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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 constitute interface requirements to the user.

SAFETY RELATED SOLENOID VALVES
(Qualification Group A)
(Qualification Group B)

APPROVED: _____
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SECTION 1 - SPECIFICATIONS

1.0 PERFORMANCE SPECIFICATIONS

1.1 Electrical Requirements

1.1.1 Voltage: 90-140 VDC

1.1.2 Frequency: N/A

1.1.3 Load: As specified for each model by the manufacturer

1.1.4 Electromagnetic Interference: N/A

1.1.5 Other: N/A

1.2 Installation Requirements: The valves must be installed such that the opening to the solenoid enclosure from the conduit hub is effectively sealed from exterior moisture. Installation instructions are provided with the applicable valve to which the solenoid valve is mounted.

1.3 Auxiliary Devices: None

1.4 Preventative Maintenance Schedule: There is no preventative maintenance required during the 8 year qualified life as specified in Section 1.9.

1.5 Design Life: 40 years

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

1.7 Performance Requirements for (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	Included under normal	Test duration	<24 hrs.	<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 & 5	$2.3 \times 10^{7}\gamma$ $1.7 \times 10^{8}\beta$ 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
1.87	Acceleration(g)	None		None	None	None	3.2/3.2/3.2(OBE) 4/4/4(SSE)	None	None	None

Notes:
a: DBE is the Design Basis Event.
b: Margin is not included in the parameters of this section.
c: Solenoid valve to direct air to/from diaphram chamber within prespecified time established by manufacturer.
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 8 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 group of ASCO solenoid valves was conducted at several different test facilities. The normal/abnormal environment testing was performed at ASCO test facilities in Florham Park, New Jersey. All radiation testing was conducted at Isomedix, Inc. in Parsippany, New Jersey. Vibration/seismic testing was performed at Acton Test Laboratory in Acton, Massachusetts and the DBE environmental testing was performed at Wyle Test laboratories in Huntsville, Alabama.

2.1 Equipment Description: ASCO Solenoid Valves - Model numbers NP-831655E, NP-8316E34E, NP-210-036-1F, NP-206-381-6RF, NP832063E

2.2	Number Tested:	5
2.3	Mounting:	As defined in Section 1.2
2.4	Connections:	As specified by manufacturer on the applicable valve assembly drawings and as defined in Section 1.2

2.5 Aging Simulation Procedure

By a sequential type test program as described by Subprogram A of Appendix B to WCAP-8587 and reported in Reference 1.

2.6 Service Conditions to be Simulated by Test(1)

		Normal	Abnormal	Containment Test	Seismic	HELB/LOCA	Post-HELB/LOCA
2.6.1	Temp. (^{o}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)	2.0×10^{7} γ		None	None	1.8×10^{8} γ	Included under HELB/LOCA
2.6.5	Chemicals	None		None	None	Note(a)	Note(a)
2.6.6	Vibration	See Fig. 1		None	None	None	None
2.6.7	Acceleration (g)	None		None	Figure 9	None	None

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

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

		Required	Not Required
2.7.5	Category V - Electrical Characteristics		
2.7.5.1	Insulation Resistance	A,C,E	B,D
2.7.5.2	Output Voltage		A,B,C,D,E
2.7.5.3	Output Current		A,B,C,D,E
2.7.5.4	Output Power		A,B,C,D,E
2.7.5.5	Response Time		A,B,C,D,E
2.7.5.6	Frequency Characteristics		A,B,C,D,E
2.7.5.7	Simulated Load		A,B,C,D,E
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	NA	

A. Performance Tests
B. Environmental Aging Tests
C. Vibration - Seismic Tests
D. Radiation Test
E. DBE 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/Seismic
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 solenoid valves 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 (IEE-382-1972), the capability of the ASCO Solenoid Valves 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 Generic Group were identified and type tested. Manufacturing processes, production tests and materials of construction for the generic component groups are monitored and controlled and a quality release provided. The sample components selected from the Generic Component Group completed the entire test sequence of Section 2.8.

2.10.3 Test Summary

2.10.3.1 The generic component group consists of three design families of solenoid valves. Within the design family the model numbers differ in elastomer material, body material, solenoid enclosure design, pipe and orifice size, and mode of normal operation (normally open/normally closed). The test valves contained ethylene propylene elastomers only. The test valves were of the normally closed design since the design contains the maximum number of parts (springs) with the only difference between the normally closed, normally open, and universal designs being the internal

springs. The normally closed design represents as severe a case for mechanical loading as the normally open and universal designs. The Section 2.12, Reference 1, document details the specific model numbers and design families qualified by this type testing.

2.10.3.2 All 5 valves were initially performance tested in accordance with the manufacturer's applicable Valve Specification Sheet and inspected to insure no damage had occurred since manufacture. All five valves successfully completed these performance tests and inspection.

2.10.3.3 All 5 solenoid valves were thermally aged in a controlled over for a time period and at a test temperature equivalent to a qualified life of 8 years. The valves were cycled during this time for 10% of the required cyclic life of the valves. After thermal aging the valves were cycled an additional 18,000 cycles for a total of 20,000 cycles and exposed to 15 cycles of pressure transients to simulate the containment pressure tests during the design life of the equipment.

2.10.3.4 All 5 valves were radiation tested by exposure to a gamma source for a dosage of 2.0×10^7 Rads.

2.10.3.5 All 5 valves were vibration/seismic tested in accordance with the requirements of Figures 1 and 9 and IEEE 344-1975.

2.10.3.6 All 5 valves were next radiation tested to a DBE dosage of 1.8×10^8 Rads of gamma radiation.

2.10.3.7 The 5 valves were then tested to the HELB environment as detailed in Figure 8.

2.10.3.8 During and after the testing identified in Sections 2.10.3.3 through 2.10.3.7 the valves were performance tested to demonstrate valve operability to the requirements of Sections 1.1 and 1.7.

2.10.4 Conclusion

The demonstrated qualified life of ASCO Solenoid Valves with EPD elastomers 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 ASCO Solenoid Valves with EPD elastomers for a period of 8 years employing the practices recommended by Reg. Guide 1.89, 1.100 and 1.73.

2.11 Section 2 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.

2.12 References

1. Cesarski, W. V., "Equipment Qualification Test Report ASCO Solenoid Valves (Environmental and Seismic Test) WCAP 8687, Supplement 2 - H02A (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 ASCO Solenoid Valves.

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
Valve accessory solenoids/ CVCS, SIS, RHR, RCS/ Category a	Containment Bldg./outside missile shield	ASCO NP 8316 NP 8320 NP210-036 NP206-381	Temperature		420 F	1 yr. Post DBE	1 yr. Post DBE	N/A	N/A	8 yrs.	Seq. Test	HE-2	Completed
			Pressure		57 psig								
			Rel. humidity		100%								
			Radiation		2.0×10^8 R(γ)								
			Chemistry		2500 ppm H_3BO_3 NaOH to 10.7 pH								

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.

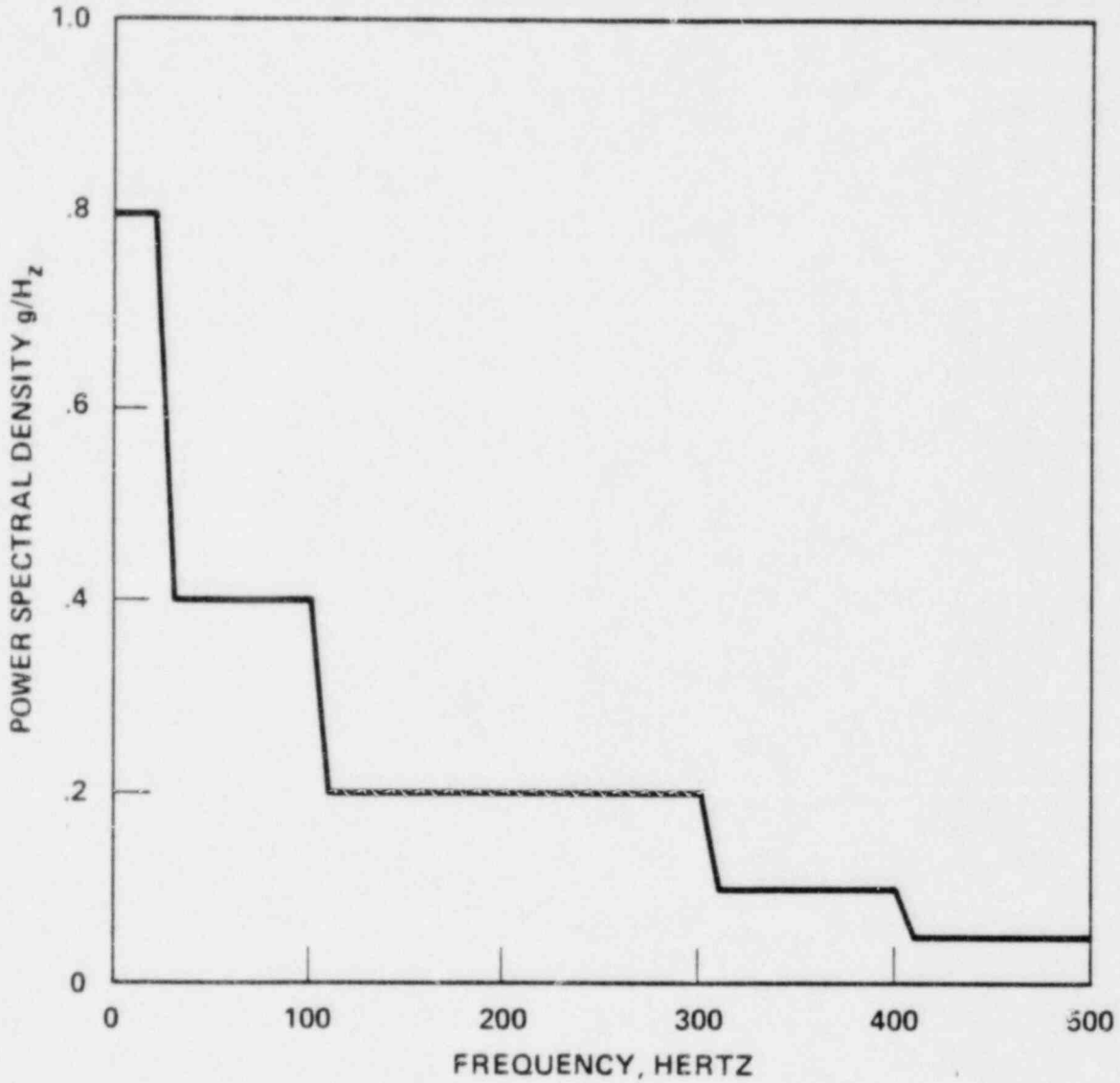

Figure 1 Plant Induced Vibration Linear Spectra Density

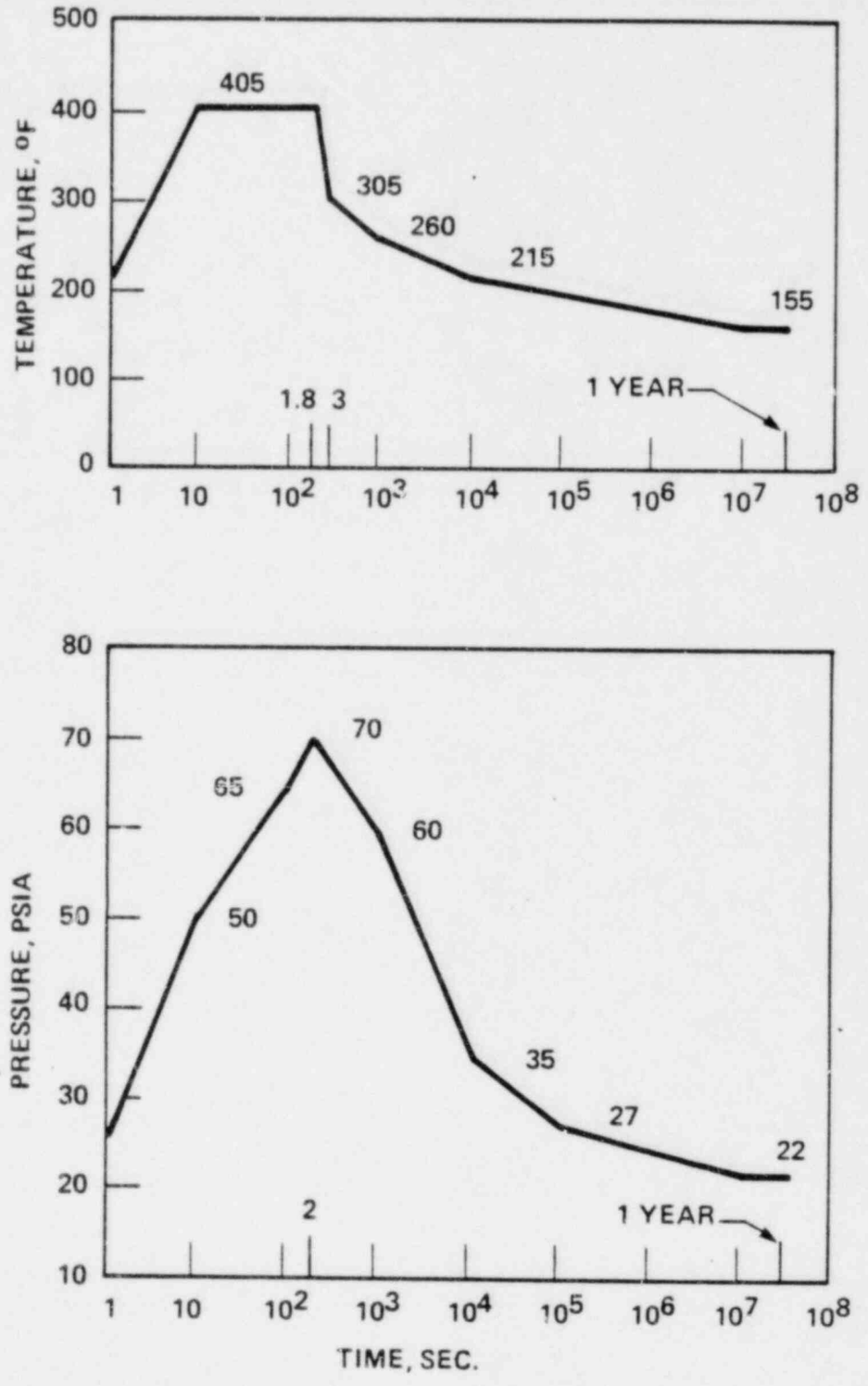

Figure 2 High Energy Line Break

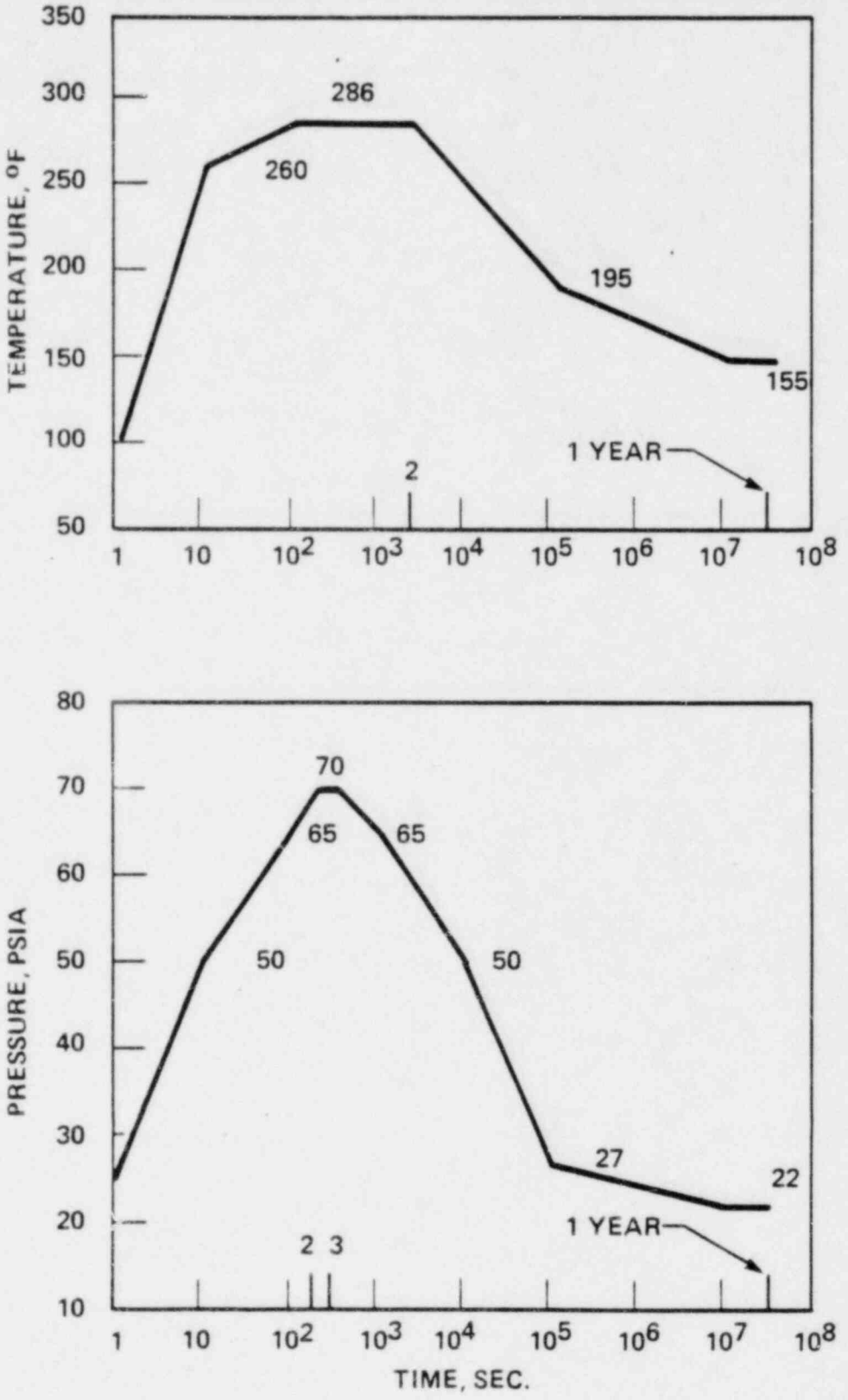

Figure 3 Loss of Coolant Accident Environment

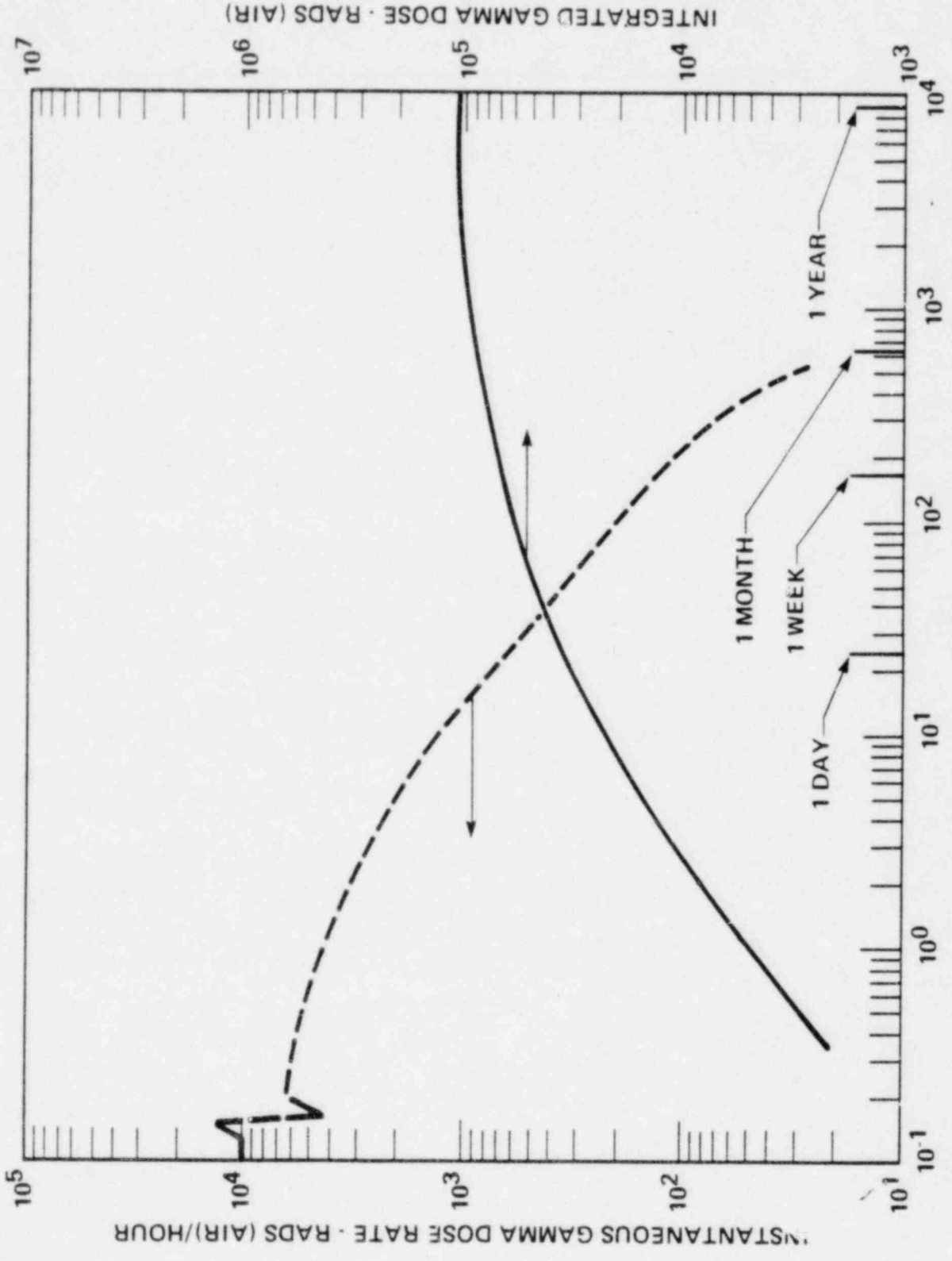

Figure 4 Gamma Dose and Dose Rate Inside the Containment as a Function of Time After a Steam Line Break Accident

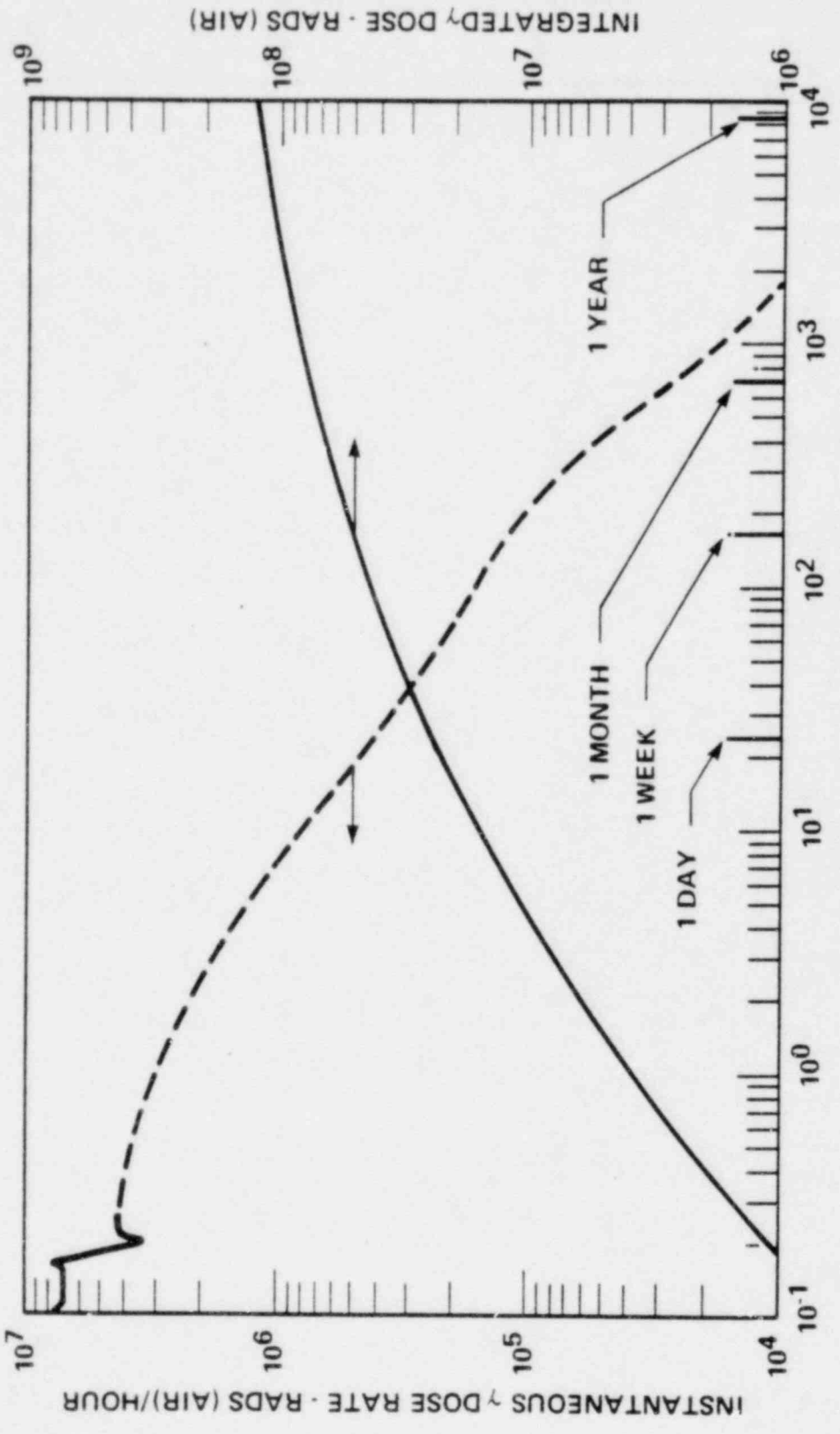

Figure 5 Gamma Dose and Dose Rate Inside the Containment as a Function of Time After LOCA

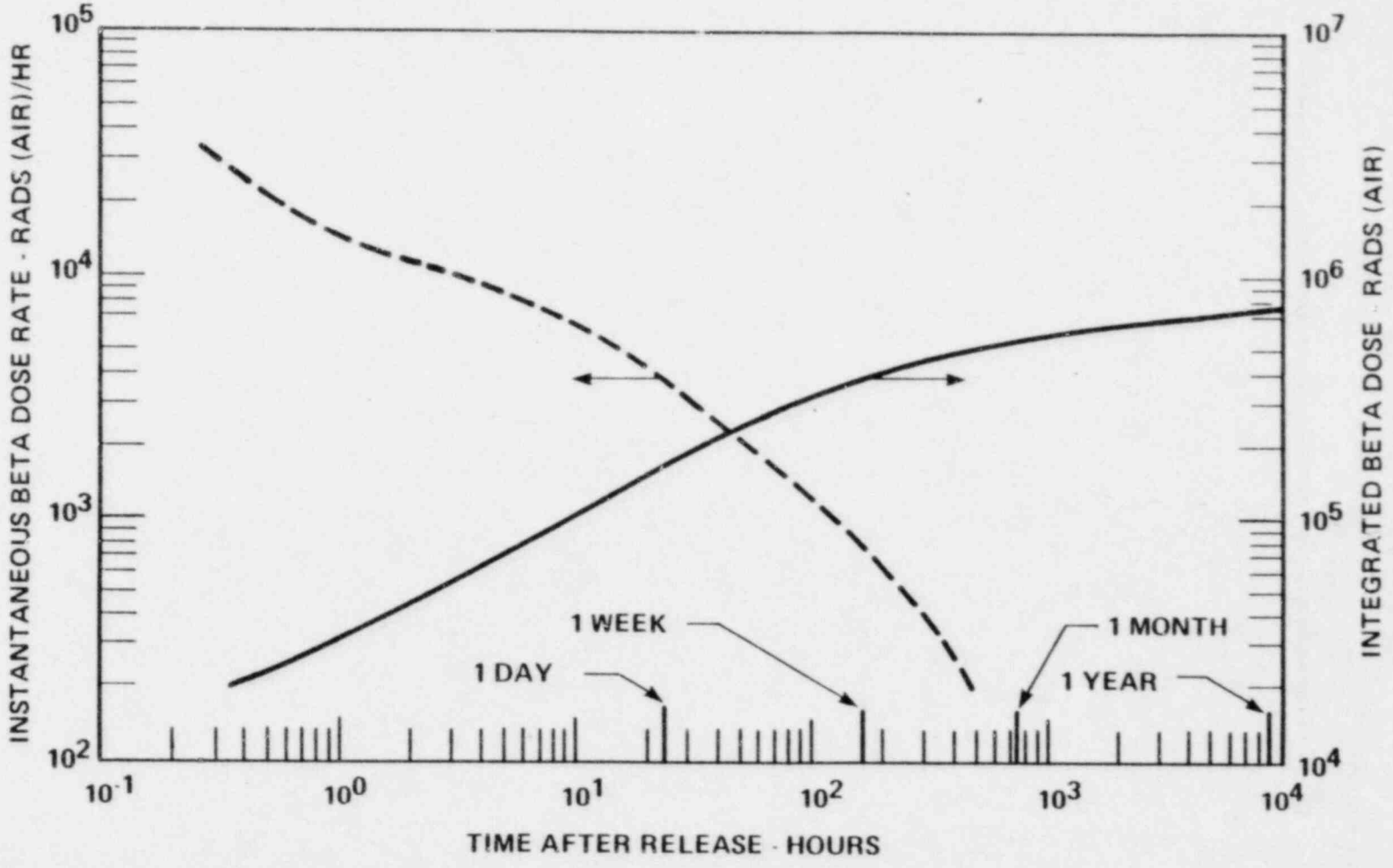

Figure 6 Beta Dose and Dose Rate Inside the Containment as a Function of Time After a Steam Line Break Accident

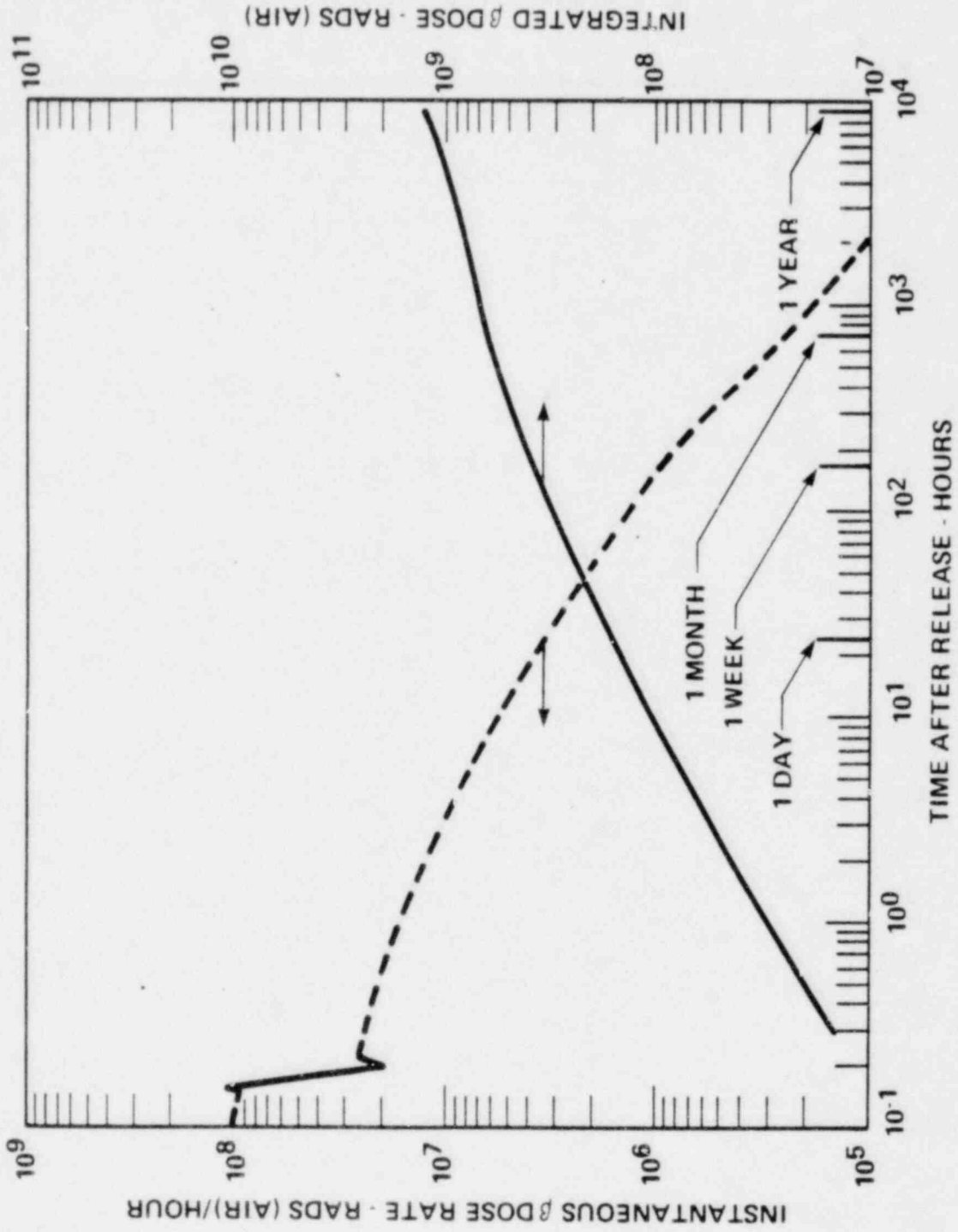

Figure 7 Beta Dose and Dose Rate Inside the Containment as a Function of Time After LOCA

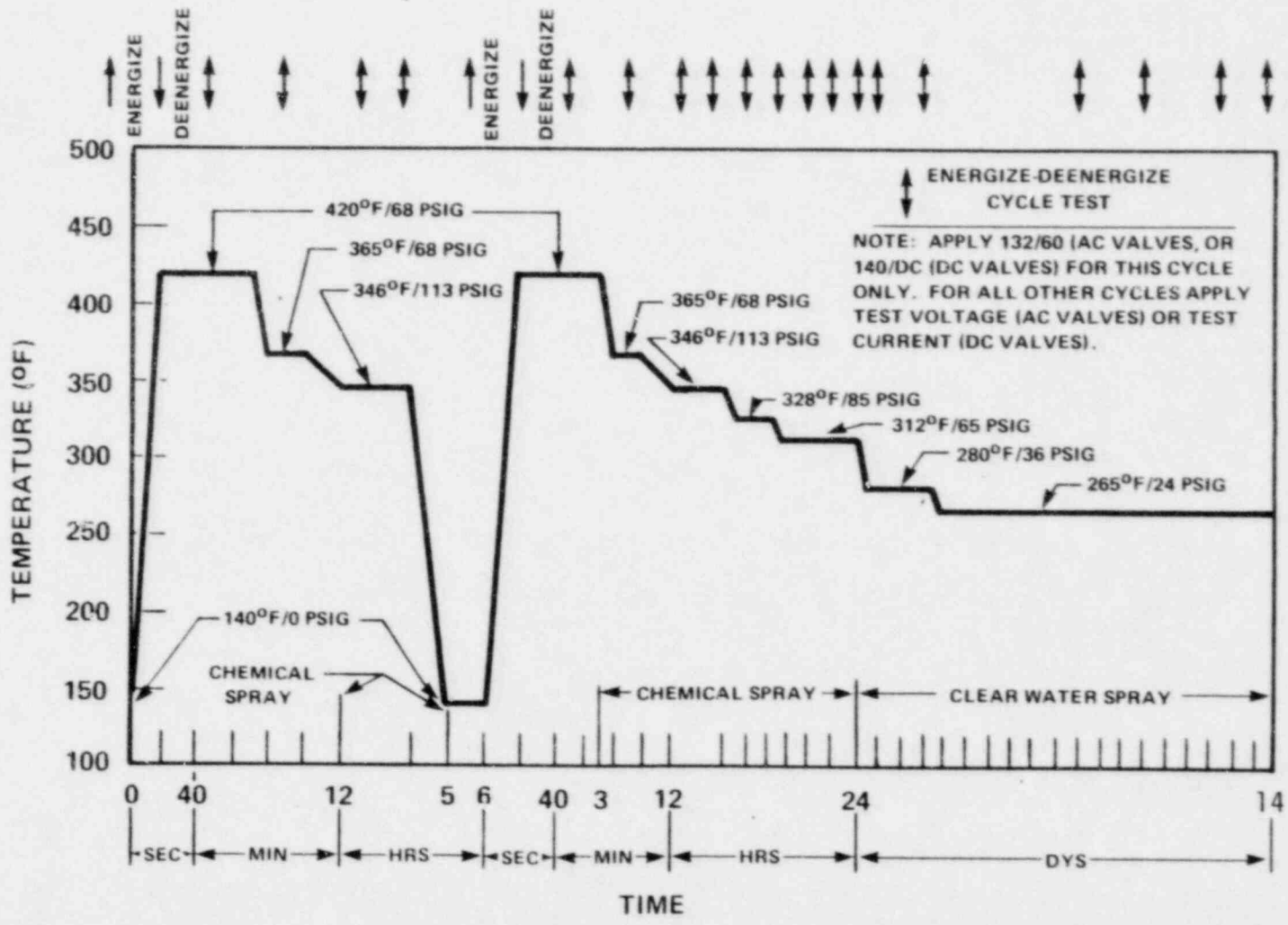

Figure 8 Environmental Qualification Parameters for Combined Loss-of-Coolant Accident (LOCA)/High Energy Line Break (HELB) Simulation

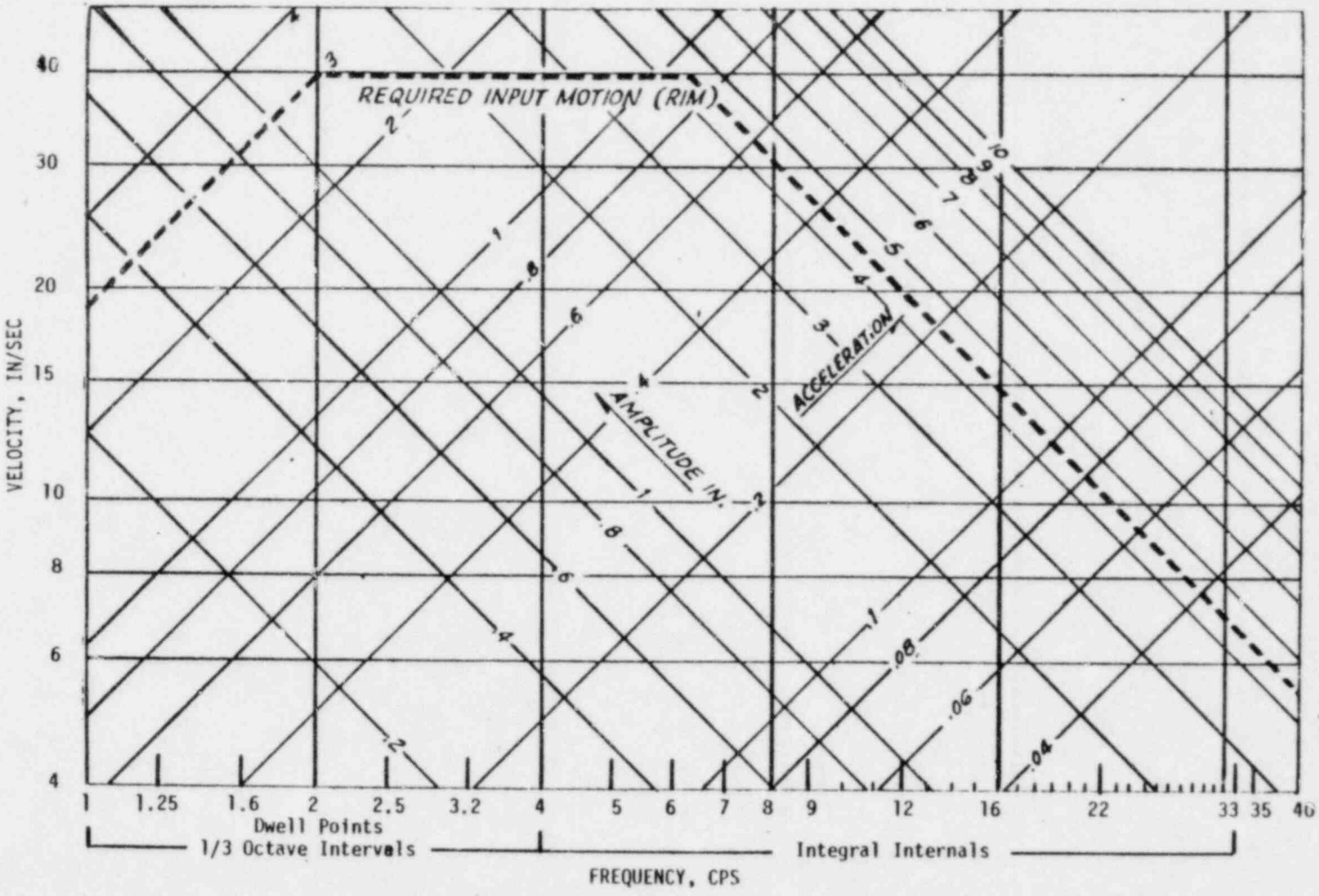

Figure 9 Seismic Qualification Required Input Motion