EQDP-ESE-17
Rev. 2, 4/82

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 (Part 1) defines the assumed limits for the equipment qualification and constitute interface requirements to the user.

Solid State Protection System (SSPS) Three Train & Safeguard Test Cabinet

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PART 1 - SPECIFICATIONS

1.0 PERFORMANCE SPECIFICATIONS

1.1 Electrical Requirements

1.1.1 Voltage: 120 VAC ±10% Single Phase, 105 - 140 VDC

1.1.2 Frequency: 60 or 50 Hz ± 5%

1.1.3 Load: Steady state - 10 amp; In Rush - 35 amp

1.1.4 Electromagnetic Interference: ± 0.5% (P-P) of output span in frequency range which could affect downstream modules: demonstrated per MIL-N-19900B 1960 Sec. 4.6.11

1.1.5 Other: The electrical requirements are described in detail in WCAP-7488L (Reference 4)

1.2 Installation Requirements: Westinghouse Drawing 7242D10 Revision 4

1.3 Auxiliary Devices: None

1.4 Preventative Maintenance Schedule: As a result of the completion of the Westinghouse Aging Evaluation Program (Phase 1, Short Term Aging) described in WCAP-8587 and discussed in WCAP-8687 Supplement 2, Appendix A1 (Component Aging) Reference 5 and Appendix A2 (Materials Aging) Reference 6 (Proprietary), 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 duty. Refer to Appendix A1, Reference 5, for mechanical cycling of relays.

1.7 Performance Requirements for Function[b]:

	Parameter	Normal Conditions	Abnormal Conditions	Containment Test Conditions	DBE Conditions[a] FLB/SLB	DBE Conditions[a] LOCA	DBE Conditions[a] Seismic	Post DBE Conditions[a] FLB/SLB	Post DBE Conditions[a] LOCA	Post DBE Conditions[a] Seismic
1.7.1	Time requirement	Continuous	12 hours	N/A	N/A	N/A	Event duration	N/A	N/A	Continuous
1.7.2	Performance requirement	Note d	As normal				As normal			As normal

1.8 Environmental conditions for Same Function[b]

1.8.1	Temperature (^{o}F)	60 - 80	Note c				Ambient			Ambient
1.8.2	Pressure (psig)	0	0				0			0
1.8.3	Humidity (% RH)	30 - 50	Note c				Ambient			Ambient
1.8.4	Radiation (R)	< 400	None				None			None
1.8.5	Chemicals	None	None				None			None
1.8.6	Vibration	None	None				None			None
1.8.7	Acceleration(g)	None	None				See Sec. 2.10.3.2			

Notes: a. DBE is the Design Basis Event.

b. Margin is not included in the parameters of this section.

c. Figure 1, envelope 3,. However, since operation at low humidity, based on Westinghouse experience, is not an operating concern, the abnormal extreme for humidity shall be 88 percent RH. Also, for plants having a Class 1E HVAC for the area in which the SSPS is located, the abnormal extremes are the same as the normal specified above.

d. Initiate reactor trip or safeguards actuation on demand.

1.9 Qualified Life: The currently demonstrated qualified life (Phase I Short Term Aging), 5 years based on the actual test conditions identified in Table 1. Westinghouse is planning an extension (Phase II Long Term Aging) of Subprogram C of the Aging Evaluation Program (Appendix B to WCAP-8587) to increase the demonstrated qualified life.

1.10 Remarks: None

PART 2 - QUALIFICATION BY TEST

2.0 TEST PLAN

The environmental qualification of the SSPS was performed at Westinghouse NICD (Normal) Hunt Valley, Maryland and Westinghouse DESC (Abnormal), Baltimore, Maryland. The seismic qualification was performed at WAESD, Large, Pa.

2.1 Equipment Description: Three Train Solid State Protection System including the Safeguards Test Cabinet and Wall-Mounted Relay Box (see Section 2.10.2). The SSPS performs both a reactor trip function and a safeguards actuation function. The Safeguards Test Cabinet is used to perform on-line testing of the safeguards actuation feature of the SSPS. The system and electrical requirements are defined in more detail in WCAP-7488L (Reference 4).

2.2 Number Tested: Type test on one (1) representative train

2.3 Mounting: Westinghouse Drawing 7242D10 Revision 4 includes the Three Train SSPS, Safeguards Test Cabinet and Wall-Mounted Box.

2.4 Connections: Terminal blocks (Power & Output); connector (input)

2.5 Aging Simulation Procedure:
As described in Subprogram C of Appendix B to WCAP-8587 and reported in Reference 5.

2.6 Service Conditions to be Simulated by Test:

		Normal	Abnormal	Cont. Test	Seismic	HELB	Post-HELB
2.6.1	Temp. (^{O}F)	Ambient	Figure 2	N/A	Ambient	N/A	N/A
2.6.2	Pressure (psig)	0	0		0		
2.6.3	Humidity (% RH)	Ambient	Figure 2		Ambient		
2.6.4	Radiation (R)	None	None		None		
2.6.5	Chemicals	None	None		None		
2.6.6.	Vibration	None	None		None		
2.6.7	Acceleration (g)	None	None		See 2.10.3		

2.7 Measured Variables

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

		Required	Not Required
2.7.1	Category I - Environment		
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	Gas 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	B	A
2.7.2.3	Frequency	A,B	
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
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

		Required	Not Required
2.7.5	Category V - Electrical Characteristics		
2.7.5.1	Insulation Resistance		A,B
2.7.5.2	Output Voltage	A,B	
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		

A: Seismic Test

B: Operational Test, ALnormal Conditions

2.8 Test Sequence Preferred

This section identifies the preferred test sequences as specified in IEEE-323-1974

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 Vibration

2.8.6 Operation (Simulated High Energy Line Break Conditions)

2.8.7 Operation (Simulated Post HELB Conditions)

2.8.8 Disassembly and Inspection

2.9 Test Sequence Actual

This section identifies the actual test sequence(s) which, in total, constitutes the overall qualification program for this equipment. The justification for employing anything other than the preferred sequence is as follows;

2.9.1 Three Train SSPS Including the Safeguards Test Cabinet and Wall Mounted Relay Box Actual Test Sequence

The DBE is simulated by the Seismic Test sequence of Section 2.9.1. The HELB Tests (Section 2.8.6 and 2.8.7) have been excluded since the SSPS equipment is not exposed to the HELB environment due to its location. The abnormal extremes test of Section 2.9.1.2 was performed on the same equipment as was used in the Seismic Test Sequence. An exact definition of the equipment tested is provided in Section 2.0 of Reference 1. 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 SSPS equipment. The aging tests demonstrate that during the qualified life there are no in-service aging mechanisms capable of reducing the capability of the SSPS equipment to perform during or after a seismic event. As a consequence, the seismic testing on the un-aged SSPS equipment is not prejudiced by any in-service aging mechanisms.

Step	Notes
2.9.1.1 Seismic Test Sequence	
2.8.1	Seismic (DBE) test sequence
2.8.2	(Three Bay SSPS including the Safeguards Test
2.8.5	Cabinet and Wall-Mounted Relay Box)
2.8.8	
2.9.1.2 Environmental Test Sequence	
2.8.1	Environmental test sequence
2.8.2	performed on the same equipment
2.8.3	tested in the Seismic
2.8.8	Test Sequence
2.9.1.3 Aging Test Sequence	
2.8.1	Aging is addressed by separate testing
2.8.2	as described in Subprogram C of Appendix B
2.8.4	to WCAP-8587 and reported in References 5 and 6.
2.8.5	
2.8.8	

2.10 Type Test Data

2.10.1 Objective

The objective of this test program is to determine, employing the recommended practices of Reg. Guide 1.89 (IEEE-323-1974) and Reg. Guide 1.100 (IEEE-344-1975), the capability of the Three Train Solid State Protection System, Safeguards Test Cabinet and Wall-Mounted Relay Box to complete the safety related functions described in EQDP Section 1.7 while exposed to the applicable environment defined in EQDP Section 1.8.

2.10.2 Equipment Tested

2.10.2.1 Three Train SSPS including the Safeguards Test Cabinet and Wall-Mounted Relay Box

2.10.2.1.1 Three Train SSPS equipment Seismic Tests are reported in Reference 2.

2.10.2.1.2 Environmental Test reported in Reference 1.

2.10.2.1.3 Aging Evaluation Program

A representative sample of critical components from the SSPS 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

Voltage and frequency tests were performed before, during and after the seismic and environmental testing to confirm that the equipment had not degraded substantially as the result of the test. These tests confirmed satisfactory operation.

2.10.3.1 SSPS, Safeguards Test Cabinet and Wall-Mounted Relay Box

2.10.3.1.1 Seismic Tests

Westinghouse requires that the Three Train Solid State Protection System, Safeguards Test Cabinet and Wall-Mounted Relay Box be located such

that it does not experience a consequent adverse environment when required to operate following a high energy line break either inside or outside containment. The single design basis event capable of producing an adverse environment at the equipment location is a seismic event. The seismic testing reported in Reference 2 was completed on new equipment at differing seismic levels employing multi-axis multi-frequency testing in accordance with IEEE-344-1975. This testing demonstrates the capability of the Three Train SSPS equipment to perform their prespecified safety-related functions, during and after seismic events up to and including those required for plants in areas of high seismic activity, in accordance with Reg. Guide 1.100 (IEEE344-1975). The generic seismic test levels contain significant margin with respect to any single plant application referencing this program.(1)

2.10.3.1.2 Environmental Test

Westinghouse requires that the SSPS, Safeguards Test Cabinet and Wall-Mounted Relay Box be located such that it does not experience a consequent adverse environment when required to operate following a high energy line

break either inside or outside containment. Therefore the only testing required is to demonstrate equipment capabilities under normal and abnormal service conditions (temperature, humidity and A.C. power voltage and frequency).

Reference 3 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, a radiation 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 Reference 1 was designed to demonstrate the capability of the Three Train SSPS, Safeguards Test Cabinet and Wall-Mounted Relay Box to meet the safety-related performance requirements specified in EQDP Section 1.7 when exposed to the variations in temperature humidity, voltage, and frequency specified by EQDP Figure 2. The test successfully demonstrated the specified safety related requirements. However, the specified maximum humidity of 95% was not maintained. During the high

temperature test a humidity of 88% RH was maintained, which justifies equipment acceptability up to and including 88% RH.

Additional margin was included in this test by submitting the equipment to a double cycle of electrical and environmental extremes as described by EQDP Figure 2. This test is considered to satisfactorily demonstrate the SSPS equipment capability to meet its safety-related functional requirements when exposed to specified normal and simulated abnormal environments (EQDP Section 1.7) and permitted range of frequency and voltage variations (EQDP Section 1.1) in accordance with IEEE-323-1974 Section 6.3.2.(2) and (3).

2.10.3.1.3 Aging Evaluation

Subprogram C of the Westinghouse Aging Evaluation Program (Appendix B, WCAP-8587) has incorporated a representative sample of components from the Solid State Protection System including the Safeguards Test Cabinet and Wall-Mounted Relay Box. This program is completed and reported in WCAP-8687 Supplement 2 Appendix A1 (Proprietary). The objective of Subprogram C is to demonstrate that during the qualified life there are no in-service aging mechanisms capable of reducing the capability of the SSPS to perform it's

safety-related function during or after a seismic event. As a consequence, the seismic testing on the full Solid State Protection System described above, is not prejudiced by any in-service aging mechanism.

2.10.4 Conclusion

The Three Train SSPS equipment was actuated and monitored both during and following the seismic testing. The seismic test demonstrated that the Three Train SSPS equipment is capable of initiating reactor trip or safeguards actuation on demand during or following a seismic event.

The currently demonstrated qualified life of the SSPS, Safeguards Test Cabinet and Wall-Mounted Relay Box is 5 years. Westinghouse is planning an extension of Sub-program C of the Aging Evaluation Program to increase the qualified life. The results of the aging program, the seismic and environmental testing described herein, demonstrate: the qualification of the Three Train SSPS, Safeguards Test Cabinet and Wall-Mounted Relay Box employing the practices recommended by Reg. Guide 1.89 and 1.100.

2.11 Section 2 Notes

(1) The generic tests proposed 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.

2.12 References

1. Vogeding E. L., "Equipment Qualification Test Report Three Train Solid State Protection System (Normal and Abnormal Temperature and Humidity Testing)", WCAP-8687 Supp. 2-E17A (Proprietary).

2. Tang, D., H. Groot, E. L. Vogeding, "Equipment Qualification Seismic Test Report, Three Train Solid State Protection System", WCAP-8687 Supp. 2-E17B (Proprietary).

3. Damerow, F. W., "Effects of Gamma Radiation Doses Below 10^4 Rads on the Mechanical Properties of Materals," WCAP-8587 Appendix C (Non-Proprietary).

4. Katz, D. N., "Solid State Logic Protection System Description" WCAP-7488L (Proprietary); January 1971.

5. Jabs, R., Parello, J., Huang, J., Yalich, M., "Equipment Qualification Test Report Short Term Component Aging Test Program;" WCAP-8687, Supplement 2, Appendix A1 (Proprietary).

6. "Equipment Qualification Test Report Materials Aging Analysis", WCAP-8687, Supplement 2, Appendix A2 (Proprietary).

PART 3 - QUALIFICATION BY EXPERIENCE AND/OR ANALYSIS

Westinghouse does not employ operating experience or analysis in support of the Qualification Program for the Three Train SSPS, Safeguards Test Cabinet, and Wall-Mounted Relay Box.

TABLE 1

ACTUAL QUALIFICATION TEST CONDITIONS

EQUIPMENT (1) SYSTEM/CATEGORY	LOCATION STRUCTURE/AREA	MANUFACTURER TYPE/MODEL	ABNORMAL/ACCIDENT ENVIRONMENTAL EXTREMES PARAMETER	SPECIFIED (2)	QUALIFIED	OPERABILITY REQ	OPERABILITY DEM	ACCURACY(%) REQ	ACCURACY(%) DEM	QUAL LIFE	QUAL METHOD	QUAL REF	QUAL PROGRAM STATUS
Solid State Protection System Safeguards Test Cabinet and Wall-Mounted Relay Box/ RPS, ESF/ Category d	Control building/ MCR	W-NICD Three Train	Temperature		$120^{o}F$	12 hr.	Two	-	-	5	Seq.	ESE-	Completed
			Pressure		Atmos.	cycles	12			yrs.	Test	16	
			Rel. humidity		88%		hr.			(3)			
			Radiation		$10^{4}R(\gamma)$		cycles						
			Chemistry		None								

Notes:

1. For definition of the category letters, refer to NUREG 0588 "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment," Appendix E, Section 2.

2. Plant specific environmental parameters are to be inserted by the applicant.

3. Phase I of the Westinghouse Aging Evaluation Program as described in WCAP-8587 Appendix B has established a qualified life of at least 5 years for this equipment, Phase II of this program will extend the qualification life to a maximum of 20 years or as far as is achievable.

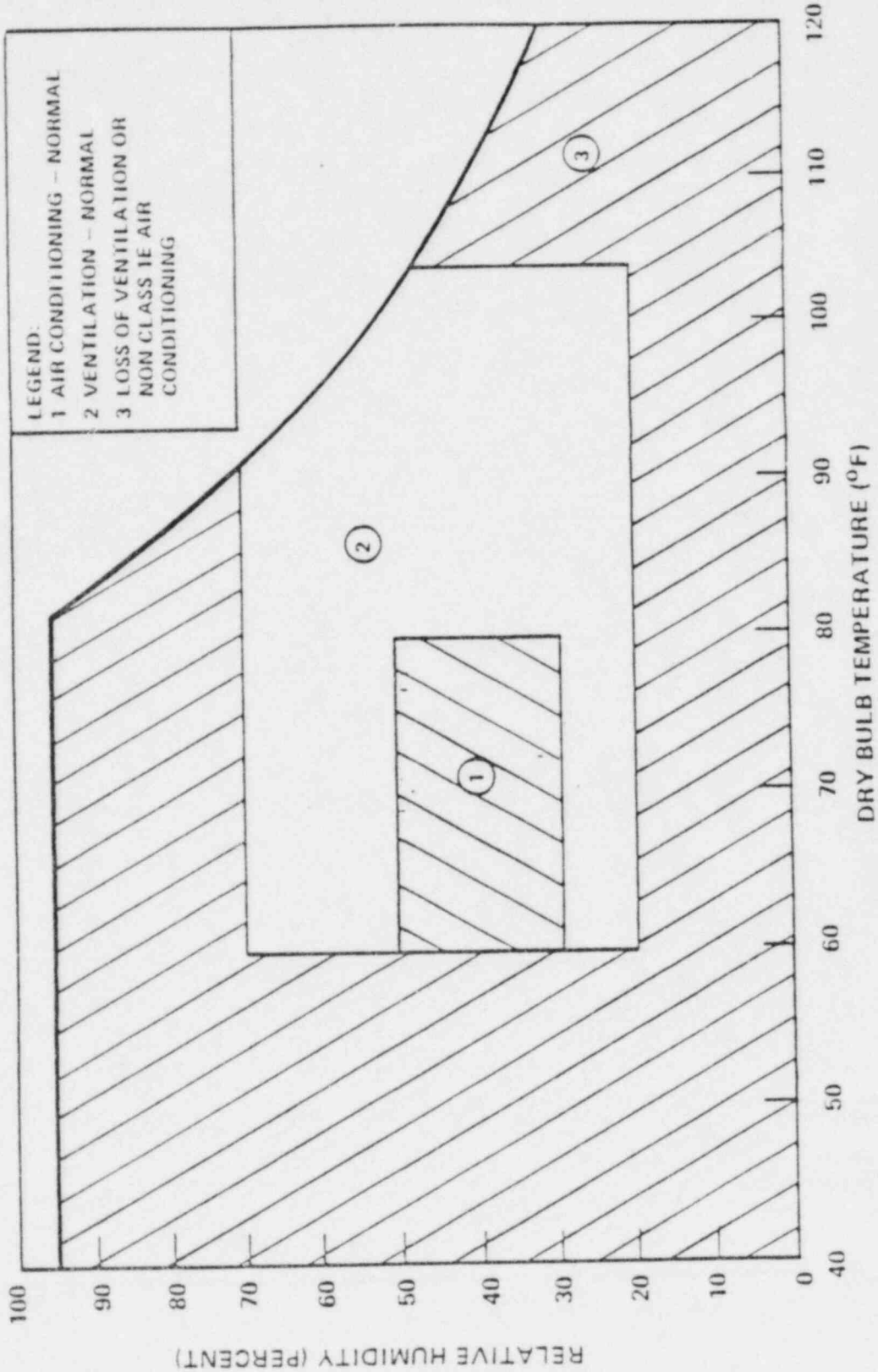

Figure 1 Temperature versus Humidity-Enclosed Environment Outside Containment

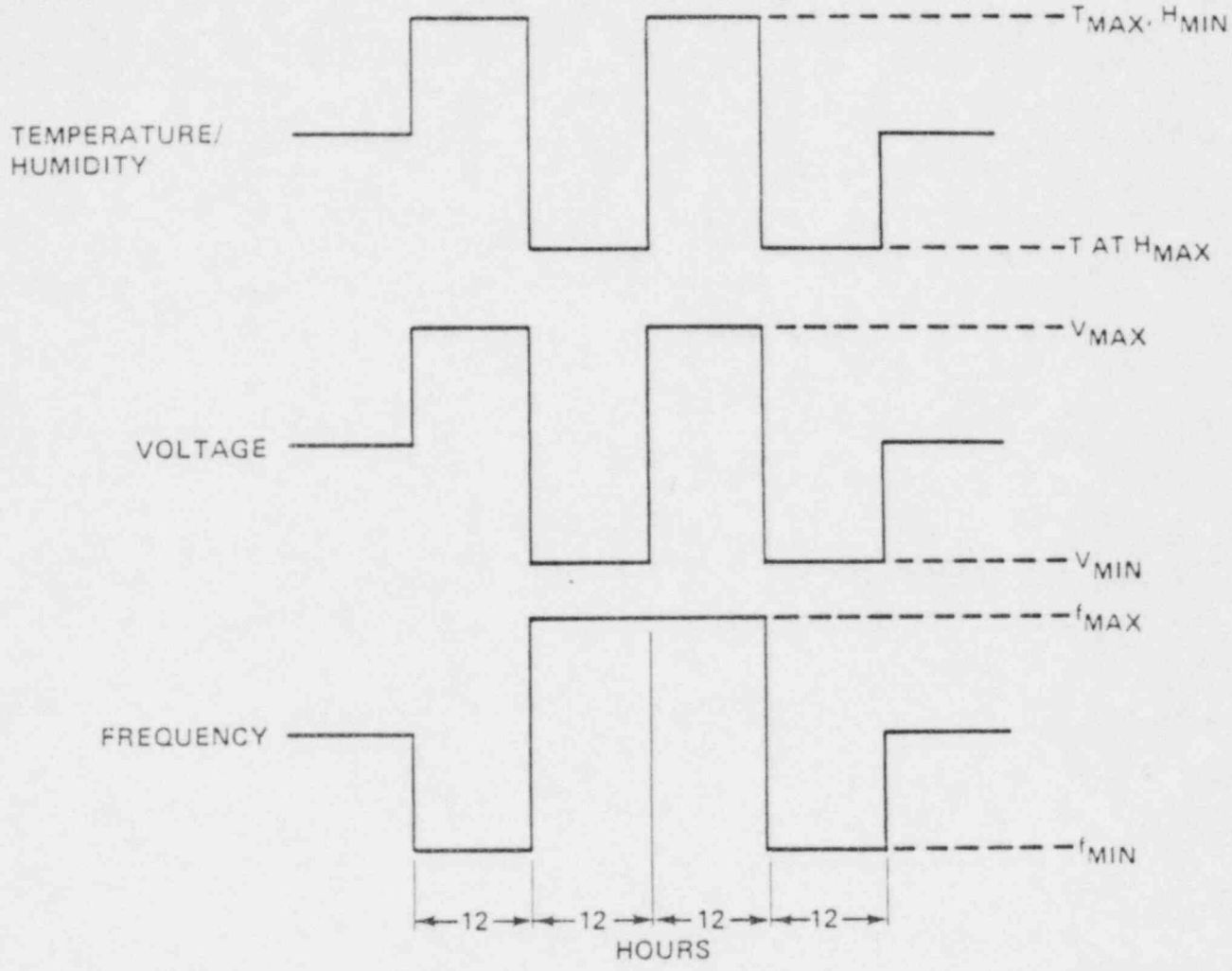

Figure 2 Verification Test Profile

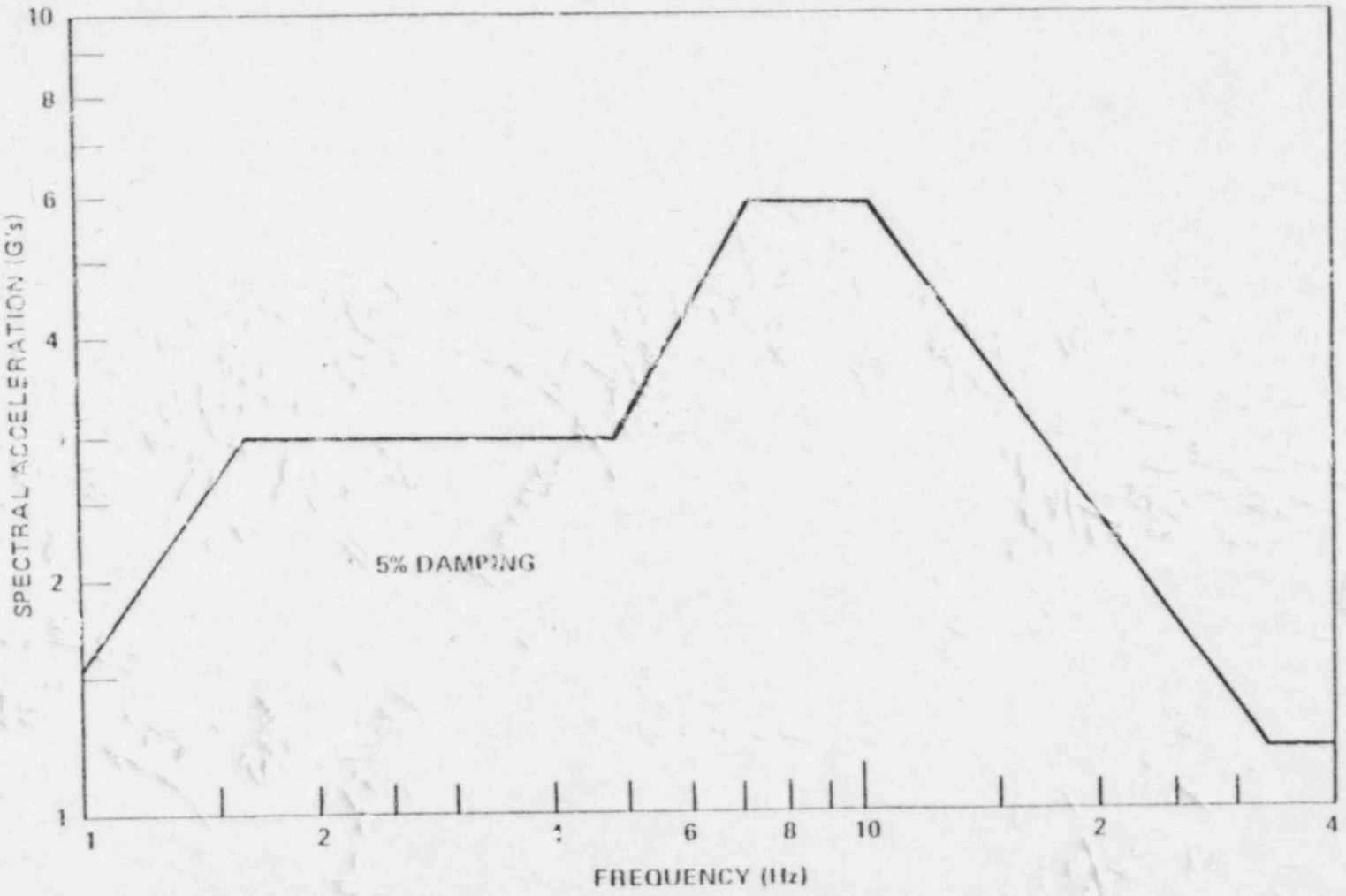

Figure 3 Refined Response Spectrum for Safe Shutdown Earthquake