WESTINGHOUSE CLASS 3

EQDP-HE-8
Rev. 0 8/83

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.

CONAX AND LITTON ELECTRICAL SEAL ASSEMBLIES

(Qualification Group A)

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SECTION 1 - SPECIFICATIONS

1.0 PERFORMANCE SPECIFICATIONS

1.1 Electrical Requirements

		(A)*	(B)*
1.1.1	Voltage:	125 VDC nominal	120 VAC nominal
1.1.2	Frequency:	N/A	60 Hz
1.1.3	Load:	1/2 amp	5 amp
1.1.4	Electromagnetic Interference	N/A	N/A
1.1.5	Other:	N/A	N/A

1.2 Installation Requirements: Specific instructions regarding the assembly/mounting of the electrical seal assemblies will be controlled by a Field Change Notice or set of installation instructions issued by Westinghouse. These installation instructions/Field Change Notice will ensure that the installation of the qualified seal is in accordance with the qualification testing installation.

1.3 Auxiliary Devices: The electrical seal assembly interfaces with devices which will generally be subject to the same conditions as the electrical seals. The qualification of these interface devices, is not an objective of this program. The interface of the electrical seal with these devices is covered in the Field Change Notice or Installation Instructions covered in Section 1.2 above. The qualification of the Litton and CONAX seals described herein applies only to applications where these seals are mounted in the same manner as the actual test. If the seal is to be used with other mounting configurations, this mounting will have to be specifically justified by the user and is not specifically justified by this testing. Specific auxiliary device mounting covered by this testing are NAMCO limit switches, ASCO solenoid valves and RTD's.

*Both (A) and (B) are requirements for various in-service application. Based on past testing the (A) requirements are more severe conditions imposed on the seal.

1.4 Preventative Maintenance Schedule: Per the Westinghouse Equipment Qualification test program, no preventive maintenance is required to support the equipment qualified life of 20 years. This does not preclude development of a preventive maintenance program designed to enhance equipment performance and identify unanticipated equipment degradation as long as this program does not compromise the qualification status of the equipment. Surveillance activities may also be considered to support the basis for/and a possible extension of the qualified life.

1.5 Design Life: 40 years

1.6 Operating Cycles (Expected number of cycles during design life, including test): 20,000 for 40 year life.

1.7 Performance Requirements for (b): CONAX and Litton Electrical Seal Assemblies

	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	Included under normal	Test duration	<24hrs.	<24 hrs.	Event duration	1 year	1 year	Continuous
1.7.2	Performance requirement	Note C		No damage	Note C	Note C	Note C	Note C	Note C	Note C
1.8	Environmental Conditions for Same Function (b)									
1.8.1	Temperature(^{o}F)	50-120	Included under normal	Ambient	Fig. 2	Fig. 3	Ambient	Fig. 2	Fig. 3	Ambient
1.8.2	Pressure (psig)	-6.7/+2.3		70	Fig. 2	Fig. 3	Ambient	Fig. 2	Fig. 3	Ambient
1.8.3	Humidity (% RH)	10-100		Ambient	100	100	Ambient	100	100	Ambient
1.8.4	Radiation (R)	$1.75 \times 10^{7}_{\gamma}$		None	$3.5 \times 10^{4}_{\gamma}$ $1.8 \times 10^{5}_{\beta}$ Fig. 4 & 6	$2.3 \times 10^{7}_{\gamma}$ $1.7 \times 10^{8}_{\beta}$ Fig. 5 & 7	None	$1.2 \times 10^{5}_{\gamma}$ $7.8 \times 10^{5}_{\beta}$ Fig. 4 & 6	$1.3 \times 10^{8}_{\gamma}$ $1.3 \times 10^{9}_{\beta}$ Fig. 5 & 7	None
1.8.5	Chemicals	None		None	Note d	Note d	None	Note d	Note d	None
1.8.6	Vibration	Figure 1		None	None	None	None	None	None	None
1.8.7	Acceleration(g)	None		None	None	None	See Figure 9	None	None	None

Notes:
a: DBE is the Design Basis Event.
b: Margin is not included in the parameters of this section.
c: Electrical seal to seal interfacing device, maintain electrical resistance among conductors and ground also pass an electrical current on demand.
d: The Spray Solution contains 2500 ppm Boron buffered with 0.88% dissolved Sodium Hydroxide to maintain a Ph of 10.5

1.9 Qualified Life: The demonstrated qualified life is 20 years based on the actual test conditions identified in Table 1.

1.10 Remarks: None

SECTION 2 - QUALIFICATION BY TEST

2.0 TEST PLAN

The complete sequence of type testing for the generic design groups of CONAX and Litton Electric seal was conducted at several different test facilities. The normal/abnormal environment testing was performed at the Acme Cleveland Development Company (ACDC) testing facility in Mayfield Heights, Ohio. All radiation testing was performed at Georgia Institute of Technology in Atlanta, Georgia. Vibration/seismic testing and DBE environmental testing were was performed at ACDC.

2.1	Equipment Description:	CONAX and Litton Electrical Seal Assemblies
2.2	Number Tested:	2
2.3	Mounting:	As defined in the installation instructions dicussed in Section 1.2 above
2.4	Connections:	The electrical seal assemblies were installed and wired to NAMCO limit switches during the entire test sequence. Details for connections and interfaces are covered by the Installation Instruction/Field Change Notice discussed in 1.2 and 1.3 above.

2.5 Aging Simulation Procedure:

By a sequential types test program as described by Subprogram A of Appendix B to WCAP-8587.

2.6 Service Conditions to be Simulated by Test[1].

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		Normal	Abnormal	Containment Test	Seismic	HELB/LOCA	Post-HELB/LO
2.6.1	Temp. (°F)	50-120	Included under Normal	Ambient	Ambient	Fig. 8	Fig. 8
2.6.2	Pressure (psig)	-6.7/+2.3		80	Ambient	Fig. 8	Fig. 8
2.6.3	Humidity (% RH)	10-100%		Ambient	Ambient	100	100
2.6.4	Radiation (R)	$1.75 \times 10^7 \gamma$		None	None	$2.3 \times 10^7 \gamma$ $1.7 \times 10^8 \beta$	$1.3 \times 10^8 \gamma$ $1.3 \times 10^9 \beta$
2.6.5	Chemicals	None		None	None	Note(a)	Note(a)
2.6.6	Vibration	Fig. 1		None	None	None	None
2.6.7	Acceleration (g)	0.7		None	Figure 9 & 10 Note (b)	None	None

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NOTE: (a) The spray solution contains 2500 PPm Boron buffered with 0.88% dissolved Sodium Hydroxide to maintain a PH of 10.5.

(b) While the equipment was RIM tested for line mounted cases on a single axis basis to peak values of 10g, the equipment was shown to be rigid below 33hz and the testing testing thus envelopes conditions for floor mounted installation where the input acceleration in multiaxis to a 4/4/4g acceleration level.

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, F	A,C,D,E
2.7.1.2	Pressure	E, F	A,B,C,D
2.7.1.3	Moisture		A,B,C,D,E,F
2.7.1.4	Composition	F	A,B,C,D,E
2.7.1.5	Seismic Acceleration	C	A,B,D,E,F
2.7.1.6	Time	B,C,D,E,F	A
2.7.2	**Category II - Input Electrical Characteristics**		
2.7.2.1	Voltage	A,B,C,F	D,E
2.7.2.2	Current	A,B,C,F	D,E
2.7.2.3	Frequency		A,B,C,D,E,F
2.7.2.4	Power		A,B,C,D,E,F
2.7.2.5	Other		A,B,C,D,E,F
2.7.3	**Category III - Fluid Characteristics**		
2.7.3.1	Chemical Composition	F	A,B,C,D,E
2.7.3.2	Flow Rate	F	A,B,C,D,E
2.7.3.3	Spray	F	A,B,C,D,E
2.7.3.4	Temperature	F	A,B,C,D,E,F
2.7.4	**Category IV - Radiological Features**		
2.7.4.1	Energy Type	D	A,B,C,E,F
2.7.4.2	Energy Level	D	A,B,C,E,F
2.7.4.3	Dose Rate	D	A,B,C,E,F
2.7.4.4	Integrated Dose	D	A,B,C,E,F

			Required	Not Required
2.7.5	Category V - Electrical Characteristics			
	2.7.5.1	Insulation Resistance	A,C,F	B,D,E
	2.7.5.2	Output Voltage	A,C,F	B,D,E
	2.7.5.3	Output Current	A,C,F	B,D,E
	2.7.5.4	Output Power		A,B,C,D,E,F
	2.7.5.5	Response Time		A,B,C,D,E,F
	2.7.5.6	Frequency Characteristics		A,B,C,D,E,F
	2.7.5.7	Simulated Load		A,B,C,D,E,F
2.7.6	Category VI - Mechanical Characteristics			
	2.7.6.1	Thrust	NA	
	2.7.6.2	Torque	NA	
	2.7.6.3	Time	NA	
	2.7.6.4	Load Profile	NA	
2.7.7	Category VII - Auxiliary Equipment			

None

A. Performance Test
B. Environmental Aging Test
C. Vibration - Seismic Test
D. Radiation Test
E. Pressure Test
F. HELB Environment Test

2.8 Test Sequence Preferred

This section identifies the preferred test sequences as specified in IEEE-323-74

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

The sample components were type tested in accordance with the preferred test sequence identified in Section 2.8.

2.10 Type Test Data

2.10.1 Objective

The objective of this test program is to demonstrate, employing the recommended practices of Reg. Guide 1.89 (IEEE-323-1974), Reg. Guide 1.100 (IEEE 344-1975) and Reg. Guide 1.73 (IEEE-382-1972), the capability of the CONAX and Litton Electrical Seals to complete their safety-related function(s) described in EQDP Section 1.7 while exposed to the applicable environments defined in EQDP Section 1.8.

2.10.2 Equipment Tested

Sample components from the CONAX and Litton Generic Groups were identified and type tested. Within the design group each model differs only in the diameter, overall size and weight, and

number of electrical conductors. The largest size and heaviest weight model with the maximum allowable number of conductors was tested for each design family. Within the design family the materials of construction, functional design and manufacturing processes are identical for all models. Manufacturing processes, production tests and material of construction for the Generic Component Groups are monitored and controlled and a quality release provided for both the test items and later production items.

2.10.3 Summary

Test Summary

2.10.3.1 One electrical seal from each design family (two seals total), with the same mounting configuration as to be used in the field, was selected and type tested for the entire sequence of tests identified in Section 2.8.

2.10.3.2 Both seals were thermally aged in a controlled oven for a time period and at a test temperature equivalent to a qualified life of 20 years. The seals were electrically cycled during this time for a number of cycles in excess of the required cyclic life of the seals.

2.10.3.3 Both seals were next electrically cycled to a total of 100,000 cycles.

2.10.3.4 Both seals were then radiation tested to a total gamma radiation dose of 2.04×10^8 Rads.

2.10.3.5 Both Seals were next vibration and seismic tested in accordance with the requirements of IEEE 344-1975 and Figures 1 and 9.

2.10.3.6 Both seals were then HELB tested to the requirements of Figure 8.

2.10.3.7 Before, during and after the testing identified in Sections 2.10.3.2 to 2.10.3.6 the seals were performance tested to demonstrate seal operability to the requirements of Sections 1.1 and 1.7. The entire CONAX seal assembly successfully completed these tests. The Litton seal assembly, except for the external cable, successfully completed these tests.

2.10.4 Conclusion

The demonstrated qualified life of the CONAX and Litton Electrical Seal Assemblies has been established in accordance with Subprogram A of the Westinghouse Aging Evaluation Program. The results of the aging program, together with the seismic and environmental testing described herein, demonstrate the qualification of the CONAX and Litton Electrical Seal Assemblies employing the practices recommended by Reg. Guide 1.89, 1.100 and 1.73.

2.11 Section 2 Notes

(1) The successfully completed tests 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. Cesarski, W. V., "Equipment Qualification Test Report CONAX and Litton Electrical Seal Assemblies (Environmental and Seismic Testing)," WCAP 8687 Supp. 2-H08A, (Proprietary).

SECTIONS 3 & 4 QUALIFICATION BY EXPERIENCE AND/OR ANALYSIS

Westinghouse does not employ operating experience or analysis in support of the qualification program for CONAX and Litton Electrical Seal Assemblies.

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
Electrical Seal Assemblies/ CVCS, SIS RHR, RCS/ Category a	Containment Bldg./outside missile shield	CONAX N11007 Litton Model CIR	Temperature Pressure Rel. humidity Radiation Chemistry		420°F 70 psig 100% 2.04×10^8 R(γ) 2500 ppm H_3BO_3 NaOH to 10.5 pH	1 yr. Post DBE	1 yr. Post DBE	N/A	N/A	20 yrs.	Seq. Test	ME-8	Completed

Notes:

(1) For definition of the equipment category, 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.

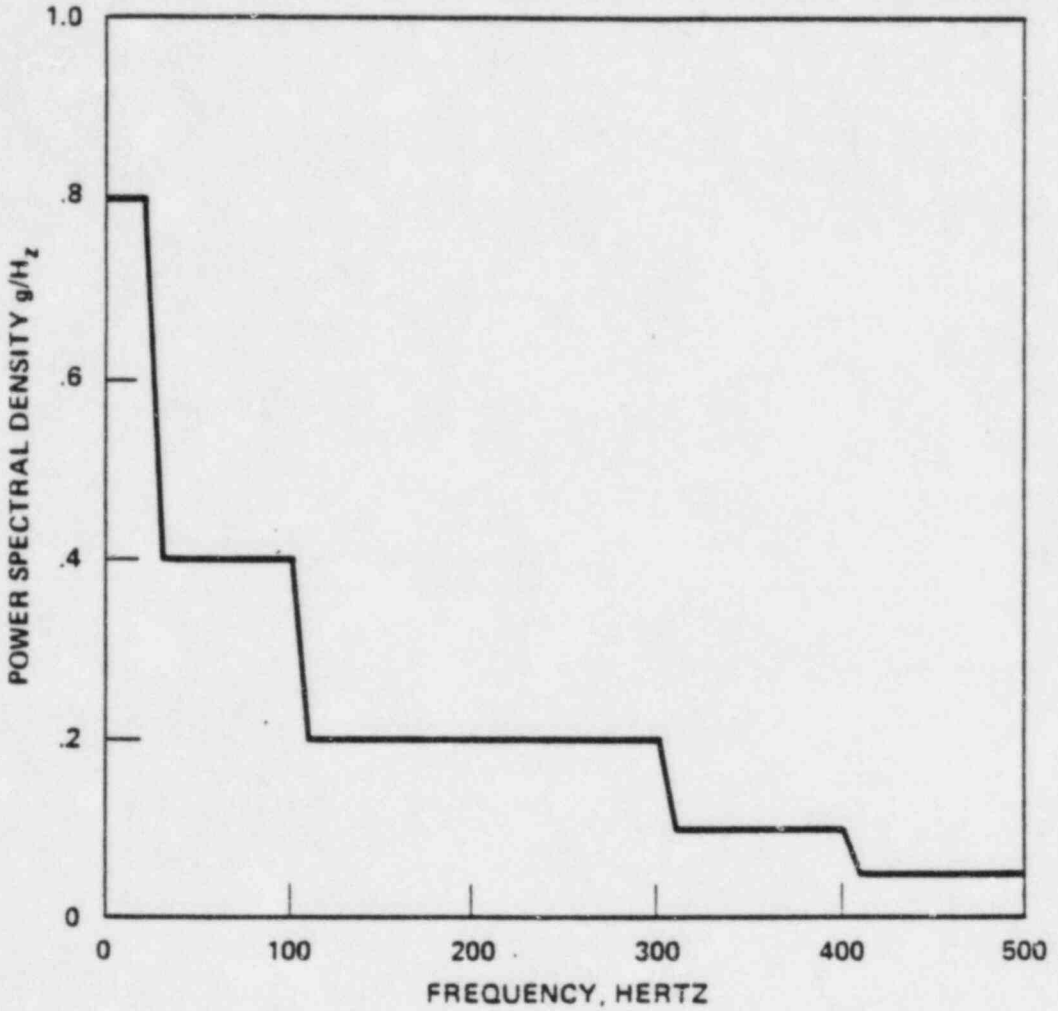


Figure 1 Plant Induced Vibration Linear Spectra Density

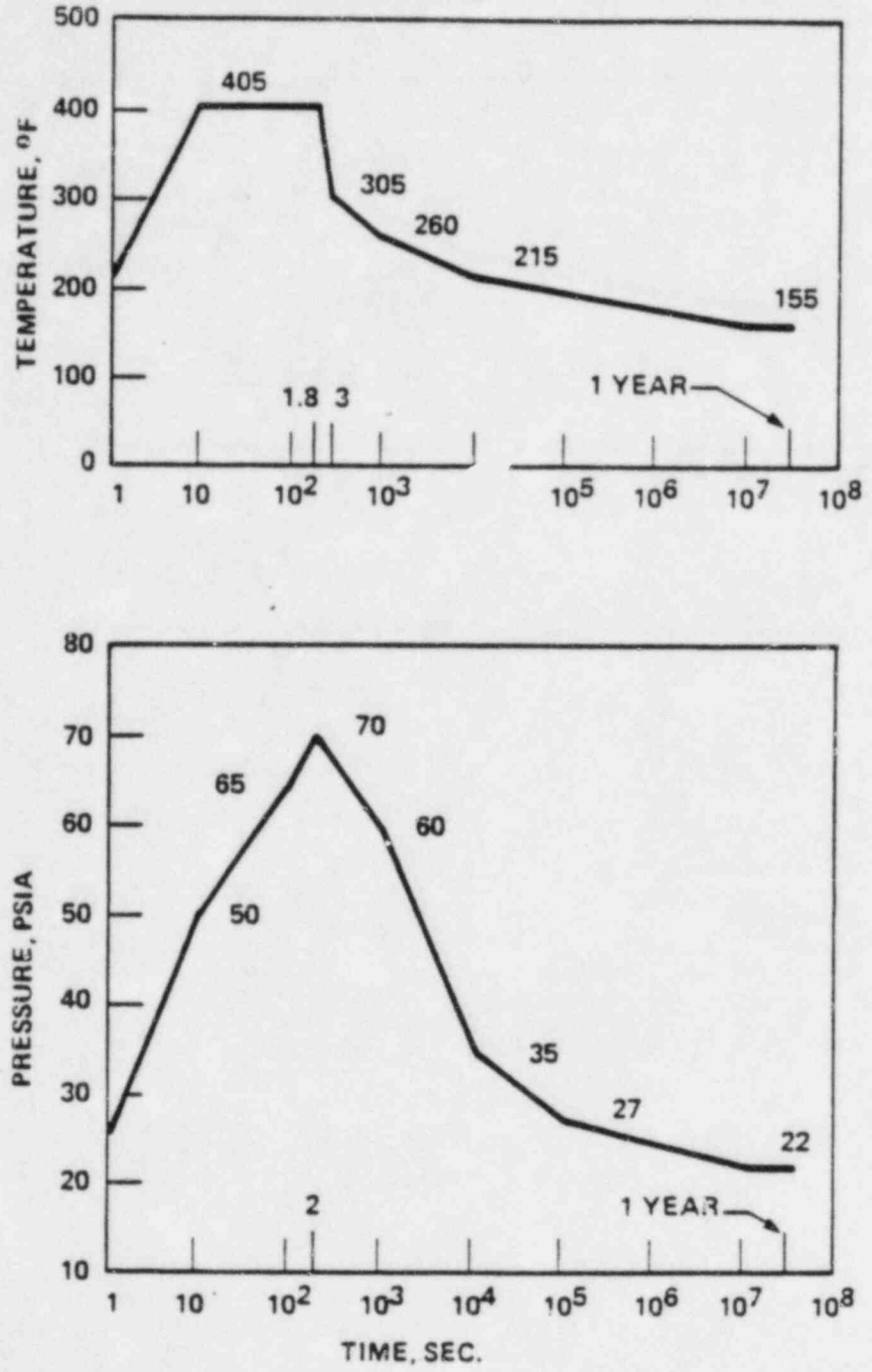


Figure 2 High Energy Line Break

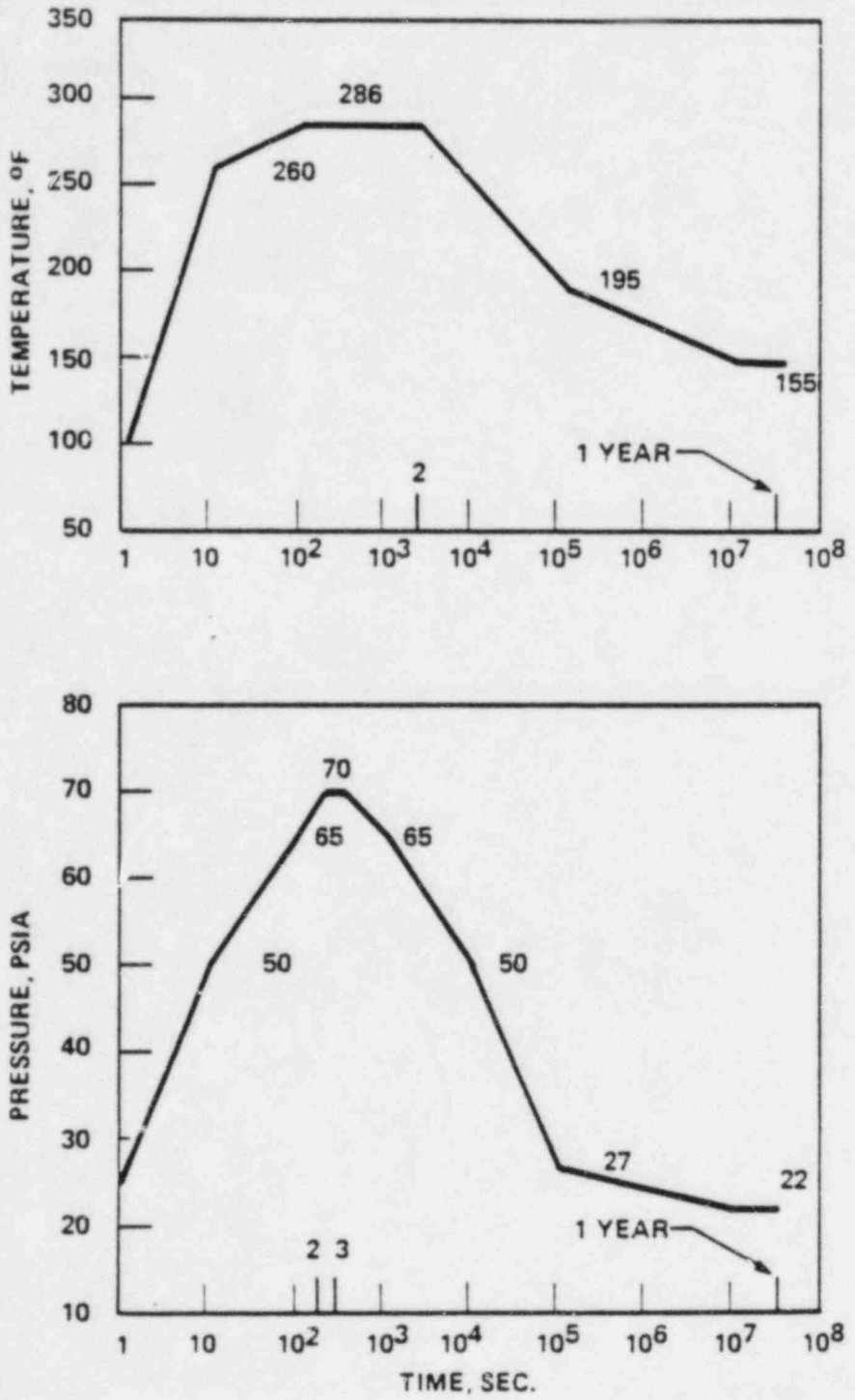


Figure 3 Loss of Coolant Accident Environment

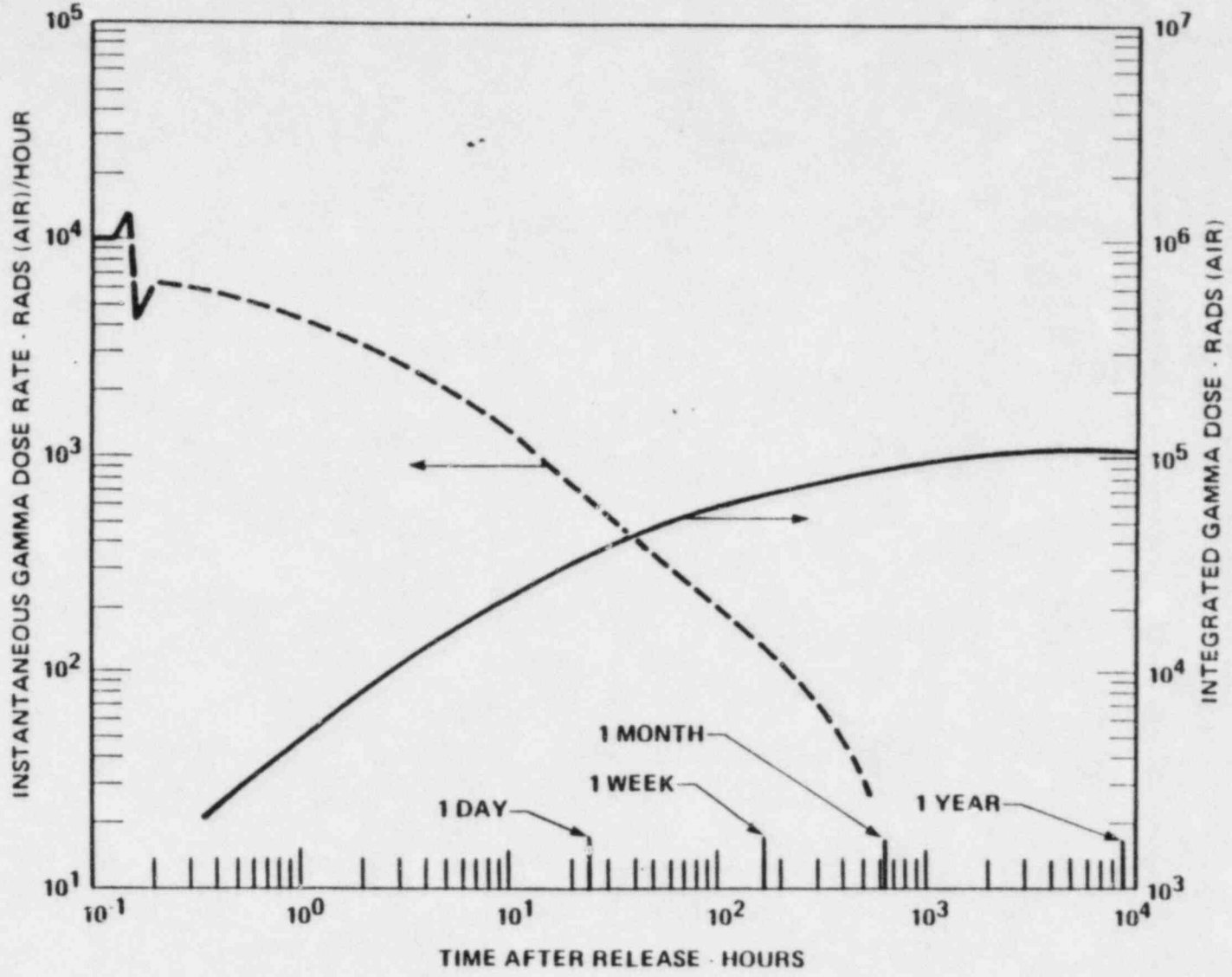


Figure 4 Gamma Dose and Dose Rate Inside the Containment as a Function of Time After a Steam Line Break Accident

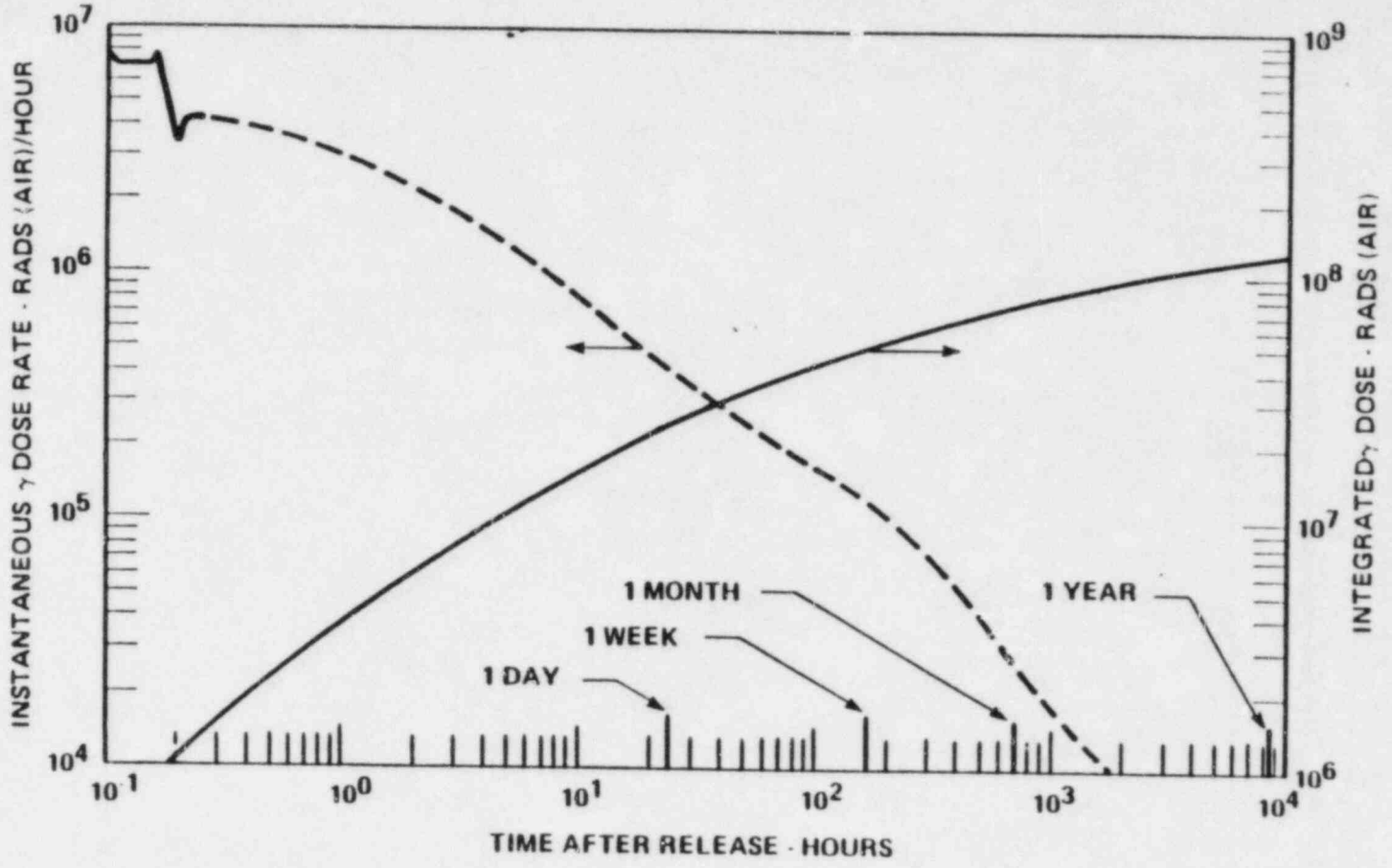


Figure 5 Gamma Dose and Dose Rate Inside the Containment as a Function of Time After LOCA

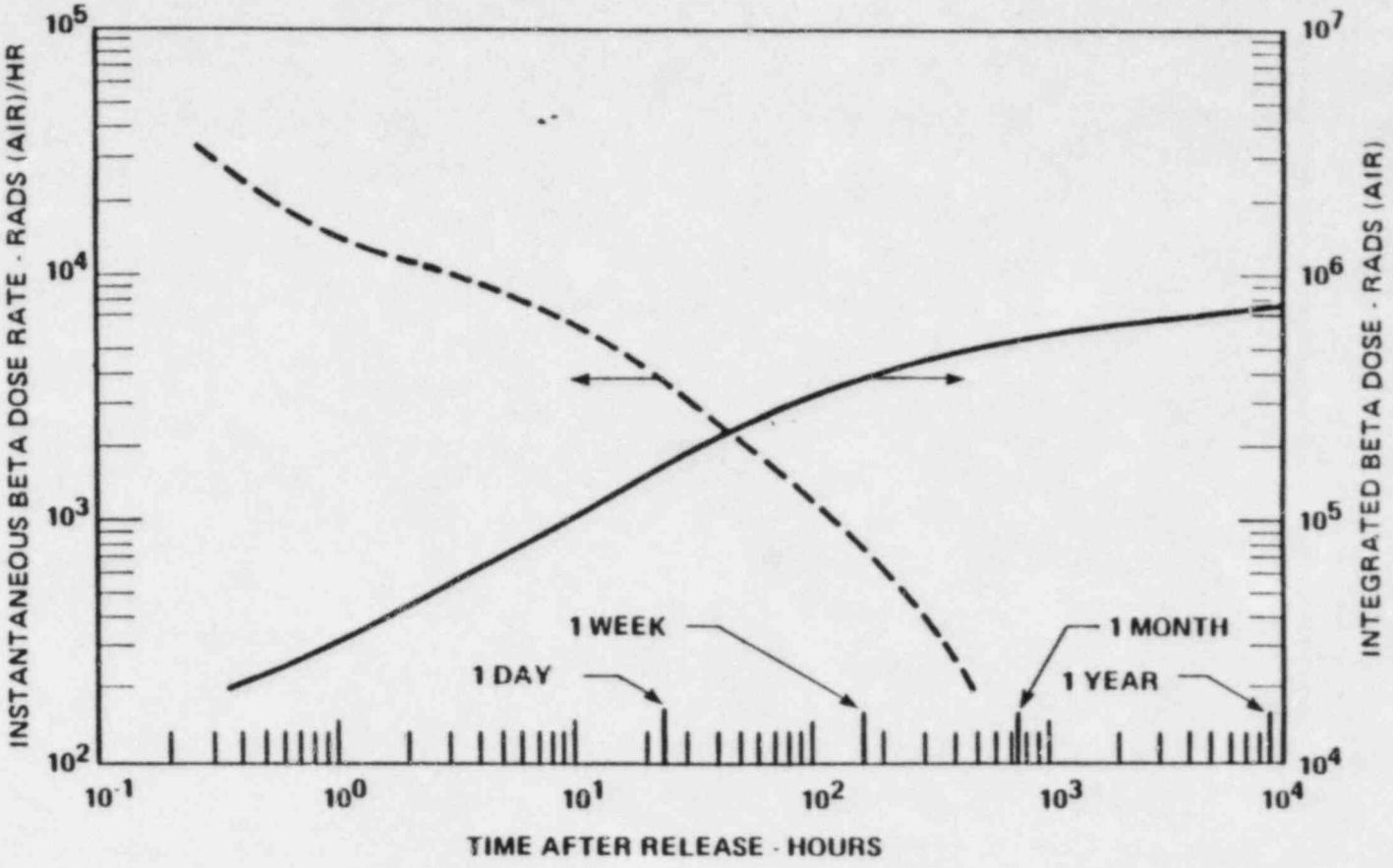


Figure 6 Beta Dose and Dose Rate Inside the Containment as a Function of Time After a Steam Line Break Accident

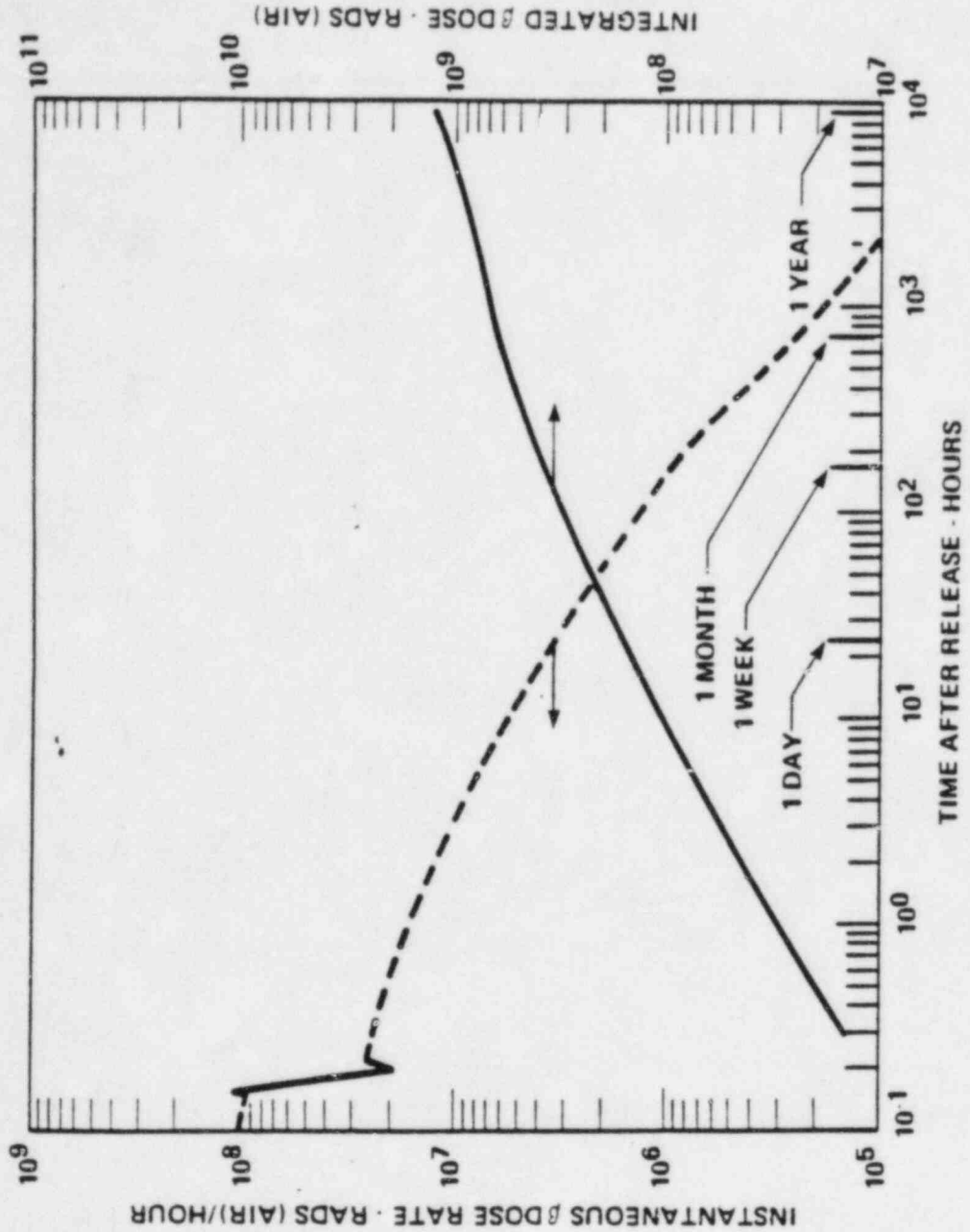
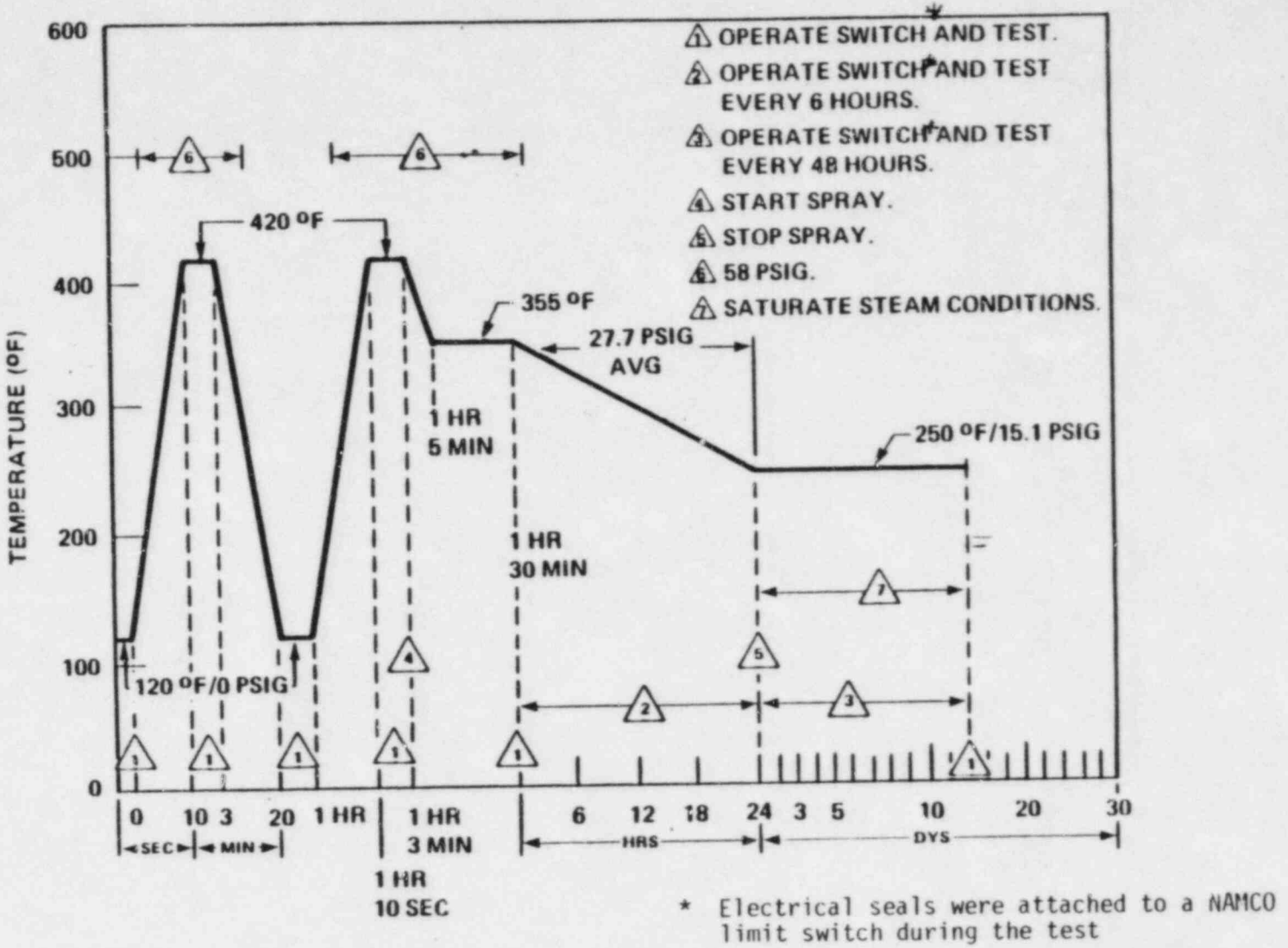


Figure 7 Beta Dose and Dose Rate Inside the Containment as a Function of Time After LOCA



* Electrical seals were attached to a NAMCO limit switch during the test

Figure 8 Test Chamber Profile for Accident Environment Simulation

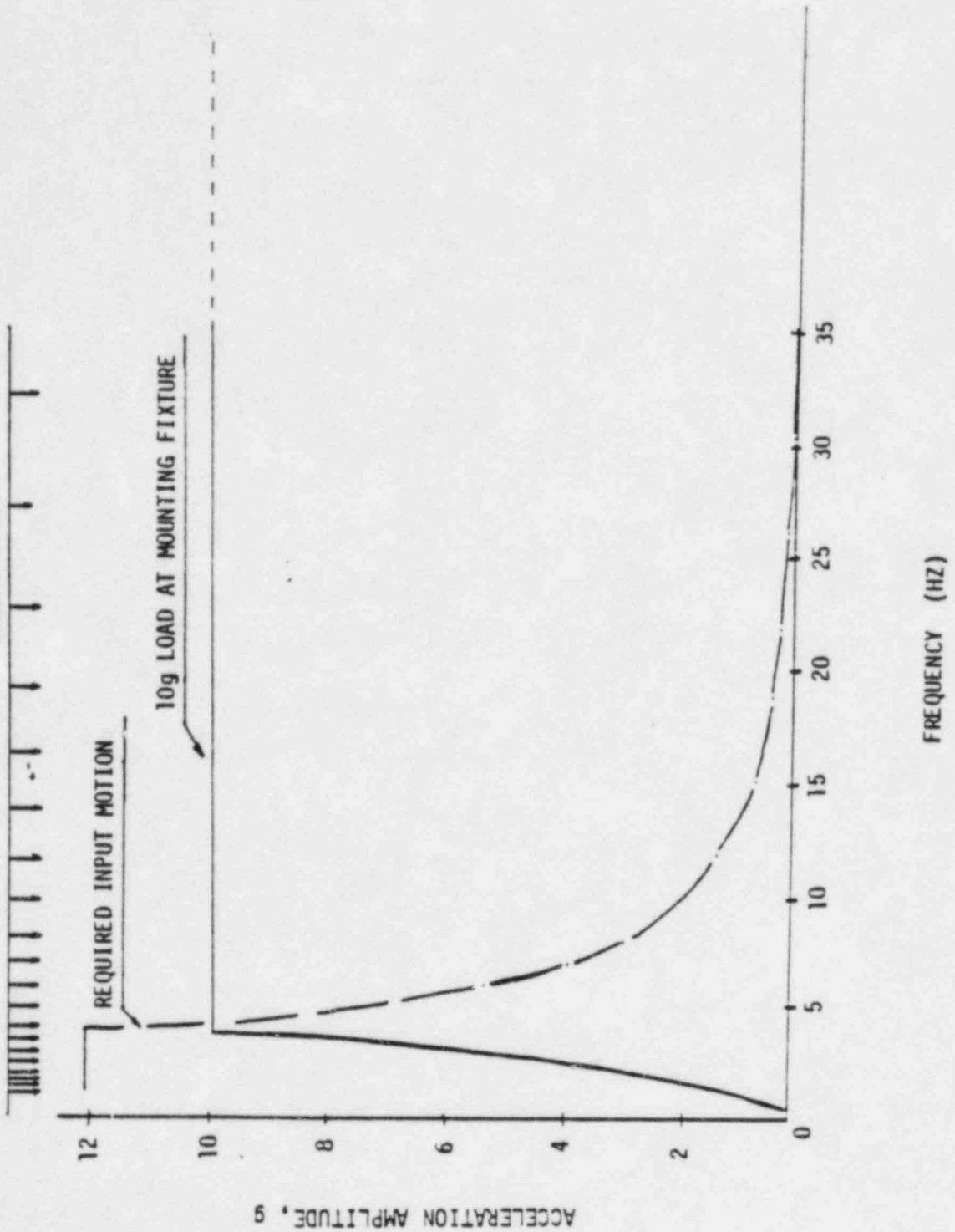


FIGURE 9 SINE DWELL TEST ENVELOPE

Dwell Frequency (1)	5 OBE Min. Time Sec. (3)	1 SSE Min. Time Sec.	Total (2) 5 OBE 1 SSE Minutes
1.0	225.0	45.0	4.5
1.2	187.5	37.5	3.75
1.4	160.7	32.14	3.22
1.7	132.35	26.47	2.65
2.0	112.5	22.50	2.25
2.4	93.75	18.75	1.88
2.8	80.35	16.07	1.61
3.4	66.2	13.24	1.33
4.0	56.25	11.25	1.13
4.8	46.9	10.0	.95
5.7	39.45	10.0	.83
6.8	33.1	10.0	.72
8.0	28.15	10.0	.64
9.6	23.45	10.0	.56
11.4	19.75	8.0	.46
13.6	16.55	7.0	.39
16.2	13.9	6.0	.33
19.0	11.85	5.0	.28
22.5	10.0	4.0	.24
27.0	8.35	4.0	.21
32.0	7.05	4.0	.19

(1) Add resonant frequencies determined by test, below 33 Hz.

(2) Actual duration to be sufficient to allow testing of limit switch* in actuated and unactuated condition.

(3) Values above 4.0 Hz. represent 5x45 - 225 cycles.

* Electrical seals attached to a NAMCO limit switch during the test.

Figure 10. Required Frequencies for Sine Wave Input (approximately 1/4 Octave Intervals)