

EQUIPMENT QUALIFICATION DATA PACKAGE

This document contains information, relative to the qualification of the equipment identified below, in accordance with the methodology of WCAP 8587. The Specification section (Section 1) defines the assumed limits for the equipment qualification and constitutes interface requirements to the user.

PROCESS PROTECTION SYSTEM

DRAFT

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WESTINGHOUSE CLASS 3

SECTION 1 - SPECIFICATIONS

1.0 PERFORMANCE SPECIFICATIONS

1.1 Electrical Requirements

- 1.1.1 Voltage: Cabinet power supply in: $118 \pm 5\%$ VAC
Cabinet power supply out: 26 ± 1 VDC (primary),
 24 ± 2 VDC (backup)
- 1.1.2 Current: Cabinet power supply in: 21.5 A max. steady state, inrush 10 times steady state
- 1.1.3 Frequency: Cabinet power supply in: $60 \pm 3\%$ Hz;
5% max. harmonic distortion
Cabinet power supply out: DC
- 1.1.4 Load: N/A
- 1.1.5 Electromagnetic Interference: N/A
- 1.1.6 Other: N/A

1.2 Installation Requirements: Per WISD Drawings 8797D33 Rev. 9 and 8797D34 Rev. 9.

1.3 Auxiliary Devices: None

1.4 Preventative Maintenance Schedule: As a result of the completion of the Westinghouse Aging Evaluation Program (References 5 and 6) no maintenance beyond that defined in the equipment instruction manual is required to support the qualified life defined in Section 1.9.

1.5 Design Life: 40 years

1.6 Operating Cycles (Expected number of cycles during design life, including test): Continuous. Refer to Appendix A1 of WCAP-8687 (Reference 5) for mechanical cycling of the potentiometer and relay.

1.7 Performance Requirements for^(b): Reactor Trip, Engineered Safeguard Functions and Post Accident Monitoring

| Parameter | Normal Conditions | Abnormal Conditions | Containment Test Conditions | DBE Conditions(a) | | | Post DBE Conditions(a) | | |
|-------------------------------|-------------------|---------------------|-----------------------------|-------------------|----------------|----------------|------------------------|------------|------------|
| | | | | FLB/SLB | LOCA | Seismic | FLB/SLB | LOCA | Seismic |
| 1.7.1 Time requirement | Continuous | 12 hours | N/A | Event duration | Event duration | Event duration | Continuous | Continuous | Continuous |
| 1.7.2 Performance requirement | Note c | Note d | N/A | Note c | Note c | Note c | Note c | Note c | Note c |

1.8 Environmental Conditions for Same Function^(b)

| | | | | | | | | | |
|------------------------|---------|-----------------------|-----|-----------------------|-----------------------|---------|-----------------------|-----------------------|---------|
| 1.8.1 Temperature (°F) | 60-80 | Fig. 1, Condition 3 | N/A | Ambient | Ambient | Ambient | Ambient | Ambient | Ambient |
| 1.8.2 Pressure (psig) | Ambient | Ambient | N/A | Ambient | Ambient | Ambient | Ambient | Ambient | Ambient |
| 1.8.3 Humidity (% RH) | 30-50 | Fig. 1, Condition 3 | N/A | Ambient | Ambient | Ambient | Ambient | Ambient | Ambient |
| 1.8.4 Radiation (R) | <400 | Included Under Normal | N/A | Included Under Normal | Included Under Normal | None | Included Under Normal | Included Under Normal | None |
| 1.8.5 Chemicals | None | None | N/A | None | None | None | None | None | None |
| 1.8.6 Vibration | None | None | N/A | None | None | None | None | None | None |
| 1.8.7 Acceleration (g) | None | None | N/A | None | None | Fig. 3 | None | None | None |

Notes: a: DBE is the Design Basis Event.
b: Margin is not included in the parameters of this section.
c: Channel accuracy $\pm 0.5\%$ span.
d: Channel accuracy $\pm 1.0\%$ span.

WESTINGHOUSE CLASS 3

1.9 Qualified Life: 5 years.

1.10 Remarks: None

SECTION 2 - QUALIFICATION BY TEST

2.0 TEST PLAN

Abnormal Environment and Seismic tests were performed in the testing laboratories at Westinghouse Industry Electronics Division (W IED) in O'Hara Township, PA. and Westinghouse Advanced Energy Systems Division (W AESD) in Large, PA.

2.1 Equipment Description: Westinghouse ISD 7300 Series Equipment

- o 2-Bay Process Protection Cabinet
- o 3-Bay Process Protection Cabinet
- o PC Cards and Card Frames
- o NIS, N-16 Subsystems

2.2 Number Tested: Type test on one (1) of each equipment type

2.3 Mounting: Cabinet: floor mounted with bolts.
Cards: mounted in card frames.

2.4 Connections: Multiconductor cables.

2.5 Aging Simulation Procedure:

By a separate component test program described by Subprogram C of Appendix B to WCAP-8587 and reported in Reference 5.

2.6 Service Conditions to be Simulated by Test⁽¹⁾

| | | <u>Normal</u> | <u>Abnormal</u> | <u>Containment Test</u> | <u>Seismic</u> | <u>HELB</u> | <u>Post-HELB</u> |
|-------|------------------|---------------|-----------------|-----------------------------|-----------------------|-------------|------------------|
| 2.6.1 | Temp. (°F) | Ambient | Fig. 2 | N/A | Ambient | N/A | N/A |
| 2.6.2 | Pressure (psig) | Ambient | Ambient | N/A | Ambient | N/A | N/A |
| 2.6.3 | Humidity (% RH) | Ambient | Fig. 2 | N/A | Ambient | N/A | N/A |
| 2.6.4 | Radiation (R) | None | None | N/A | None | N/A | N/A |
| 2.6.5 | Chemicals | None | None | N/A | None | N/A | N/A |
| 2.6.6 | Vibration | None | None | N/A | None | N/A | N/A |
| 2.6.7 | Acceleration (g) | None | None | N/A | Fig. 3 ⁽²⁾ | N/A | N/A |

2.7 Measured Variables

This section identifies the parameters required to be measured during the test sequence(s).

A. Seismic Test

B. Operational Test, Normal and Abnormal Conditions

| 2.7.1 | Category I - Environment | <u>Required</u> | <u>Not Required</u> |
|---------|--|--------------------|---------------------|
| 2.7.1.1 | Temperature | B | A |
| 2.7.1.2 | Pressure | | A,B |
| 2.7.1.3 | Moisture | B | A |
| 2.7.1.4 | Composition | | A,B |
| 2.7.1.5 | Seismic Acceleration | A | B |
| 2.7.1.6 | Time | A,B | |
| 2.7.2 | Category II - Input Electrical Characteristics | | |
| 2.7.2.1 | Voltage | A,B | |
| 2.7.2.2 | Current | A,B | |
| 2.7.2.3 | Frequency | A,B ⁽³⁾ | |
| 2.7.2.4 | Power | | A,B |
| 2.7.2.5 | Other | | A,B |
| 2.7.3 | Category III - Fluid Characteristics | | |
| 2.7.3.1 | Chemical Composition | | A,B |
| 2.7.3.2 | Flow Rate | | A,B |
| 2.7.3.3 | Spray | | A,B |
| 2.7.3.4 | Temperature | | A,B |

WESTINGHOUSE CLASS 3

| | | <u>Required</u> | <u>Not Required</u> |
|---------|--|-----------------|---------------------|
| 2.7.4 | Category IV - Radiological Features | | |
| 2.7.4.1 | Energy Type | | A,B |
| 2.7.4.2 | Energy Level | | A,B |
| 2.7.4.3 | Dose Rate | | A,B |
| 2.7.4.4 | Integrated Dose | | A,B |
| 2.7.5 | Category V - Electrical Characteristics | | |
| 2.7.5.1 | Insulation Resistance | | A,B |
| 2.7.5.2 | Output Voltage | A,B(3) | |
| 2.7.5.3 | Output Current | | A,B |
| 2.7.5.4 | Output Power | | A,B |
| 2.7.5.5 | Response Time | | A,B |
| 2.7.5.6 | Frequency Characteristics | | A,B |
| 2.7.5.7 | Simulated Load | | A,B |
| 2.7.6 | Category VI - Mechanical Characteristics | | |
| 2.7.6.1 | Thrust | | A,B |
| 2.7.6.2 | Torque | | A,B |
| 2.7.6.3 | Time | | A,B |
| 2.7.6.4 | Load Profile | | A,B |
| 2.7.7 | Category VII - Auxiliary Equipment | | |
| | None | | |

2.8 Test Sequence Preferred

This section identifies the preferred test sequence as specified in IEEE-323-74, Section 6.3.2.

- 2.8.1 Inspection of Test Item
- 2.8.2 Operation (Normal Condition)
- 2.8.3 Operation (Performance Specifications Extremes, Section 1)
- 2.8.4 Simulated Aging
- 2.8.5 Seismic Vibration
- 2.8.6 Operation (Simulated High Energy Line Break Conditions)
- 2.8.7 Operation (Simulated Post HELB Conditions)
- 2.8.8 Inspection

2.9 Test Sequence Actual

This section identifies the actual test sequence(s) used in the qualification of the 7300 Series Process Protection System. The following subsections indicate separate test sequences completed on different, but essentially identical, equipment and/or components. The justification for employing anything other than the preferred sequence is as follows:

The DBE is simulated by the test sequence of Section 2.9.2. The HELB Tests (Sections 2.8.6 and 2.8.7) are not required since the 7300 Series Process Protection System is, due to its location, not exposed to the HELB environment. The aging test employs the preferred test sequence (Section 2.8) excluding HELB and Abnormal Extremes (Sections 2.8.6, 2.8.7 and 2.8.3) on a representative sample of components from the Process Protection System. The Aging Tests demonstrate that during the qualified life there are no in-service aging mechanisms capable of reducing the capability of the Process Protection System to perform during or after a seismic event. As a consequence, the seismic testing on the un-aged 7300 Series Process Protection System equipment is not prejudiced by any in-service aging mechanisms.

WESTINGHOUSE CLASS 3

| <u>Step</u> | <u>Notes</u> |
|---|---|
| 2.9.1 Production Test Sequence | |
| 2.8.1 | System test performed on all production units |
| 2.8.2 | |
| 2.8.8 | |
| 2.9.2 Environmental and Seismic Test Sequence | |
| 2.8.1 | |
| 2.8.2 | |
| 2.8.3 | Abnormal Environment extremes followed by seismic |
| 2.8.5 | test on the same equipment |
| 2.8.8 | |
| 2.9.3 Aging Test Sequence | |
| 2.8.1 | |
| 2.8.2 | Aging is addressed by separate testing as |
| 2.8.4 | described in Subprogram C of Appendix B to |
| 2.8.5 | WCAP-8587 and reported in References 5 and 6. |
| 2.8.8 | |

2.10 Type Test Data

2.10.1 Objective

The objective of this qualification test program is to demonstrate, employing the recommended practices of Regulatory Guide 1.89 (IEEE-323-1974) and Regulatory Guide 1.100 (IEEE-344-1975) the capability of the 7300 Series Process Protection System to perform its safety related functions described in Section 1.7 while subjected to the simulated abnormal environments and seismic service conditions defined in Section 1.8.

2.10.2 Equipment Tested

2.10.2.1 Normal Environment Testing

A system test under normal environmental conditions is performed on each 7300 Series Process Protection System at the completion of the manufacturing process.

2.10.2.2 Abnormal Environment and Seismic Testing

The modules which are used in the 7300 Series Process Protection System were tested. For details see Table 1 of Reference 1.

2.10.2.3 Aging Evaluation Program

A representative sample of critical components from the 7300 Series Process Protection System is included in Subprogram C of the Aging Evaluation Program described in Appendix B to WCAP-8587 and reported in Reference 5.

2.10.3 Test Summary

2.10.3.1 Environment Testing

Westinghouse requires that the 7300 Series Process Protection equipment be located such that it will not be exposed to an adverse environment as the result of a high energy line break. Therefore testing is only required to demonstrate equipment capability under normal and abnormal service conditions.

Reference 4 summarizes the results of available radiation testing of organic and inorganic materials and justifies that for radiation doses less than 10^4 rads, no deterioration in material structural properties is detectable. As a consequence, irradiation simulation is not required on this equipment, since estimated in-service radiation doses will not prejudice the capability of the equipment to perform under design basis event (i.e. seismic event) conditions.

The environmental testing reported in References 1 and 3 demonstrated the capability of the 7300 Series Process Protection System modules, to meet the safety-related performance requirements specified in Section 1.7 when exposed to the abnormal environment specified in Section 1.8. Margin was included in this test by submitting the equipment to a double cycle of electrical and environmental extremes also shown in Figure 2. This test is considered to satisfactorily demonstrate qualification of the Process Protection System in accordance with IEEE-323-1974 Section 6.3.2.(2) and (3).

2.10.3.2 Seismic Tests

The single design basis event capable of producing an adverse environment at the equipment location is a seismic event. The seismic testing reported in References 1, 2 and 3, was completed on new equipment employing multi-axis, multi-frequency inputs in accordance with Reg Guide 1.100 (IEEE-344-1975). Reference 2 describes testing of the two and three bay cabinets. These tests provided the basis for the development of the device required response spectra used in the seismic qualification of Process Protection System modules reported in References 1 and 3.

2.10.3.3 Aging Evaluation

Subprogram C of the Westinghouse Aging Evaluation Program (Appendix B, WCAP 8587) has incorporated a representative sample of components from the 7300 Series Process Protection System. This program is completed and is reported in Reference 5. Subprogram C demonstrates that during the qualified life there are no in-service aging mechanisms capable of reducing the capability of the Process Protection System to perform during or after a seismic event.

2.10.4 Conclusion

The currently demonstrated qualified life of the 7300 Series Process Protection System is 5 years. Westinghouse is planning an extension of Subprogram C of the Westinghouse Aging Evaluation Program to increase the demonstrated qualified life. The results of the aging program, together with the seismic and environmental testing described herein, demonstrate the qualification of the Process Protection Equipment. Because of differences in individual NSSS Process

Protection Systems, test results must be considered on a plant specific basis to establish the qualification of a particular Process Protection System.

2.11 Notes

- (1) The generic tests completed by Westinghouse employ parameters designed to envelope a number of plant applications. Margin is a plant specific parameter and will be established by the applicant.
- (2) Test response spectrum (TRS) to envelope the required response spectrum (RRS).
- (3) Frequency and output voltage measurements were required only for the testing reported in Reference 3.

2.12 References

1. Capone, J. A., Maurer, B. F., Schell, L. "Equipment Qualification Test Report Process Protection System (Supplemental Testing)", WCAP-8687, Supplement 2-E13C (Proprietary), (later)
2. Skeers, D. M. "Equipment Qualification Test Report Process Protection System", WCAP-8687, Supplement 2-E13B (Proprietary), January 1981.
3. Coslow, B. J., "Equipment Qualification Test Report, Process Protection System (Seismic Testing)", WCAP-8687, Supplement 2-E13A (Proprietary), October 1980.
4. Damerow, F. W., "Effects of Gamma Radiation Doses Below 10^4 Rads on the Mechanical Properties of Materials", Appendix C WCAP-8587 (Non-Proprietary) January 1981.
5. Jabs, R., Parello, J., Huang, J., Yalick, M., "Equipment Qualification Tests Report Short Term Component Aging Test Program", WCAP-8685, Supplement 2 Appendix A1 (Proprietary), March 1981.
6. "Equipment Qualification Test Report Material Aging Analysis", WCAP-8687, Supplement 2, Appendix A2 (Proprietary), March 1981.

WESTINGHOUSE CLASS 3

SECTIONS 3 & 4 QUALIFICATION BY EXPERIENCE AND/OR ANALYSIS

Westinghouse does not employ operating experience or analysis in support of the qualification program for the 7300 Series Process Protection System.

WESTINGHOUSE CLASS 3

TABLE 1

ACTUAL QUALIFICATION TEST CONDITIONS

| EQUIPMENT (1) SYSTEM/CATEGORY | LOCATION STRUCTURE/AREA | MANUFACTURER TYPE/MODEL | ABNORMAL/ACCIDENT ENVIRONMENTAL EXTREMES | | OPERABILITY | | ACCURACY(%) | | QUAL LIFE | QUAL METHOD | QUAL REF | QUAL PROGRAM STATUS |
|----------------------------------|----------------------------|----------------------------|--|---------------|----------------------|-------------|-------------|------|--------------|----------------|-------------|---------------------------|
| | | | PARAMETER | SPECIFIED (2) | QUALIFIED | REQ | DEM | REQ | DEM | | | |
| Process | Control | W ISD | Temperature | | 120°F | 12 hrs. Two | | ±0.5 | ±0.5 | 5 | Seq. | ESE - Ongoing |
| Protection | building/ | 7300 Series | Pressure | | Atmos. | | 12 | span | span | yrs. | Test | 13 |
| System/ | MCR | Process | Rel. humidity | | 95% | | hr. | | | | | |
| RPS | | Protection | Radiation | | 10 ⁴ R(y) | | cycles | | | | | |
| Category d ⁽¹⁾ | | System | Chemistry | | None | | | | | | | |
| | | Modules | | | | | | | | | | |

Notes:

- For definitions of category letters, refer to NUREG-0588 "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment," Appendix E, Section 2.
- Plant specific environmental parameters are to be inserted by the applicant.

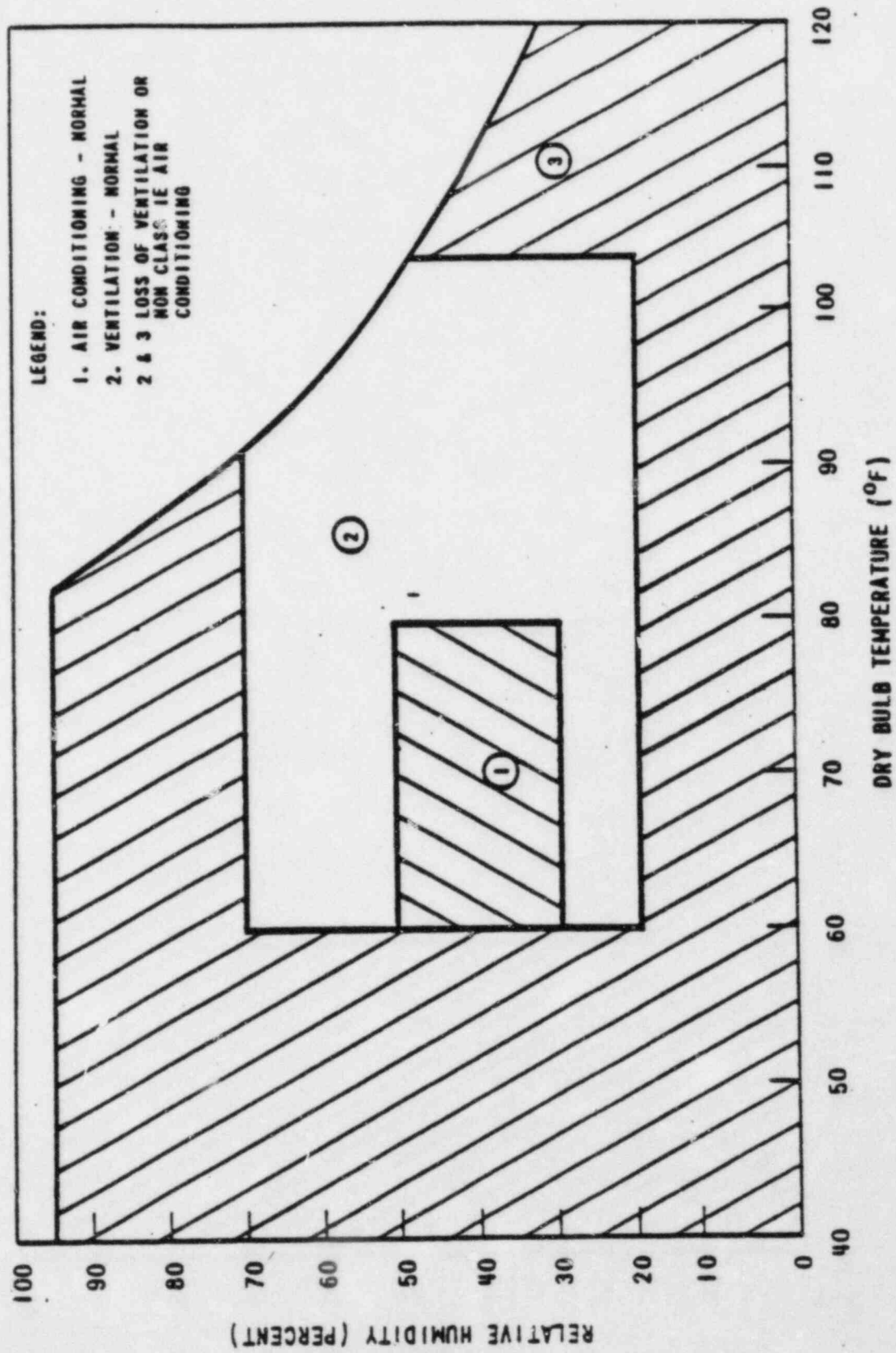


Figure 1 Temperature Versus Humidity - Enclosed Environments Outside Containment

WESTINGHOUSE CLASS 3

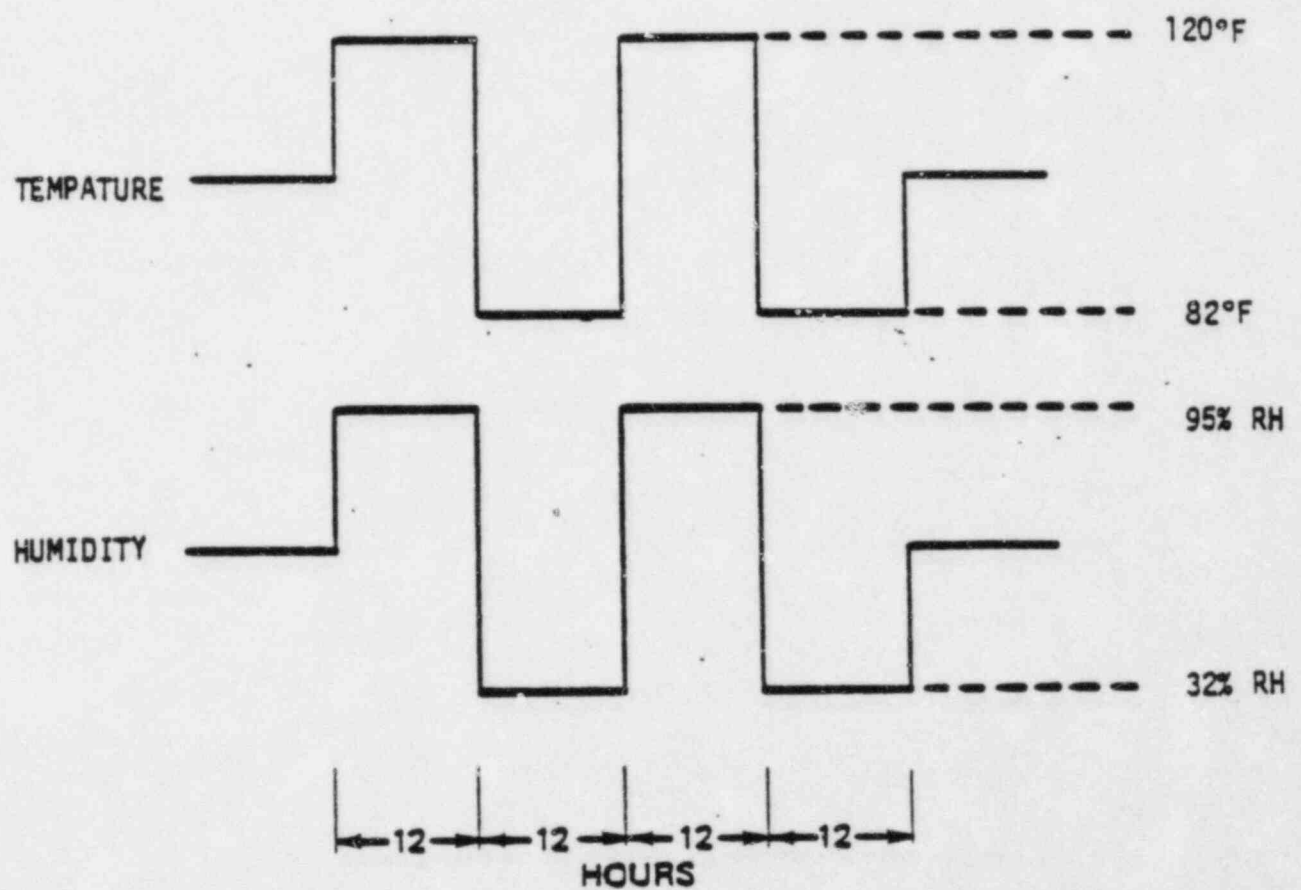


Figure 2 Enviromental Test Profile Requirement

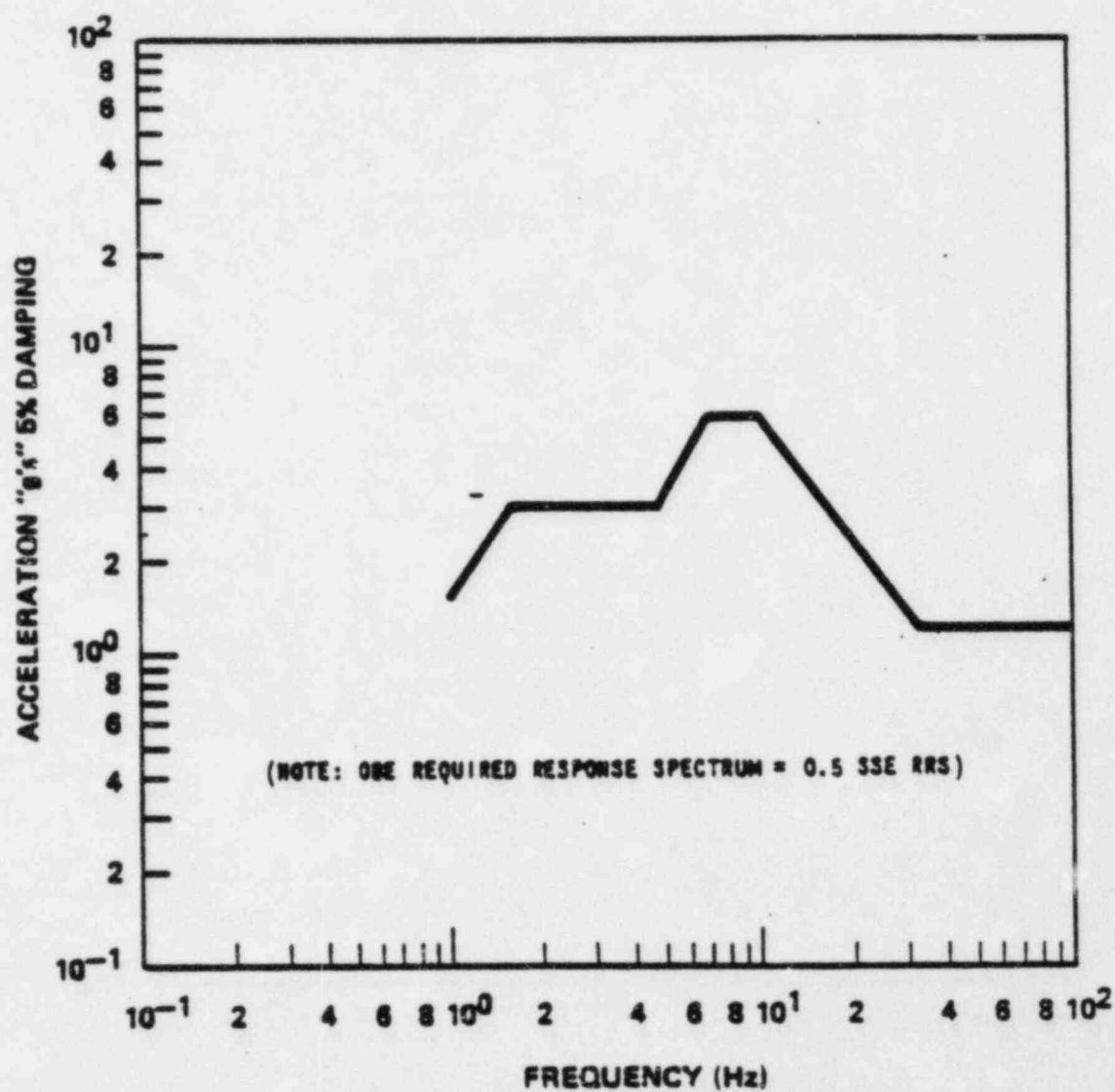


Figure 3 Required SSE Floor Response Spectrum

SNUPPS
Interim Justification Position for the
Seismic Qualification of the
Boron Dilution Fix
(ESE-47)

The Boron Dilution Protection System equipment, which consists of the Source and Intermediate Range Drawers, Source/Intermediate Range Detector and Source Range Pre-Amplifier, and NIS Console has completed seismic and environmental testing. The seismic testing was successfully completed for all equipment. The Boron Dilution Protection System is classified as NUREG-0588 Category C equipment.

Although the Source-Range Pre-amplifier successfully passed the seismic and environmental tests, it was noticed to be noise susceptible during system verification testing which leads to an operational concern.

For this reason, a new pre-amplifier (model MK II) was designed. SNUPPS will operate with this redesigned part, which is yet to be seismically qualified. The unit has been functionally tested and determined, in fact, to be a superior design to the MK I with respect to filtering extraneous noise. Environmental qualification testing (temperature and humidity cycling) has been performed with successful results.

Seismic testing of the pre-amplifier will be accomplished early in 1984. Again, the MK I demonstrated its quality of design and manufacture in sustaining its capabilities throughout the range of seismic tests. The MK II's similarities to the previous design with respect to function, size, mounting and manufacture provide a high degree of confidence that seismic testing of the MK II will be successful.

Upon completion of testing of the MK II pre-amplifier, a draft report titled "Boron Dilution Fix (Source and Intermediate Range Drawers and Source Range Pre-Amplifier)" and a report titled "NIS Console, Source and Intermediate Range Drawers, Source Range Pre-Amplifier Box (Environmental Testing)" will be issued.

All reports would then reflect the redesigned equipment. All testing, including reports, will be complete in June 1984.