	LOCATION	Required Duration of Operation for DBA (1) LOCA	(2) MSLB	Normal/Abnormal DBA (3) ENVIRONMENTAL CONDITION	FSAR SECTION
CONTAINMENT ISOLATION SYSTEM	Valves & Piping	Inside Containment & Outside Containment	Continuous	Not Required	A2, B4	6.2.4
	Piping Penetrations	"	"	"	" "	"
	Instrumentations & Controls	"	"	"	" "	"
COMBUSTIBLE GAS CONTROL SYSTEMS						6.2.5
(a) Containment Spray System	See Containment Heat Removal System					"
(b) Containment Recirculation	Hydrogen pocket Ventilation fans & drives	Inside Containment Inside Crane Wall	Continuous	Not Required	A1	"
(c) Containment Atmosphere Monitoring System	Hydrogen monitors	"	"	"	"	"
(d) Hydrogen Control System	Hydrogen recombiner Units	"	"	"	"	"
(e) Containment Purge	Purge fans & drivers	"	Not Required	"	"	"
EMERGENCY CORE COOLING SYSTEM						6.3
(a) Core Flooding System	Core Flood Tanks Piping & Valves Instrumentations & Controls	Inside Containment Inside Crane Wall	Continuous	Continuous	A1	"
(b) Safety Injection Systems (LPI & HPI)	BWST	Outside Containment	Continuous	Continuous	C1	"
	Pumps & drivers	"	"	"	B4, B11	"
	Heat exchangers	"	Re-cir mode	Re-cir mode	B4	"
	Valves & piping	Inside & Outside Containment	Continuous	Continuous	A1, A2, B4	"

TABLE 3.11.1-1
(Sheet 3 of 8)

SYSTEM	EQUIPMENT	LOCATION	Required Duration of Operation for DBA (1) LOCA	(2) MSLB	Normal/Abnormal DBA (3) ENVIRONMENTAL CONDITION	FSAR SECTION
	Instrumentations & Controls	Inside & Outside Containment	Continuous	Continuous	A2, B4	6.3
	Sumps & screens	Inside Containment Outside Crane Wall	Continuous	Continuous	A2	"
FISSION PRODUCT REMOVAL & CONTROL SYSTEMS:						6.5
(a) Containment Spray System	See Containment Heat Removal System					6.5.2
(b) Containment System	Containment Structures	Containment	Continuous	Continuous	A1, A2	6.5.3.1
ONSITE POWER SYSTEMS						8.3
(a) A-C Power System	4160 Volt Distribution buses & switchgears	Outside Containment	Continuous	Continuous	B1	8.3.1
	120 V a-c vital I&C power system	Outside Containment	"	"	"	"
	Diesel Generators & associated equipments	Outside Containment	"	"	B5	"
	Electrical Cables	All areas	"	"	A, B., C, D, E	"
	Electrical Penetrations	Inside & Outside Containment	"	"	A2	"
(b) D-C Power System	Battery chargers, distribution switchgear & panels	Outside Containment	"	"	B1	8.3.2
	Batteries	"	"	"	"	"
	Electrical cables	All areas	"	"	A, B, C, D, E	"
	Electrical penetrations	Inside & Outside Containment	"	"	A2	"

TABLE 3.11.1-1
(Sheet 4 of 8)

SYSTEM	EQUIPMENT	LOCATION	Required Duration of Operation for DBA (1) LOCA	Required Duration of Operation for DBA (2) MSLB	Normal/Abnormal DBA (3) ENVIRONMENTAL CONDITION	FSAR SECTION
SPENT FUEL POOL COOLING & CLEAN UP SYSTEM	Pumps & drivers	Outside Containment	(Note 4)	(Note 4)	B3	9.1.3
	Heat exchangers	"	"	"	"	"
	Valves & piping	"	"	"	"	"
	Instrumentation & Control	"	"	"	"	"
SHUTDOWN COOLING WATER SUBSYSTEM OF NUCLEAR SERVICE WATER SYSTEM	SCW pumps & drivers	Outside Containment	Continuous	Continuous	B1	9.2.1
	SCW heat exchangers	"	"	"	"	"
	SCW piping & valves	"	"	"	"	"
	SCW Instrumentation & Controls	"	"	"	"	"
EMERGENCY SHUTDOWN SERVICE WATER SYSTEM	Spray pond	Outside Containment	Continuous	Continuous	E	9.2.5
	ESW pumps & drivers	"	"	"	"	"
	Piping & Valves	"	"	"	"	"
	Spray nozzles	"	"	"	"	"
COMPONENT COOLING WATER SYSTEM	The portion of piping, valves & instrumentation performing safety function	Outside Containment	Continuous	Continuous	B11	9.2.2
NUCLEAR INSTRUMENT	Nuclear air compressor packages including after coolers, moisture separator, receivers & air dryers	Outside Containment	Continuous	Continuous	B1	9.3.1.3
	Distribution piping & valves	Outside & Inside Containment	Continuous	Continuous	A2, B1	"

TABLE 3.11.1-1
(Sheet 5 of 8)

SYSTEM	EQUIPMENT	LOCATION	Required Duration of Operation For DBA (1) LOCA	Required Duration of Operation For DBA (2) MSLB	Normal/Abnormal DBA (3) ENVIRONMENTAL CONDITION	FSAR SECTION
AIR CONDITIONING HEATING, COOLING & VENTILATION SYSTEMS						
(a) Control & Aux. Equip. Room of GSB	Air Conditioning System & associated equipments	Outside Containment	Continuous	Continuous	B8	9.4.1
(b) Fuel Handling Area System of GSB	Air Conditioning & atmosphere cleanup systems & associated equipments	Outside Containment	Continuous	Continuous	B3	9.4.2
(c) Safeguards Area of GSB	Air Conditioning system & associated equipments	Outside Containment	Continuous	Continuous	B4	9.4.5
(d) Containment Purge System	Fans & drivers	Inside Containment	Continuous	Continuous	A1, A2	9.4.6
	Air duct work & dampers	Inside crane wall	"	"	" "	"
	Instrumentation & Controls	Inside Containment	"	"	" "	"
(e) Diesel Generator Area of GSB	Ventilation System & associated equipments	Outside Containment	Continuous	Continuous	B5	9.4.8
(f) Switchgear, Battery & Cable-spreading Area of GSB	Air Conditioning System & associated equipments	Outside Containment	Continuous	Continuous	B12	9.4.9
(g) Electrical & Piping Tunnels of GSB	Air Conditioning System & associated equipments	Outside Containment	Continuous	Continuous	B10	9.4.12
	Atmosphere Cleanup System & associated equipments	"	"	"	"	"
(h) Component Cooling & Aux. Pump Room Area of GSB	Air Conditioning & atmosphere cleanup systems & associated equipments	Outside Containment	Continuous	Continuous	B11	9.4.13

TABLE 3.11.1-1
(Sheet 6 of 8)

SYSTEM	EQUIPMENT	LOCATION	Required Duration of Operation For DBA (1) LOCA	Required Duration of Operation For DBA (2) MSLB	Normal/Abnormal DBA (3) ENVIRONMENTAL CONDITION	FSAR SECTION
(i) Spray Pond Pumphouse	Heating & Ventilating System & associated equipments	Outside Containment	Continuous	Continuous	E	9.4.15
(j) HVAC Area of GSB	Make up air intake system	Outside Containment	Continuous	Continuous	B6	9.4.16
DIESEL GENERATOR FUEL OIL STORAGE & TRANSFER SYSTEM	Bunker Storage Tank	Outside Containment	Continuous	Continuous	C2	9.5.4
	Fuel Oil day tank	"	"	"	"	"
	Fuel Oil transfer pumps & drivers	"	"	"	"	"
	Piping & valves	"	"	"	"	"
	Instrumentation & Controls	"	"	"	"	"
DIESEL GENERATOR COOLING WATER SYSTEM	Jacket water cooler	Outside Containment	Continuous	Continuous	B5	9.5.5
	Jacket water standpipe	"	"	"	"	"
	Jacket water pumps & drivers	"	"	"	"	"
	Keepwarm pump & drivers	"	"	"	"	"
	Piping & valves	"	"	"	"	"
	Instrumentations & Controls	"	"	"	"	"
DIESEL GENERATOR STARTING AIR SYSTEM	Start air compressors & drivers	Outside Containment	Continuous	Continuous	B5	9.5.6
	Start air dryers	"	"	"	"	"
	Starting air tanks	"	"	"	"	"
	Piping & valves	"	"	"	"	"
	Instrumentation & Controls	"	"	"	"	"

TABLE 3.11.1-1
(Sheet 7 of 8)

SYSTEM	EQUIPMENT	LOCATION	Required Duration of Operation for DBA (1) LOCA	(2) MSLB	Normal/Abnormal DBA (3) ENVIRONMENTAL CONDITION	FSAR SECTION
DIESEL GENERATOR LUBRICATION SYSTEM	Lube Oil sump tanks	Outside Containment	Continuous	Continuous	B5	9.5.7
	Lube Oil pumps & drivers	"	"	"	"	"
	Lube Oil coolers & heaters	"	"	"	"	"
	Lube Oil keepwarm pumps & drivers	"	"	"	"	"
	Lube Oil filters	"	"	"	"	"
	Piping & valves	"	"	"	"	"
	Instrumentation & Controls	"	"	"	"	"
MAIN STEAM SYSTEM	Isolation Valves	Outside Containment	Continuous	Continuous	D	10.3
	Safety valves	"	Not Required	Continuous	"	"
	Modulating atmospheric dump valves	"	Not Required	Continuous	"	"
	Piping from steam generators to the isolation valves	"	Continuous	Continuous	"	"
MAIN FEEDWATER SYSTEM	Feedwater isolation valves	Outside Containment	Continuous	Continuous	D	10.4.7
AUXILIARY FEEDWATER SYSTEM	Demin. water storage tank	Outside Containment	Short term(6)	Continuous	C2	10.4.9
	Pumps & drivers	"	"	"	B4	"
	Piping & valves	"	"	"	"	"
	Instrumentation & Controls	"	"	"	"	"

TABLE 3.11.1-1
(Sheet 8 of 8)

SYSTEM	EQUIPMENT	LOCATION	Required Duration of Operation for DBA (1) LOCA	(2) MSLB	Normal/Abnormal DBA (3) ENVIRONMENTAL CONDITION	FSAR SECTION
REACTOR PROTECTION SYSTEM	RPS Cabinet	Outside Containment	Short term[6]	Short term[6]	B8	7.2
	Process sensing channels	Inside Containment Inside crane wall	"	"	A1	"
	Reactor trip switchgears	Outside Containment	"	"		"
	RPS & CFC remote control modules	"	"	"		"
	Aux. protective cabinets	Outside Containment	"	"		"
ENGINEERED SAFETY FEATURES ACTUATION SYSTEM	ESFAS auxiliary relay cabinets	Outside Containment	Short term[6]	Short term[6]	B8	7.3
	Process sensing channels	Inside crane wall & Outside Containment	"	"	A1, A2, B1	"
	Actuation logic	"	"	"		"
CONTAINMENT ATMOSPHERIC MONITOR SYSTEM	Hydrogen monitors	Inside Containment	Continuous	Available	A2	6.2.5

NOTES:
1. The design basis LOCA is based on the postulated 11.17 ft^2 double ended reactor coolant pump suction pipe break.
2. The design basis MSLB is based on the postulated 28" main steam line break.
3. See Table 3.11.1-2 for Normal/Abnormal & DBA Environmental Conditions
4. Spent fuel pool cooling requirement is independent of the plant conditions and the system would be in operation as long as there is spent fuel in the pool.
5. Piping is required to maintain its integrity during and after the accident.
6. Short term is defined as no longer than 24 hours after the accident initiation. See Class 1E list for specific equipment period of operability requirements for all equipment required to operate during a LOCA or MSLB.
7. Certain post accident monitoring instrumentation is required for long term operation.

TABLE 3.11.1-2
(Sheet 1 of 4)

SUMMARY OF SEISMIC CATEGORY I STRUCTURES/BUILDINGS
INTERIOR ENVIRONMENT CONDITIONS

PLANT AREA	ENVIRONMENTAL CONDITION CODE *(10)	SUMMER (NORMAL) *(11)			WINTER (NORMAL) *(11)		RADIATION DOSAGE		DBA (Extremes)	ABNORMAL (Extremes)	PRESSURE *(8)	VIBRATION
(HVAC System)	(FSAR Ref.)	Design DB F (Max.)	RH% (Max.) (Min.)	WB F (Max.) (Min.)	Design DB F (Min.)	RH%	Normal Rads/Yr.	Accident *(1) Rads	F Summer F Winter % RH	F Summer F Winter % RH		
Containment	A				*(6)			*(2)				
Containment Inside Crane Wall Re-circ Mode (Non-Redundant -CFC) Purge Mode (Redundant-CPD)	A1 (9.4.6)	Rec-135F Purge-95F	80% 20%	89.0F 66.0F	Rec-95F Prg-55F	Vary	Later	See Table 3.11.5-2	See Figure 3.11.1-1,2 3.11.1-3,4	135F 95F 20%-80%	Normal Balanced with Atmosphere LOCA-3.11.1-2 MSLB-3.11.1-4	Note *(13)
Containment Outside Crane Wall Re-circ *(4) Mode (Non-Redundant-CFC) Purge Mode (Redundant-CPD)	A2 (9.4.6)	Rec-135F Purge-95F	80% 20%	89.0F 66.0F	Rec-95F Prg-55F	Vary	428	*(2) See Table 3.11.5-2	See Figure 3.11.1-1,2 3.11.1-3,4	135F 95F 20%-80%	Balanced with Atmosphere	Note *(13)
General Service Building	B											
Primary Aux. Area (Non-Redundant-HPA)	B1 (9.4.7)	98F	60% 40%	85.5F 77.5F	55F	30%±5%	3.91	Later	Later *(9)	Later *(9)	Negative	Note *(13)
Waste Treatment Area (Non-Redundant-HRW)	B2 (9.4.3)	98F	60% 40%	85.5F 77.5F	55F	30%±5%	1.16	$1.23x10^{4}$	Later *(9)	Later *(9)	Negative	Note *(13)
Fuel Handling Area (Redundant-HSF) *(12)	B3 (9.4.2)	80F	60% 40%	69.0F 84.0F	55F *(6)	40%	< 10.00	44.5	80F 80F 60%	80F 80F 40%-60%	Negative	Note *(13)

TABLE 3.11.1-2
(Sheet 2 of 4)

PLANT AREA (HVAC SYSTEM) General Services Bldg. (cont)	ENVIRONMENTAL CONDITION CODE *(10) (FSAR Ref.)	SUMMER (NORMAL) *(11) Design DB F (Max.)	SUMMER (NORMAL) *(11) RH% (Max.) (Min.)	SUMMER (NORMAL) *(11) WB F (Max.) (Min.)	WINTER (NORMAL) *(11) Design DB F (Min.)	WINTER (NORMAL) *(11) RH%	RADIATION DOSAGE Normal Rads/Yr.	RADIATION DOSAGE Accident Rads (1)	DBA (Extremes) F Summer F Winter % RH	ABNORMAL (Extremes) F Summer F Winter % RH	PRESSURE *(8)	VIBRATION
Safeguards Area (Redundant-HSG)	B4 (9.4.5)	98F	60% 40%	85.5F 77.5F	55F	30%±5%	< 10.00	< 10.00	130F *(5) 55F 50%-45%	130F *(5) 55F 50%-45%	Negative	Note *(13)
Diesel Generator Area (Redundant-HDB) (Diesels on)	B5 (9.4.8)	85F	60% 40%	85.5F 77.5F	10F	15%±5%	< 10.00	< 10.00	130F *(5) 10F 30%-20%	130F *(5) 10F 30%-20%	Slightly Positive	Note *(13)
Diesel Generator Area (Redundant-HDG) (Diesels off)	B5 (9.4.8)	90F	60% 40%	73F 67F	55F	30%±5%	< 10.00	< 10.00	N/A	N/A	Slightly Positive	Note *(13)
Mechanical Equip. Area for Class I & II Equipment (Redundant-MER)	*(3) B6 (9.4.16) (9.4.17)	99F	60% 40%	85.5F 77.5F	55F	30%±5%	Later	Later	130F *(3) 10F *(5) 50%-45% *(9)	130F *(3) 10F *(5) 50%-45% *(9)	Slightly Positive	Note *(13)
Electrical Equip. Room Primary Aux. Area (Non-Redundant)	B7 (9.4.7)	98F	60% 40%	85.5F 77.5F	55F	30%±5%	< 10.00	< 10.00	130F *(14) 10F 50%-45%	130F *(14) 10F 50%-45%	Slightly Positive	N/A
Control & Aux. Equipment Room (Redundant-HCL)	B8 (9.4.1)	75F	50% 45%	62.5F 61.0F	75F	45%	< 10.00	< 10.00	75F 75F 40%-10%	75F 75F 40%-10%	Positive	N/A

TABLE 3.11.1-2
(Sheet 3 of 4)

PLANT AREA (HVAC SYSTEM)	ENVIRONMENTAL CONDITION Code *(10)	SUMMER (NORMAL) *(11) Design DB F (Max.)	RH% (Max.) (Min.)	WB F (Max.) (Min.)	WINTER (NORMAL) *(11) Design DB F (Min.)	RH%	RADIATION DOSAGE Normal Rads/Yr.	Accident *(1) Rads	DBA (Extremes) F Summer F Winter % RH	ABN. (Extremes) F Summer F Winter % RH	PRESSURE *(8)	VIBRATION
Electrical, Piping Tunnels & Containment Penetration Areas (Redundant-HPT)	B10 (9.4.12)	95F	60% 40%	85.5F 77.5F	55F	30%±5%	10.00	Later	130F *(5) 55F 50%±45%	130F *(5) 55F 50%±45%	Negative	Note *(13)
Component Cooling & Makeup Pump Area (Redundant-HCA)	B11 (9.4.13)	95F	60% 40%	85.5F 77.5F	55F	30%±5%	10.00	Later	130F *(5) 55F	130F *(5) 55F	Negative	Note *(13)
Switchgear, Battery & Cablespreading Area (Redundant-HSC)	B12 (9.4.9)	85F (104F) SWGR	50% 35%	70.5F 65.5F	*(6) 86F	35%	10.00	10.00	90F 90F 40%±10%	85F 85F 40%±10%	Slightly Positive	N/A
Tank Enclosure Area	C											
Demineralized & Borated Water Storage Tank (Redundant-MER)	C1 (9.4.19) (9.4.20)	98F	60% 40%	85.5F 77.5F	55F	30%±5%	10.00	N/A	130F *(5) 10F 50%±45%	130F *(5) 10F 50%±45%	Slightly Positive	N/A

TABLE 3.11.1-2
(Sheet 4 of 4)

PLANT AREA (HVAC SYSTEM)	ENVIRONMENTAL CONDITION CODE *(10) (FSAR Ref.)	SUMMER (NORMAL) *(11) Design DB F (Max.)	SUMMER (NORMAL) *(11) RH% (Max.) (Min.)	SUMMER (NORMAL) *(11) WB F (Max.) (Min.)	WINTER (NORMAL) *(11) Design DB F (Min.)	WINTER (NORMAL) *(11) RH%	RADIATION DOSAGE Normal Rads/Yr.	RADIATION DOSAGE Accident (*1) Rads	DBA (Extremes) F Summer F Winter % RH	ABNORMAL (Extremes) F Summer F Winter % RH	PRESSURE *(8)	VIBRATION
Steam & Feedwater Isolation Valve House	D											
Steam & Feedwater Isolation Valve Area (Non-Redundant-HIA)	D1 (9.4.14)	90F	70% 40%	85.5F 77.5F	55F	30%+-5%	$12.5x10^3$	$2x10^6$	HELB*(7) 420F *(9) 100%	Later	Slightly Positive	Note *(13)
Electrical Equipment Room in Steam & Feedwater Isolation Valve House	D2		Later									
Spray Pond Pump House (Redundant-VAB)	E (9.4.15)	98F	70% 40%	88.5F 77.5F	55F	30%-5%	N/A	N/A	121F 55F	121F 55F	Slightly Positive	Note *(13)

NOTES: 3.11.1-2

D. B. = Dry Bulb Temperature

W. B. = Wet Bulb Temperature

R. H. = Percentage Relative Humidity

Max. = Maximum

Min. = Minimum

N/A = Not applicable. The environmental parameter is not present or significant enough to warrant consideration.

* (1) Dose rates in Rads under accident conditions has been integrated over the duration of accident, DBA or LOCA which results in maximum dose rate.

* (2) Maximum hypothetical accident release in the Containment, gamma radiation. Integrated dose levels, applicable to equipment located inside containment building with respect to the time after the LOCA, are provided in Table 3.11.5-2.

* (3) Mechanical equipment room containing Class I and II equipment will have ventilation available under LOCA and LOOP.

* (4) Under normal operating conditions, while in recirculation mode, the containment interior temperature may fluctuate between 95°F and 135°F, depending on the number of air-conditioning fan coil units in operation; 130°F for one fan, 112°F for two fans, 100°F for three fans, and if all fans are running.

* (5) The indicated temperature of 130°F is the maximum daily temperature which may last for five (5) hours in any 24-hour period. The twenty-four hour average for such extreme environmental conditions will be 117°F. The duration of this environmental condition can be as long as twenty-nine (29) consecutive days, but may occur only once during the 40-year design life of the plant. It is possible that these temperature conditions may occur concurrent with other design basis events, including LOCA or LOOP.

* (6) During plant shutdown, the minimum temperature of 55°F DB will be maintained.

* (7) Values listed for temperature, humidity, pressure, and radiation are for a main steam line break outside containment in the area of the main steam valves. All other areas are governed by the values listed for LOOP.

* (8) Pressure requirements within individual areas depend on the contamination level within that area. Air flow pattern will be from a zone with lower contamination level towards a zone with higher contamination level within the same area. This is also true in the case when air flow from one area to an adjoining area.

* (9) No air circulation is provided during and following a LOCA or LOOP.

* (10) Provides cross reference between Table 3.11.1-1 and Table 3.11.1-2 for environmental conditions.

* (11) Exterior Environmental Design Conditions (Normal)

	Summer	Winter
Design Dry Bulb Temperature	110°F	-10°F
Design Wet Bulb Temperature	70°F	-10.2°F
Design Relative Humidity	12%	90%
Design Dew Point Temperature	46°F	-13°F

* (12) Based on normal spent fuel pool water temperature of 140°F.

* (13) All the rotating machines identified, such as pumps, compressors, fans, etc., are subject to non-seismic vibration during their operation. All safety-related pumps are designed such that the peak-to-peak vibration is within the following limits at rated speed and at a capacity of ± 10% from rated capacity:

Double Amplitude Vibration (Mils) At Rotational Frequencies

Speed	At the Sleeve Bearings
1200 and below	4.0 mils*
1201 to 1800	3.0 mils*

*Vibrations are measured on the rotating shaft.

* (14) During LOOP or DBA conditions, this area is fed by natural circulation from the safeguards area HV&AC system. Temperature alarms are provided which facilitate operator action to open dampers.

TABLE 3.11.5-2

TIME-DEPENDENT INTEGRATED BETA AND GAMMA DOSE IN THE CONTAINMENT ATMOSPHERE

TIME AFTER LOCA	BETA (Rad)	GAMMA (Rad)	TOTAL (Rad)
1 Hr	2.6(+6)	5.0(+5)	3.1(+6)
12 Hrs	1.2(+7)	2.2(+6)	1.4(+7)
1 Day	1 8(+7)	2.9(+6)	2.1(+7)
10 Days	6.4(+7)	8.5(+6)	7.3(+7)
1 Mo	8.4(+7)	1.1(+7)	9.5(+7)
6 Mos	9.8(+7)	1.1(+7)	1.1(+8)
1 Yr	1.1(+8)	1.1(+7)	1.2(+8)

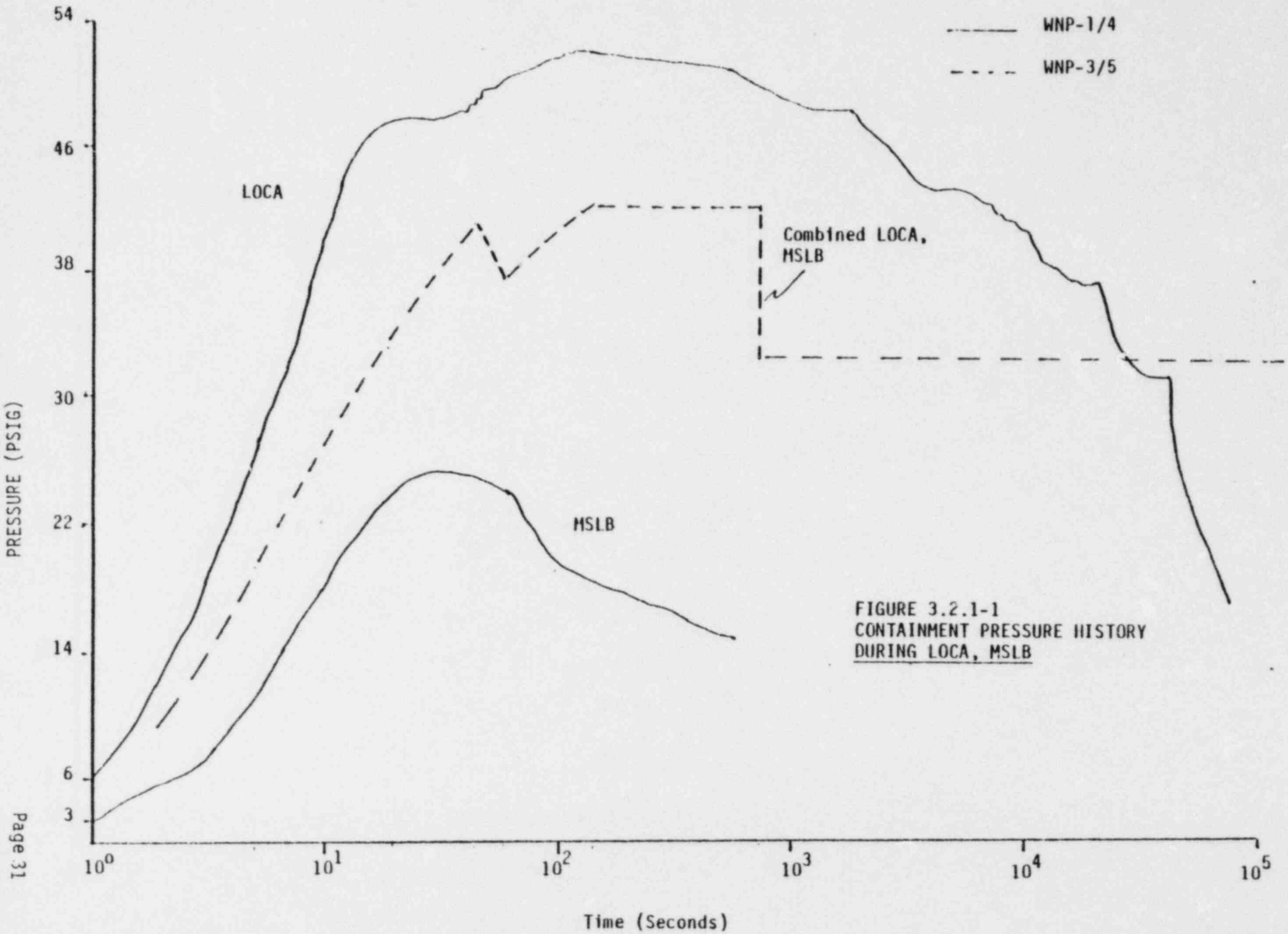


FIGURE 3.2.1-1
CONTAINMENT PRESSURE HISTORY
DURING LOCA, MSLB

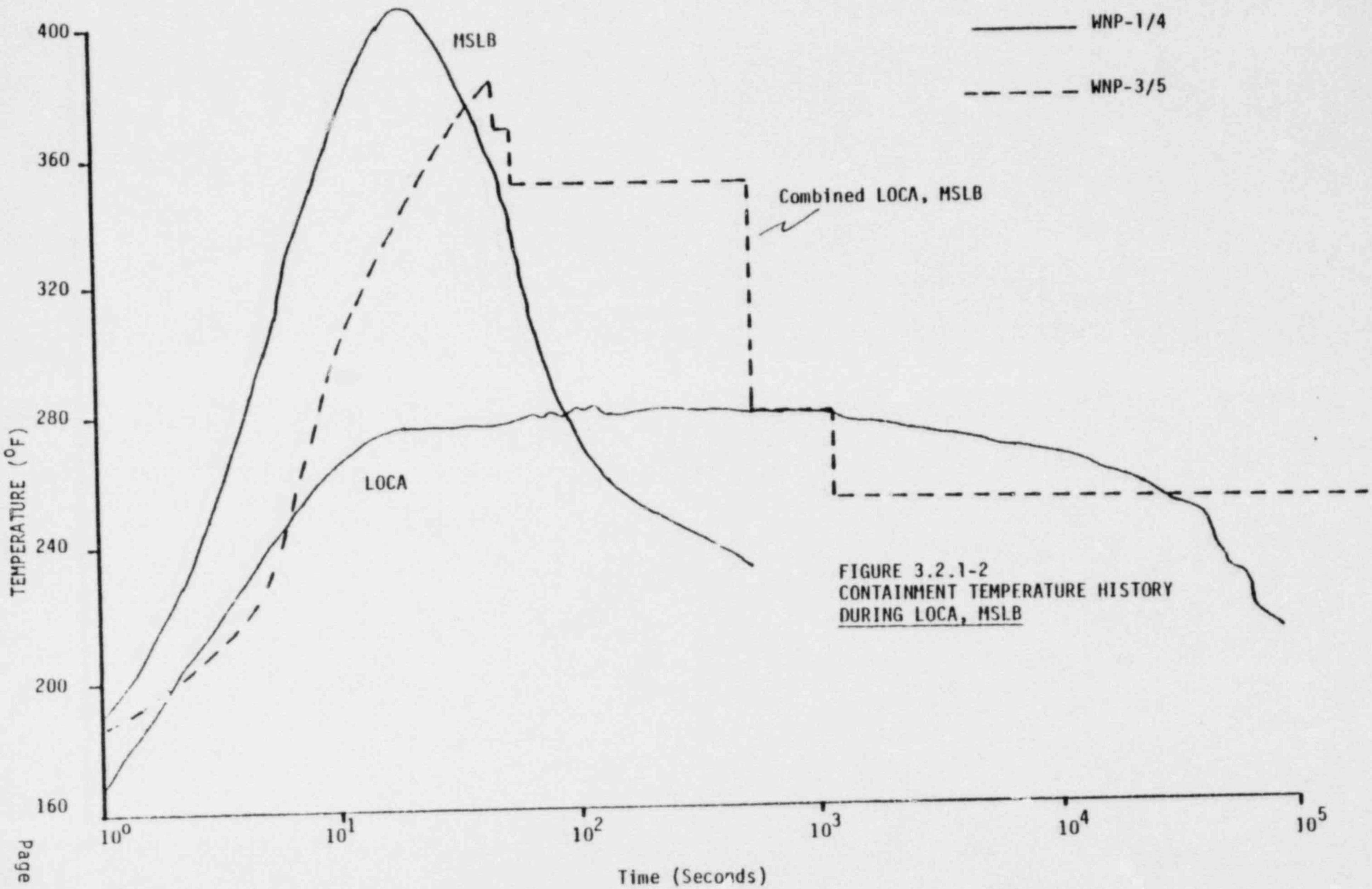


FIGURE 3.2.1-2
CONTAINMENT TEMPERATURE HISTORY
DURING LOCA, MSLB

3.2.1.2 WNP-3/5 Environmental Service Conditions

- Control Room

The control room areas will be heated and air conditioned--with protection provided against radiation to allow safe and continued occupancy. The HVAC system consists of two Class 1E, capacity air-handling trains which prevent system loss in the event of a single component failure.

During loss of off-site power, the redundant HVAC system is automatically placed on the emergency power source supplied from on-site diesel generators. Transfer from normal operation to emergency filtration is accomplished automatically upon a high radiation or high chlorine level signal. Therefore, no special environmental design requirements for loss of ventilation or air conditioning need be incorporated in the design of safety-related electrical and instrumentation equipment located in the control room. The ability of the Class 1E equipment to perform its safety function under the environmental service conditions is demonstrated in the equipment qualification program.

- Auxiliary Building

Equipment required for Class 1E operation is assigned to separate rooms according to redundant actuation trains. These rooms are heated and cooled by Class 1E HVAC units which may be placed on the emergency power source upon loss of off-site power.

The auxiliary building ventilation systems consist of the main ventilation system (which provides normal auxiliary building ventilation), the ECCS area filtered-exhaust system (which provides post-accident air filtration of the ECCS area), and the ECCS area fan coolers (which supply cooling to the safety-related pump areas required to function during the DBE).

The portion of the auxiliary building main HVAC system which provides ventilation to the ECCS area will be isolated automatically upon initiation of a postulated DBE. Simultaneously, the ECCS filtered-exhaust system and fan cooling system will be actuated to provide cooling and ventilation to the pump areas throughout their required operation.

Since the safety-related equipment and HVAC systems are separated by rooms according to redundant actuation trains, a single component failure in the HVAC will produce loss of cooling only within its actuation train. The remaining train is designed to provide the necessary safety function during the postulated DBE. The ability of the Class 1E equipment to perform its safety function under the environmental service conditions is demonstrated in the equipment qualification program.

• Fuel-Handling and Storage Areas

The fuel-handling area heating and ventilating system consists of a supply subsystem, an exhaust subsystem, and a return-air subsystem.

The normal operation of this ventilation system is to provide outside air to both the fuel-handling area and fuel-storage pools from the supply subsystem. The exhaust subsystem will draw air from the fuel-pool area and discharge to the atmosphere via the return-air subsystem discharge duct. Similarly, the return-air subsystem draws air from the entire fuel-handling building for return to the supply air subsystem or the atmosphere, depending on the temperature of the outside air. Each of the above subsystems is equipped with redundant fans in parallel, one fan on standby, to ensure continuous operation of the ventilation system.

In the event of a postulated fuel-handling accident, the supply and return-air subsystems each contain dampers, arranged in series, to isolate the fuel-handling building from the atmosphere. The fuel-handling building ventilation, then, is interconnected and maintained by the ECCS filtered-exhaust system. The ability of the Class 1E equipment to perform its safety function under the environmental service conditions is demonstrated in the equipment qualification program.

• Containment

In the reactor building, the combustable gas control system and the shield building ventilation system are the only safety-related ventilation systems.

Since neither system contributes to the heating or cooling of the containment environment, during accident conditions safety-related components must be designed and qualified to function under DBE conditions. Examples of such components are instrumentation transducers, motor and solenoid-operated valves. These items are qualified to withstand the extreme temperature, humidity and radiation effects of the postulated DBE.

Figures 3.2.1-1 and 3.2.1-2 illustrate the pressure and temperature profiles produced by a postulated DBE in the WNP-3/5 containment region. The equipment is qualified to withstand these profiles and a 40-year integrated radiation dose including the DBE event.

• Diesel Generator Area

Each diesel generator room is provided with three(3) Class 1E, 33-1/3-percent-capacity exhaust fans plus a separate heating and ventilating unit. The exhaust fans provide additional cooling to the room when the diesel is operating. The separate unit supplies filtered, conditioned air to maintain room conditions when the diesel is in standby.

- The exhaust fans and the separate HVAC unit are supplied power from a normal source. Upon a loss of off-site power, power to each HVAC unit is supplied by the respective diesel generator. Thus, a single component failure affects only one of the two standby generators, leaving the remaining generator to supply emergency power to mitigate the consequences of a DBE and provide safe shutdown of the plant.

All safety-related components associated with the diesel generators are qualified to withstand the operating, environmental, and seismic stresses exhibited in Table 3.11.1-1.

- Switchgear, Battery, and Cable=Spreading Area

This area is provided with redundant Class 1E, Seismic Category I HVAC systems. Upon loss of off-site power, the systems are automatically connected to separate emergency buses and powered by separate diesel generator units.

The redundant systems are required to operate during both normal and accident conditions to maintain an acceptable operational environment for the safety-related equipment in each electrical-equipment and battery room. No single component failure will result in the loss of heating, ventilating, and air conditioning to any room in this area. The operating environment that this HVAC equipment is designed to maintain is defined by Table 3.11.1-1. The ability of the Class 1E equipment to perform its safety function under the environmental service conditions is demonstrated in the equipment qualification program.

- CCWS Dry Cooling Towers Equipment Area

Redundant electrical equipment is located in two separate CCWS cooling tower rooms. Each room is served by a Class 1E 100%-capacity air-handling unit located within the room it serves. The unit must provide acceptable operating conditions for the Class 1E equipment within the room during normal and accident conditions.

In the event of loss of off-site power, the separate air-handling units will be switched to their respective diesel source of emergency power. No single component failure will result in the loss of ventilating capability to both equipment rooms. Table 3.11.1-1 reflects the environmental conditions provided by the air-handling units. The ability of the Class 1E equipment to perform its safety function under the environmental service conditions is demonstrated in the equipment qualification program.

3.2.2 Seismic Conditions

Plant seismic response spectra are developed in accordance with the criteria stated in the "Standard Review Plan", Section 3.7. Section 3.7 of the Supply System SAR responds to the Standard Review Plan by providing the criteria used for the development of the individual plant seismic response spectra.

Floor response spectra have been developed for each elevation of the various plant building areas using an analysis of the time history method. These floor response spectra are inserted in the technical specifications for vendor use in seismic qualification of safety-related equipment.

The Required Response Spectra (RRS), Test Response Spectra (TRS) and test results are contained in the individual test reports for each equipment type and in some cases for components.

Summaries of the WNP-1/4 qualification plans contained in Appendix A also reference the individual test reports. WNP-3/5 project summaries will be provided in conjunction with the WNP-3/5 FSAR.

The details with respect to the methods used for seismic qualification are discussed in Section 4.2.3.

3.3 Class 1E Electrical/I&C Equipment Acceptance Criteria

The Supply System Equipment Qualification Program evaluates the report submitted to provide qualification of electrical and I&C equipment based on the criteria established in Section 2.0. The acceptance criteria used to evaluate this report covers three major areas:

- Content of the Qualification Plan/Test Procedure
- Technical Adequacy of the Qualification Plan/Test Procedure
- Demonstration of the Equipment to Perform Its Safety Function per the Test Procedure.

3.3.1 Content

The Supply System acceptance criteria requires that the vendor qualification plan/test procedures address specific items. Among the more important of these items are the equipment description, aging simulation methods, service conditions simulated, and the test sequence. Appendix C provides the detail of the qualification acceptance criteria.

3.3.1.1 Equipment Description

It is important that the vendor describe the equipment and its model number so that the Supply System may ensure that the equipment to be installed in the plant is the same as that tested. The mounting of the equipment and connections must also be described. These are reviewed by the Supply System to ensure that the expected plant installation is simulated accurately by the qualification method.

3.3.1.2 Aging Simulation

The vendor aging procedures are reviewed for detail and justification of methods. Arrhenius and/or stress analysis methods are required to ensure conformance with IEEE 323 and NUREG-0588.

3.3.1.3 Service Conditions

The vendor qualification procedures are reviewed to ensure that the Supply System service conditions, as defined by the Technical Specifications, are addressed and enveloped.

3.3.1.4 Test Sequence

Section 6.3.2 of IEEE 323-1974 requires that the specific sequence of testing be conducted which accurately simulates and envelopes plant-specific service conditions. The vendor qualification program is reviewed to ensure compliance with this requirement.

3.3.2 Technical Adequacy

The items discussed under 3.3.1 above, are reviewed for technical detail and accuracy to conform to the Supply System Technical Specifications, IEEE 323-1974, or its daughter standards that are supported by regulatory guides and/or NRC documents. Appendix C illustrates the depth of technical detail required from the vendor in preparing an acceptable qualification program. The summary reports contained in Appendix A also present the parameters required to meet or envelope the Supply System plant requirements.

TABLE 3.11.1-1
(Sheet 1 of 5)

EQUIPMENT REQUIRED TO PERFORM SAFETY FUNCTIONS
DURING AND SUBSEQUENT TO A DESIGN BASIS ACCIDENT

SYSTEM	EQUIPMENT	LOCATION	LOCA	MSLB	ENVIRONMENTAL CONDITION (NOTE 1)	FSAR SECTION
Air Conditioning, Heating, Cooling, & Ventilation Systems						
(a) Control Room	Air Conditioning System, I&C, Associated Equipment	Outside Containment	Continuous	Continuous	I-C	9.4.1
(b) ECCS Area Fan Coolers	"	"	"	"	I-C,D,E	9.4.2.2
(c) Electrical Equipment & Battery Room	"	"	"	"	I-C,D	9.4.2.3
(d) Fuel Handling Bldg.	"	"	Not Required	Not Required	I-C,D,E	9.4.2.4
(e) Diesel Generator	"	"	Continuous	Continuous	I-C,D,H	9.4.2.5
Diesel Generator Fuel Oil Storage & Transfer System	Storage Tanks	"	"	"	I-G	9.5.4
	Fuel Oil Transfer Pumps	"	"	"	"	"
	Day Tank	"	"	"	"	"
	Interconnecting Piping & Valves	"	"	"	"	"
	Instrumentation & Controls	"	"	"	I-C,D	"
Diesel Generator Cooling Water System	Jacket Water Cooler	"	"	"	I-C,D,H	9.5.5
	Jacket Water Pump	"	"	"	"	"
	Intercooler	"	"	"	"	"
	Intercooler Water Pump	"	"	"	"	"
	Valves & Piping	"	"	"	"	"
	Instrumentation & Controls	"	"	"	I-C,D	"
	Lube Oil Cooler	"	"	"	I-C,D,H	"

TABLE 3.11.1-1
(Sheet 2 of 5)

EQUIPMENT REQUIRED TO PERFORM SAFETY FUNCTIONS
DURING AND SUBSEQUENT TO A DESIGN BASIS ACCIDENT

SYSTEM	EQUIPMENT	LOCATION	LOCA	MSLB	ENVIRONMENTAL CONDITION (NOTE 1)	FSAR SECTION
Diesel Generator Starting Air System	AC Motor Driven Compressor Starting Air Dryer	Outside Containment	Continuous	Continuous	I-C,D	9.5.6
	Air Receivers	"	"	"	"	"
	Solenoid Operated Starting Valve	"	"	"	"	"
	Piping & Valves	"	"	"	"	"
	Instrumentation & Controls	"	"	"	"	"
Reactor Coolant System	Reactor Vessel	Inside Containment	Not Required	Not Required	I-A,B	5.0-5.2
	Steam Generators I&C	"	Continuous	Continuous	"	"
	Pressurizer I&C	"	"	"	"	"
	Reactor Coolant Pump, Mon. Sys.	"	"	"	"	"
	RCS Piping I&C	"	"	"	"	"
Containment Heat Removal System						
Containment Spray System	Spray Pumps & Drivers	Outside Containment	"	"	I-C,D,E	6.2.2.2.2.1
	Shutdown Cooling Heat Exchangers I&C	"	"	"	"	9.2.10.2.2
	Refueling Water Tank					9.3.4.8.3f
	Valves & Piping I&C	Inside & Outside Containment				6.2.2.2.2.5
	Insulation & Heat Tracing	"				6.2.2.2.2.7
	Instrumentation & Controls	"				6.2.2.5.2

TABLE 3.11.1-1
(Sheet 3 of 5)

EQUIPMENT REQUIRED TO PERFORM SAFETY FUNCTIONS
DURING AND SUBSEQUENT TO A DESIGN BASIS ACCIDENT

SYSTEM	EQUIPMENT	LOCATION	LOCA	MSLB	ENVIRONMENTAL CONDITION (NOTE 1)	FSAR SECTION
Radiation Monitoring System	Instrumentation & Controls	Inside & Outside Containment	Continuous	Continuous	I-A,B,C,D,E,F,G,H	11.1.4 12.1.4
Main Steam System	Isolation Valves	Outside Containment	"	"	I-A,B	10.3
	Safety Valves	"	Not Required	"	"	"
	Modulating Atmospheric	"	Continuous	"	I-A,C	"
	I&C On Piping From Steam Generators to the Isolation Valves	"	"	"	I-A,E	"
Main Feedwater System	Feedwater Isolation Valves, I&C	"	"	"	"	10.4.7
Auxiliary Feedwater System	Pumps & Drivers	"	Short-Term	"	I-C,D,E	10.4.7.2
	Condensate Storage Tank	"	"	"	I-C,D	"
	I&C On Piping & Valves	Inside & Outside Containment	"	"	I-A,B,C,D,E	"
	Instrumentation & Controls	"	"	"	I-C,D	"
Onsite Power Systems						
(a) A-C Power System	4.16kV Distribution	Outside Containment	Continuous	"	"	8.3.1.1.3
	480V Distribution	"	"	"	"	8.3.1.1.4
	120V Vital	"	"	"	"	8.3.1.1.6
	Cables	"	"	"	"	"
	Electrical Panel	"	"	"	"	"

TABLE 3.11.1-1
(Sheet 4 of 5)

EQUIPMENT REQUIRED TO PERFORM SAFETY FUNCTIONS
DURING AND SUBSEQUENT TO A DESIGN BASIS ACCIDENT

SYSTEM	EQUIPMENT	LOCATION	LOCA	MSLB	ENVIRONMENTAL CONDITION (NOTE 1)	FSAR SECTION
(b) D-C Power System	125V DC	Outside Containment	Continuous	Continuous	I-C,D	8.3.2.1.1
	Electrical Cables	"	"	"	"	"
	Electrical Penetrations	"	"	"	I-A,B,C,D,E	"
Emergency Core Cooling System						
(a) Core Flooding System	I&C On Safety Operation Tanks	Inside Containment	"	"	I-A,B	6.3
	I&C on Piping & Valves	Inside & Outside Containment	"	"	I-A,B,C,D,E	"
(b) Safety Injection System	I&C Refueling On Water Tank	Outside Containment	"	"	I-C	
	Safety Injection Pumps & Drivers	"	"	"	I-C,D,E,	"
	I&C On Valves & Piping	Inside & Outside Containment	"	"	I-A,B,C,D,E	"
Containment Isolation System	I&C on Valves & Piping	"	"	"	I-A,B,C,D,E	6.2.4
Combustible Gas Control Systems						6.2.5
Sampling & Monitoring System	Filters	Outside Containment	"	"	I-C,D,E	6.2.5.2.3
	H_2 Analyzer	"	"	"	"	"
	Sample Cylinder	"	"	"	"	"
	Sample Pumps	"	"	"	"	"
	Piping & Valves	"	"	"	"	"
Containment H_2 Purge	Fans & Drivers	"	"	Not Required	"	6.2.5.2.2
H_2 Recombination System	H_2 Recombination Units	Inside Containment	"	Continuous	I-A,B	6.2.[illegible].1

TABLE 3.11.1-1
(Sheet 5 of 6)

EQUIPMENT REQUIRED TO PERFORM SAFETY FUNCTIONS
DURING AND SUBSEQUENT TO A DESIGN BASIS ACCIDENT

SYSTEM	EQUIPMENT	LOCATION	LOCA	MSLB	ENVIRONMENTAL CONDITION (NOTE 1)	FSAR SECTION
Spent Fuel Pool Cooling & Cleanup System	Pumps & Drivers	Outside Containment	Isolated During LOCA	Not Required	(Later)	9.1.3
	Heat Exchangers	"	"	"	"	"
	Valves & Piping	"	"	"	"	"
	Instrumentation & Control	"	"	"	"	"
Component Cooling Water System	Dry Cooling Tower	"	Continuous	Continuous	I-F	9.2.2
	Shutdown Cooling HX	"	"	"	I-C,D,E	"
	Pumps & Drivers	"	"	"	"	"
	Essential Valves & Piping	"	"	"	"	"
	Surge Tank	"	"	"	"	"
	Instrumentation & Control	"	"	"	I-C,D	"
Reactor Protection System	RPS Cabinet	Outside Containment	Short-Term	Short-Term	I-C	7.2
	Core Protection Calculator	"	"	"	"	"
	Process Instrument Channels	Inside Containment	"	"	I-A,B	"
	Reactor Trip Switchgear	Outside Containment	"	"	I-C,D	"
	RPS Remote Control Modules	"	"	"	I-C	"
	Auxiliary Protection Cabinets	"	"	"	I-C,D	"
Engineering Safety Features Actuation System	ESFAS Auxiliary Relay Cabinets	Outside Containment	Continuous	Continuous	I-C	7.3
	Instrumentation & Control	Inside & Outside Containment (Outside Shield Wall)	"	"	I-A,B,C,D	"
	Actuation Logic	Outside Containment	"	"	I-C,D	"

NOTE 1: Table of WNP-3/5 Environment Conditions

DESIGNATION	ENVIRONMENT
I-A - Containment Environment:	Loss-of-Coolant or Steam Line Break
I-B - Containment Environment:	Normal Environment
I-C - Auxiliary Building Environment:	Normal Environment
I-D - Auxiliary Building Environment:	Loss-of-Coolant Accident
I-E - Auxiliary Building Environment:	Steam Line Break (Outside Containment)
I-F - CCWS Dry Cooling Tower Electrical Equipment Rooms:	All Plant Conditions
I-G - DGFOST Rooms:	All Plant Conditions
I-H - Diesel Generator Areas:	Diesels Running

The specified conditions for each category are listed below and equipment will be rated for operation for these and more severe conditions.

I-A

PARAMETER	NORMAL	ACCIDENT	
Temperature	40-122^{o}F	383^{o}F Instantaneous Peak 370^{o}F for 20 seconds 350^{o}F for 10 minutes 250^{o}F for 90 hours 200^{o}F for 7 days 175^{o}F for 3 weeks 150^{o}F for 1 year	
Pressure/Steam	0-5 psig/	40-44 psig for 10 minutes	
Partial Pressure or Relative Humidity	10-90% RH	30-35 psig for 90 hours 8-10 psig for 7 days 5 psig/100% RH to 1 year	
Radiation Dose	1 x 10^7 Rads	3.3 x 10^7 Rads*	
		30-100 min	After 100 min
Chemical (Spray Environment, Intensity is 0.7 Gal/Min/Ft^2 directed vertically downward)**	N/A H_3BO_3 pH(NAOH Buffer)	4000-6800 ppm 10.0-11.0	4000-6800 ppm 9.0-10-0

I-B

Temperature	40^{o}F-122^{o}F
Pressure	0 psig - 5 psig
Humidity	20% - 90% RH
Radiation	1 x 10^7 Rads
Chemical	Not Applicable

*Dose consists of 40 year integrated dose plus 1 year LOCA dose.

**The manufacturer shall determine the most severe conditions within these ranges, and conduct any qualification to these minimum conditions.

I-C

PARAMETER	NORMAL	ACCIDENT
Temperature/Humidity	40^oF-104^oF at 20% RH to (**) -	
Pressure	Atmospheric	
Radiation	3.5×10^4 (Max.)	
Chemical	Not Applicable	

I-D

Temperature		120^oF for 4 hours Decrease 120^oF to 104^oF
Humidity		20% - 90% RH
Pressure		Atmospheric
Radiation		3.5×10^4 (Max.)(*)
Chemical		Not Applicable

I-E

Temperature/Humidity		110^oF/50% RH Long Term 330^oF/100% RH Short Term
Pressure		Atmospheric
Radiation		3.5×10^4 Rads(*) (Max.)
Chemical		Not Applicable

I-F

Temperature	40^oF-104^oF	40^oF-104^oF
Pressure	Atmospheric	Atmospheric
Humidity	0-100%	0-100%
Radiation	Negligible	3.4×10^2 Rads (*)
Chemical	Not Applicable	Not Applicable

I-G

Temperature	0^oF-120^oF	0^oF-120^oF
Pressure	Atmospheric	Atmospheric
Humidity	0-100%	0-100%
Radiation	Negligible	4.7×10^2 Rads(*)
Chemical	Not Applicable	

*Dose consists of 40 year integrated dose plus 1 year LOCA dose.

**The manufacturer shall determine the most severe conditions within these ranges, and conduct any qualification to these minimum conditions.

4.0 QUALIFICATION PROGRAM METHODOLOGY

The methods below are used by the Supply System to qualify Class 1E instrumentation and electrical equipment to the requirements of IEEE 323-1974, or its daughter standards that are supported by regulatory guides and/or NRC documentation. These methods are used to qualify equipment to meet postulated service conditions discussed in Section 3.2 of this document.

The first portion of this section discusses methods used in qualification. These methods consist of:

- Qualification by type testing
- Qualification through operating experience, supported by partial type testing
- Ongoing qualification, after establishing an equipment qualified life
- Combined qualification by analysis, supported by partial type testing
- Qualification by utilizing military qualification methods.

The second portion of this section addresses the types of service conditions to which the above methods are used to qualify equipment. Where the conditions below cannot be simulated within the limits of the state-of-the-art, engineering judgement will be used. These service conditions are:

- Humidity
- Temperature
- Radiation
- Operational
- Vibration
- Chemical
- Seismic
- LOCA and HELB

4.1 General Qualification Methods

IEEE 323-1974 provides for the following general methods to qualify Class 1E equipment.

- Qualification by type testing
- Qualification through operating experience, supported by partial type testing
- Ongoing qualification, after establishing an equipment qualified life
- Combined qualification by analysis, supported by partial type testing
- Qualification by utilizing military qualification methods.

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Analysis alone is not listed in this document, although it is part of IEEE 323-1974. In most qualification programs, the combined qualification approach by test and analysis has been used.

4.1.1 Qualification by Type Testing

The type test program is used to demonstrate that the Class 1E equipment can perform its safety function within the accuracy and response time requirements applicable for normal, abnormal and DBE service conditions. The type test will consist of a demonstration of safety functions under a planned sequence of simulated service conditions both before and after age conditioning. Adequacy of the type test program is determined from the Supply System "Acceptance Criteria for Class 1E Equipment Qualification".

This method is the preferred means used by the Supply System to qualify Class 1E equipment.

4.1.2 Operating Experience

IEEE 323-1974 defines operating experience as an "accumulation of verifiable service data for conditions equivalent to those for the equipment to be verified". In this context, experience can serve as a basis for determining the qualified life of equipment (e.g., systems, subsystems, components).

In order to determine that Class 1E equipment is qualified by operating experience, the following acceptance criteria must be met:

- Comparison and identification of differences between the equipment in service (operating) and the proposed equipment, such as differences in equipment design, service conditions, and environmental conditions. An analysis must be provided to justify any extrapolation involved due to differences found.

- Identification and history of failures of the in-service equipment must be provided.

- The mandatory maintenance requirements should be stated to provide adequate confidence that the qualified life of the proposed equipment will equal or exceed the in-service equipment.

- The seismic conditions experienced by the in-service equipment must be documented to demonstrate that these conditions envelop the site seismic requirements. Also, the aging failure mechanisms must be identified for the in-service equipment.

- The equipment selected for operating experience must have performed under conditions equal to or surpassing the severity of the site-specific operating conditions. If not, supplemental type testing is required of the in-service equipment (e.g., radiation and DBE exposure).

- Margin will be suitably considered when determining the levels for which qualification is being sought.

When auditable data is provided which demonstrates the above criteria are met, the equipment will be considered qualified by reason of operating experience. This qualification will be valid for a length of time no longer than the natural aging period.

If the above criteria are met, operational experience can be the most effective method of qualifying equipment. Operating experience also is useful in supplementing the methods described in Sections 4.1.1, 4.1.3, and 4.1.4.

4.1.3 Ongoing Qualification

This method is discussed in IEEE 323-1974. The method allows Class 1E equipment to be placed in service with an established qualified life of less than the required design life.

The qualified life is estimated by means of a mathematical model, then verified using the test and/or analysis methods described by Sections 6.3, 6.4 and 6.5 of IEEE 323-1974. Identical equipment can be installed for service limited to the verified life.

The qualified life may be extended by removing the in-service equipment prior to the end of its qualified life, and reperforming the original aging and type testing. This will extend this type of equipment's qualified life by an amount equal to the original verified life plus the in-service natural aging.

4.1.4 Combined Qualification

Class 1E equipment may be qualified by a combination of test, analysis, or previous operating experience. There may be various rationales for qualifying equipment by the combined approach. Sample reasons are:

1. The equipment is too complex for analysis or too large for testing alone.

2. Tests of selected samples of a particular design group may vary in size but have similar materials and design principals. Qualification of the entire design group may be achieved through proper analysis techniques using data from the selected test samples.

3. Verification of an analytical model by partial type testing.

4. Use of operating experience to develop a basis for simulated aging techniques.

5. Analyses correlating the interfaces and degrading effects between two subassemblies that have been qualified separately to demonstrate the design requirements when the subassemblies are combined.

6. Military qualification methods may be used to establish a basis for the Class 1E equipment's qualified life.

The combined qualification demonstrates the equipment can perform its safety function under normal, abnormal, and DBE service conditions throughout its qualified life. Combined qualification provides auditable data by which the various primary qualification methods may be brought together to satisfy the equipment qualification program.

4.2 Design Conditions

This section is provided to show how the various qualification methods in Section 4.1 are used to qualify Class 1E equipment to the effects of:

- Aging
- Radiation
- Seismic
- Design Basis Events

These service conditions are the most complex and difficult to provide qualification methods for and were, therefore, selected for description.

4.2.1 Aging

Simulation of aging is not well bounded. Engineering judgement plays an important role in the present state-of-the-art. Each of the qualification methods mentioned in Section 4.1 may be employed to establish an interval for Class 1E equipment qualified life. Methods for aging of equipment are discussed in the following sections.

4.2.1.1 Aging Qualification By Testing

Age conditioning is a process of controlled physical deterioration that will provide an evaluation of the equipment's vulnerability to aging mechanisms that could affect the ability of that equipment to perform its safety function. Age conditioning stresses are intended to produce equipment degradation levels that exceed or equal expected in-service degradation. Age conditioning addresses the effects of temperature, vibration and operational cycling as follows:

1. Temperature effects on aging are addressed using the form of the Arrhenius model:

$$t_o = t_A \exp\left[\frac{E_A}{k_B}\left(\frac{1}{T_o} - \frac{1}{T_A}\right)\right]$$

Where:

t_o = Equipment lifetime in service
t_A = Equipment lifetime at the aging temperature
T_o = Service temperature, °Kelvin
T_A = Aging temperature, °Kelvin
E_A = Activation energy, electron-volts
k_B = Boltzmann's Constant, 8.617 X 10^{-5}eV/°K

This model is extremely useful in estimating the useful life of insulating materials and other "soft-goods" materials for which the activation energies are known.

The temperature effects on electronic components are often handled using the methods described in Section 2.0 of MIL-HNDBK-217C. WPPSS will use both the Arrhenius and the MIL-HNDBK methods as a basis to derive a qualified life for materials and components that make up the Class 1E equipment.

2. In-service vibration which is determined to have an aging mechanism on Class 1E equipment will be addressed in the test sequence prior to seismic testing. The methods will employ specific standards such as IEEE 382, for which vibration aging methods are described.

3. Operational cycling effects are simulated by subjecting the test specimen to the number of cycles anticipated in plant service.

The determination of qualified life is based on conservative engineering analysis which takes into account, as applicable:

4. Results of age conditioning

5. Equipment service conditions

6. Existing type test results

7. Equipment design data

8. The equipment maintenance and replacement schedules.

4.2.1.2 Age Qualification by Analysis Using NRC, Military, EPRI Literature

Where there are no aging mechanisms that could affect the ability of the Class 1E equipment to perform its safety function, the simulated aging test is omitted. This is justified through use of Arrhenius, MIL-HNDBK-217C, EPRI or NRC documentation.

4.2.2 Radiation

An important factor in determining the qualification of Class 1E equipment is the potential radiation exposure which the equipment could receive. The radiation dosage described in Section 3.0 is used to qualify the equipment. Where the radiation dosage is above the threshold damage level of the equipment, qualification is performed by actually exposing the equipment to a gamma source to achieve the combined Beta/gamma integrated dose.

Where it can be demonstrated that the effects of Beta and/or gamma radiation does not degrade the capability of the equipment or material to perform its safety function, such as metallic elements, or the threshold damage level is not exceeded, the radiation exposure is omitted from the testing.

4.2.3 Seismic Conditions

The basic principles of seismic qualification are described in IEEE 344-1975, as supplemented by Regulatory Guide 1.100. These principles are applied by the vendors to qualify Class 1E equipment to meet postulated seismic forces. Where required, the equipment is aged and irradiated to IEEE 323-1974 requirements prior to the seismic qualification. Two methods are used for seismic qualification of WNP-1/4 and WNP-3/5 projects:

- Combined Analysis and Testing
- Testing

4.2.3.1 Seismic Qualification Using Combined Analysis And Testing

This test method involves analysis using a verified (by partial testing) computer model to meet the intent in Section 7.0 of IEEE 344-1975. It is used in cases where:

- The equipment mass or size exceeds the capability of the testing facilities. An example of this would be a section of a motor control center line-up. The section is seismically tested with the results analyzed and extended to the entire MCC line-up.

- Components of a Class 1E system are tested individually with the results analyzed and combined for system use.

The main steam isolation valve is an example of this case. The actuator is seismically tested under simulated valve loading conditions; a stress analysis is performed on the valve body. The results of both the test and stress analysis are then analyzed to show operation capability under the postulated seismic stresses.

4.2.3.2 Testing

The Supply System employs proof testing in the majority of the seismic qualification programs. The guidance provided in Section 6.0 of IEEE 344-1975 is used by equipment suppliers in qualifying Class 1E equipment.

The test sequence includes vibration aging (if applicable, see Section 4.2.1.1.2) resonance search (if applicable), OBE and SSE tests.

1. Vibration Aging - If required due to equipment location, vibration aging is performed prior to OBE and SSE testing.

2. Exploratory Test - Exploratory tests are conducted if 1) vibrating aging is required, 2) the complete required response spectrum may not be enveloped by the test response spectrum, 3) calculated resonant frequencies are in the frequency range of seismic concern, and 4) the other applicable support interfaces cannot be simulated on the test table. When conducted, the exploratory tests will be at an acceleration level that is intended to excite all modes between 1 and 33 Hz.

3. OBE Test - The Operating Base Earthquake (OBE) or a more conservative test is performed with the test specimens. These tests are performed at levels expected to simulate the earthquake which could occur during the operating life of the plant. Five OBE tests are conducted (minimum) in each of the equipment's three principal axes. Each test input is applied biaxially for a 30-second duration and is designed to envelop the OBE required response spectrum. The equipment is operated during and after the OBE testing to demonstrate satisfactory performance of the required safety function.

4. SSE Test - The Safe Shutdown Earthquake (SSE) tests are conducted on all test specimens. This test is conducted at maximum levels for which the building structure, safety systems and components are designed to remain functional. A minimum of one SSE test is performed in each of the equipment's three principal axes. Each test is applied biaxially to envelop the SSE required response spectrum for a 30-second duration.

4.2.4 Operational Simulation During A DBE

Operational simulation consists of applying one or more of the qualification methods described in Section 4.1 to the Class 1E equipment to ensure that it will perform the safety function under the plant-specific environmental and seismic conditions.

In most cases, the only acceptable form of operational simulation is by actual test. There are cases, however, where analysis with justification is used. For example, a Class 1E valve-body may be analyzed to show that it will perform its safety function during any postulated event.

Some equipment is designed to operate before, during, and after a postulated event. Other equipment, such as an isolation valve, is intended to function immediately following the event. Therefore, the Class 1E equipment is tested in an operational condition determined by its intended safety function. If a malfunction is experienced during the testing, the effects of the malfunction are determined and documented in the final test report.

4.3 Qualification Methods Application

The methods discussed in Section 4.1 are used in Class 1E equipment qualification. The purpose of this section is to describe how these methods are applied to specific Class 1E equipment. For ease of review and to meet Appendix E or NUREG-0588 requirements, summary reports of these equipment qualification programs have been prepared.

The equipment types selected are:

- Switchgear
- Valve Operators
- Motors
- Cable
- Connectors
- Electrical Penetration Assemblies
- Terminal Blocks

Appendix A of this document contains the summary reports for the above identified equipment. Additional summary reports, similar to those provided in Appendix A which will encompass the remainder of the Class 1E equipment will be contained in the FSAR's for WNP-1/4 and WNP-3/5 projects.

5.0 EQUIPMENT QUALIFICATION PROGRAM IMPLEMENTATION AND DOCUMENTATION

This section describes the Supply System Class 1E equipment qualification program implementation and the types of documentation required.

The prime objective of the Supply System qualification program is to provide documented evidence that the Class 1E equipment is qualified. The documentation is of such a form that proof of qualification is maintained and that the plant operations group may use this documentation in performing equipment maintenance as necessary.

5.1 The Supply System Equipment Qualification Program

The Supply System Class 1E equipment qualification program consists of following quality assurance procedures already in place. In addition, engineers at the Supply System, the Architect Engineer, and the equipment suppliers participate in programs that specifically address the requirements of the documents mentioned in Section 2.0.

The Supply System qualification program includes the specific activities which occur during the construction and operation of the nuclear power plants. These consist of design-related activities, specification-related activities, bid evaluation, procurement, and operations. During the operational phase, extension of qualified life and design modification become important activities related to equipment qualification.

5.1.1 Design Phase

The Architect Engineer has the primary design responsibility to develop specific information related to the Class 1E equipment to be used in the plant. The Supply System follows quality assurance procedures in the review of that information. The design information developed by the Architect Engineer related to equipment qualification consists of the following:

- Safety function and description
- Electrical and mechanical requirements
- Seismic loads
- Performance requirements under operational phases such as plant startup, normal plant operation, plant shutdown, Design Basis Event (DBE) and post-DBE.
- Environmental conditions anticipated during storage, construction, and operation (including DBE and post-DBE).
- Interface requirements, including definition of the functional and physical interfaces involving structures and systems.

Equipment specifications are reviewed for compliance with the plant design requirements by both the Architect Engineer and the Supply System during the design phase.

5.1.2 Specification Phase

The bid specifications are prepared incorporating information developed during the design phase. In the bid specifications, the following equipment qualification information is included:

- Required conformance to IEEE 323-1974.
- Required conformance with the qualification standards for the specific equipment being procurred.
- Desired qualified life.

- Designation of the safety function.
- Environmental conditions to which equipment will be qualified.
- Range, type, and duration of design basis event environment.
- Operating Basis Earthquake and Safe Shutdown Earthquake conditions imposed at the equipment location.
- Equipment performance requirements.
- The requirement for identification of subcontractors, including testing laboratories.

The most important items in equipment qualification are the requirements contained in the bid specifications. Without proper requirements, great difficulty can be expected in obtaining information related to equipment qualification.

The range, type, and duration of environmental conditions are specifically defined in the bid specifications so that the vendor can supply equipment that satisfies the safety function requirements. Curves and/or tables depicting in-containment and ex-containment temperature, pressure, and radiation profiles are provided.

The bid specification provides floor response spectra on the Operational Basis Earthquakes and Safe Shutdown Earthquakes for specific equipment-mounting locations. The equipment supplier then is required to develop these criteria in the seismic qualification process.

The documentation provided by the vendor for qualification testing includes the following:

- Qualification test plan
- Test procedure
- Test report with applicable analyses, test data, results, and conclusions.

Supply System engineers and the Architect Engineer have a review cycle reserved for each of the above items prior to final approval of each vendor qualification program.

5.1.3 Bid Evaluation Phase

After receipt and review of the Supply System bid specifications, the bidder is required to submit an outline of the equipment qualification program for evaluation. The extent to which the program conforms to the requirements of IEEE 323-1974 and to the qualification requirements in the specification, partially determines the selection of the successful bidder.

5.1.4 Procurement Phase

The procurement phase of the design activities at the Supply System consist of awarding the contract to the selected vendor, reviewing each part of the vendor's equipment qualification program, and ensuring that the equipment is qualified in accordance with that program. The detailed activities consist of:

- Reviewing the complete vendor qualification program for that piece of equipment.
- Monitoring the progress of the vendor qualification program.
- Reviewing the results of the vendor qualification program.
- Establishing a program to maintain and verify qualification for in-service equipment. This includes an equipment storage period, as necessary.

Each qualification program is reviewed using the Supply System acceptance criteria described in Section 3.3 of this document. Based on the review of the qualification program results, additional requirements may be established for maintenance and replacement to ensure an equipment 40-year qualified life.

5.1.5 Operations Phase

Requirements exist to maintain equipment qualification during storage, installation, startup, and operation, based on vendor recommendations. These recommendations, along with the qualification program results, are incorporated into standard Supply System procedures to ensure continued qualification status. Spare parts are procured according to recommendations established by the vendor.

In addition, continued evaluation of the equipment performance is made to extend the equipment's qualified life whenever possible.

5.1.5.1 Maintenance of Qualified Life

Initial equipment qualification does not necessarily ensure that each component of a system will continue to be qualified during its service life. Qualification status throughout equipment service life requires component maintenance and/or replacement. The Supply System procedures identify the minimum maintenance schedules to retain equipment qualifications throughout service life.

5.1.5.2 Extension of Qualified Life

The qualified life of certain equipment may be less than the plant design life. In such cases, a replacement program, additional qualification testing, additional analyses supported by testing, or operating history may be used to demonstrate that the equipment can perform its safety function beyond its established qualified life.

Qualification retesting may be performed using sample aged components or by advanced qualification techniques, as they become identified, to extend equipment qualified life.

Analyses may be presented to extend equipment qualified life when the Supply System can identify physically measurable parameters that accurately reflect the state of component deterioration.

Other methods will be used to extend equipment qualified life if these methods adequately demonstrate that the equipment will perform its safety function for the additional period of time.

5.1.5.3 Design Modifications

The wide variety of equipment used in Supply System nuclear projects require that guidelines be established in performance of any design modifications. Each equipment type and situation must be evaluated to determine the impact that the design modification would have on the equipment qualification. This evaluation will determine the extent of any additional qualification required.

Where changes affect neither the aging mechanism nor the possible failure modes, requalification is not required. Where there is such an effect, requalification is performed to demonstrate that the modified equipment can perform its safety function for the specific period of time.

The techniques described in Section 4.0 (i.e., analysis, type testing, or combined analysis and testing) will also be used in the requalification of design modifications.

5.2 Documentation

The Class 1E equipment qualification program contains documentation which demonstrates the equipment capability to perform its intended safety function under the service conditions in which it must operate. The fundamental criteria for this documentation is contained in the Supply System acceptance criteria, discussed in Section 3.3 of this document. This section indicates that the document requirements of IEEE 323-1974 must be satisfied in each vendor qualification program prior to Supply System acceptance.

The information developed by the Supply System Class 1E Qualification Program must be accessible and available to personnel for audits and available to operational personnel during the plant operation phase. To accomplish this, the Supply System maintains a system of records in accordance with 10CFR50, Appendix B.

5.2.1 Vendor Documentation Submittals

The vendor documentation submittals consist of qualification test plans, test procedures, test reports and a final documentation package. Supply System review of this documentation results in approval or negotiation to ensure conformance to the qualification acceptance criteria.

5.2.2 Documentation Submitted to the U.S. NRC

The information that is submitted to the NRC will meet the objectives of the documents identified in Section 2.0 of this report. These requirements establish the need for these categories of information:

- Equipment qualification summary reports and information satisfying Appendix E of NUREG-0588.
- Information required by present Regulatory Guides and Standard Review Plans.
- A list of Class 1E I&C/electrical equipment.

5.2.2.1 Summary Report Information

Example summary reports are provided in Appendix A of this document in response to Appendix E requirements of NUREG-0588.

5.2.2.2 Required Licensing Information

The standard review plans require that specific information be available for inspection by the NRC Staff. This information, as described in Sections 2.13 and 2.14 of this document, will be provided.

5.2.2.3 Class 1E I&C/Electrical Equipment List

The Supply System is in the process of developing the Class 1E equipment list. This list contains detailed information regarding the equipment and its qualification status. Appendix B, Part I of this document contains the definition of the codes and entries used in the equipment list.

The information provided in this equipment list may be sorted in many ways to obtain reports which allow correlation in such areas as equipment location and qualification methods. This list will be submitted as part of the FSAR for NRC Staff review.

5.2.3 File System

The Supply System maintains files in accordance with established Quality Assurance procedures which conform to Appendix B, 10CFR50 requirements.

These files include:

- Equipment specifications
- Test plans and acceptance criteria
- Test results
- Analyses and other documentation required to support any assumptions contained in the reports
- Summary reports of the qualification programs
- Correspondence related to each qualification program.

6.0 CONCLUSION

This report has been provided by the Washington Public Power Supply System to illustrate the Supply System's methodology in complying with IEEE 323-1974, or its daughter standards that are supported by regulatory guides and/or NRC documentation.

The Supply System Equipment Qualification Program ensures that all safety-related I&C/electrical equipment has been identified, that postulated accident environments have been defined, and that an equipment qualification program has been developed to demonstrate the required equipment performance within the specified service conditions.

APPENDIX A

SAMPLE SUMMARY REPORTS OF EQUIPMENT QUALIFICATION PROGRAMS OF CLASS 1E EQUIPMENT

CLASS 1E
VENDOR EQUIPMENT QUALIFICATION PROGRAM
SUMMARY

I. Equipment Identification

Type:	5KV, 250MVA, 1200 AMP Switchgear
Manufacturer:	Gould, Inc.
Model No.:	5HK-250

II. Equipment Classification

Safety Function: Operate on demand and where required to maintain continuity of a circuit during the DBA Conditions (LOCA) and earthquakes if no electrical fault or overload condition exists. Should a short circuit or other circuit overload condition occur during the DBA or earthquake, open and reclose.

DBA Exposure: This equipment is subjected to Operating Basis Earthquake (OBE) and Safe Shutdown Earthquake (SSE) conditions. Other adverse environmental conditions do not exist in the location of this equipment.

Time to Fulfill Safety Function: The equipment is required to carry rated current and open any circuit with an overload or fault condition during and after a postulated LOCA, OBE or SSE.

III. Equipment Description

The switchgear equipment is composed of the enclosure, primary circuit components, circuit breaker and other components such as meters, relays, switches, transformers, and interface components.

IV. Qualification Environment

Normal:	Temperature:	$55^{o}F$ to $85^{o}F$
	Pressure:	Slightly Positive
	Relative Humidity:	35% to 50%
	Radiation	10 rads/year
Abnormal:	Temperature:	$85^{o}F$
	Pressure:	Slightly Positive
	Relative Humidity:	40% $\pm$ 10%
	Radiation:	10 rads/year

DBE: Operating Basis Earthquake (OBE) and Safe Shutdown Earthquake (SSE).

V. Summary of Qualification Plan

A. Aging:

The objective of the qualification plan is to satisfy the criteria contained in IEEE 323-1974 for the WNP-1/4 plant specification.

V. Summary of Qualification Plan (cont)

Thermal: A thermal aging analysis is performed to show that thermal aging is not a factor which prevents the equipment from performing its safety function during seismic events. Where analysis indicates unacceptable effects, thermal aging is performed prior to seismic testing.

Radiation: An analysis was performed which shows that the WNP-1/4 radiation parameter (410 rads) for this equipment is not a factor which would prevent the equipment from performing its safety function during seismic events.

Vibration: Self-induced vibration and vibration from nearby equipment is not a factor which would contribute to the aging of this equipment. Therefore, vibration aging is not performed on this equipment.

Operational: Components susceptible to operationally induced failure mechanisms are cycled a conservative number of times to represent the design life cycles. Components of static design and those whose design life cycles are a small fraction of its capability are exempted.

B. Seismic: The basic equipment in the as-produced condition is subjected to five OBE and one SSE (minimum) random, multifrequency, biaxial excitations in each of two directions. The equipment is monitored for proper electrical functioning during excitation. Locations of components (protective relays, current transformers, etc.) are monitored for excitation levels and compared to the qualification data for the component.

C. DBA: LOCA not applicable. MSLB not applicable.

D. Other: Design Tests: Basic equipment in the as-produced condition is subjected to flammability, dielectric, continuous current, load current switching, short time current carrying, short circuit interruption and momentary current tests.

VI. Summary of Test Results

The analyses and test results show the switchgear will perform its function under the conditions specified in Part II of this report provided the periodic maintenance of Section 9 and parts replacement schedule of Section 7 of Reference 1 are adhered to.

This switchgear equipment is an assembly of two types of components. The first type comprises the "basic equipment" which includes standardized primary and secondary components which perform the basic function of switchgear equipment. The second type of

VI. Summary of Test Results (cont)

components furnished with switchgear is the "variable assortment" of control, instrumentation and protection equipment.

A. Aging - Thermal & Radiation(N/A): The analysis was divided into two phases. The first phase addressed the "basic equipment" and identified the possible failure modes and their effects on system operation. Further studies and analyses showed (through Arrhenius projections of existing laboratory and operational data, and application of conductive coatings to prevent ionizing of air gaps in encapsulation) that most of the failure modes could be prevented from occurring in a service environment of 40C and a cumulative radiation of 10^5 rads. Data used for the Arrhenius projections show satisfactory operation for greatly extended periods above the possible 38C environment.

The second analytical phase ("variable assortment") included a review of manufacturer's data and reports, and research of data on basic materials and techniques applicable to the "variable assortment". These analyses showed projected operating life of 40 years under the normal and DBE conditions for most of the items. They also identified those with a less than 40 year life and quantified the required replacement time to ensure a margin for safe operation. Details of these analyses, on going tests, a list of the "variable assortment" and reference documents used in assessing them are in Reference 1.

Operational: Circuit breakers met all performance criteria after the 10,000 cycles of operation which greatly exceed the 1200 operations requirements.

B. Seismic: A sample set of the "basic equipment" in the as produced condition was subjected to five OBE and two SSE biaxial RRS in two axes. All circuits were electrically loaded, operated and monitored for proper functioning. All equipment operated satisfactorily before, during and after the seismic exposure. Margin of 4% to over 31% on the SSE RRS was provided.

Accelerometers were placed at strategic locations and outputs recorded during the vibration runs. The data was then used to evaluate the seismic withstand capability of the "variable assortment" equipment. Where manufacturers' data showed the equipment would satisfactorily meet the vibration environment of its location in the switchgear structure it was considered qualified. Where data was insufficient, vibration testing was performed to the spectrum of the equipment location.

All of this equipment is qualified by one of these methods. The list of these "variable assortment"

B. Seismic (cont)

equipment and how qualified seismically for this program are in Reference 2.

A typical test response spectrum with the required responses is given in Figure 1.

The supplier qualification report presents experimental and analytical findings which indicate that anticipated environmental effects during a qualified life period required for WNP-1/4 do not put the equipment into a condition during a seismic event other than when new. These findings, and an appropriate component replacement program, permit seismic verification testing of new components.

Other - Design Tests: Requirements of all tests were satisfactorily met. The recommended maintenance or adjustments were made at the required intervals. See Reference 1.

VII. Modifications to Equipment

None

VIII. Attachments

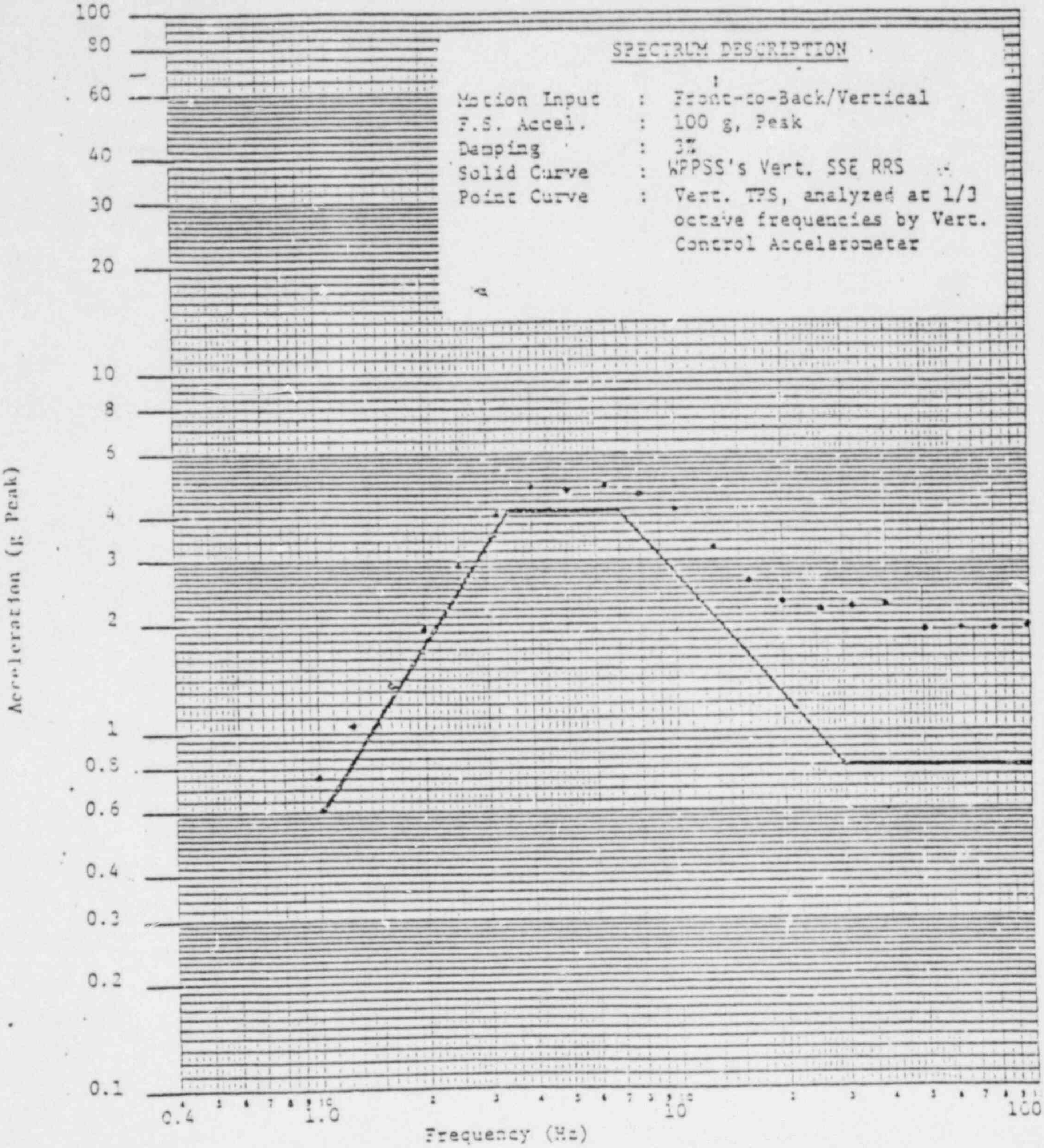
Figure 1, Typical Seismic Test Response Spectrum

IX. References

1. Gould Report 33-51659-QS Revised 3-28-79. Qualification Summary Report 5KV Switchgear Contract 47, Transmittal 60A.

2. Gould Report 33-51659-SS, dated 9-78. Seismic Certification for Class 1 Electrical Equipment Contract 47, Transmittal 75.

Spectrum Reference Source
Test Program No. 44002-1
Run No. 13, VCA, 3% (SSE)



COMPARISON OF THE WPPSS VERTICAL SSE RRS TO THE VERTICAL TRS OF THE 4 FRAME SHK-250 TEST SPECIMEN

Figure 1

CLASS 1E
VENDOR EQUIPMENT QUALIFICATION PROGRAM
SUMMARY

I. Equipment Identification

Type: Modular Type Penetration, 600 Volt Power, Control & Instrumentation.

Manufacturer: Westinghouse

Model No.: Prototype Modules Include:
Serial No. 328; small size low voltage cables,
Serial No. 261; larger size low voltage cables and
Serial No. 246; two tri-axial cables

II. Equipment Classification

Safety Function: The penetrations function electrically to carry signals to and from safety devices and current to power these devices within the containment. They also provide a pressure barrier to prevent any gases from leaking from the containment during normal plant operating conditions, during Loss of Coolant Accident (LOCA), Main Steam Line Break (MSLB) Operating Basis Earthquake (OBE) and Safe Shutdown Earthquake (SSE).

DBA Exposure: The penetrations are located and mounted on the containment liner-wall and are exposed to LOCA and MSLB conditions.

Time to Fulfill Safety Function: The penetrations must function both electrically and as a pressure barrier for the period of time that the DBA or earthquake is postulated to exist, the longest being the LOCA which is postulated to exist 100 days.

III. Equipment Description

The electric penetration is a device which, when sealed into its aperture in a bulkhead, allows for the passage of electrical circuits and information through the wall of a nuclear containment vessel without compromising the integrity of the containment vessel's pressure boundary. Its double module seal allows for the continuous monitoring of the module's gas leakage rate. Connectors, terminals, terminal blocks and wire are also part of the complete plant installation. Summaries of their qualification follow as separate documents.

IV. Qualification Environment

Normal:		Temperature:	55F(13C) to 95F(35C)
		Humidity:	20% to 80%
		Radiation:	1.71×10^4
Abnormal:		See Accident and DBE	
Accident:	LOCA:	Temperature:	See Figure 2
		Pressure:	See Figure 1
		Radiation:	1×10^8 rads integrated over accident and one year following.
		Spray:	Continuous for 48 hours and intermittant for additional 98 days, to consist of 2100 ppm boric acid with Sodium Hydroxide to pH of 9-11.
	MSLB:	Temperature:	See Figure 2
		Pressure:	See Figure 1
	DBE:	Seismic:	See Figure 3

V. Summary of Qualification Plan

The objective of the qualification plan is to satisfy the criteria contained in IEEE 317-1972 for the WNP-1/4 plant specifications.

A. Aging:

Thermal: Develop Arrhenius plot by linear regression analysis of test data and determine a time and temperature for accelerated aging of the penetration modules to a 40 year life at 70C through extrapolation of that plot.

Radiation: Samples to be exposed to a cummulative dose of 1.1×10^8 rads from a Cobalt-60 source.

Vibration: Self-induced vibration and vibration from nearby equipment is not a factor which would contribute to the aging of this equipment. Therefore, vibration aging is not performed on this equipment.

Operational: Normal operation produces heating effects which are well below the 70C value considered in the thermal aging portion of this program. Thus, operational aging is included in the thermal aging, above.

B. Seismic: The sample is to be subjected to biaxial random vibration with a frequency spectrum of 0.7 to 100 Hertz. The input shall be applied to the sample six times (five OBE and one SSE) in each of four biaxial directions.

C. MSLB:LOCA: See Figures 1 and 2.

D. Other: Temperature extremes cycling. Samples shall be placed in an environment of -34C for one and one half hours, 23C for four hours and then one and one half hours at 93C with 95% humidity. This is to be done for five complete cycles.

Mechanical shock. The samples shall be subjected to a sand drop test twice from a height to induce a force in excess of one and one quarter g.

Thermal cycling. Samples shall be subjected to 120 cycles between 21C and 77C at a rate of change of 28C per hour.

Gas Leak Rate. Samples shall be pressurized with helium to 75 psig and the pressure to be monitored throughout testing to determine leak rate.

Electrical Tests. Continuity, dielectric strength, and insulation resistance are to be performed at the start, during cycling and aging, DBA, and following short-circuit tests.

Rated Short-Time Over Load Current Test

The modules shall be connected so that same size wires are connected in such a manner as to allow the required current to flow through the maximum number of cables.

The test on module, S/N 328 (cable sizes #12, #10, and #4), to be performed as follows: using heating tape, heat the cables to an ambient of 122F(50C). Apply rated current plus margin (5%) through the three cable sizes, the temperature being recorded after stability is reached. At this point a current seven times rated current plus margin to be applied to the cable size under test for a ten second duration. The maximum cable temperature is to be recorded.

The test on module, S/N 261 (cable size #2, #1/0, 250 KC MIL, and 350 KC MIL), shall be performed by heating one cable of each size to approximately 194F(90C) and then applying seven times rated current plus margin to the cable size under test for ten seconds and recording the maximum temperature.

Short-Circuit Current Duration Test (performed next after the Rated Short-Time Overload Current Test).

The modules, are to be installed and secured in a test mounting collar in the same manner as they would be sealed into a bulkhead. Three cables of the same size are to be fastened together at the inboard side of the module and their extensions on the outboard side secured to the three phase power source. Heat the wires to be tested to a minimum of 194F(90C) prior to applying the short circuit current.

After programming the power source to produce the required current for the proper number of cycles, the unit shall be turned on, thereby delivering the faulted current to the cables. The maximum temperature attained by the tested cable size due to the short circuit current shall be recorded. At the conclusion of the test performed on the first triad of wires, the second group shall be connected and the test repeated. This procedure is to continue until all the required cable sizes of both modules have been tested.

Installation welding. The module shall be welded to a linear nozzle and the developed temperatures measured at the conductor insulation and the epoxy seal.

VI. Summary of Test Results

The analysis and test results sh the penetrations will perform their function under the conditi ns specified in Part II of this report. The combination of terminals, terminal block and wire in an electrical enclosure is being evaluated for performance in MSLB environment.

Aging:

Thermal: Cast epoxy penetration seals were tested at four temperatures from 150 to 200C and using linear regression analysis an Arrhenius curve was developed that showed 99.7% of the seals will have a life greater than 342 years at 70C. Based on this curve the samples were aged at 150C for 100 hours to simulate 40 year life at 70C. This gave a margin of 35C over the maximum normal service temperature.

Radiation: The samples were exposed to gamma radiation from a Cobalt-60 source for 220 hours at a rate of 0.5×10^6 rads per hour. The samples were rotated periodically to obtain a dose of 1.1×10^8 rads. This gave a margin of 10%.

Seismic: The penetration modules were pressurized into 64 psig, energized with 21,000 volts dc and then subjected to biaxial random vibration with a frequency spectrum of 0.7 to 100 Hertz. The input was applied six times (five OBE and one SSE) in each of four biaxial directions. Margin of 50% or more was provided between required levels and the test levels. See Figure 3 for SSE vertical response (worst case requirement). There was no visual or apparent evidence of mechanical damage or deterioration of the penetration as a result of the seismic vibration. See reference 3.

DBA: LOCA: The three modules were installed in the steam chamber, and each conductor was attached to its power supply. The power supplies were adjusted to deliver the following voltages and currents to the respective cable during the test:

#12AWG and #10AWG	20 Amps at 600 Volts
#4AWG and #2AWG	90 Amps at 600 Volts
#1/0	125 Amps at 600 Volts
250 KCMIL and 350 KCMIL	320 Amps at 600 Volts

The penetrations were then exposed to the Design Basis Accident Pressure and Temperature profiles shown in Figures 1 and 2. A chemical solution was sprayed intermittently on the modules, at a rate of 0.15 gallon per minute for a total of 81 gallons during the 30 day period. The first 63 gallons of solution (7 hours of spray, 0.15 gal/min) consisted of 4000 ppm of boric acid buffered with sodium hydroxide to a pH of 8.5. This exceeds the WNP-1/4 requirements and produces a more severe test. The remaining 18 gallons of spary consisted of 2100 ppm boric acid buffered to a pH of 9-11 with sodium hydroxide. This solution was consistent with WNP-1/4 requirements.

Insulation resistance readings were taken daily throughout the test. At the conclusion of the LOCA testing, the modules were leak tested. The leakage measured at 1.1×10^{-4} std. cc/sec (1×10^{-2} std cc/sec, maximum, was specified).

The insulation resistance readings were within acceptable limits. The dielectric strength test was performed and all cables passed the test after cycling and aging. All cables passed the test after the design basis accident with the exception of cables 10 and 13 in Module Serial No. 328. These cables, along with #15, were used to conduct the short circuit current duration test and were stressed beyond the IPCEA maximum recommended I^2t

value of 5.6 x 10^5 by 46%. This overstressing could have contributed to this failure; however, one of the overstressed cables and four other #10 cables satisfactorily met the test. Sometime after 41 hours into the the DBA and prior to 71 hours, borated water and condensate accumulated in the chamber putting the penetrations under water. Several of the cables failed the insulation resistance at 71 hours. The drain valve was adjusted and all but the triax cables had recovered by the 97 hour test. This is not detrimental as the penetrations are located above any flood line and the triax cables need to operate only at the beginning of DBA to signal its occurrence. A margin of 60F was provided throughout most of the profile.

MSLB: The LOCA test exposure is used to demonstrate capability to met MSLB environment. A margin of 50 psi is provided over the maximum pressure. A margin of 55F is provided over the maximum temperature calculated to be transferred to the penetration. The calculation was based on the methodology of Appendix B of NUREG-0588 (Aug. 79) see Reference 4. The result of all post LOCA exposure tests were satisfactory.

Other: The results of the Temperature Extreme, Mechanical Shock, Thermal Cycling, Gas Leak Rate, Continuity, Dielectric Strength, Insulation Resistance, Rates Short-Time Overload Current, and Short Circuit Current Duration Tests were satisfactory except for Dielectric Strength as discussed under LOCA results. See Reference 1.

Welding of the modules into place was satisfactorily demonstrated. See Reference 1.

VII. Modifications to Equipment

None

VIII. Attachments

Figures 1, 2 and 3.

IX. References

1. Qualification of Modular Type Electrical Penetrations, Westinghouse Electric Corporation, Report No. PEN-TR-77-59, July, 1977, WNP-1/4, Contract 55, T-33. This transmittal also contains the following reports:

- 75-7B5-BISAL-R2; Research Report
- PEN-ABE-1-74-4; Module Capacity Test Report
- PEN-TR-76-47; Test Report on simulated field installation welding of an electrical penetration module type fitting to a 12 inch nozzle.

2. Letter - UEWP-78-0073, B. D. Redd, Project Engineering Manager to WNP-1/4 Project Manager, J. P. Thomas, Containment Electrical Penetrations, January 13, 1978.

3. PEN-TR-77-107; Report of Seismic Vibration Testing of One Medium Voltage Penetration, Revised 4-5-78.

4. Temperature transient response in safety-related equipmwnt following MSLB, UEWP-80-179.

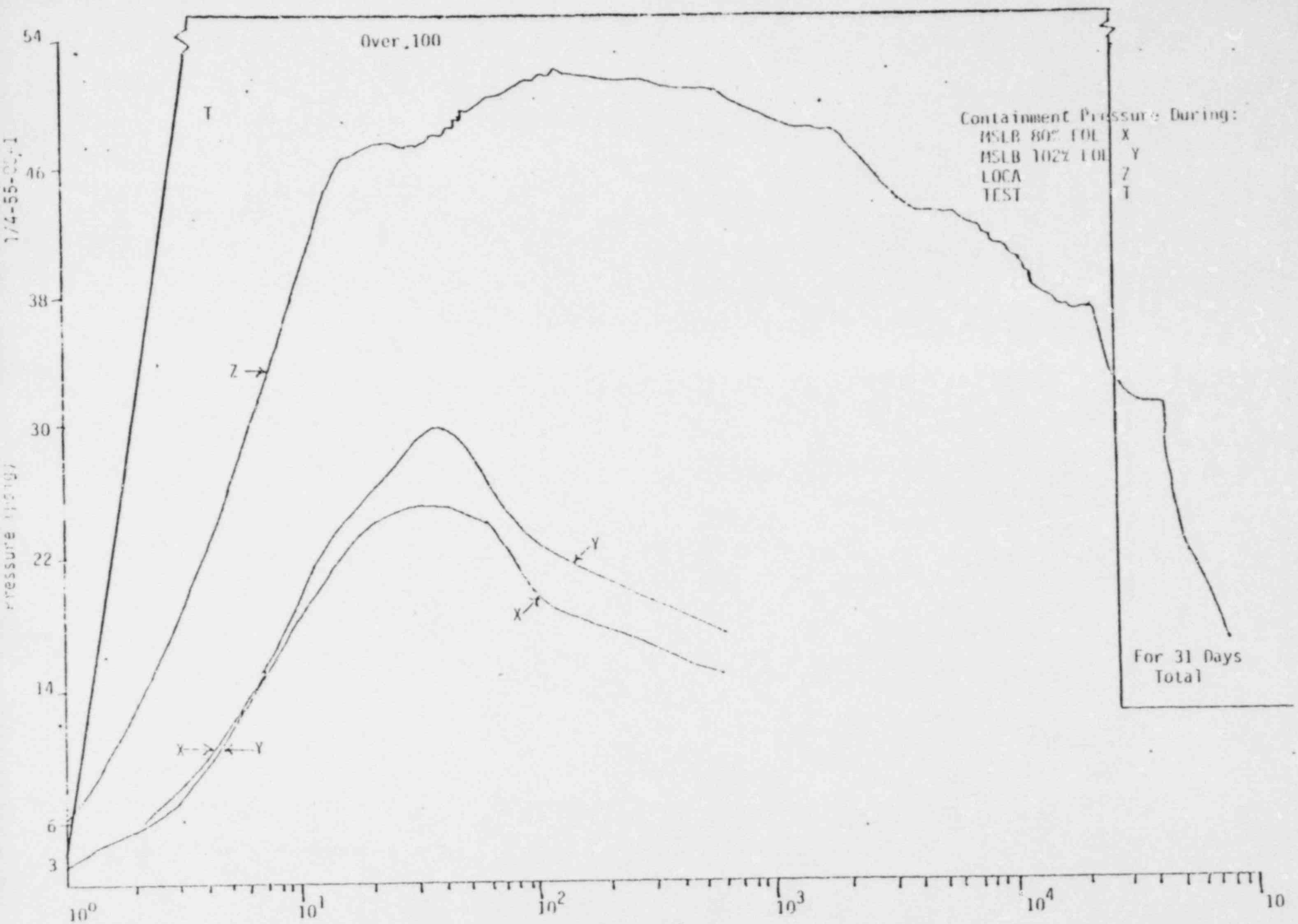


Figure 1 - Containment Pressure (LOCA & MSLB)

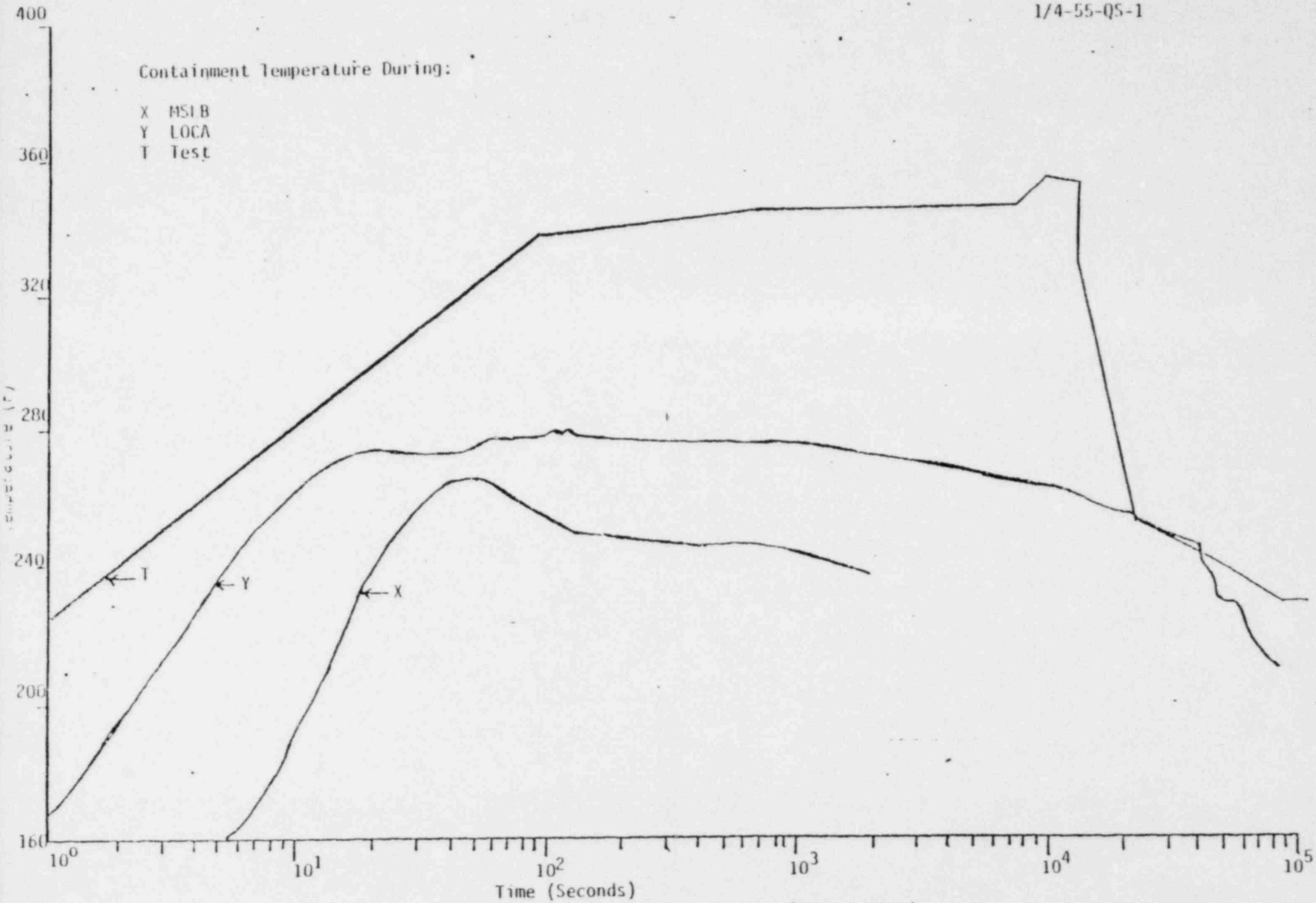


Figure 2 - Containment Temperature (LOCA & MSLB)

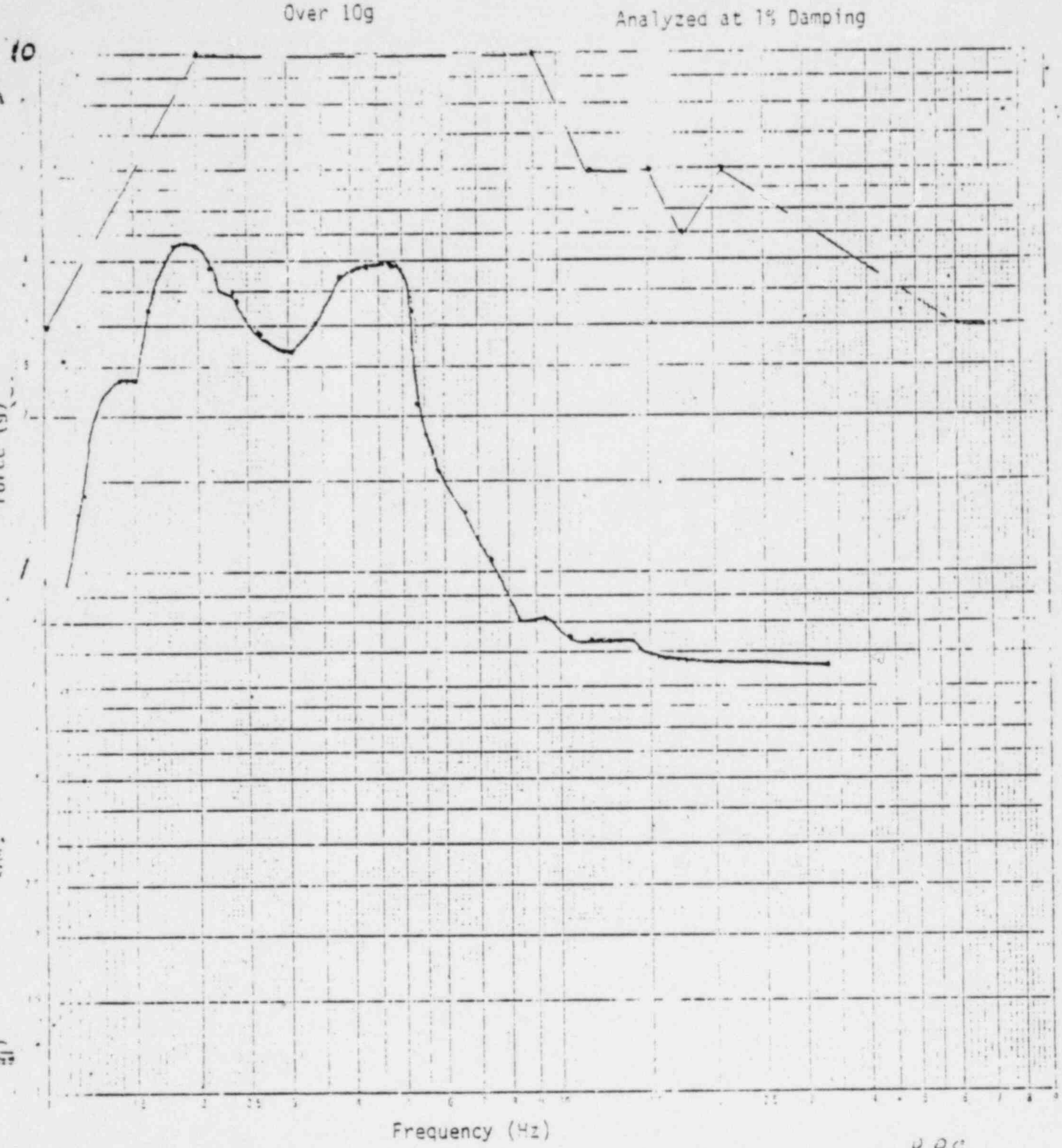


Figure 3 Analysis of Control Accelerometer During SSE Input

CLASS 1E
VENDOR EQUIPMENT QUALIFICATION PROGRAM
SUMMARY

I. Equipment Identification

Type:	High Temperature Terminal Lug
Manufacturer:	AMP Inc.
Model No.:	53000 Series

II. Equipment Classification

Safety Function: The terminations carry signals to and from safety devices and current to power these devices within the containment.

DBA Exposure: The terminations are located in terminal boxes outside the containment and are exposed to HELB.

Time to Fulfill Safety Function: The terminations must function continuously for the period of time that the HELB or earthquake is postulated. Also, the terminals must function throughout a postulated 100-day LOCA period, but are not exposed to the associated environment.

III. Equipment Description

The terminal lugs are of polyvinylidene flouride (KYNAR), pre-insulated type, which provide the interface connection for wires and terminal blocks.

IV. Qualification Environment

Normal:	Temperature:	55F(13C) to 100F(38C)
	Pressure:	Atmospheric
	Relative Humidity:	12 to 70%
	Radiation:	10 rads/year
Abnormal:	Temperature:	10F(-12C) to 130F(54C)
	Relative Humidity:	5 to 95%
DBA:	HELB	

V. Summary of Qualification Plan

The objective of the qualification plan is to satisfy the criteria contained in IEEE 323-1974 for the WNP-1/4 plant specifications.

A. Aging:

Thermal: Conduct an analysis to determine expected life and define a time and temperature for accelerated aging to 40 year life at 70C.

Radiation: Samples to be exposed to a cummulative dose of 2×10^8 rads from a Cobalt-60 source.

Vibration: Self-induced vibration and vibration from nearby equipment is not a factor which would contribute to the aging of this equipment. Therefore, vibration aging is not performed on this equipment.

Operational: The effects of normal operation produce heating effects which are included in the thermal aging portion of this program.

B. Seismic: Seismic vibration is not a factor which would produce common mode failures due to the mass of the terminals and the mechanical restraints placed on the wiring.

C. LOCA, MSLB: See Figure 4 of this summary report. This profile the temperatures and pressures anticipated for a HELB outside of containment.

D. Other: Out-gassing, flammability, tensil strength, axial load and voltage drop are among the tests performed.

VI. Summary of Results

The analysis and test results from the LOCA testing (Figure 4) indicate that these terminals will perform their safety function in much more severe environments thatn required by ex-containment applications. The WNP-1/4 HELB requirements are currently being defined, however, it is not anticipated that the environment produced by an HELB will approach the severity of the LOCA/Chemical Spray testing performed on the terminals.

Aging:

Thermal: Tests were conducted to determine the activation energy of the insulation by a thermogravimetric analysis. From this it was determined the terminals would have an equivalent life of 3.35 million years at 70C when aged at 163C for 120 hours. Samples aged at 163C for 120 hours showed no deterioration of the insulation.

Radiation: Samples were subjected to a dose of 2×10^8 rads by exposing to a Cobalt-60 source. These samples were then exposed to the LOCA profile. This gave a margin of over 1×10^8.

DBA: LOCA: The radiation aged samples were subjected to the temperature, pressure, spray profile of Figure 4. All performance requirements were met after exposure. The samples were not thermally aged prior to this test due to the long life shown by the analysis.

The satisfactory performance assures proper operation in ex-containment environments.

Other: The results of all of the other tests were satisfactory.

VII. Modifications to Equipment

None

VIII. Attachment

Figure 4

IX. References

1. Engineering Test Report GPR 575-98, AMP, Inc., September 9, 1976.

2. Engineering Test Report of AMP, Radiation Resistance PIDG Terminals. GPR 575-99, April 16, 1974.

3. Product Specification for PIDG Terminals, AMP, Inc., Report No. 108-11023, May 3, 1974.

4. Radiation Exposure Test Data Summary, AMP, Inc., Report No. 3425-200 (1-14), June 13, 1975.

5. Product Bulletin, Nuclear Terminals and Splices, AMP, Inc., Report No. 309-1, 1975.

6. Analysis of PIDG Thermal Aging conducted by AMP, Inc., Wyle Laboratories Report, Report No. 44275-1, December 19, 1978.

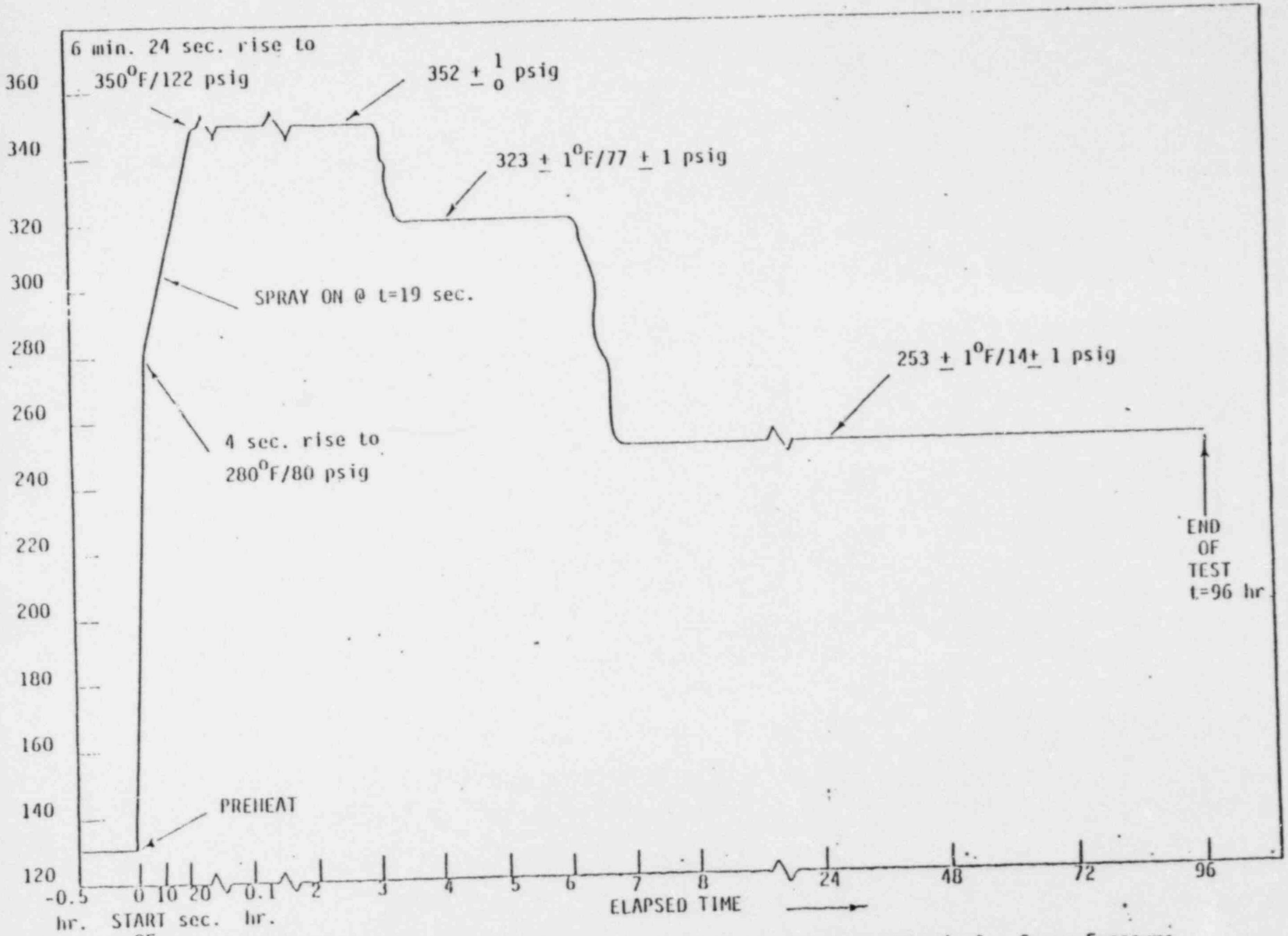


FIGURE 4: Temperature/Pressure Profile During Steam/Chemical - Spray Exposure
AMP Lug

CLASS 1E
VENDOR EQUIPMENT QUALIFICATION PROGRAM
SUMMARY

I. Equipment Identification

Type:	Electrical Cables
Manufacturer:	Rockbestos Company
Model No.:	Firewall III

II. Equipment Classification

Safety Function: The cables carry signals to and from safety devices and current to power these devices within the containment during normal plant operating conditions, during Loss of Coolant Accident (LOCA), Main Steam Line Break (MSLB).

DBA Exposure: The cables are located in the containment penetrations with the penetration "pigtails" exposed to LOCA and MSLB conditions.

Time to Fulfill Safety Function: The cable must function for the period of time that the DBA or earthquake is postulated to exist, the longest being the LOCA which is postulated to exist 100 days.

III. Equipment Description

(1) A single conductor with 30 mils of flame retardant, irradiation cross-linked polyolefine insulation.

(2) Inner insulation of polymer LD covered by a layer of either radiation cross-linked modified polyolefin or radiation cross-linked cellular polyolefin (both types were tested) and an outer jacket over the shield of radiation cross-linked, flame retardant, non-corrosive, modified polyolefin.

IV. Qualification Environment

Normal:	Temperature:	55°F to 95°F
	Relative Humidity:	20% to 80%
	Radiation:	428 rads/year
Abnormal:	Temperature:	135°F (Max.)
	Relative Humidity:	20% to 80%
	Radiation:	428 rads/year

Accident:

LOCA:

Temperature:	See Report 1/4-55-QS-1, Figure 2
Pressure:	See Report 1/4-55-QS-1, Figure 1
Radiation:	1.2×10^8 rads integrated over accident and one year following.
Spray:	Continuous for 48 hours and intermittant for an additional 98 days, to consist of 2100 ppm boric acid with sufficient sodium hydroxide buffer to achieve a pH of 9-11.

MSLB:

Temperature:	See Report 1/4-55-QS-1, Figure 2
Pressure:	See Report 1/4-55-QS-1, Figure 1

V. Summary of the Qualification Plan

The objective of this plan is to satisfy the criteria of IEEE 383-1974.

A. Aging:

Thermal: Develop an Arrhenius projection to determine a time and temperature to accelerate age the cables to a 40 year life. Age cables to those conditions.

Radiation: Samples are to be exposed to cummulative dose of 2×10^8 rads from a Cobalt-60 source.

Vibration: Self-induced and vibration from nearby equipment has no aging effect on the cables.

Operational: Cable operation produces thermal aging effects, which are determined from the Arrhenius methods used above.

B. Seismic: Seismic events produce effects only at the interface connections. The interface is qualified separately and not included in this program.

C. LOCA, MSLB: See Figure 5 of this summary report.

D. Other: The flame test requirement of IEEE 383-1974 was satisfied for the cross-linked polyolefin insulations through testing the coaxial unit to paragraph 2.5 of the IEEE standard.

VI. Summary of Results

The analysis and test results show that the cables will perform their function under the conditions specified in Part II.

Aging:

Thermal: Regression line test data was assembled according to IEEE 101-1972, and an Arrhenius plot was developed for this insulation. The plot showed that 650 hours at 150°C simulated a 40 year life in an ambient temperature of 90°C. Or, that 135 hours at an aging temperature of 150°C would simulate a 40 year life in an ambient temperature of 75°C.

The single conductor cable was aged in an oven temperature of 150°C for 1300 hours. The coaxial sample was aged 168 hours in an oven temperature of 150°C. Thus, the thermal aging performed on these samples enveloped the Arrhenius curves with margin to demonstrate the life of the insulation is well beyond the 40 year environmental conditions of the WNP-1/4 plant.

Radiation: The thermally aged samples were subjected to 2×10^8 rads by exposing them to a Cobalt-60 source. This envelopes the WNP-1/4 requirement with adequate margin.

DBA:

LOCA:
MSLB

The radiation and thermally aged samples were then subjected to the temperature, pressure and spary conditions described by Figure 5 of this summary report. Following exposure, all samples passed the voltage withstand test while wrapped around a 40X-cable diameter mandrel and immersed in tap water. 2000 volts was applied to the coaxial cable and 2400 volts to the single conductor unit. Comparison of Figure 5 with Figures 1 and 2 of the summary report 1/4-55-QS-1B indicates that margins of 50 psig and 60°F were achieved.

The chemical spray, combined with the high pressure margin, indicates a more severe postulated accident conditions.

Other: The flame testing performed on the cross-linked polyolefin dinsulation demonstrates this material's ability to withstand the IEEE 383-1974 test.

VII. Modifications to Equipment

None

VIII. Attachments

Figure 5

IX. References

1. Report: Qualification of Firewall II Coaxial Constructions for Class 1E Service, dated 1-18-78.
2. Report: Qualification of Firewall II Class 1E Electric Cables, dated 6-7-78.

1/4-55-QS-1B

LOCA Profile

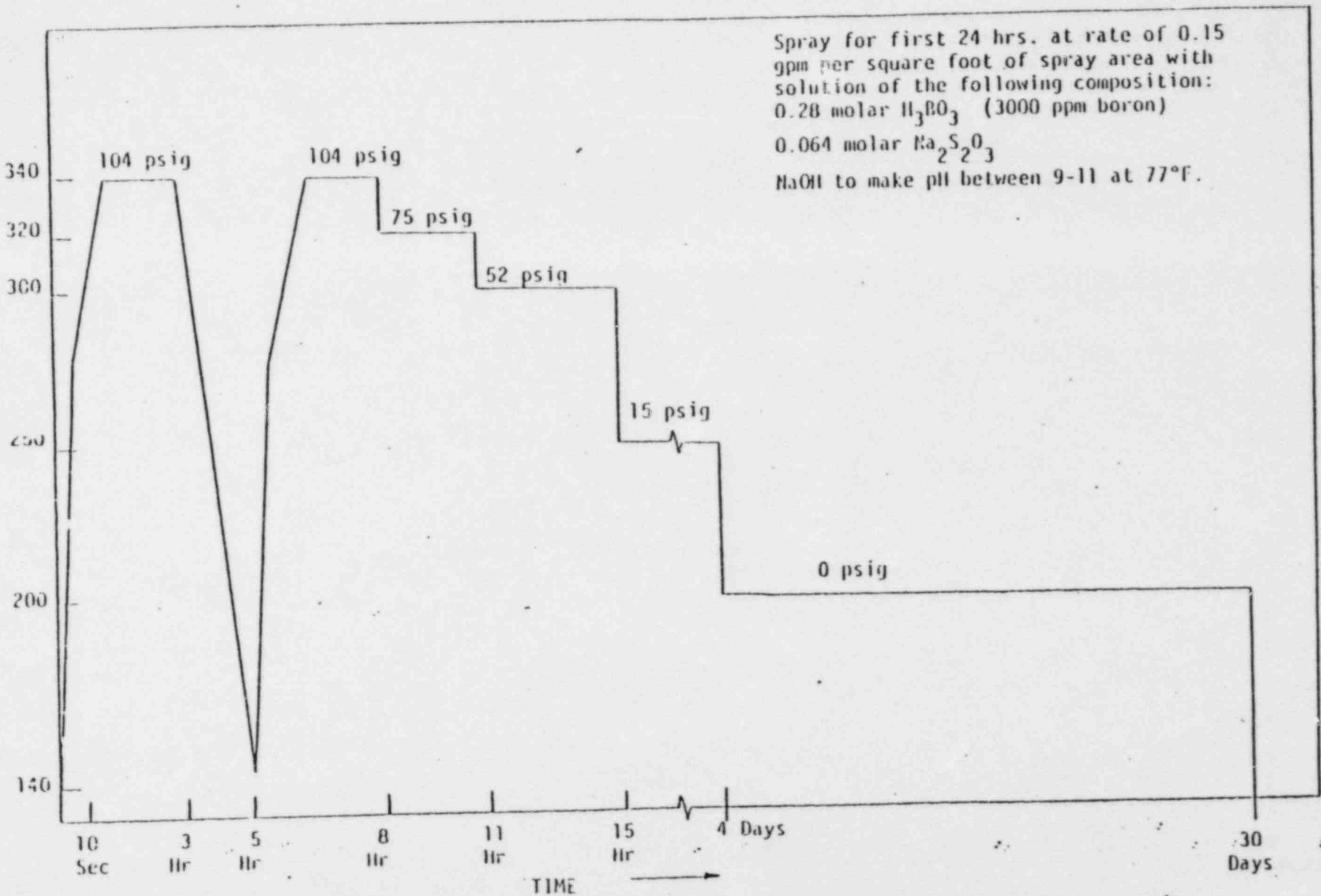


Figure 5 Temperature/Pressure Profile Exposure of Firewall III Cable

CLASS 1E
VENDOR EQUIPMENT QUALIFICATION PROGRAM
SUMMARY

I. Equipment Identification

Type:	Self-contained Hydraulic Actuator
Manufacturer:	Anchor/Darling Valve Company
Model No.:	Prototype Unit

II. Equipment Classification

Safety Function: Actuate main steam and feedwater isolation valves under normal, abnormal design basis event and post design basis event conditions.

DBA Exposure: The valve actuators are subject to MSLB outside of containment environment. The actuators are required to isolate the containment ar main feedwater system.

Time to Fulfill Safety Function: The safety function requires the valves to close within 1.8 to 3 seconds upon receipt of activation signal.

III. Equipment Description

The prototype hydrualic actuator equipment is composed of hydraulic components (cylinder, accumulator, valves) and pneumatic components (pneumatic reservoir, solenoid valves, in-line check valve, pressure transducer), and interface components. The electrical components are described in Paragraph VII under Modifications.

IV. Qualification Environment

Normal:	Temperature:	55F(12C) to 85F(30C)
	Pressure:	Atmospheric
	Relative Humidity:	40% to 70%
	Radiation:	12.5×10^3 rads/year
Abnormal:	Temperature:	10F(-12C) to 130F(54C)
	Relative Humidity:	5% to 95%
Accident:	LOCA:	Not applicable (see Section III, above).
	MSLB: Temperature:	420°F (Max.)
	Relative Humidity:	100%
	Radiation:	2×10^6 rads (TID)
	Pressure:	Slightly Positive
DBE:	Operating Basis and Safe Shutdown Earthquake.	

V. Summary of Qualification Plan

The qualification plan is to satisfy the objectives of IEEE 323-1974, IEEE 344-1975 and IEEE 382-1972.

A. Aging:

Thermal & Radiation:

The deterioration due to environmental exposure is judged to be insigificant for metallic components. Therefore, no environmental aging will be performed on components, sub-assemblies, or parts consisting of metallics only. Environmental aging effects must be taken into account for all non-metallic components.

An aging tempertaure of 250°F (120°C) will be used for all non-metallic components. The actuator supplier establishes 122°F (50°C) as the "normal" ambient temperature, which is well above WNP-1/4 requirements. Based on these values, the actuator non-metallics were aged at 250°F for 13.2 days to simulate five years life in a 122°F ambient.

The maximum radiation dose the valve actuator will experience (based on 40 years service with 50% margin on a 2 Mrad accident dose) is 5 Mrads. A major portion of the non-metallic components in the actuator system consists of elastomeric "O" ring type seals. Only three (3) varieties are present: Buna N (Nitrile), Viton (fluorocarbon), and Ethylene Propylene; and they will be irradiated as components, separate from the actuator system.

The maintenance/replacement period for the actuator's non-metallics is ten years so the qualification dose will be 3 Mrads using a 25% margin on the accident dose.

Shielding effects will be taken into consideration during the irradiation of the elastomers to account for the shielding that exists in actual usage.

Separate sets of non-metallic components or sub-assemblies and parts containing these components will be irradiated as defined above and following irradiation will be temperature aged as also defined above.

These components will be introduced into the actuator active control system after the initial functional test (described below).

Vibration: Considered during the operational test below and seismic test described in Paragraph V-B.

Operational: It is anticipated that no more than 700 full-stroke cycles and 1000 exercise cycles will be required of the actuator while installed for 40 years in any nuclear power plant. A total number of 800 full-stroke cycles will be applied on one control side--the active one. This accounts for an additional 100 total cycles providing the necessary margin--in this case 14%--to meet the objective of IEEE 323-1974. A total of 1200 exercise cycles will also be applied to the active control side, thus providing an additional 200 cycles, or 20% margin, to meet the objective of IEEE 323-1974. All cycles will be performed using the active control system and the active accumulator, where applicable. AC and DC solenoids will be included in the cycle aging process. They will be changed such that half the aging cycles will be with AC and half with DC solenoid valves. All cycles will be run at a minimum temperature of 122F. Saturated steam mixed with ambient air vented to atmosphere will produce a relative humidity in excess of 90% during these cycles.

Humidity: See the operational test.

Other: The actuator will be functionally tested prior to and after the radiation exposure/thermal aging test. The actuator will again be functionally tested after the operational test. During each of these functional tests, the hydraulic actuator will be fully stroked: (a) using the pump and the active AC controls. Then it will be exercised using the active DC controls. Stroking, exercising and accumulator charging times will be checked and recorded. Bucking cylinder closing pressure will be checked and recorded for all closing strokes at the fully closed position.

B. Seismic: The test program will consist of a dynamic evaluation test to determine natural frequencies, biaxial random multifrequency testing, and sine beat tests.

C. DBA: MSLB: The qualification actuator will be subjected to an accident condition as described in Figure 1. The actuator will be actuated at each point as noted on the graph using the active controls only. Each actuation will be performed by using one accumulator to extend the actuator rod and the actuator pump to retract it.

VI. Summary of Test Results

The results of the tests show that the valves will perform their safety functions under the conditions described below. These valves, with periodic maintenance and component part replacement, are qualified for a 40-year service life.

A. Aging:

Thermal & Radiation: Non-metallic components and sub-assemblies of the prototype actuator were subjected to temperature and radiation aging. The temperature was held at 250F(121C) for 13.2 days. This is equivalent to 17 years at 90F and gives a seven year margin over the 10 year qualified life. Other identical components were uniformly exposed to a Cobalt-60 source for a period of time that yielded an air equivalent dose of gamma radiation at 2.5 Mrads. VI.

After the radiation exposure and temperature aging, the components were functionally tested under a simulated load including full-stroke cycling. The functional tests included exercise cycles which were 10% of the full-stroke cycle using the actuator system pump as a power source. The tests showed no indications of degradation.

Vibration: Vibration was considered but the extent to which the seismic tests were conducted (32 tests compared to the IEEE 344-1975 requirement of 12) more than meets the minimum requirements. See Paragraph VI-B below.

Operational: System cyclic aging tests consisting of 800 full-stroke cycles and 1200 exercise cycles which provide a 40-year qualified life including margin, were conducted. The tests were run at a minimum temperature of 122F (50C), which was 32F margin above maximum normal postulated service condition for WNP-1/4, and a relative humidity in excess of 90%.

The test time complied with the cycle aging requirements without compromise to mechanical or electrical integrity.

Humidity: The humidity tests were successfully run during the operational tests above.

Other: None

B. Seismic: The seismic test program consisted of a dynamic evaluation to determine natural frequencies, biaxial random multifrequency testing, and sine beat tests. The program demonstrated that the specimen possessed sufficient structural integrity to withstand the prescribed seismic environment to perform its intended safety function.

The test program included of a dynamic evaluation using the frequency range of 1-40 Hertz to determine natural or resonant frequencies.

There were five (5) random multifrequency tests at the OBE level and two (2) below. Next, two (2) more random biaxial tests were conducted at the same orientation but one was at the SSE level and one below. Seven (7) sine beat test runs were made (still in the same orientation). The orientation was then changed 90° and the nine (9) random biaxial tests were repeated, three (3) at below OBE level, five (5) at OBE level and one (1) at SSE level. Finally, under this second orientation, the seven (7) sine beat test runs were repeated.

Margins of 83% or more was provided on the SSE RRS except below 1.5 Hz due to test equipment limitation. See Figure 2 (Attachment 5) for typical response spectra.

During the OBE tests the specimen was in the open position. During the SSE tests; the specimen was operated in the emergency closing operation. During the sine beat tests the specimen operated successfully in the emergency closing operation one (1) time at each test frequency. The TRS data was analyzed at 1/2, 1, 2, 3, and 5 percent damping.

These tests amply qualify these actuators to the required service (the associated piping systems have been shown through analysis to transmit less than 3g) as the OBE and SSE tests envelop the 3g limit.

Seismic analysis of the terminal box was successfully conducted verifying that the terminal box mounts would survive the design basis earthquake to which the actuator would be subjected.

C. DBA: HELB: The prototype actuator, with aged components, installed, was subjected to accident qualification testing. Saturated steam was used to attain a peak surroundings temperature of 450°F according to the time/temperature profile shown in Figure 1. The actuator closing times remained within acceptable limits throughout the simulated DBA testing.

The testing was performed with the actuator surrounded by an "ambient box". Thus, no pressure restrictions existed and saturated steam was produced. This approaches the WNP-1/4 pressure requirements for HELB accidents involving main steam line breaks in the main steam isolation valves.

D. Other: None

VII. Attachments

1. Figure 1 - Main Steam/Feedwater Isolation Valve Accident Temperature Test.
2. Table 1 - A/DV Hydraulic Actuator Bill of Material (Safety Related Item)
3. Table 2 - Qualified Parameters.
4. Figure 2 - Accident Temperature Profile (when available)
5. Figure 3 - Vibration Response Spectra

IX. References

1. Qualification Report for the Anchor/Darling Valve Self-Contained Hydraulic Actuator and Accessories, Report No. QR-1, Revision A, WNP-1/4, Contract 87, T-064A.

2. Qualification Report for the Anchor/Darling Valve Self-Contained Hydraulic Actuator and Accessories, Report No. QR-1, Revision B WNP-1/4, Contract 87, T-064B.

3. Terminal Box Support Seismic Calculations, Anchor/Darling Valve Company, WNP-1/4, Contract 87, T-65.

4. Test Report on Electrical Terminations Subjected to Design Basis Accident Environment, Conex Corporation, Report No. IPS-107.

5. Testing for Thermal Endurance: A case History Based on Polysulfone Thermal Plastic, paper presented by T.E. Bugel, Union Carbide Corporation.

6. Connectron, Inc., letter, Schmidt, Connectron, Inc., to Kresco, Anchor/Darling Valve Company, Justification for Equivalency of NSS3 to NU-2 Terminal Blocks.

7. Engineering Test Report GPR 575-98, AMP, Inc., September 9, 1976.

8. Engineering Test Report of AMP, Radiation Resistance PIDG Terminals, GPR 575-99, April 16, 1974.

9. Product Specification for PIDG Terminals, AMP, Inc., Report No. 108-11-23, May 3, 1974.

10. Radiation Exposure Test Data Summary, AMP, Inc., Report No. 3245-200 (1-14), June 13, 1975.

11. Product Bulletin, Nuclear Terminals and Splices, AMP, Inc., Report No. 309-1, 1975.

12. Analysis of PIDG Thermal Aging conducted by AMP, Inc., Wyle Laboratories Report, Report No. 44275-1, December 19, 1978.

13. Final Report, Qualification Tests of Class 1E Electric Cables in a Simulated Steam-Line-Break and Loss of Coolant Accident Environment, Final Report, F-C4113.

14. Qualification Tests of Class 1E Electric Cables in a simulated Steam-Line-Break and Loss of Coolant Accident Environment, Brand-Rex Company, Franklin Institute Research Laboratories Report No. F-C4771.

15. Long Term Thermal Aging Arrhenius Plot, 40-year Life, Brand-Rex Company.

16. Specification for Ultrol @ Flame-Retardant Utility Station Control Cable, Brand-Rex Company, Report No. BR-8084A, January 1976.

17. Qualification Tests of Electric Cable Under Conditions Simulating Normal Reactor Containment Service and a Loss of Coolant Accident, Samuel Moore and Company, November 1973. Franklin Institute Research Laboratories, Report F-C3683.

18. Qualification of NAMCO Controls Limit Switch to IEEE Standards 344-1975, 323-1974, and 382-1972, Rev. 1, NAMCO Controls Company, Acme Cleveland Development Company.

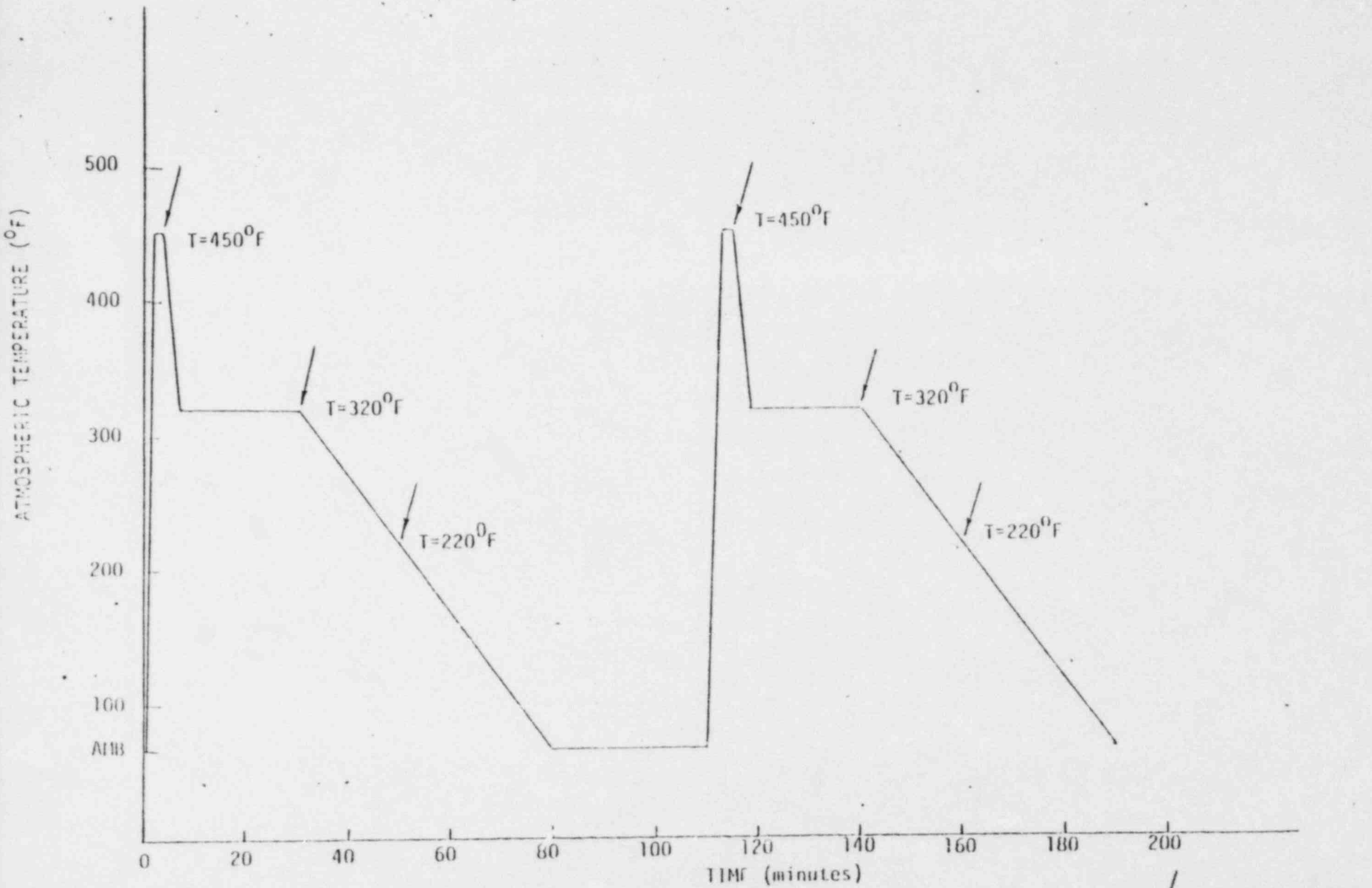


FIGURE 1
MAIN STEAM/FEEDWATER ISOLATION VALVE ACCIDENT TEMPERATURE TEST

Table 1

A/DV HYDRAULIC ACTUATOR BILL OF MATERIAL (SAFETY RELATED ITEMS)

Component	Component Model No.'s: Prototype Actuator	WPPSS 1/4 FW	WPSS 1/4 MS	Qualification Source Reference
A. Hydraulic Components				
1. Cylinder	P-H[1] Dwg #763007 R/F (7" bore x 5" rod x 25" stroke)	Same as Prototype		1
2. Hydraulic/Pneumatic Accumulator	P-H Dwg #763011 R/B (15 gal - 9" bore)	P-H Dwg #773046-1 R/A[3] (18 1/2 gal - 9" I.D.)	P-H Dwg #773046-02 R/A[3] (16 gal 9" I.D.)	1
3. 4-Way Hydraulic Valves (M, N, M_1 & N_1)	T-R[2] Mod #23304-7001-2852 (75 gpm)	T-R[3] Mod #23104-7001-2852 (25 gpm)	T-R Mod #23304-7001-2852 (75 gpm)	1
4. Pilot Operated (P.O.) Check Valves	P-H Mod #CPS-2400-S-VX1775	P-H Mod #CPS-1200-S VX-1775	P-H Mod #CPS-2400-S-VX-1775	1
5. Accumulator Discharge Flow Control Valve (G & G)	TR-R Mod #C-224-3/4S-28	Same as Prototype		1
6. Cylinder Rod End Flow Control Valve (F & F)	P-H Mod #MVI-1200	Same as Prototype		1
7. Manifold Mounted Check Valves	P-H Mod CS-1200S	Same as Prototype		1
B. Pneumatic Components				
1. Pneumatic Reservoir	P-H Dwg #763018 R/B	Same as Prototype		1
2. 3-Way Solenoid Valves ($A, A_1, B, B_1, C, C_1, D, D_1$)	Skinner Mod V51161090/1100	Same as Prototype		1
3. In-Line Check Valves	P-H Mod #C-800B	Same as Prototype		1
4. Nitrogen Pressure Transducers	Sensotec Mod A-10	Same as Prototype		1

C. Electrical Components				
1. Terminal Strips		Connectron Mod. NU 2	Connectron Mod NU 2	4,5,6
2. Soln. Valve Wiring		Brand-Rex 2/C-14AWG	Brand-Rex 2/C-14AWG	13,14,15,16
3. Wire Terminal Lugs		AMP-PIDG Type	AMP-PIDG Type	7,8,9,10,11,12
4. Wire/Soln. Connector	Amphenol AN 3106E1056-4S	Same as Prototype		1
5. Limit Switches	Namco Mod. EA-180	Namco Mod. EA-180	Namco Mod. EA-180	18
6. Limit Switch Wire		Brand-Rex 7/C & 2/C-14AWG	Brand-Rex 7/C & 2/C-14AWG	13,14,15,16
7. Pressure Transducer Wire		Samuel Moore 3/C-16AWG	Samuel Moore 3/C-16AWG	17

Notes:

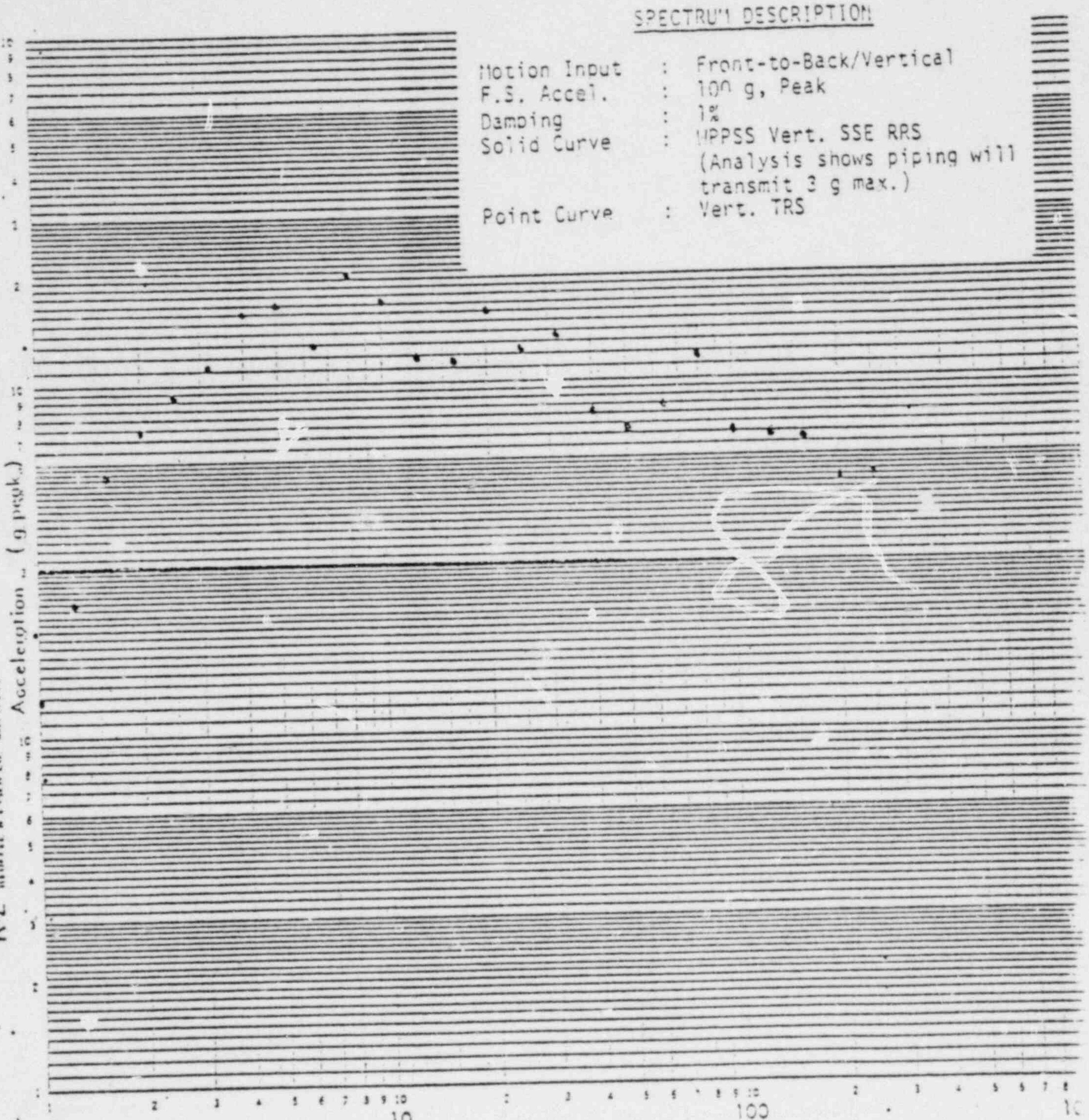
1. P-H, Parker Hannifin.
2. T-R, Teledyne Republic.
3. Component of the same generic design as that of the prototype.

Table 2

Qualified Parameters

NORMAL CONDITION	WPPSS 1 & 4 MSIV & FWIV APPLICATIONS	A/DV PROTOTYPE HYDRAULIC ACTUATOR	POWER CABLE	TERMINAL BLOCKS	TERMINAL LUGS	INSTRUMENTATION CABLE	LIMIT SWITCHES
Temperature	55°- 90°F	93.6°F	90°C (194°F)	92.5°F	90°F	77°C (171°F)	
Pressure	Atm.	Atm.	-	-	-	-	-
Humidity	40% - 60%	90%	-	-	-	-	-
Radiation	70 Rads	2.5 MRad	200 MRad	250 MRad	200 MRad	200 MRad	204 MRad
ABNORMAL CONDITION							
Temperature	420°F	450°F	385°F (1)	420°F (5)	350°F (2)	340°F (2)	340°F (4)
Pressure	1.6 psig	Atm.	60 psig	57.5 psig	122 psig	105 psig	70 psig
Humidity	100%	100%	100%	100%	100%	100%	100%
DBE (Seismic)		Wyle Report 43847-2 Sec. 10	Not req'd per IEEE383-74	Not req'd per IEEE383-74	Not req'd per IEEE383-74	Not req'd per IEEE383-74	Acme-Cleveland Development Report
DBE (MSLB)		Wyle Report 43847-2 Sec. 12	Ref. FIRL Rpt. No. FC4771 Attach. 4-1 Figure #2	Ref. Conax Rpt. No. LPS-107 Pages 10-12 Figure #3	Ref. AMP Rpt. No. GPR-575-98 Page 3 Figure #4	Ref. FIRL Rpt. No. F-C3683 Page 3-4 Figure #5	Acme-Cleveland Development Report

(1) Extrapolation of the Arrhenius Data indicates that failure would occur after 4 hours at 420°F.
(2) Extrapolation of the Arrhenius Data indicates that failure would occur after 200,000 hours at 420°F.
(3) Extrapolation of the Arrhenius Data indicates that failure would occur after 3 hours at 420°F.
(4) An unaged Namco Limit Switch was used during the prototype actuator DBE Test.
(5) Supplemental analysis on material provided (polysulfone thermoplastic).



Comparison of the WPPSS Vertical SSE RRS to the Vertical TRS of the Self-Contained Hydraulic Actuator

Figure 3

CLASS 1E
VENDOR EQUIPMENT QUALIFICATION PROGRAM
SUMMARY

I. Equipment Identification

Type:	Type 23, Series Nuclear Limit Switch
Manufacturer:	NAMCO Controls
Model No.:	EA 180-31302 and EA 180-32302

II. Equipment Classification

Safety Function: Provide control and position indication for the main steam and main feedwater isolation systems.

DBA Exposure: The valve actuators are subject to MSLB outside of containment environment.

Time to Fulfill Safety Function: See Main Steam and Feedwater Isolation Valve Actuator Summary, 1/4-87-OS-1.

III. Equipment Description

The equipment is a snap-lock position, limit switch.

IV. Qualification Environment

Normal & Abnormal: Same as Main Steam and Feedwater Isolation Valve Actuator Summary.

Accident (MSLB): Same as Main Steam and Feedwater Isolation Valve Actuator Summary.

DBA: Exposure Operating Basis Earthquake (OBE) and Safe Shutdown Earthquake (SSE).

V. Summary of Qualification Plan

The plan objective is to satisfy the criteria presented in IEEE 323-1974 for the WNP-1/4 MSIV specifications.

A. Aging:

Thermal & Radiation: The switch will be heat aged and irradiated to a level of 204 Mrads gamma radiation from a Cobalt-60 source at 1.25 Mev and carried out at a rate of one Mrad per hour.

Vibration:	Enveloped by the operational tests below and the seismic tests in forthcoming Paragraph V-B.
Operational:	The switch will be subjected to 100,000 actuation cycles in order to simulate the normal switching.
Humidity:	The thermal aging test will be conducted in a humid environment.
Other:	None

B. Seismic: A single axis seismic test will be performed on the sample in each of three axes and the switch to be monitored electrically during the test. Biaxial testing will not be conducted since analysis indicates negligible cross-coupling.

C. DBA: LOCA: The temperatures and pressures used to do a LOCA test are presented in Figure 6. During the test, a caustic spray will be continuously recycled over the test sample.

DBA: MSLB: A separate test will not be conducted to simulate MSLB for the LOCA test mentioned above demonstrates the adequacy of this switch to meet MSLB requirements. Calculations supporting this arugement are forthcoming.

D. Other: None.

VI. Summary of Test Results

The switch performed satisfactorily as it maintained all required performance characteristics during all parts of the tests. The switch performed it's safety function during postulated normal/abnormal and accident conditions.

A. Aging:

Thermal & Radiation:	Arrhenius methods were used to provide a basis for the thermal aging of this component. A life of 7 years in the maximum normal temperature of 85°F was established by artificially aging the switch assembly at 200°F for 200 hours. The switch was irradiated to an integrated total dose of 204 Mrads gamma radiation from a Cobalt-60 source.
Vibration:	Enveloped by the Operational tests below and the seismic test results in Paragraph VI-B.

Operational: The switch was subjected to 100,000 actuation cycles in order to simulate switching functions of the unit. The actuation was accomplished by a cam mechanism operating at 70 actuations per minute. The electrical loading during this part of the test was 500 milliamps at 100 volts DC. This simulated mechanical and electrical aging of the unit.

Humidity: See Themal Aging for Humidity considerations.

Other: None.

B. Seismic: Shaker table testing was conducted on the limit switch and single axis tests performed in each of three axes. The test spectrum consisted of a range of input motion from 1 to 35 Hz in 1/2 octive intervals maintained at an acceleration of 9.52g. A cross-coupling analysis was conducted on the components which determined that the cross-coupling is not limiting in the unit, and therefore, single axis vibration testing was considered acceptable. Vibrational aging to simulate in service condition was performed at 100Hz, 1.3g's, and for 10^8 cycles. Electrical load was applied during these vibrations. The performance of all the switches except #61 was monitored for contact chatter greater than 2 milliseconds. None was observed.

The 9.52g test acceleration seismically qualifies the limit switch to its 40 year service life because of the substation margin over the 3g limitation on its associated valve actuator (see Paragraph VI-G of report 1/4-87-QS-1).

C. DBA: LOCA: The temperature and pressure profile for the design basis accident exposure used in the tests is provided in Figure 4. Switch #61 was mounted in a test chamber and held at the specified temperature and pressure (Attachment 1).

The switch was subjected to a caustic spray composed of boric acid, water, sodium thoiosulfate and sodium hydroxide, and was recycled during the entire time. Spraying was initiated following the second transient temperature rise. The flow rate of the spray was 0.015 gallons per minute per square foot. The pH of the spray was maintained between 10 and 11.

The switch was transferred from the high to a low pressure chamber following the first of four days of the LOCA test. It remained in the low pressure chamber for the rest of the 30-day test period.

MSLB: The test profile used during this generic program is that of a LOCA condition with caustic spray and is conservative with respect to the SLB requirements in all parameters except temperature. During the actuation test (see Reference 1) a non-thermally aged EA-180 limit switch was used which experienced a 450F temperature peak. This switch was mechanically and seismically tested during the mechanical aging and seismic test portion of the actuator program. These additional tests coupled with the generic test program above demonstrate the adequacy of the NAMCO limit switch EA-180 series for this application.

D. Other: Contact resistance was measured on the switch. In all phases of the test, the open circuit contact resistance of the switch remained above 50 kohms.

The closed circuit current remained within two milliamps of the baseline closed circuit current. During seismic testing, the trip point (with 2-inch arm) varied by 0.060 inches or less for all units seismically tested.

VII. Attachments

1. Figure 4 - Test Chamber Temperature Profile for Accident Environment Simulation - NAMCO Limit Switches (E-180).
2. Accident Temperature Profile, MSLB Requirements (to be provided later).

VIII. References

1. Qualification of NAMCO Controls Limit Switch to IEEE Standards 344-1975, 323-1974, and 382-1972, Rev. 1, NAMCO Controls Company, Acme Cleveland Development Company.

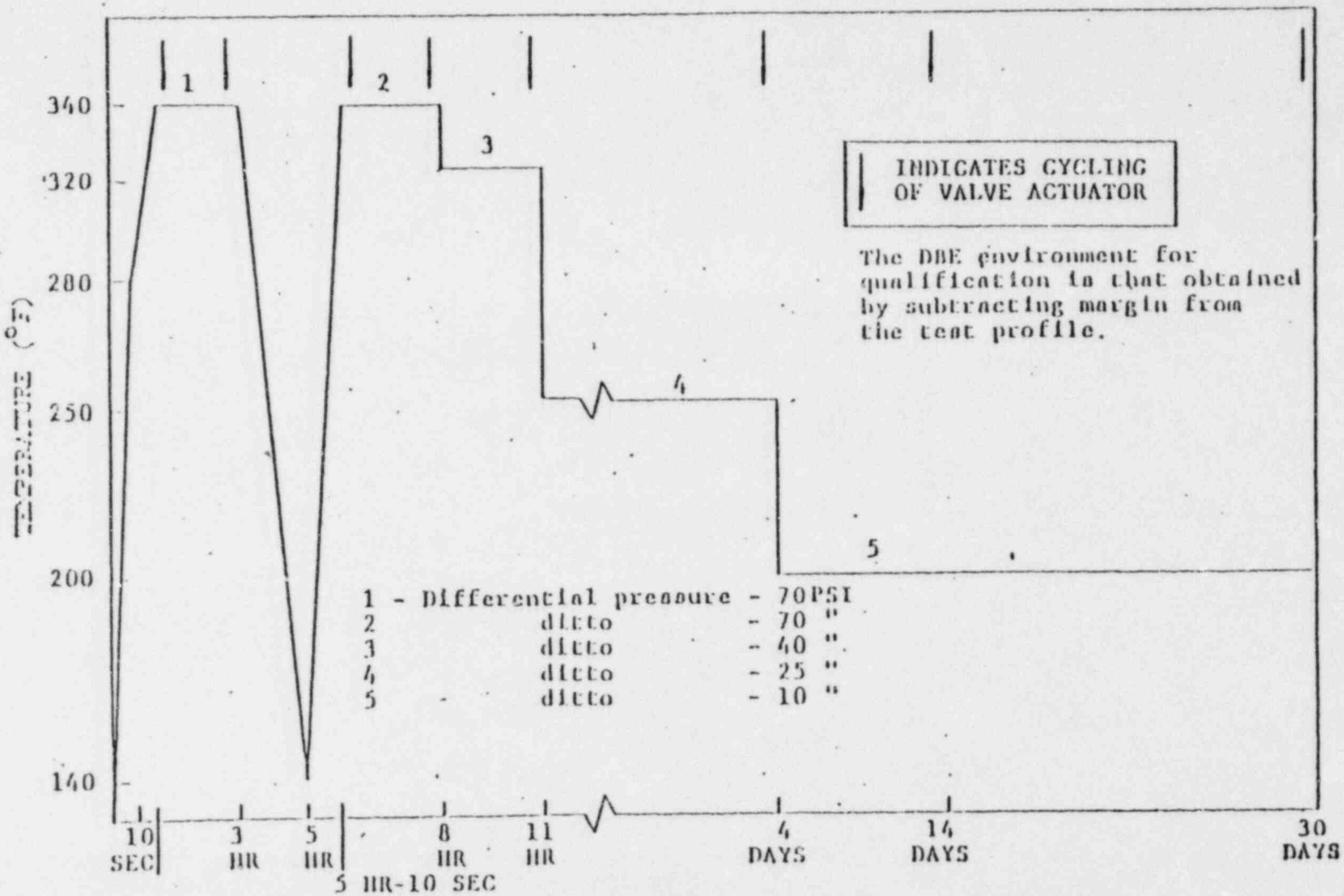


Fig 4
Test Chamber Temperature Profile for Accident Environment Simulation

Namco Limit Switches (E-180)

174-87-QS-1A

CLASS 1E
VENDOR EQUIPMENT QUALIFICATION PROGRAM
SUMMARY

I. Equipment Identification

Type:	2 Conductor, 14 AWG, 19 Strand, 600 V Rated Control Cable
Manufacturer:	Brand Rex Company
Model No.:	Model - ULTROL

II. Equipment Classification

Safety Function:	Transmit power to solenoid valves and limit switches on the main steam and main feedwater valves.
DBA Exposure:	The valve actuators are subject to MSLB outside of containment environment.
Time to Fulfill Safety Function:	See Main Steam and Feedwater Isolation Valve actuator summary, 1/4-87-QS-1.

III. Equipment Description

The equipment consists of two (2) cross-linked, polyethylene control cables; one to supply power to the solenoid valves and another to wire limit switches to terminal box. Internal electrical conduit is provided for cable protection.

IV. Qualification Environment

Normal Abnormal:	Same as Main Steam and Feedwater Isolation Valve actuator summary report.
DBE: Seismic:	Same as Main Steam and Feedwater Isolation Valve actuator summary report.

V. Summary of Qualification Plan

The objective of this plan is to qualify this equipment cabling to satisfy the criteria of IEEE 383-1974 in the WNP-1/4 specified environments.

A. Aging:

Thermal & Radiation:	Arrhenius methods were used to demonstrate a qualified life of greater than 40-years in an ambient temperature of 85.5°F.

B. Seismic: Seismic testing of the wire and interface configuration was demonstrated by the Main Steam and Feedwater Isolation Valve Summary Report, and is not repeated in this test.

C. DBA: LOCA: The test will be in accordance with the procedures recommended in IEEE std. 383-1974. The cables shall be exposed to a steam/chemical spray environment throughout the 30 days of the test.

D. Other: Mandrel bend and high-potential withstand tests will be conducted.

VI. Summary of Test Results

The results of the tests show the cable will perform satisfactorily under the conditions of Part IV of this report.

A. Aging:

Thermal & Radiation: Representative cables of the one used in production were selected for testing in accordance with Table 1 of IEEE-383-1974.

The cables were thermally aged to an equivalent 40-year life by exposure to 277F (136C) temperature for 468 hours. The cables were exposed to 200 megarads of gamma radiation using a cobalt-60 source. The cables were rotated to give a uniform radiation exposure. There were no visible changes that would affect performance in meeting all requirements.

Vibration: Not applicable, see Section V-A, B.

Operational: The cables performed their required electrical function both during and following the aging and LOCA tests.

Humidity: The LOCA test (described below) successfully subjected the cables to an intense steam/chemical spray.

B. Seismic: Not applicable, see Section V-A, B.

C. DBA: LOCA:

The LOCA test temperature/pressure profile to which the cables were exposed is illustrated in Attachment 1. The cables were exposed to a steam/chemical spray environment thoughout the 30 days of the test. The cables were sprayed continuously with a chemical solution consisting of H_3BO_3 (3000 parts per million boron) buffered with sodium hydroxide to a PH of between 10.C and 10.5 at room temperature (75-80F).

Extrapolation of Arrhenius data for the insulation material shows that the cable could survive for several hours prior to failure at 420F. The enclosure on the cable coupled with Arrenius extrapolation demonstrate the adequacy of the cable of the thermal conditions in this application.

The peak test temperature was 346F and it was held for two hours while the required peak exists only for a short period. This approach is further justified due to the fact that the humidity and pressure levels greatly exceed the requirement and the electrical cable is contained in metalic conduit and will not experience the full level temperature excursion.

MSLB:

Aged and irradiated cables were also exposed to a superheated steam blast (autocalve temperature rose to 370F within 10 seconds) and 370F was held for two minutes then lowered to 350F and held for another 8 minutes. At this time the cable was cooled to 302F by a chemical spray of 6200 ppm boron mixed with 50 ppm Hydrazine and solution pH between 8.6 and 10.0 maintained with trisodium phosphate. The 302 F temperature was held for 10 hours until conclusion of the test. All cables demonstrated satisfactory performance during MSLB test with substantial margins of life remaining.

D. Other:

After the 16-day exposure to the steam/chemical spray, the cables were removed from the test vessel and subjected to final mandrel-bend and high-potential withstand tests. Al cables withstood the mandrel and high-potential test both before and after the steam/ chemical spray tests. There was not evidence to show the cables will not meet or exceed their requirements.

VIII. Attachments

1. Accident Temperature Profile, MSLB requirement (to be furnished later).

2. Figure 7--Actual Temperature/Pressure Profile for Simulation of LOCA for Brand Rex Qualification Report

IX. References

1. Qualification Tests of Class IE Electric Cables in a simulated Steam-Line-Break and Loss of Coolant Accident Environment, Brand-Rex Company, Franklin Institute Research Laboratories Report No. F-C4771.

2. Long-Term Thermal Aging Arrhenius Plot, 40-year Life, Brand-Rex Company.

3. Specification for Ultrol @ Flame-Retardant Utility Station Control Cable, Brand-Rex Company, Report No. BR-8084A, January 1976.

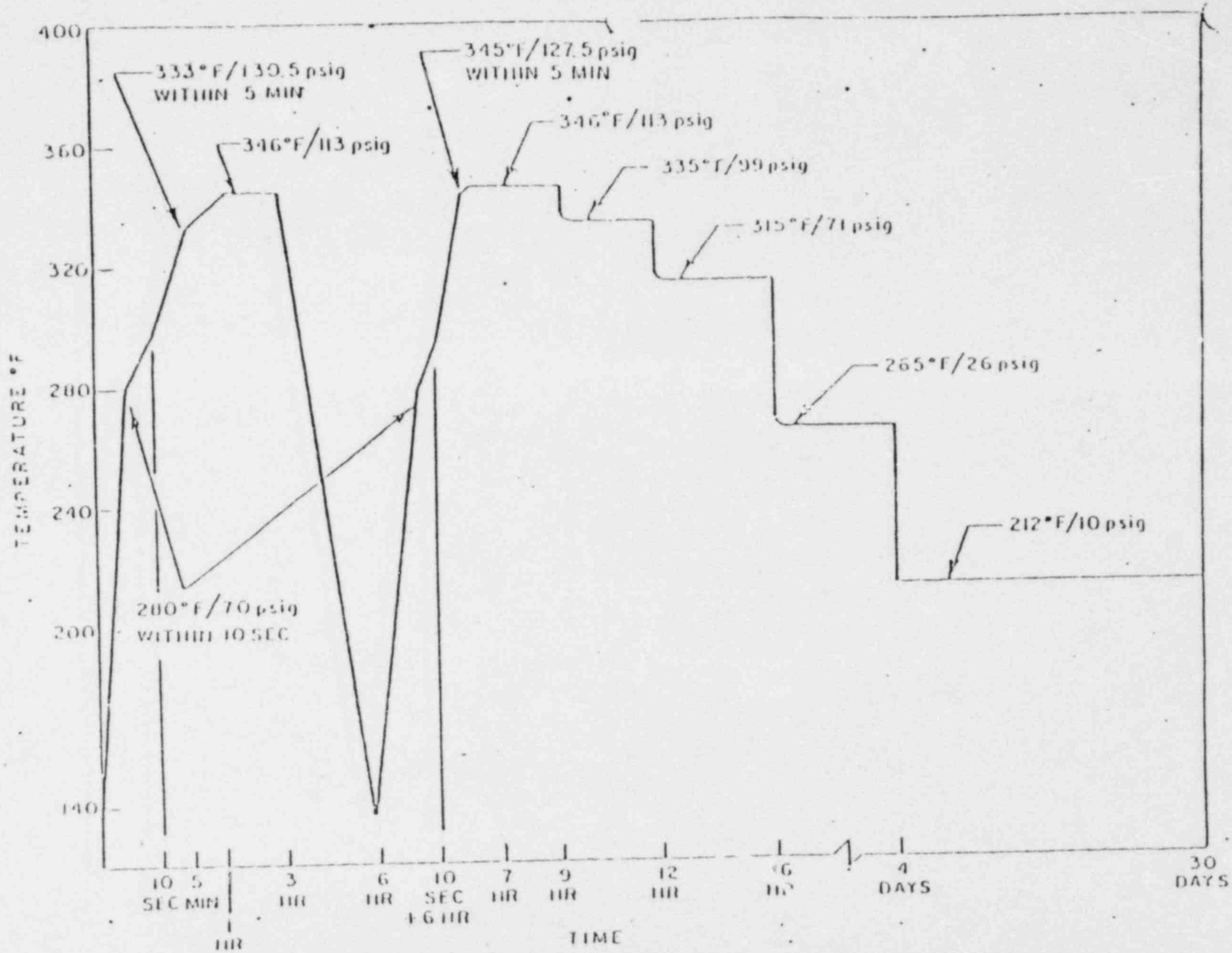


Figure 7 Actual Temperature/Pressure Profile for Simulation of LOCA For Brand Rex Qualification Report

CLASS 1E
VENDOR EQUIPMENT QUALIFICATION PROGRAM
SUMMARY

I. Equipment Identification

Type:	Modular Terminal Block
Manufacturer:	Connectron Inc.
Model No.:	Model No.-2

II. Equipment Classification

Safety Function: The terminal blocks provide the electrical interface and mechanical termination to and from the Main Steam and Main Feedwater Isolation valves. The terminal blocks must remain intact during a DBE to provide physical separation of electrical connections.

DBA Exposure: The terminal blocks are protected by an enclosure from the MSLB conditions.

Time to Fulfill Safety Function: This device must fulfill its safety function within the time and requirements of the system (see Paragraph II of A/DV Actuator Qualification Summary Report 1/4-87-QS-1).

III. Equipment Description

The equipment consists of the NU-2 terminal block. It is rated at 600 volts, 50 amps, will accommodate terminal of wire sizes 16 thru 10 AWG and the insulating material is polysulfone.

IV. Qualification Environment

See Main Steam and Feedwater Isolation Valve Summary Report 1/4-87-QS-1.

V. Summary of Qualification Plan

The NU-2 terminal blocks are qualified by a type-test performed on similar terminal blocks: Connectron, Inc., Model No. NSS3 with the same material (thermal plastic molded polysulfone).

A. Aging:

Thermal & Radiation: The activation energy (2.53 eV) of polysulfone material is of such magnitude to preclude the need for thermal aging. However, the terminal block will be both thermally and radiation aged prior to DBE testing.

Vibration: The Main Steam and Feedwater Isolation Valve Summary Report, 1/4-87-QS-1, demonstrated the ability to withstand self-induced vibration effects on the wiring and interface components. The testing is not repeated here.

Operational: Same as Vibration, above.

Other: Functional testing will be done by energizing the terminal blocks to verify their electrical integrity following the above aging tests.

B. Seismic: Same as Vibration, above.

C. DBE: LOCA: The LOCA test will be conducted using the thermally and irradiation aged terminal blocks mounted in terminal boxes. The terminal blocks will be energized during the LOCA test. See Figure 8.

MSLB: A report by Union Carbide (Reference 2) indicates that the half-life of polysulfone material at $410 \pm 36^{\circ}F$ is a matter of days. Main steam line break environments exist only a matter of minutes. Therefore, there is no doubt of this material's ability to survive the MSLB environment in a $420^{\circ}F$ environment for 1-2 minutes. No testing is necessary.

D. Other: High-potential withstand tests will be conducted. Flashover tests will be conducted on adjacent terminals of the terminal blocks during the test. Insulation resistance, dielectric strength and continuity tests will also be performed during the type-test.

VI. Summary of Test Results

The objective of this testing was to satisfy the criteria of IEEE 323-1974 for WNP-1/4 plant specifications.

A. Aging:

Thermal & Radiation: The terminal blocks were aged to an accelerated life by exposure to a temperature of 300F(146C) for a period of 74 hours. Arrhenius data indicates this is equivalent to 6.1×10^{9} years in an ambient temperature of $85.5^{\circ}F$.

An integrated dosage of 25 Mrads gamma radiation was imposed on the blocks. No noticeable effect was detected after the irradiation.

Vibration: See Section V-A, above.

Other: Functional testing by energizing the terminal blocks verified their electrical integrity following the above aging tests.

B. Seismic: See Section V-B, above.

C. DBA: LOCA/MSLB: The aged and irradiated terminal blocks were mounted in terminal boxes and exposed to LOCA tests consisting of the temperature and pressure profile described in Figure 8.

Based on the test results presented in Reference 2, the LOCA temperatures used are justified. The half life of the material at 420F(216C) is a matter of days. However, the specified abnormal condition is anticipated to last only a matter of minutes. Insulation resistance measurements before and during the LOCA tests indicate the terminal blocks will meet and exceed requirements.

D. Other: The prototype test terminal blocks successfully completed the high-pot testing. The high-pot testing was conducted after sequential testing of the blocks by exposing them to aging, radiation, and to LOCA conditions. The terminal blocks are considered qualified to perform their safety function under the conditions they will experience in the WNP plants. Also, there were no indications of any flashover.

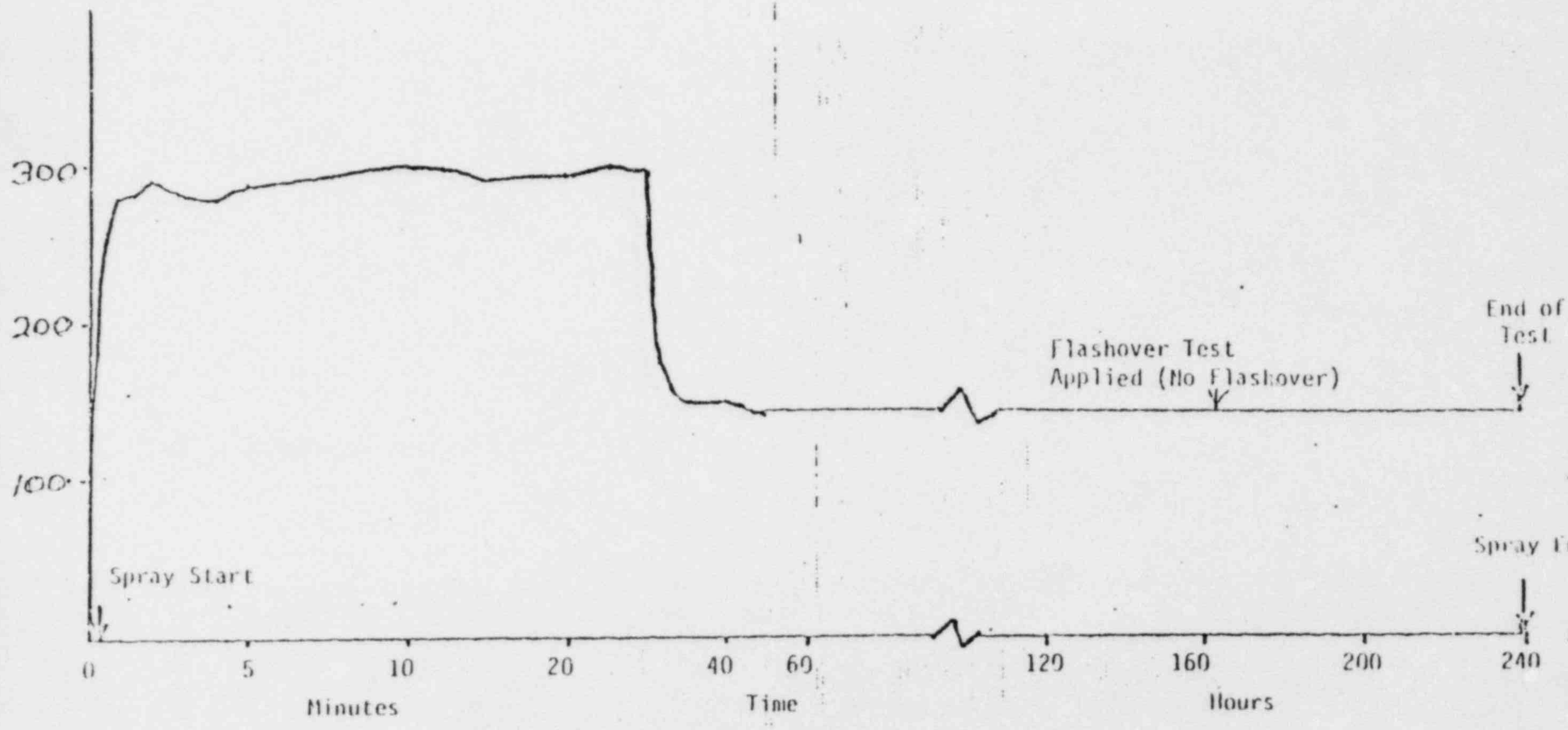
VII. Attachments

1. Figure 8 - Conax Terminal Blocks NU-2 Accident Temperature Test (Terminals Inside Terminal Box Protected from Direct Spary).

VIII. References

1. Terminal Box Support Seismic Calculations, Anchor/Darling Valve Company, WNP-1/4, Contract 87, T-65.

2. Testing for Thermal Endurance: A case History Based on Polysulfone Thermal Plastic, paper presented by T.E. Bugel, Union Carbide Corporation.



1/4-87-QS-1C

Figure 8
Conax Terminal Blocks NU-2 Accident Temperature Test
(Terminals Inside Terminal Box Protected From Direct Spray)

CLASS 1E
VENDOR EQUIPMENT QUALIFICATION PROGRAM
SUMMARY

AMP, Inc., PIDG High Temperature Terminal Lug:

The terminal lugs of this qualification program are only subject to an "outside containment" environment. The qualification of this equipment covered for the penetrations, under Contract 55, and reference is made to that summary report, 1/4-55-QS-1A.

CLASS 1E
VENDOR EQUIPMENT QUALIFICATION PROGRAM
SUMMARY

I. Equipment Identification

Type:	5kV Power Cables
Manufacturer:	Okonite Company
Model No.:	Okonite Insulated Cable (Flame Retardant)

II. Equipment Classification

Safety Function: Safety function of these cables is to carry rated voltage and current.

DBA Exposure: This cable is used in many areas of the plant. It could be exposed to HELB outside containment. There are no applications of this cable inside containment on safety related equipment.

Time to Fulfill Safety Function: This cable is a component of various systems and has a time requirement imposed on it by these systems.

III. Equipment Description

5000 volt single conductor power cable insulated with Okoguard (Flame Retardant - EP) overlayed with shielding tape and Okolon jacket.

IV. Qualification Environment

Normal:	Temperature:	104F(40C)
	Humidity:	60% Maximum
	Radiation:	10 rads/year
Abnormal:	Temperature:	-11F(-24C) to 131F(55C)
	Humidity:	5% to 100%
	Radiation:	10 rads/year

Accident: HELB: The profiles for ex-containment high-energy-line-break events are currently under preparation. However, it is not anticipated that these profiles will approach the severity of the in-containment accident conditions postulated for WNP-1/4, or the DBA environments that were performed during the qualification testing.

V. Summary of the Qualification Plan

The objective is to satisfy the requirements of IEEE 383-1974 for the WNP-1/4 plant specifications.

A. Aging:

Thermal: Develop an Arrhenius plot by linear regression analysis of test data and determine a time and temperature for acceleration aging of the cable to a 40 year life at 90C through extrapolation of that plot.

Radiation: Samples to be exposed to a cummulative dose of 2 x 10^8 rads from a Cobalt-60 source.

Vibration: Self-induced vibration and vibration from nearby equipment is not a factor in contributing to the aging of this equipment. Therefore, vibration aging is omitted from the qualification testing.

Operational: Normal operation produces heating effects, which are incorporated in the thermal aging portion of this program.

B. Seismic: The cabling is arranged and restrained raceways and trays. This equipment is analysed for seismic effects, which precludes the need for seismic testing of individual cables.

C. DBA: Although not required, the plan included exposure to LOCA, see Figure 1.

D. Other: Flammability: IEEE-Std-393-1974, Par. 2.5 except that burner is set at 210,000 BTU/hour.

VI. Summary of Test Results

The analyses and test results demonstrate that this cable will perform its safety function under more severe environments than are anticipated by the ex-containment requirements listed in Part II of this summary report.

Aging:

Thermal: Insulation samples were aged at various temperatures for the times needed to reduce to 40% retention of elongation. From this data an Arrhenius curve was developed by regression analysis for a 40 year life which is higher than 90C. To verify the curve, samples of jacketed cables were aged to three points on it and the retention of elongation of the insulation was measured. The results showed 60 to 90% retention of elongation, a considerable margin. Also, the samples have operational experience correlation using data from cables installed in an actual fossil power plant.

The flame test was not conducted on samples containing splices. However, an analysis was conducted to show that the heat producing material being added by the Raychem splice was only 5.1% of the total heat available and was therefore not significant. See Reference 1.

VII. Modification to Equipment

None

VIII. Attachments

Figure 1

IX. References

1. Nuclear Qualification Report, Supply System 1178-1 for Okonite Okoguard Insulated Cable 5 and 15kV. WNP-1/4, Contract 104, C-5C.

2. Trip Report by P. F. Milliken, dated 8-22-79, "Observe Flame Testing of 600 Volt Control Cables and 5kV Power Cables".

3. Okonite IOC dated 8-20-79, "Flame Testing After Aging", T-24.

4. Okonite IOC (undated), "Flame Tests on Cables with Raychem Splices and Terminations", T-5D.

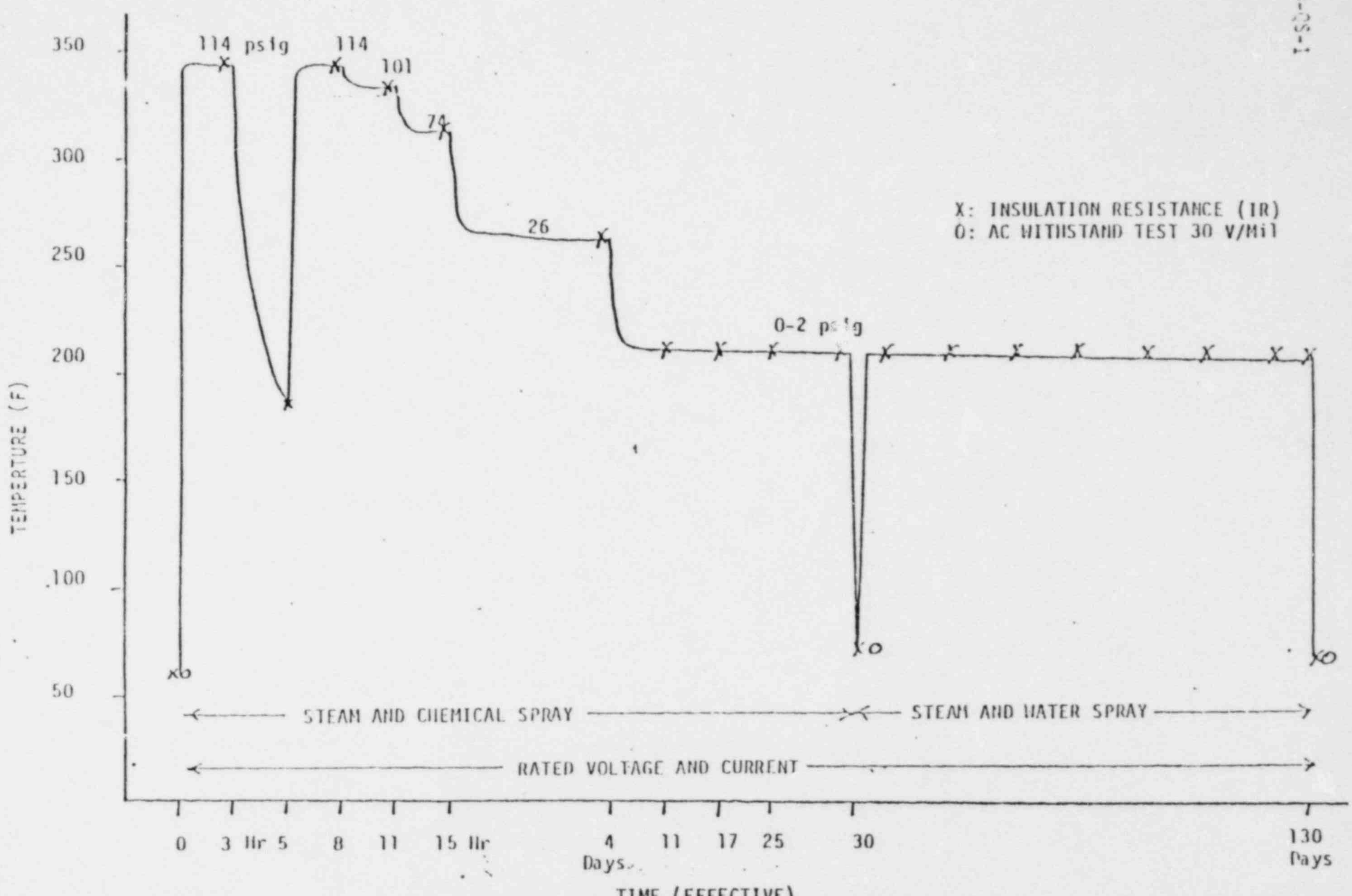


Figure 1 - Test Profile Okonite 5kv Cable

APPENDIX B

WNP-1/4

INSTRUMENTATION/ELECTRICAL EQUIPMENT LIST

DESCRIPTION OF THE FIELDS OF THE SAMPLE CLASS 1E INSTRUMENTATION AND ELECTRICAL EQUIPMENT LIST

The Class 1E sample list contains information on the various types of equipment supplied as balance of plant equipment for the 1/4 Project. An identical format will be used on the 3/5 Project. The following items are definitions of the fields.

Field/Name (Alpha-Numeric Field Length)	Definition
Equipment Number (24 CH.)	Equipment identification code that uniquely identifies each piece of equipment by system, component or detailed designation within the component type.
Project (2 CH.)	The project for which the equipment is used.
Description Code (3 CH.)	A type of equipment classification such as RLY/001 (e.g., RLY for relay, 001 for detailed designation within the component type).
Composite Equipment Number (25 CH.)	The equipment piece number for which this component is a part.
Life (4 CH.)	The qualified life of this equipment in years.
Hours to Operate (8 CH.)	The hours required to operate in an accident environment.
Document Location (20 CH.)	This field indicates, for a major equipment type, where the summary report for that equipment is located. Detailed documentation, such as test reports, are referenced by the summary reports. For individual components, the detailed test report is referenced.

Field/Name	Definition
Safety Function (30 CH.)	This field provides the function that the equipment is required to perform during postulated DBE.
Manufacturer's Reference Number (4 CH.)	A code number which identifies the manufacturer of the component as defined in the Reporting Procedures Manual for the Nuclear Plant Reliability Data System, Southwest Research Institute, Table 9.
Manufacturer's Model Number (20 CH.)	The manufacturer's unique number which provides a means to identify the component.
Quantity (3 CH.)	The number of the same items associated with a major piece of equipment (e.g., relays assigned to a MCC cabinet).
Location (20 CH.) - Building (1 CH.) - Elevation (3 CH.) - Detail (13 CH.) - Zone (3 CH.)	Location of a component given by 1) code to identify the building in which the component is located, 2) the elevation of the component above sea level, 3) building coordinates or containment AZIMUTH of the component, and 4) the zone assigned to distinguish the area in the plant where the component is located.
Description (50 CH.)	The identifier which provides information regarding the component or equipment name.
Use (2 CH.)	Contains codes which describe equipment use during accident conditions and/or normal plant shutdown.

A code number identification has been used for the Seismic Qualification, Use and Environmental Qualification fields. The codes described in the following sections are used.

SEISMIC QUALIFICATION INPUT FIELDS
WNP-1/4 AND WNP-3/5 CLASS 1E LIST

Seismic Qualification Test Analysis

S E I S M I C	Q U A L I F I C A T I O N		
TEST	ANAL	F/O	COMP
X X X	X X	X X	X

The Seismic Qualification Input Fields are to be arranged as indicated above. There are six fields in the layout format arranged into four groups. Each field is a single digit or dual digit, as indicated, numerical code entry. Each field should have sort and call-up capability.

The following describes the individual fields and groups, and provides representative codes with their definition. Additional codes with their definition will be developed as the need is identified.

Standard Input Array and Codes for Seismic Data Input

X X X X X X X X

The Test Group: (3 CH.)

Input motion - such as for Random Motion Multi-frequency a 1 would appear here. (1 CH.)

Code for the number of axes and manner of input motions was simultaneously applied. (1 CH.)

A code for the method of resonance determination is entered here. (1 CH.)

Note: These are three distinct fields and sort capabilities should be provided on each field.

The Analysis Group: (2 CH.)

The code for analysis type is entered here.

The Functional Operability Group: (2 CH.)

The code for type of Spurious Operation is entered here.

The Compliance Group: (1 CH.)

The code for compliance to IEEE-344 is entered here.

Codes for the Method of Resonance Determination:

X X X X X X X

0	Later or not required.
1	Resonance Sweep. A sinusoidal input (sine sweep) with continuously varying frequency is applied. The frequency band covers the range of frequencies from 1 to 33 hertz. This test is used as a resonance search test at low input (.2g-.4g) in support of sine Dwell (XX4) or sine heat (XX5) testing.
2	Resonance Analysis. The resonance of the specimen is determined by analysis. (The specimen is modeled using single degree of freedom oscillators.)

Codes for the Number of Axes and Manner of Seismic Input:

X X X X X X X

0 Later or not required.

1 Single axis input. The input motion is applied to each principle axes independently.

2 Biaxial input. The input motion is applied to two principle axis simultaneously. The time phasing of the input is time-incoherent for Random Motion. For single frequency tests, such as, sine beat, the inputs are applied in-phase and then 180° out-of-phase. For both Random and single frequency biaxial testing, the specimen is rotated 90° and the above procedure repeated.

3 Tri-axial input. The input motion is applied to each principle axes simultaneously.

4 Modified Bi-axial input. The specimen is mounted on the shake table in a fixture that supports the specimen at a 45° incline from the vertical. The input motion is then applied colinear with the specimen mounting. The input amplitude is adjusted by the 2 to account for resultant forces produced in the vertical and one principle horizontal axes. Thus, the time phasing of the input is in-phase for the axis (vertical and one horizontal) tested.

Codes for the Manner of Seismic Input Motion

X X X X X X X

0 Later or not required.

1 Random Motion Multifrequency Test. The amplitude of which is controlled in 1/3 octave or narrower, frequency bandwidth filters with individual output gain controls. Minimum duration of test is 30 seconds.

2 Random Motion Multifrequency with sine beat superimposing. A composite excitation utilizing input motion of 1 with sine beat of (IEEE-344, 1975 6.6.3.4).

3 Complex Wave. Not used (IEEE-344, 1975 6.6.3.5).

4 Continuous Sine Test (Sine Dwell). A continuous sinusoidal test conducted at the resonants frequencies determined from resonance search or analysis or near 33 hertz if no resonances are present between 1 and 33 hertz. Any resonances are widely spaced. (IEEE-344, 1975 6.6.2.2).

Codes for the Manner of Seismic Input Motion (cont)

X X X X X X X X

5	Sine Beat Test. A test consisting of the application of sine beats of peak acceleration corresponding to resonance frequencies of the specimen or near 33 hertz if no resonances are present between 1 and 33 hertz. Any resonances are widely spaced (IEEE-344, 1975 6.6.2.3).
6	Sine Sweep Test. A sinusoidal input with continuously varying frequency is applied the input amplitude is equal to the ZPA of the RRS except at low frequencies where the value of the TRS may follow the RRS. Justification is provided.
7	Both 1 and 5 were performed.
8	Random Motion Multifrequency Test and Sine Beat Test. Both 1 and 2 were performed.
9	Continuous Sine Test (Sine Dwell) Over a Frequency Range. A continuous sinusoidal test conducted in 1/3 octave bands over the frequency range 1 to 35 Hz.

Codes for Analysis Group:

X X X X X X X X

0 0	Later or not required.
0 1	Static analysis is performed by applying the seismic forces through the center of gravity of the specimen in addition to all other applicable loads. A precondition to the use of static analysis is that the specimen must contain no significant resonances below 33 hertz.
0 2	Dynamic Analysis. The specimen is modeled to best represent it's mass distribution and stiffness characteristics. A response spectrum model analysis technique or a time history analysis is used. Results are combined using the square-root of the sum of the square basis except for closely spaced or in-phase models where the absolute value is used.
0 3	Extrapolation. The results of testing on a prototype specimen is analyzed and the results extended to cover a generic line of similar equipment. Where the differences are significant, justification is provided.

CODES FOR FUNCTIONAL OPERABILITY INPUT FIELD

XXX XX XX X

0 Later or not required.

1 Spurious operation that does not effect the operation of the safety function; the devices' capability to perform the safety function is acceptable without modification.

2 Spurious operation; modification to the device was essential to performance of the safety function. The device was found to be acceptable after modification or substitution.

3 Spurious operation; combination of 1 and 2.

4 No occurrance of spurious operation; devices' capability to perform its safety function has been found acceptable during and after qualification test or analysis.

Type of Spurious Operation

XXX XX XX X

0 Later or not required.

1 Contact Chatter

2 Loose parts due to vibration

3 Broken parts due to vibration

4 Failure to operate

Codes for the Compliance Group

TEST	ANL	F/O	C
X X X	X X	X X	X

0 The equipment's seismic qualification is not required.

5 The equipment's seismic qualification complies with IEEE-344, 1975.

"USE" Input Field
1/4 & 3/5 Class 1E List

The "USE" input field is to be arranged as 2, one digit fields. They shall be arranged as shown below. These fields should have sort and call-up capability.

<u>Standard Input Array and Codes for the "USE" Field</u> (2 CH.)

```
X X
| |
| └──────The code for the equipments use during plant shutdown
|        is entered here.
|
└────────The code for the equipment use during accident conditions
         is entered here.
```

<u>Codes for the Equipment "USE" During a Design Basis Accident & Normal Plant Shutdown</u>

<u>USE</u>

X X

0 The equipment is not required before, during, or after an accident.

1 Equipment that will experience the environmental conditions of design basis accidents for which it must function to mitigate said accidents, and that will be qualified to demonstrate operability in the accident environment for the time required for accident mitigation with safety margin to failure. (See Hours to Operate)

2 Equipment that will experience environmental conditions of design basis accidents through which it need not function for mitigation of said accidents, but through which it must not fail in a manner detrimental to plant safety or accident mitigation, and that will be qualified to demonstrate the capability to withstand any accident environment for the time during which it must not fail with safety margin to failure.

3 Equipment that will experience environmental conditions of design basis accidents through which it need not function for mitigation of said accidents, and whose failure (in any mode) is deemed not detrimental to plant safety or accident mitigation, and need not be qualified for any accident environment, but will be qualified for its non-accident service environment.

4 Equipment that will not experience environmental conditions of design basis accidents and that will be qualified to demonstrate operability under the expected extremes of its non-accident service environment. This equipment would normally be located outside the reactor containment.

The Code for the Equipments "USE" During Plant Shutdown

X X

0 The equipment is not required to operate to shutdown the plant during normal conditions.

1 The equipment is required to operate for Hot Shutdown only during normal plant conditions.

2 The equipment is required to operate for Cold Shutdown only during normal plant conditions.

3 The equipment is required to operate for both Hot and Cold Shutdown during normal plant conditions.

ENVIRONMENTAL QUALIFICATION INPUT FIELDS & GROUPS
1/4 & 3/5 CLASS 1E LIST

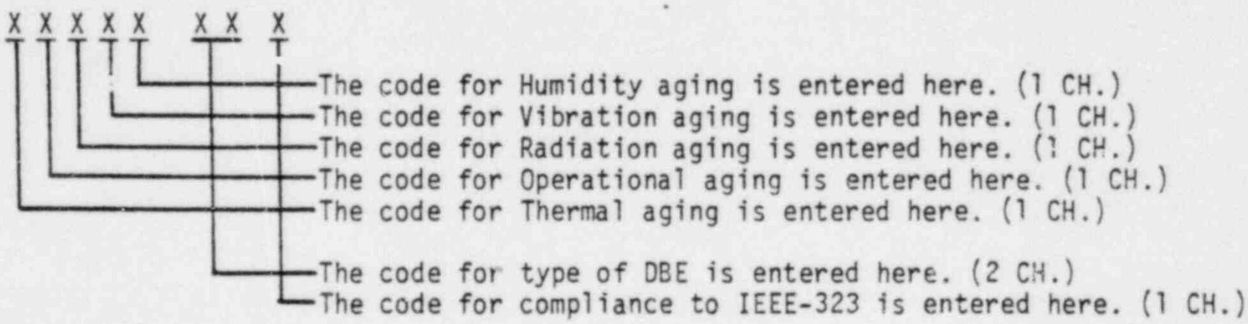
The data provided in the attached sheets give the detailed description and definition of the fields and groupings of the Environmental Qualification for the 1/4 and 3/5 Class 1E List.

There are 7 fields contained in 3 groups. Each field is a single digit numerical entry for the Aging and Compliance Group and a double digit entry for the DBE Group and should have sort and call-up capability. The output layout is as follows:

```
E N V I R O N  Q U A L
A G E I N G  D B E  C O M P
X X X X X X  X X X       X
```

Standard Input Array and Codes for Environmental Qualification Data Input

The Aging Group (8 CH.)



General Codes for the Aging Group

X X X X X   X X   X

0	Later or not required.
1	Aging by this parameter has been addressed by inclusion in the type test. (IEEE-323, 1974 5.1)
2	Aging by the parameter has been addressed by Operating Experience. (IEEE-323 5.2)
3	Aging by the parameter has been addressed by Analysis. (IEEE-323, 1974 5.2)
4	Aging by this parameter was addressed by a combination of 1 and 2, (IEEE-323, 1975 5.4)
5	Aging by this parameter was addressed by a combination of 1 and 3, (IEEE-323, 1975 5.4)
6	Aging by this parameter was addressed by a combination of 2 and 3, (IEEE-323, 1975 5.4)
7	Aging by this parameter is being addressed by a program of on-going testing. (IEEE-323, 1975 5.5)
8	Aging by the parameter has been included in the DBE.
9	Aging by the parameter has been considered. It has been determined that either this parameter will have no affect on the speciman to perform its safety function or that due to the specimans mounting location in the plant this parameter is of benign nature.

The Codes for the DBE Simulation Test

X X X X X   X X   X

0 0	Later or not required.
0 1	LOCA test simulation. The speciman in its aged condition (including accident radiation) is subjected to the profile of pressure, temperature, and spray expected during a Loss of Coolant Accident as defined in Chapter 15 (FSAR).
0 2	LOCA test simulation. The specim[illegible] in its aged condition is subjected to the simultaneous exposure of Accident radiation, temperature, pressure and spray expected during a Loss of Coolant Accident as defined in Chapter 15.

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CONTRACT	EQUIPMENT NUMBER DESCRIPTION SAFETY FUNCTION	COMPOSITE EQUIP NO MFG LIFE	MFG MODEL NUMBER HRS OPR	USE	QTY	BLDG ELEV ZONE LOC. DETAIL DOCUMENT LOCATION	SEISMIC TEST FO	ENVIRN ANL C	AGING DBE	C
55	APN-EPA-HJ2 RTD's & Instrum Thermocouple Elec Pent Asly Provide Cont Isolation	APN-EPA-HJ2 W120 40	 WX-33125 2400	43	1	R 440 1B 221 DEG 1/4-55-QS-1	121 40	00 5	19199 07	 4
55	APN-EPA-HJ3 General Use Low & Medium Power AC EPA Provide Cont Isolation	APN-EPA-HJ3 W120 40	 WX-33121 2400	43	1	R 448 1B 212 DEG 1/4-55-QS-1	121 40	00 5	19199 07	 4
55	APN-EPA-HJ4 General Use Low & Medium Power AC EPA Provide Cont Isolation	APN-EPA-HJ4 W120 40	 WX-33121 2400	43	1	R 471 3C 152 DEG 1/4-55-QS-1	121 40	00 5	19199 07	 4
55	APN-EPA-HJ5 General Use Heavy Power AC Elec Pent Assembly Provide Cont Isolation	APN-EPA-HJ5 W120 40	 WX-33122 2400	43	1	R 467 3C 144 DEG 1/4-55-QS-1	121 40	00 5	19199 07	 4
55	APN-EPA-HJ6 General Use Heavy Power AC Elec Pent Assembly Provide Cont Isolation	APN-EPA-HJ6 W120 40	 WX-33122 2400	43	1	R 471 3C 147 DEG 1/4-55-QS-1	121 40	00 5	19199 07	 4
55	APN-EPA-HJ7 General Use Control Power AC & DC EPA Provide Cont Isolation	APN-EPA-HJ7 W120 40	 WX-33120 2400	43	1	R 467 3C 152 DEG 1/4-55-QS-1	121 40	00 5	19199 07	 4

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CONTRACT	EQUIPMENT NUMBER DESCRIPTION SAFETY FUNCTION	COMPOSITE EQUIP NO MFG LIFE	MFG MODEL NUMBER HRS OPR	USE	QTY	BLDG LOC. DETAIL DOCUMENT LOCATION	ELEV	ZONE	SEISMIC TEST FO	ENVIRN ANL C	AGING DBE	C
22	CFC-FAN-17A	CFC-FAN-17A				R	435	3B	2##	01	00000	
	Vaneaxial Fan	B515	24D65 Tube Axial			Column 9			##	5	00	0
	H2 Pocket IMS Vent	40	2400	23	1	1/4-22-QS-1						
22	CFC-FAN-17B	CFC-FAN-17B				B	435	3B	2##	01	00000	
	Vaneaxial Fan	B515	24D65 Tube Axial			Column 8			##	5	00	0
	H2 Pocket IMS Vent	40	2400	23	1	1/4-22-QS-1						
22	CFC-FAN-18A	CFC-FAN-18A				R	405	4A	2##	01	00000	
	Vaneaxial Fan	B515	24D65 Tube Axial			Column 1			##	5	00	0
	H2 Pocket LCC Vent	40	2400	23	1	1/4-22-QS-1						
	Fan/Train A											
22	CFC-FAN-18B	CFC-FAN-18B				R	405	4A	2##	01	00000	
	Vaneaxial Fan	B515	24D65			Column 1			##	5	00	0
	H2 Pocket LCC	40	2400	23	1	1/4-22-QS-1						
	Vent Fan/Train B											
22	HCA-FAN-2A	HCA-ACT-1A				G	479	19E	2##	01	00000	
	Centrifugal Fan	B515	980 BLD			H-3			##	0	00	0
	RTRN Air FN for MK-UP	40	696	43	1							
	PMP Area											
22	HCA-FAN-2B	HCA-ACT-1B				G	455	19E	2##	01	00000	
	Centrifugal Fan	B515	980 BLD			H-3			##	0	00	0
	RTRN Air FN for MK-UP	40	696	43	1							

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CONTRACT	EQUIPMENT NUMBER DESCRIPTION SAFETY FUNCTION	COMPOSITE EQUIP NO MFG MFG MODEL NUMBER LIFE HRS OPR USE QTY	BLDG ELEV ZONE LOC. DETAIL DOCUMENT LOCATION	SEISMIC ENVIRN TEST ANL AGING FO C DBE C
22	HCL-FAN-1A Centrifugal Fan Air Mover For MK-UP	HCL-AHU-1A B515 600 HVM BIG BUFFALO 40 696 43 1	G 479 19E G4	2## 01 00000 ## 0 00 0
22	HCL-FAN-1B Centrifugal Fan Air Mover for Control Room	HCL-AHU-1B B515 360 PCMW BIG BUFFALO 40 # 43 1	G 399 30A C-3	2## 01 00000 ## 0 00 0
22	HCL-FAN-3A Vaneaxial Fan RTRN Air Fan for Control Room	HCL-FAN-3A B515 33A9 Adjustax 40 # 43 1	G 462 30D D-2	2## 01 00000 ## 0 00 0
22	HCL-FAN-3B Vaneaxial Fan RTRN Air Fan for Control Room	HCL-FAN-3B B515 33A9 Adjustax 40 # 43 1	G 462 30D D-2	2## 01 00000 ## 0 00 0
22	HCL-FAN-4A Vaneaxial Fan Exhaust Fan for Toilet & Kitch	HCL-FAN-4A B515 A 7/15 Axial 40 # 43 1	G 501 11E K-9	2## 01 00000 ## 0 00 0
22	HCL-FAN-4B Vaneaxial Fan Exhaust Fan for Toilet & Kitch	HCL-FAN-4B B515 A 7/15 Axial 40 # 43 1	G 501 11E K-9	2## 01 00000 ## 0 00 0

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CONTRACT	EQUIPMENT NUMBER DESCRIPTION SAFETY FUNCTION	COMPOSITE EQUIP NO MFG LIFE	MFG MODEL NUMBER HRS OPR	USE	QTY	BLDG ELEV ZONE LOC. DETAIL DOCUMENT LOCATION	SEISMIC TEST FO	ENVIRN ANL C	AGING DBE C
22	HCL-FAN-5A Vaneaxial Fan Remt Emrg, Air, Intake E. of RX	HCL-FAN-5A B515 40	29B9 Adjustax #	43	1	Y 479 8 REM AIR INT	2## ##	01 0	00000 00 0
22	HCL-FAN-5B Vaneaxial Fan Remt Emrg, Air Intake E. of RX	HCL-FAN-5B B515 40	29B9 Adjustax #	41	1	Y 479 8 REM AIR INT	2## ##	01 0	00000 00 0
22	HCL-FAN-6A Vaneaxial Fan Remt Emrg, Air Intake S. of RX	HCL-FAN-6A B515 40	29B9 Adjustax #	43	1	Y 479 5 REM AIR INT	2## ##	01 0	00000 00 0
22	HCL-FAN-6B Vaneaxial Fan Remt Emrg, Air Intake S. of RX	HCL-FAN-6B B515 40	29B9 Adjustax #	43	1	Y 479 5 REM AIR INT	2## ##	01 0	00000 00 0
22	HDG-FAN-2A Vaneaxial Fan Air Mover for Diesel Gen. Area	HDG-AHU-1A B515 40	54D9 696	43	1	G 429 20C F-3	200 00	02 0	00000 00 0

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22	HDG-FAN-2B Vaneaxial Fan Air Mover for Diesel Gen. Area	HDG-AHU-1B B515 54D9 40 696	43	1	G 429 19C G-3	200 00	02 0	00000 00	 0
22	HDG-FAN-4A Vaneaxial Fan Emrg, Exhaust Fan Diesel Gen. Area	HDG-FAN-4A B515 48D9 Adjustax 40 696	43	1	G 429 20C E-2	2## ##	01 0	00000 00	 0
22	HDG-FAN-4B Vaneaxial Fan Emrg, Exhaust Fan Diesel Gen. Area	HDG-FAN-4B B515 48C9 Adjustax 40 696	43	1	J-3	2## ##	01 0	00000 00	 0
22	HPT-FAN-1A Centrifugal Fan Air Mover for Elec. & Pipe Tunnel	HPT-AHU-1A B515 480 HVH BIG BUFFALO 40 696	43	1	G 399 30A A-8	2## ##	01 0	00000 00	 0
22	HPT-FAN-1B Centrifugal Fan Air Mover for Elec. & Pipe Tunnel	HPT-AHU-1B B515 480 HVH BIG BUFFALO 40 696	43	1	G 399 30A A-8	200 00	02 0	00000 00	 0

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CONTRACT	EQUIPMENT NUMBER / DESCRIPTION / SAFETY FUNCTION	COMPOSITE EQUIP NO	MFG	MFG MODEL NUMBER	LIFE	HRS OPR	USE	QTY	BLDG	ELEV	ZONE	LOC. DETAIL / DOCUMENT LOCATION	SEISMIC TEST FO	SEISMIC ANL C	ENVIRN AGING	DBE C
22	HPT-FAN-2A Vaneaxial Fan RTRN Air Fan/Elec. & Pipe Tunnel	HPT-FAN-2A	B515	43D9 Adjustax	40	696	43	1	G	399	30A	D-10	2## ##	01 0	00000 00	0
22	HPT-FAN-2B Vaneaxial Fan RTRN Air Fan/Elec. & Pipe Tunnel	HPT-FAN-2B	B515	43D9 Adjustax	40	696	43	1	G	399	30A	D-10	2## ##	01 0	00000 00	0
22	HSC-FAN-1A Vaneaxial Fan Circ. Fan for Switchgear Area	HSC-AHU-1A	B515	960 PCHW BIG BUFFALO	40	#	43	1	G	399	30A	C-3	2## ##	01 0	00000 00	0
22	HSC-FAN-1B Vaneaxial Fan Circ. Fan for Switchgear Area	HSC-AHU-1B	B515	960 PCHW BIG BUFFALO	40	#	43	1	G	399	30A	C-5	2## ##	01 0	00000 00	0
22	HSC-FAN-3A Vaneaxial Fan RTRN Air Fan Switchgear Area	HSC-FAN-3A	B515	54D9 Adjustax	40	#	43	1	G	421	30B	C-4	2## ##	01 0	00000 00	0

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22	HSC-FAN-3B Vaneaxial Fan RTRN Air Fan Switchgear Area	HSC-FAN-3B B515 54D9 Adjustax 40 # 43 1	G 442 30B C-4	2## 01 00000 ## 0 00 0
22	HSC-FAN-4 Propeller Fan Battery Room Exhaust Fan	HSC-FAN-4 B515 28/18 LB BREEZO 40 # 43 1	G 421 30B D-8	2## 01 00000 ## 0 00 0
22	HSC-FAN-5B Propeller Fan Battery Room Exhaust Fan B Train	HSC-FAN-5B B515 28/18 LB BREEZO 40 # 43 1	G 421 30B B-4	2## 01 00000 ## 0 00 0
22	HSC-FAN-6B Propeller Fan Battery Room Exhaust Fan B Train	HSC-FAN-6B B515 28/18 LB BREEZO 40 # 43 1	G 421 30B A-6	2## 01 00000 ## 0 00 0
22	HSC-FAN-7A Propeller Fan Battery Room Exhaust Fan A Train	HSC-FAN-7A B515 28/18 LB BREEZO 40 # 43 1	G 431 30B B-7	2## 01 00000 ## 0 00 0
22	HSC-FAN-8A Propeller Fan Battery Room Exhaust Fan A Train	HSC-FAN-8A B515 28/18 LB BREEZO 40 # 43 1	G 421 30B B-8	2## 01 00000 ## 0 00 0

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CONTRACT	EQUIPMENT NUMBER DESCRIPTION SAFETY FUNCTION	COMPOSITE EQUIP NO MFG MGF MODEL NUMBER LIFE HRS OPR	USE	QTY	BLDG ELEV ZONE LOC. DETAIL DOCUMENT LOCATION	SEISMIC ENVIRN TEST ANL AGING FO C DBE C
22	HSC-FAN-9A Vaneaxial Fan Exhaust Fan Switchgear Area	HSC-FAN-9A B515 22A5 Adjustax 40 #	43	1	G 501 10E H-6	2## 01 00000 ## 0 00 0
22	HSC-FAN-9B Vaneaxial Fan Exhaust Fan Switchgear Area	HSC-FAN-9B B515 22A5 Adjustax 40 #	43	1	G 501 10E H-6	2## 01 00000 ## 0 00 0
22	HSF-FAN-1A Centrifugal Fan Air Mvrs/Spent Fuel Storage	HSF-ACT-1A B515 730 BLD 40 #	43	1	G 519 25D W-9.2	2## 01 00000 ## 0 00 0
22	HSF-FAN-1B Centrifugal Fan Air Mvrs/Spent Fuel Storage	HSF-ACT-1B B515 730 BLD 40 #	43	1	G 519 25D T-9.2	2## 01 00000 ## 0 00 0
22	HSF-FAN-2A Centrifugal Fan Air Mvrs/Spent Fuel Storage	HSF-ACT-2A B515 730 BLD 40 #	43	1	G 519 8E R-9.2	2## 01 00000 ## 0 00 0

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CONTRACT	EQUIPMENT NUMBER DESCRIPTION SAFETY FUNCTION	COMPOSITE EQUIP NO MFG MFG MODEL NUMBER LIFE HRS OPR	USE	QTY	BLDG ELEV ZONE LOC. DETAIL DOCUMENT LOCATION	SEISMIC TEST FO	 ANL C	ENVIRN AGING DBE C
22	HSF-FAN-2B Centrifugal Fan Air Mvrs/Spent Fuel Storage	HSF-ACT-2B B515 730 BLD 40 #	43	1	G 519 8E S-9.2	2## ##	01 0	00000 00 0
22	HSF-FAN-3A Centrifugal Fan Air Movers/Spent Fuel Storage	HSF-AHU-1A B515 805BL 40 #	43	1	G 498 24C U-7.2	2## ##	01 0	00000 00 0
22	HSF-FAN-3B Centrifugal Fan Air Movers/Spent Fuel Storage	HSF-AHU-1B B515 805BL 40 #	43	1	G 479 6C U-7.2	2## ##	01 0	00000 00 0
22	HSF-FAN-4A Centrifugal Fan Air Movers/Spent Fuel Storage	HSF-AHU-2A B515 805BL 40 #	43	1	G 498 6D U-9.2	200 00	02 0	00000 00 0
22	HSF-FAN-4B Centrifugal Fan Air Movers/Spent Fuel Storage	HSF-AHU-2B B515 805BL 40 #	43	1	G 479 6C U-9.2	200 00	02 0	00000 00 0
22	HSG-FAN-1A Centrifugal Fan Air Movers for Safeguards Area	HSG-AHU-01A B515 720 PCH BIG BUFFALO 40 696	43	1	G 501 14E S-3	2## ##	01 0	00000 00 0

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22	HSG-FAN-1B	HSG-AHU-01B				G	501	14E	2##	01	00000	
	Centrifugal Fan	B515	720 PCH BIG BUFFALO			S-3			##	0	00	0
	Air Movers for Safeguards Area	40	696	43	1							
22	HSG-FAN-2A	HSG-AHU-1A				G	501	14E	2##	01	00000	
	Centrifugal Fan	B515	900DLD			U-3			##	0	00	0
	Air Movers for Safeguards Area	40	696	43	1							
22	HSG-FAN-2B	HSG-AHU-1B				G	501	14E	2##	01	00000	
	Centrifugal Fan	B515	980DLD			U-3			##	0	00	0
	Air Movers for Safeguards Area	40	696	43	1							
22	MER-FAN-1A	MER-AHU-01A				G	501	15E	2##	01	00000	
	Centrifugal Fan	B515	600 HVH BIG BUFFALO			P-3			##	0	00	0
	Air Movers for Mech. Equip Room	40	696	43	1							
22	MER-FAN-1B	MER-AHU-01B				G	501	15E	2##	01	00000	
	Centrifugal Fan	B515	600 HVH BIG BUFFALO			P-3			##	0	00	0
	Air Movers for Mech. Equip Room	40	696	43	1							

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CONTRACT	EQUIPMENT NUMBER / DESCRIPTION / SAFETY FUNCTION	COMPOSITE EQUIP NO / MFG / LIFE	MFG MODEL NUMBER / HRS OPR	USE	QTY	BLDG ELEV ZONE / LOC. DETAIL / DOCUMENT LOCATION	SEISMIC TEST FO	ENVIRN ANL C	AGING DBE C
22	MER-FAN-2A Centrifugal Fan Air Movers for Mech. Equip. Room	MER-AHU-1A B515 40	 980BLD 696	43	1	G 501 15E K-3	2## ##	01 0	00000 00 0
22	MER-FAN-2B Centrifugal Fan Air Movers for Mech. Equip. Room	MER-AHU-1B B515 40	 980BLD 696	43	1	G 501 15E K-3	2## ##	01 0	00000 00 0
22	MER-FAN-4A Vaneaxial Fan Exhaust Fan for Small Equip. Room	MER-FAN-4A B515 40	 28/18 Vaneaxial 696	43	1	G 519 P-5	2## ##	01 0	00000 00 0
22	MER-FAN-4B Vaneaxial Fan Exhaust Fan for Small Equip. Room	MER-FAN-4B B515 40	 28/18 Vaneaxial 696	43	1	G 519 P-4	2## ##	01 0	00000 00 0
22	MER-FAN-7A Vaneaxial Fan Exhaust FN/Borated Wtr Storage Area	MER-FAN-7A B515 40	 29A9 Adjustax 696	43	1	G 449 22A W-6.5	2## ##	01 0	00000 00 0
22	MER-FAN-7B Vaneaxial Fan Wtr Storage Area	MER-FAN-7B B515 40	 29A9 Adjustax 696	43	1	G 449 22A W-6.5	2## ##	01 0	00000 00 0

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22	VAB-FAN-12A Vaneaxial Fan Spray Pond/Pmp HS Exhaust	VAB-FAN-12A B515 29A9 Adjustax 40 696 43 1	S 448 1A PP HSE A	2## 01 00000 ## 0 00 0
22	VAB-FAN-22B Vaneaxial Fan Spray Pond/Pmp HS Exhaust	VAB-FAN-22B B515 29A9 Adjustax 40 696 43 1	S 448 1A PP HSE B	2## 01 00000 ## 0 00 0

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CONTRACT	EQUIPMENT NUMBER / DESCRIPTION / SAFETY FUNCTION	COMPOSITE EQUIP NO / MFG	MFG MODEL NUMBER / LIFE HRS OPR	USE	QTY	BLDG ELEV ZONE / LOC. DETAIL / DOCUMENT LOCATION			SEISMIC TEST FO	ENVIRN ANL C	AGING DBE C
47	APN-SWG-EA/A56	APN-SWG-EA/A56				G	421	30B	121	##	31399
	Instrument Compartment	G187	Dwg 33-51659-B202			E-10			4#	5	04 4
	Provide Monitoring Function	40	2400	43	1						
47	APN-SWG-EA/A57	APN-SWG-EA/A57				G	421	30B	121	##	31399
	Instrument Compartment	G187	Dwg 33-51659-B202			E-10			4#	5	04 4
	Provide Monitoring Function	40	2400	43	1						
47	APN-SWG-EA/A58	APN-SWG-EA/A58				G	421	30B	121	##	31399
	Instrument Compartment	G187	Dwg 33-51659-B202			E-10			4#	5	04 4
	Under Voltage to EPSS	40	2400	43	1						
47	APN-SWG-EA/A59	APN-SWG-EA/A59				G	421	30B	121	##	31399
	Instrument Compartment	G187	Dwg 33-51659-B202			E-10			4#	5	04 4
	Provide Monitoring Function	40	2400	43	1						
47	APN-SWG-EA/A60	APN-SWG-EA/A60				G	421	30B	121	##	31399
	ALT Backup Feeder										
	Breaker Compartment	G187	Dwg 33-51659-B202			E-10			4#	5	04 4
	Provide Backup On/Off Control	40	2400	43	1						
47	APN-SWG-EA/A61	APN-SWG-EA/A61				G	421	30B	121	##	31399
	Backup Feeder Breaker	G187	Dwg 33-51659-B202			E-10			4#	5	04 4
	Provide Redundant Backup	40	2400	43	1						
47	APN-SWG-EA/A62	APN-SWG-EA/A62				G	421	30B	121	##	31399
	Blank Electrical Cubicle	G187	Dwg 33-51659-B202			E-10			4#	5	04 4
	Spare	40	0	00	1						

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47	APN-SWG-EA/A63 Loop Cooling Water Pump CCW-PMP-5A Provide Power Loop CCW-PMP-5A	APN-SWG-EA/A63 G187 Dwg 33-51659-B202 40 696 23	1	G 421 30B E-10	121 ## 31399 4# 5 04 4
47	APN-SWG-EA/A64 Unit Substation EA1 Distribute Power	APN-SWG-EA/A64 G187 Dwg 33-51659-B202 40 2400 43	1	G 421 30B E-10	121 ## 31399 4# 5 04 4
47	APN-SWG-EA/A65 Make Up Pump MUS-PMP-1A Provide Power Mu PMP Motor	APN-SWG-EA/A65 G187 Dwg 33-51659-B202 40 2400 43	1	G 421 30B E-10	121 ## 31399 4# 5 04 4
47	APN-SWG-EA/A66 Auxiliary Feedwater Pump FWA-PMP-1A Provide Pow Aux FWA-PMP-1A	APN-SWG-EA/A66 G187 Dwg 33-51659-B202 40 2400 43	1	G 421 30B E-10	121 ## 31399 4# 5 04 4
47	APN-SWG-EA/A67 Unit Substation EA4 Distribute Power	APN-SWG-EA/A67 G187 Dwg 33-51659-B202 40 2400 43	1	G 421 30B E-10	121 ## 31399 4# 5 04 4
47	APN-SWG-EA/A68 Unit Substation EA5 Distribute Power	APN-SWG-EA/A68 G187 Dwg 33-51659-B202 40 2400 43	1	G 421 30B E-10	121 ## 31399 4# 5 04 4
47	APN-SWG-EA/A69 Emgr Shutdown Pump ESW-PMP-1A Provide Power ESW-PMP-1A	APN-SWG-EA/A69 G187 Dwg 33-51659-B202 40 2400 33	1	G 421 30B E-10	121 ## 31399 4# 5 04 4

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CONTRACT	EQUIPMENT NUMBER DESCRIPTION SAFETY FUNCTION	COMPOSITE EQUIP NO MFG LIFE	MFG MODEL NUMBER HRS OPR	USE	QTY	BLDG ELEV ZONE LOC. DETAIL DOCUMENT LOCATION			SEISMIC TEST FO	ENVIRN ANL C	AGING DBE	C
47	APN-SWG-EA/A70	APN-SWG-EA/A70				G	421	30B	121	##	31399	
	Make Up Pump MUS-PMP-3C	G187	Dwg 33-51659-B202			E-10			4#	5	04	4
	Provide Power MUS-PMP-3C	40	2400	43	1							
47	APN-SWG-EA/A71	APN-SWG-EA/A71				G	421	30B	121	##	31399	
	Unit Substation EA6	G187	Dwg 33-51659-B202			E-10			4#	5	04	4
	Distribute Power	40	2400	43	1							
47	APN-SWG-EA/A72	APN-SWG-EA/A72				G	421	30B	121	##	31399	
	Diesel Generator Breaker	G187	Dwg 33-51659-B202			E-10			4#	5	04	4
	Connect Diesel Gen to Bus	40	2400	33	1							
47	APN-SWG-EA/A73	APN-SWG-EA/A73				G	421	30B	121	##	31399	
	Shutdown Cooling Water											
	Pump Breaker	G187	Dwg 33-51659-B202			E-10			4#	5	04	4
	Provide Power,											
	SD CW PMP Motor	40	2400	33	1							
47	APN-SWG-EA/A74	APN-SWG-EA/A74				G	421	30B	121	##	31399	
	Containment Spray											
	Pump CSS-PMP-1A	G187	Dwg 33-51659-B202			E-10			4#	5	04	4
	Provide Power CSS PMP Motor	40	2400	31	1							
47	APN-SWG-EA/A75	APN-SWG-EA/A75				G	421	30B	121	##	31399	
	Unit Substation EA2	G187	Dwg 33-51659-B202			E-10			4#	5	04	4
	Distribute Power	40	2400	43	1							
47	APN-SWG-EA/A76	APN-SWG-EA/A76				G	421	30B	121	##	31399	
	Decay Heat Removal											
	Pump DHR-PMP-1A	G187	Dwg 33-51659-B202			E-10			4#	5	04	4
	Provide Power DHR PMP Motor	40	2400	33	1							

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47	APN-SWG-EA/A77	APN-SWG-EA/A77				G	421	30B	121	##	31399	
	Unit Substation EA3	G187	Dwg 33-51659-B202			E-10			4#	5	04	4
	Distribute Power	4[illegible]	2400	43	1							
47	APN-SWG-EA/Z16	APN[illegible]A/Z16				G	421	30B	121	##	31399	
	SWGR Batt & Cable											
	Spreading Area Chiller	G1[illegible]	[illegible]-51659-B202			E-10			4#	5	04	4
	Provide Power to Chiller	4[illegible]	2400	43	1							
47	APN-SWG-EA/Z17	APN-SWG-EA/Z17				G	421	30B	121	##	31399	
	Containment Chiller											
	CFC-CHL-1A	G187	Dwg 33-51659-B202			E-10			[illegible]	5	04	4
	Provide Power CFC-CHL-1A	40	696	43	1							
47	APN-SWG-EA/Z18	APN-SWG-EA/Z18				G	421	30B	121	##	31399	
	Containment Chiller											
	CFC-CHL-2A	G187	Dwg 33-51659-B202			E-10			#4	5	04	4
	Provide Power CFC-CHL-2A	40	696	43	1							
47	APN-SWG-EA/Z19	APN-SWG-EA/Z19				G	421	30B	121	##	31399	
	Fuel Handling Containment											
	Purge Chiller HSF-CHL-4A	G187	Dwg 33-51659-B202			E-10			4#	5	04	4
	Provide Power HSF-CHL-4A	40	2400	43	1							
47	APN-SWG-EB	APN-SWG-EB				G	421	30B	121	##	31399	
	5 KV Switchgear	G187	Dwg 33-51659-B202			E-4			4#	5	04	4
	Maintain Circuit Continuity	40	2400	43								
47	APN-SWG-EB/A78	APN-SWG-EB/A78				G	421	30B	121	##	31399	
	Instrument Compartment	G187	Dwg 33-51659-B202			E-4			4#	5	04	4
	Under Voltage to EPSS	40	2400	43	1							

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47	APN-SWG-EB/A79 Instrument Compartment Provide Monitoring Function	APN-SWG-EB/A79 G187 40	 Dwg 33-51659-B202 2400	 43	 1	G E-4	421	30B	121 4#	## 5	31399 04	 4
47	APN-SWG-EB/A80 Main Feeder Breaker Provide On/Off Control	APN-SWG-EB/A80 G187 40	 Dwg 33-51659-B202 2400	 43	 1	G E-4	421	30B	121 4#	## 5	31399 04	 4
47	APN-SWG-EB/A81 Alt Backup Feeder Breaker Compartment Provide Backup Power	APN-SWG-EB/A81 G187 40	 Dwg 33-51659-B202 2400	 43	 1	G E-4	421	30B	121 4#	## 5	31399 04	 4
47	APN-SWG-EB/A82 Backup Feeder Breaker Provide Redundant Backup	APN-SWG-EB/A82 G187 40	 Dwg 33-51659-B202 2400	 43	 1	G E-4	421	30B	121 4#	## 5	31399 04	 4
47	APN-SWG-EB/A83 Emgr Shutdown Pump Provide Power	APN-SWG-EB/A83 G187 40	 Dwg 33-51569-B202 2400	 43	 1	G E-4	421	30B	121 4#	## 5	31399 04	 4
47	APN-SWG-EB/A84 Unit Substation EB1 Distribute Power	APN-SWG-EB/A84 G187 40	 Dwg 33-51569-B202 2400	 43	 1	G E-4	421	30B	121 4#	## 5	31399 04	 4
47	APN-SWG-EB/A85 Contn Spray Pump 1-CSS PMP-2-B Provide Power CSS-PMP-2B	APN-SWG-EB/A85 G187 40	 Dwg 33-51569-B202 2400	 31	 1	G E-4	421	30B	121 4#	## 5	31399 04	 4

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47	APN-SWG-EB/A86	APN-SWG-EB/A86				G 421 30B	121	##	31399
	Decay Heat Removal								
	Pump DHR PMP-2-B	G187	Dwg 33-51569-B202			E-4	4#	5	04 4
	Provide Power DHR-PMP-2B	40	2400	33	1				
47	APN-SWG-EB/A87	APN-SWG-EB/A87				G 421 30B	121	##	31399
	Shutdown Water Cooling								
	Pump NSW-PMP-2B	G187	Dwg 33-51569-B202			E-4	4#	5	04 4
	Provide Power NSW-PMP-2B	40	2400	33	1				
47	APN-SWG-EB/A88	APN-SWG-EB/A88				G 421 30B	121	##	31399
	Instrument Compartment	G187	Dwg 33-51569-B202			E-4	4#	5	04 4
	Under Voltage to EPSS	40	2400	43	1				
47	APN-SWG-EB/A89	APN-SWG-EB/A89				G 421 30B	121	##	31399
	Unit Substation EB2	G187	Dwg 33-51569-B202			E-4	4#	5	04 4
	Distribute Power	40	2400	43	1				
47	APN-SWG-EB/A90	APN-SWG-EB/A90				G 421 30B	121	##	31399
	Auxiliary Feedwater								
	Pump FWA-PMP-2B	G187	Dwg 33-51569-B202			E-4	4#	5	04 4
	Provide Power FWA-PMP-2B	40	2400	43	1				
47	APN-SWG-EB/A91	APN-SWG-EB/A91				G 421 30B	121	##	31399
	Blank Electrical Cubicle	G187	Dwg 33-51569-B202			E-4	4#	5	04 4
	Spare	40	0	00	1				
47	APN-SWG-EB/A92	APN-SWG-EB/A92				G 421 30B	121	##	31399
	Diesel Generator EDG-DG-18	G187	Dwg 33-51569-B202			E-4	4#	5	04 4
	Connect Diesel Gen to Bus	40	2400	33	1				

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	DESCRIPTION	MFG	MFG MODEL NUMBER			LOC. DETAIL			TEST	ANL	AGING	
	SAFETY FUNCTION	LIFE	HRS OPR	USE	QTY	DOCUMENT LOCATION			FO	C	DBE	C
47	APN-SWG-EB/A93	APN-SWG-EB/A93				G	421	30B	121	##	31399	
	Unit Substation EB3	G187	Dwg 33-51569-B202			E-4			4#	5	04	[illegible]
	Distribute Power	40	2400	43	1							
47	APN-SWG-EB/A94	APN-SWG-EB/A94				G	421	30B	121	##	31399	
	Loop Cooling Water											
	Pump Con PMP 6B	G187	Dwg 33-51569-B202			E-4			4#	5	04	4
	Provide Power PMP 6B	40	696	23	1							
47	APN-SWG-EB/A95	APN-SWG-EB/A95				G	421	30B	121	##	31399	
	Make Up Pump MUS-PMP-2B	G187	Dwg 33-51569-B202			E-4			4#	5	04	4
	Provide Power MUS-PMP-2B	40	2400	43	1							
47	APN-SWG-EB/A96	APN-SWG-EB/A96				G	421	30B	121	##	31399	
	Auxiliary Feedwater											
	Pump FWA-PMP-2B	G187	Dwg 33-51569-B202			E-4			4#	5	04	4
	Provide Power FWA-PMP-2B	40	2400	43	1							
47	APN-SWG-EB/A97	APN-SWG-EB/A97				G	421	30B	121	##	31399	
	Unit Substation EB4	G187	Dwg 33-51569-B202			E-4			4#	5	04	4
	Distribute Power	40	2400	43	1							
47	APN-SWG-EB/A98	APN-SWG-EB/A98				G	421	30B	121	##	31399	
	Unit Substation EB5	G187	Dwg 33-51569-B202			E-4			4#	5	04	4
	Distribute Power	40	2400	43	1							
47	APN-SWG-EB/A99	APN-SWG-EB/A99				G	421	30B	121	##	31399	
	Unit Substation EB6	G187	Dwg 33-51569-B202			E-4			4#	5	04	4
	Distribute Power	40	2400	43	1							

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CONTRACT	EQUIPMENT NUMBER	COMPOSITE EQUIP NO				BLDG	ELEV	ZONE	SEISMIC	ENVIRN		
	DESCRIPTION	MFG	MFG MODEL NUMBER			LOC. DETAIL			TEST	ANL	AGING	
	SAFETY FUNCTION	LIFE	HRS OPR	USE	QTY	DOCUMENT LOCATION			FO	C	DBE	C
47	APN-SWG-EB/Z21	APN-SWG-EB/Z21				G	421	30B	121	##	31399	
	Swgr Batt & Cable											
	Spreading Area Chiller	G187	Dwg 33-51569-B202			E-4			4#	5	04	4
	Provide Power	40	2400	43	1							
47	APN-SWG-EB/Z22	APN-SWG-EB/Z22				G	421	30B	121	##	31399	
	Containment Chiller	G187	Dwg 33-51569-B202			E-4			4#	5	04	4
	Provide Power	40	696	43	1							
47	APN-SWG-EB/Z23	APN-SWG-EB/Z23				G	421	30B	121	##	31399	
	Containment Chiller											
	CFC-CHL-2B	G187	Dwg 33-51569-B202			E-4			4#	5	04	4
	Provide Power CFC-CHL-2B	40	696	43	1							
47	APN-SWG-EB/Z24	APN-SWG-EB/Z24				G	421	30B	121	##	31399	
	Fuel Handling											
	Containment Purge Chiller	G187	Dwg 33-51569-B202			E-4			4#	5	04	4
	Provide Power	40	2400	43	1							
47	APN-TØS-AB/SB5	APN-TØS-AB/SB5				G	399	14A				
	Duplex Switch					U-3						
					1							
47	BCS-MØN-1/RA5	RCS-MØN-1/RA5				I	423	2A	121	##	31399	
	Reactor Coolant Pump Monitor	G187				ISØL VLV			4#	5	04	4
					1							
47	RCS-MØN-2/RA6	RCS-MØN-2/RA6				I	423	2A	121	##	31399	
	Reactor Coolant Pump Monitor	G187				ISØL VLV			4#	5	04	4
					1							

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47	RCS-MØN-3/RA7	RCS-MØN-3/RA7				I 423 2A	121	##	31399	
	Reactor Coolant Pump Monitor	G187				ISØL VLV	4#	5	04	4
					1					
47	RCS-MØN-4/RA8	RCS-MØN-4/RA8				I 423 2A	121	##	31399	
	Reactor Coolant Pump Monitor	G187				ISØL VLV	4#	5	04	4
					1					
55	APN-EPA-HAI	APN-EPA-HAI				R 428 4A				
	15 KV Power Elec									
	Pent Assembly	W120	WX33118			55 DEG				
	Provide Cont Isolation	40	2400	43	1	1/4-55-QS-1				
55	APN-EPA-HA3	APN-EPA-HA3				R 428 4A				
	15 KV Elec Pent Assembly	W120	WX33118			57 DEG				
	Provide Cont Isolation	40	2400	43	1	1/4-55-QS-1				
55	APN-EPA-HA5	APN-EPA-HA5				R 428 4A				
	15 KV Elec Pent Assembly	W120	WX33118			60 DEG				
	Provide Cont Isolation	40	2400	43	1	1/4-55-QS-1				
55	APN-EPA-HA7	APN-EPA-HA7				R 428 4A				
	15 KV Power Elec									
	Pent Assembly	W120	WX33118			62 DEG				
	Provide Cont Isolation	40	2400	43	1	1/4-55-QS-1				
55	APN-EPA-HB4	APN-EPA-HB4				R 495 3D	121	00	19199	
	Control Rod Power									
	Elec Pent Assembly	W120	WX33130			95 DEG	40	5	07	4
	Provide Cont Isolation	40	2400	43	1	1/4-55-QS-1				

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		LIFE	HRS OPR	USE	QTY				
55	APN-EPA-HB5 Control Power Rod Elec Pent Assembly Provide Cont Isolation	APN-EPA-HB5 W120 40	 WX-33130 2400	 43	 1	R 495 3D 99 DEG 1/4-55-QS-1	121 40	00 5	19199 07 4
55	APN-EPA-HB6 Control Power Rod Elec Pent Assembly Provide Cont Isolation	APN-EPA-HB6 W120 40	 WX-33130 2400	 43	 1	R 495 3D 104 DEG 1/4-55-QS-1	121 40	00 5	19199 07 4
55	APN-EPA-HB7 Control Power Rod Elec Pent Assembly Provide Cont Isolation	APN-EPA-HB7 W120 40	 WX-33130 2400	 43	 1	R 495 3D 108 DEG 1/4-55-QS-1	121 40	00 5	19199 07 4
55	APN-EPA-HB8 Control Power Rod Elec Pent Assembly Provide Cont Isolation	APN-EPA-HB8 W120 40	 WX-33130 2400	 43	 1	R 495 3D 112 DEG 1/4-55-QS-1	121 40	00 5	19199 07 4
55	APN-EPA-HB9 Control Rod Position Indicator Elec Pent Assembly Provide Cont Isolation	APN-EPA-HB9 W120 40	 WX-33130 2400	 43	 1	R 491 3D 95 DEG 1/4-55-QS-1	121 40	00 5	19199 07 4
55	APN-EPA-HC1 Control Rod Position Indicator Elec Pent Assembly Provide Cont Isolation	APN-EPA-HC1 W120 40	 WX-33131 2400	 43	 1	R 491 3D 99 DEG 1/4-55-QS-1	121 40	00 5	19199 07 4

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55	APN-EPA-HC2	APN-EPA-HC2				R 491 3D	121	00	19199
	Control Rod Position								
	Indicator Elec Pent Assembly	W120	WX-33131			104 DEG	40	5	07 4
	Provide Cont Isolation	40	2400	43	1	1/4-55-QS-1			
55	APN-EPA-HC6	APN-EPA-HC6				R 491 3D	121	00	19199
	Control Rod Thermocouple								
	Elec Pent Assembly	W120	WX-33126			108 DEG	40	5	07 4
	Provide Cont Isolation	40	2400	43	1	1/4-55-QS-1			
55	APN-EPA-HC9	APN-EPA-HC9				R 444 1B	121	00	19199
	Pressurized Heaters Power								
	Elec Pent Assembly	W120	WX-33132			218 DEG	40	5	07 4
	Provide Cont Isolation	40	2400	43	1	1/4-55-QS-1			
55	APN-EPA-HD1	APN-EPA-HD1				R 444 1B	121	00	19199
	Pressurized Heaters Power								
	Elec Pent Assembly	W120	WX-33132			221 DEG	40	5	07 4
	Provide Cont Isolation	40	2400	43	1	1/4-55-QS-1			
55	APN-EPA-HE2	APN-EPA-HE2				R 467 1C	121	00	19199
	Signal Cable Reactor Protect								
	Sys Elec Pent Asly	W120	WX-33127			207 DEG	40	5	07 4
	Cont Isol-Maint CKT Integrity	40	2400	43	1	1/4-55-QS-1			
55	APN-EPA-HE4	APN-EPA-HE4				R 467 1C	121	00	19199
	General Use Control								
	Power AC & DC EPA	W120	WX-33120			212 DEG	40	5	07 4
	Cont Isol-Maint CKT Integrity	40	2400	43	1	1/4-55-QS-1			

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55	APN-EPA-HE8 General Use Low & Medium Power AC Elec Pont Asly Cont Isol-Maint CKT Integrity	APN-EPA-HE8 W120 40	WX-33121 2400	43	1	R 471 1C 215 DEG 1/4-55-QS-1	121 40	00 5	19199 07 4
55	APN-EPA-HF6 Instrum Thermocouples & RTD's Elec Pent Asly Cont Isol-Maint CKT Integrity	APN-EPA-HF6 W120 40	WX-33123 2400	43	1	R 467 1C 215 DEG 1/4-55-QS-1	121 40	00 5	19199 07 4
55	APN-EPA-HG4 Signal Cable Incore Instrum Elec Pent Assembly Provide Cont Isolation	APN-EPA-HG4 W120 40	WX-33128 2400	43	1	R 444 3B 158 DEG 1/4-55-QS-1	121 40	00 5	19199 07 4
55	APN-EPA-HH1 Signal Cable Incore Instrum Elec Pent Assembly Provide Cont Isolation	APN-EPA-HH1 W120 40	WX-33129 2400	43	1	R 444 3B 167 DEG 1/4-55-QS-1	121 40	00 5	19199 07 4
55	APN-EPA-HH3 Signal Cable Reactor Protection Sys Elec Pent Asly Cont Isol-Maint CKT Integrity	APN-EPA-HH3 W120 40	WX-33127 2400	43	1	R 444 3B 101 DEG 1/4-55-QS-1	121 40	00 5	19199 07 4
55	APN-EPA-HH5 Instrum Thermocouples & RTD's Elec Pent Asly Cont Isol-Maint CKT Integrity	APN-EPA-HH5 W120 40	WX-33123 2400	43	1	R 444 3B 112 DEG 1/4-55-QS-1	121 40	00 5	19199 07 4

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55	APN-EPA-HH6	APN-EPA-HH6				R	444	3B	121	00	19199	
	General Use Control Power											
	AC & DC Elec Pent Asly	W120	WX-33120			107 DEG			40	5	07	4
	Cont Isol-Maint CKT Integrity	40	2400	43	1	1/4-55-QS-1						
55	APN-EPA-HH8	APN-EPA-HH8				R	448	3B	121	00	19199	
	General Use Low & Medium											
	Power AC EPA	W120	WX-33121			112 DEG			40	5	07	4
	Cont Isol-Maint CKT Integrity	40	2400	43	1	1/4-55-QS-1						
55	APN-EPA-HI5	APN-EPA-HI5				R	444	1B	121	00	19199	
	Signal Cable Reactor Protect											
	Sys Elec Pent Asly	W120	WX-33127			207 DEG			40	5	07	4
	Cont Isol-Maint CKT Integrity	40	2400	43	1	1/4-55-QS-1						
55	APN-EPA-HI7	APN-EPA-HI7				R	444	1B	121	00	19199	
	General Use Control Power											
	AC & DC Elec Pent Asly	W120	WX-33120			212 DEG			40	5	07	4
	Provide Cont Isolation	40	2400	43	1	1/4-55-QS-1						
55	APN-EPA-HI8	APN-EPA-HI8				R	448	1B	121	00	19199	
	General Use Heavy Power											
	AC Elec Pent Asly	W120	WX-33122			212 DEG			40	5	07	4
	Provide Cont Isolation	40	2400	43	1	1/4-55-QS-1						
55	APN-EPA-HJ1	APN-EPA-HJ1				R	448	1B	121	00	19199	
	General Use Heavy Power											
	AC Elec Pent Asly	W120	WX-33122			221 DEG			40	5	07	4
	Provide Cont Isolation	40	2400	43	1	1/4-55-QS-1						

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
CLASS 1E EQUIPMENT LIST
MASTER REPORT

CONTRACT	EQUIPMENT NUMBER DESCRIPTION SAFETY FUNCTION	COMPOSITE EQUIP NO MFG	MFG MODEL NUMBER LIFE	HRS OPR	USE	QTY	BLDG ELEV ZONE LOC. DETAIL DOCUMENT LOCATION	SEISMIC TEST FO	ENVIRN ANL C	AGING DBE C
55	APN-EPA-HK3 Signal Cable Reactor Protect Sys Elec Pent Asly Cont Isol-Maint CKT Integrity	APN-EPA-HK3 W120 40	 WX-33127 2400		43	1	R 463 3C 141 DEG 1/4-55-QS-1	121 40	00 5	19199 07 4
55	APN-EPA-HK5 Instrum Thermocouple & RTD's Elec Pent Assembly Provide Cont Isolation	APN-EPA-HK5 W120 40	 WX-33124 2400		43	1	R 463 3C 152 DEG 1/4-55-QS-1	121 40	00 5	19199 07 4
87	FWS-V-16B Main Feedwater Isolation Valve Prov FW Line Containmt Isolat	FWS-V-16B A391 40	 A/DV Dwg 94-14730 2400		43	1	I 463 1B VLV HSE 1/4-87-QS-1	000 43	01 5	00000 00 0
87	FWS-V-17A Main Feedwater Isolation Valve Prov FW Line Containmt Isolat	FWS-V-17A A391 40	 A/DV Dwg 94-14731 2400		43	1	I 463 1B VLV HSE 1/4-87-QS-1	000 43	01 5	00000 00 0
87	FWS-V-28B Main Feedwater Isolation Valve Prov FW Line Containmt Isolat	FWS-V-28B A391 40	 A/DV Dwg 94-14730 2400		43	1	I 463 2C VLV HSE 1/4-87-QS-1	000 43	01 5	00000 00 0
87	FWS-V-29A Main Feedwater Isolation Valve Prov FW Line Containmt Isolat	FWS-V-29A A391 40	 A/DV Dwg 94-14731 2400		43	1	I 463 2B VLV HSE 1/4-87-QS-1	000 43	01 5	00000 00 0

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
CLASS 1E EQUIPMENT LIST
MASTER REPORT

CONTRACT	EQUIPMENT NUMBER DESCRIPTION SAFETY FUNCTION	COMPOSITE EQUIP NO MFG LIFE	MFG MODEL NUMBER HRS OPR	USE	QTY	BLDG ELEV ZONE LOC. DETAIL DOCUMENT LOCATION	SEISMIC TEST FO	ANL C	ENVIRN AGING DBE C
87	MSS-V-1C	MSS-V-1C				I 471 1C	000	01	00000
	Main Steam Isolation Valve	A391	A/DV Dwg 94-14396			VLV HSE	43	5	00 0
	Prov MS Line Containmt Isolat	40	2400	43	1	1/4-87-QS-1			
87	MSS-V-2C	MSS-V-2C				I 471 1A	000	01	00000
	Main Steam Isolation Valve	A391	A/DV Dwg 94-14395			VLV HSE	43	5	00 0
	Prov MS Line Containmt Isolat	40	2400	43	1	1/4-87-QS-1			
87	MSS-V-3C	MSS-V-3C				I 471 2C	000	01	00000
	Main Steam Isolation Valve	A391	A/DV Dwg 94-14395			VLV HSE	43	5	00 0
	Prov MS Line Containmt Isolat	40	2400	43	1	1/4-87-QS-1			
87	MSS-V-4C	MSS-V-4C				I 471 2C	000	01	00000
	Main Steam Isolation Valve	A391	A/DV Dwg 94-14397			VLV HSE	43	5	00 0
	Prov MS Line Containmt Isolat	40	2400	43	1	1/4-87-QS-1			
104	APN-ELC-GA25/030	APN-ELC-GA25				G	###	##	53193
	Electrical Power Cable-								
	1/C-250MCM-5KV	0040	114-23-2533			General Plant	##	#	01 4
	Cond Elect-Maint CKT Integrity				LOT	1/4-104-QS-1			
104	APN-ELC-GA35/031	APN-ELC-GA35				G	###	##	53193
	Electrical Power Cable-								
	1/C-350MCM-5KV	0040	114-23-2537			General Plant	##	#	01 4
	Cond Elect-Maint CKT Integrity				LOT	1/4-104-QS-1			
104	APN-ELC-GA41/029	APN-ELC-GA41				G	###	##	53193
	Electrical Power Cable-								
	1/C-350MCM-5KV	0040	114-23-2531			General Plant	##	#	01 4
	Cond Elect-Maint CKT Integrity				LOT	1/4-104-QS-1			

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
CLASS 1E EQUIPMENT LIST
MASTER REPORT

CONTRACT	EQUIPMENT NUMBER DESCRIPTION SAFETY FUNCTION	COMPOSITE EQUIP NO MFG LIFE	MFG MODEL NUMBER HRS OPR	USE	QTY	BLDG ELEV ZONE LOC. DETAIL DOCUMENT LOCATION	SEISMIC TEST FO	ANL C	ENVIRN AGING DBE	C
104	APN-ELC-GA50/032 Electrical Power Cable- 1/C-500MCM-5KV Cond Elect-Maint CKT Integrity	APN-ELC-GA50 0040	114-23-2543		LOT	G General Plant 1/4-104-QS-1	### ##	## #	53193 01	4

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
ACCEPTANCE CRITERIA FOR CLASS 1E EQUIPMENT QUALIFICATION

1.0 PURPOSE AND SCOPE

This instruction establishes the criteria to which Class 1E equipment qualification plans and test results are evaluated to determine adequacy to meet the requirements of IEEE 323-1974, or its daughter standards that are endorsed by Regulatory Guides and/or NRC documents.

2.0 DEFINITIONS

The definitions section provided in IEEE 323-1974, or its daughter standards apply.

3.0 PROCEDURE

The following criteria shall be considered when Class 1E equipment qualification documents are being reviewed.

3.1 Contents of the Vendor Qualification Program

The following information is required of all Class 1E qualification programs.

1. Identification of all Class 1E equipment, components and sub-components as follows:

   a. Functional designation
   b. Manufacturer
   c. Manufacturer's type number and/or model number
   d. Applicable equipment, component, or sub-component description (motor control center, relay, transistor, etc.)

2. Equipment safety function category:

   a. Equipment that will experience the environmental conditions of design basis accidents for which it must function to mitigate said accidents, and that will be qualified to demonstrate operability in the accident environment for the time required for accident mitigation with safety margin to failure.

   b. Equipment that will experience environmental conditions of design basis accidents through which it need not function for mitigation of said accidents, but through which it must not fail in a manner detrimental to plant safety or accident mitigation, and that will be qualified to demonstrate the capability to withstand any accident environment for the time during which it must not fail with safety margin to failure.

that

c. Equipment aht will experience environmental conditions of design basis accidents through which it need not function for mitigation of said accidents, and whose failure (in any mode) is deemed not detrimental to plant safety or accident mitigation, and need not be qualified for any accident environment, but will be qualified for its non-accident service environment.

d. Equipment that will not experience environmental conditions of design basis accidents and that will be qualified to demonstrate operability under the expected extremes of its non-accident service environment. This equipment would normally be located outside the reactor containment.

3. For each type of equipment in the categories of equipment listed in item 2 above, provide separately the equipment design specification requirements, including:

   a. The system safety function requirements.

   b. An environmental envelope as a function of time that includes all extreme parameters, both maximum and minimum values, expected to occur during plant shutdown, normal operation, abnormal operation, and any design basis event (including LOCA and MSLB), including post-event conditions.

   c. Time required to fulfill its safety function when subjected to any of the extremes of the environment envelope specified above.

   d. Technical bases should be provided to justify the placement of each type equipment in the categories 2.b and 2.c listed above.

4. Provide the qualification test plan, test procedures, and acceptance criteria for at least one of each group of equipment of item 1.d as appropriate to the category identified in item 2 above. If any method other than type testing was used for qualification (operating experience, analysis, combined qualification, or ongoing qualification), describe the method in sufficient detail to permit evaluation of its adequacy.

5. For each category of equipment identified in item 2 above, state the actual qualification envelope simulated during testing (defining the duration of the hostile environment and the margin in excess of the design requirements). If any method other than type testing was used for qualification, identify the method and define the equivalent "qualification envelope" so derived.

6. A summary of test results that demonstrates the adequacy of the qualification program. If analysis is used for qualification, justification of all analysis assumptions must be provided.

7. Identification of the qualification documents which contain detailed supporting information, including test data, for items 4, 5 and 6.

The Equipment Qualification Check List is included as part of the documentation package. The list is included in this Appendix as an attachment.

TABLE I

	MARGINS TO BE USED IN CONJUNCTION WITH SPECIFIED SERVICE CONDITIONS
1. Temperature	+15°F (8°C) - for saturated conditions. Test shall not exceed Sat + 10 psi for the peak service temperature.
2. Pressure	+10% of gauge but not more than 10 psi.
3. Radiation	+10% on accident dose.
4. Voltage	+, -5% of rated value unless otherwise specified. *
5. Time	+10% of the time period the equipment is required to be functional following the DBE - 1 hour, minimum. *
6. Environmental Transients	The initial transient and the swell at peak temperature shall be applied at least twice.
7. Vibration	+10% added to the acceleration of the response spectrum at the mounting point of the equipment.

*A lesser margin may be used--provided adequate justification is provided.

ATTACHMENT

CHECK LIST EQUIPMENT QUALIFICATION

This check list is designed as an aid in reviewing Class 1E Equipment Qualification Reports to assure that the objectives of IEEE 323-1974 and NUREG-0588 have been met. Like components with the same environmental and seismic characteristics can be listed on one sheet, as a supplement to this list.

I. IDENTIFICATION

Equipment Functional Designation	Equipment Location		Manufacturer	Manufacturer Model/Type Number	WPPSS Technical Specification	WPPSS Tag Number(s)
	Bldg.	Elev.				

ADDITIONAL INFORMATION (REF: NUREG-0588, APPX. E, SECTION 1d): ______________________

____

II. OPERABILITY REQUIREMENTS

Environmental Designator (FSAR Table 3.11.1-)	Design Basis Accident	Time Required To Operate During DBA	Nature Of Operation	Equipment Category (NUREG-0588, Appx. E, Sect.2)

EQUIPMENT FUNCTION: ____

____

____

III. QUALIFIED ENVIRONMENT

Complete Exhibit 1 (Attached). Compare Exhibit 1 to FSAR designated service condition. Does supplier's qualified service meet or exceed the FSAR requirements?

☐ YES - Proceed to Item IV

☐ NO - Describe the difference. Indicate whether differences will impair the equipment function. Justify any conclusions that qualification to less than full service requirements is acceptable. (Attach additional sheets as required.)

____

____

____

____

IV. MARGIN

Identify margins, if any, provided by the equipment qualification on Exhibit 2 (attached). Compare the listed margins to the suggested IEEE 323-1974 values. Provide justification for any margin values listed less than the recommended IEEE 323-1974 values. The radiation margin suggested in IEEE 323 may be neglected if the methods in Appendix D of NUREG-0588 are used. Time margins indicated for short time period functioning devices must be justified if the margin indicated is less than 1 hour.

Are the margins acceptable?

☐ YES - Proceed to Item V.

☐ NO - Describe differences and indicate whether differences are significant

☐ SIGNIFICANT ☐ NOT SIGNIFICANT

JUSTIFICATION: ____

____

____

V. EQUIPMENT MOUNTING AND ORIENTATION

1) Was equipment qualified for a unique installed orientation (horizontal, vertical, etc)? Specify orientation of required installation (check all that are permissible).

☐ HORIZONTAL (FLOOR) ☐ HORIZONTAL (WALL)

☐ VERTICAL (FLOOR) ☐ VERTICAL (WALL)

☐ HORIZONTAL, ELEVATED (PIPING, DUCT, ETC.)

☐ VERTICAL, ELEVATED (PIPING, DUCT, ETC.)

☐ CANTED AT _____ DEGREES FROM VERTICAL (PIPING, DUCT, ETC.)

☐ OTHER - CLARIFY ____

____

2) Seismic test mounting method (welding, bolts, rivits, etc.) ____________

Was test mount the same as the intended site installation?

☐ YES - Proceed to Item VI.

☐ NO - Explain ____

____

VI. QUALIFICATION METHOD

1) Identify qualification method:

	ENVIRONMENTAL	SEISMIC
☐ TYPE TEST - REPORT No.		
☐ ANALYSIS - REPORT No.		
☐ OPERATING EXPERIENCE - REPORT No.		
☐ ON-GOING QUALIFICATION - REPORT No.		

☐ COMBINATION OF METHODS (CHECK AND IDENTIFY ALL THAT APPLY)

2) Describe the qualification method. Identify codes and standards utilized. Discuss all extrapolations from test data that supplier claims qualify different items by extension. If on-going qualification is used, describe initial qualified life of the equipment and identify the scope of inspection, re-testing or analysis to maintain and extend this qualified life. (Attach a separate sheet, if required.)

____

____

____

3) Were type tests conducted in the following sentence? List supplier justification for omitted steps or variation in test sequence.

a. Inspection
b. Operation (Baseline)
c. Operation (Environmental Extremes)
d. Aging:
   i) Thermal
   ii) Radiation
   iii) Humidity
   iv) Mechanical Cycling
   v) Vibration
e. Operation (Baseline)
f. Seismic
g. Operation (Baseline)
h. DBA Operation
i. Post-DBA Operation & Inspection

☐ YES - Proceed to 4).

☐ NO - Provide supplier justification and compare actual test sequence severity.

____

____

____

____

☐ EQUIPMENT IS NOT QUALIFIED

4) Are any synergistic effects known to exist with this equipment?

☐ YES - Describe the method used to age the equipment ____________

____

____

____

☐ NO - The test sequence in Item 3) applies, as necessary.

5) Are chemical effects, existing in the equipment's mounting space, detrimental to the equipment safety function?

☐ YES - Explain means of protection ____________

____

____

☐ NO - Not Applicable

6) Is submergence a factor in the location of this equipment?

☐ YES - Explain means of protection ____________

____

____

☐ NO - Not a factor.

7) Does the equipment perform satisfactorily in its operational mode before, during and after the testing?

☐ YES - Describe the operational parameters monitored ____________

____

____

☐ NO - Explain the corrective action ____________

____

____

8) Provide additional test information as follows:

a. The environmental extremes in Exhibit 1 meets or exceeds the parameters of the FSAR, Table 3.11.1- , plus margin.

☐ YES

☐ NO - Justify____

____

____

____

b. Thermal Aging Methods

☐ Arrhenius, describe adequacy____

____

☐ Other, describe adequacy____

____

____

c. Was the aging justification of IEEE 650-1979, Section 5.1.2.2.1 used?

☐ YES - Explain the adequacy of the stress analysis presented and justify the non-harsh environment in which the equipment is to be used.____

____

____

____

☐ Not Applicable

d. Radiation exposure (aging and accident dose) value (Exhibit 1) conforms to the value specified in FSAR, Table 3.11.1-   , plus margin.*

☐ YES -

☐ NO - Explain and justify ______________________________

____

____

*Margin may be omitted if the values in FSAR, Table 3.11.1- were derived using the methods of NUREG-0588, Appx. D.

e. Humidity aging was addressed by ______________________________

____

____

f. Vibration aging was addressed by ______________________________

____

____

g. Test temperatures were measured by:

☐ Direct Mounted Thermocouples

☐ Other - Describe and justify______________________________

h. Seismic Qualification Method

☐ Random, Multi-Frequency, Biaxial Testing - Proceed to i.

☐ Single Axis Testing - Proceed to j.

☐ 45 Degree Inclined Plane, Biaxial Testing - Proceed to k.

☐ Analysis - Proceed to l.

i. The seismic testing consisted of 5 OBE's and 1 SSE per equipment orientation for a total of 12 test runs?

☐ YES - Proceed to Item m.

☐ NO - Explain and justify______________________________

j. Single axis testing was justified by one of the following?

☐ The characteristics of the seismic input motion produce equipment motion dominated by a single frequency (i.e., structural filtering effects).

☐ The anticipated response of the equipment is represented by one mode.

☐ The test input motion has sufficient intensity and duration to excite all modes to the required amplitudes, such that the testing response spectra will envelope the corresponding response spectra of the individual modes.

☐ None of the above, explain and justify______________________________

k. The seismic testing consisted of 5 OBE's and 1 SSE per equipment orientation for a total of 24 test runs.

☐ YES - Proceed to Item m.

☐ NO - Explain and justify_______________________________

____

____

l. The equipment stress analysis report was reviewed and approved?

☐ YES - Proceed to Item m.

☐ NO - Explain and justify_______________________________

____

____

m. The seismic testing and/or analyses envelope the WPPSS specified seismic levels?

☐ YES - Proceed to Item n.

☐ NO - Explain and justify_______________________________

____

____

n. The performance characteristics monitored were:_______________

____

____

____

o. Satisfactory performance was exhibited under nominal and extreme power supply conditions?

Environmental Testing

☐ YES

☐ NO - Explain ____________________

____

____

____

Seismic Testing

☐ YES

☐ NO - Explain ____________________

____

____

____

p. Performance characteristics during testing were monitored in what manner?

Environmental Testing

☐ Continuously

☐ Intermittently, at _____ intervals

☐ Other - Explain ____________________

____

____

Seismic Testing

☐ Continuously

☐ Intermittently, at _____ intervals

☐ Other-Explain ____________________

____

____

q. Does the test report(s) identify that the instrumentation was in current calibration and traceable to the National Bureau of Standards?

Environmental Testing

☐ YES

☐ NO - Explain ____________________

____

____

Seismic Testing

☐ YES

☐ NO - Explain ____________________

____

____

10) Did the qualification test interfaces (electrical connections, piping, supports, etc.) simulate the installed condition?

Environmental Testing

☐ YES

☐ NO - Explain ______________________

____

____

Seismic Testing

☐ YES

☐ NO - Explain ______________________

____

____

VII. EVALUATION

1) The equipment qualified life is:

☐ 40 Years

☐ Other - Specify life and replacement schedule ______________________

____

____

2) Documentation

Supplier Report Number(s)	Summary Report Number	Subject	Proprietary (YES/NO) (If Yes, Identify Location)

3) Is the qualification report(s) acceptable to WPPSS?

Environmental Report

☐ YES

☐ NO - Explain ______________________

____

____

____

Seismic Report

☐ YES

☐ NO - Explain ______________________

____

____

____

WPPSS

EXHIBIT 1

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

EQUIPMENT QUALIFICATION REPORT

OWNER: WPPSS
FACILITY: WNP
SPEC:

MPL:
FPD:

PAGE NO:
REVISION:
DATE:

EQUIPMENT DESCRIPTION	ENVIRONMENT			DOCUMENT REF.		QUALIFICATION METHOD	OUTSTANDING ITEMS
	PARAMETER	FSAR	QUALIFICATION	FSAR	QUAL.		
SYSTEM	OPERATING TIME						
TAG NUMBER	TEMPERATURE (F)						
MANUFACTURER	PRESSURE (PSIA)						
MODEL NUMBER COMPONENT	RELATIVE HUMIDITY (%)						
FUNCTION/SERVICE	CHEMICAL SPRAY						
	RADIATION (RAD)						
	AGING						
LOCATION: BLDG ELEVATION COLUMN	ACCURACY						
FLOOD LEVEL ELEV: ABOVE FLOOD LEVEL? YES NO							

DOCUMENTATION REFERENCES	NOTES

WPPSS

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

EQUIPMENT QUALIFICATION REPORT

OWNER: WPPSS
FACILITY: WNP
SPEC:

MPL:
PPD:

PAGE NO:
REVISION:
DATE:

DOCUMENTATION REFERENCES (Cont'd)	NOTES (Cont'd)

WP-1003

EXHIBIT 2

% QUALIFICATION MARGIN COMPARED WITH THE REQUIRED DESIGN PARAMETERS (FSAR TABLE 3.11.1-)

CONDITION / PARAMETER	NORMAL/ABNORMAL	DESIGN BASIS ACCIDENT	
		LOCA	MSLB
TEMPERATURE, %			
PRESSURE, %			
RADIATION, %			
VOLTAGE, %			
FREQUENCY, %			
TIME, %			
ENVIRONMENTAL TRANSIENTS, %			
VIBRATION, %			

The above is true and correct to the best of my knowledge.

PRIMARY REVIEWER ______________________ (AE) ______________ (DATE)

SECONDARY REVIEWER ____________________ (WPPSS) ____________ (DATE)