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.

GARRETT (P.O.R.V) SOLENOID OPERATED

PILOT VALVE

AND

Position Indication Device

APPROVED: for E. P. Rahe, Manager
Nuclear Safety Department

Westinghouse Electric Corporation
Nuclear Energy Systems
P.O. Box 355
Pittsburgh, Pennsylvania 15230

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: N/A

1.1.4 Electromagnetic Interference: N/A

1.1.5 Other: N/A

1.2 Installation Requirements: The valve must be installed such that the opening to the solenoid enclosure from the conduit hub is effectively sealed from exterior moisture. The Position Indication Device (P.I.D.) must also be sealed in the same manner.

1.3 Auxiliary Devices: None

1.4 Preventative Maintenance Schedule: Per the Westinghouse Equipment Qualification test program, the maintenance required to maintain the qualified life stated in Section 1.9 is to replace the Ethylene Propylene Diene Momer Rubber (E.P.D.M.) gaskets and thread sealant used to seal the electrical compartment cover every five (5) 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): 800 for a 40 year life.

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(°F)	50-120	Included under normal	Ambient	Fig. 2	Fig. 3	Ambient	Fig. 2	Fig. 3	Ambient
1.8.2	Pressure (psig)	-6.7/+.3		70	Fig. 2	Fig. 3	Ambient	Fig. 2	Fig. 3	Ambient
1.8.3	Humidity (Percent RH)	10-100		Ambient	100	100	Ambient	100	100	Ambient
1.8.4	Radiation (R)	1.75×10^7 γ		None	3.5×10^4 γ 1.8×10^5 β Fig. 4 and 6	2.3×10^7 γ 1.8×10^8 β Fig. 5 and 7	None	1.2×10^5 γ 7.8×10^5 β Fig. 4 and 6	1.3×10^8 γ 1.3×10^9 β Fig. 5 and 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	Fig. 8	None	None	None

Notes:
a: DBE is the Design Basis Event.
b: Margin is not included in the parameters of this section.
c: The valve shall stroke open in 0.5 seconds or less and shall close in one second or less.
d: The spray solution contains 2500 ppm Boron buffered with 0.88 percent dissolved Sodium Hydroxide to maintain a ph of 10.5.

1.9 Qualified Life: The demonstrated qualified life is 40 years based on the actual test conditions identified in Table 1. Note: E.P.D.M. Gaskets and thread Sealant must be replaced every five (5) years.

1.10 Remarks:

None

SECTION 2 - QUALIFICATION BY TEST

2.0 TEST PLAN

The complete sequence of type testing for the Garrett Pilot Valve and Position Indication Device was conducted at several different test facilities. The inservice thermal aging simulation, mechanical cycling test, containment pressure test simulation, vibration aging, seismic simulation, the Design Basis Environment test and qualification functional testing were conducted at National Technical Systems, Testing Division, Saugus, Calif. The inservice and accident gamma radiation testing was performed by Isomedix, Inc. in Parisippany, N.J.

2.1	Equipment Description:	Garrett solenoid operated pilot valves, models 3750021 and 3750029, and the Garrett position indication device that is used on the model 3750029 pilot valve and the main P.O.R.V. The actual tested valve was a 3750029 that incorporates the P.I.D.
2.2	Number Tested:	1
2.3	Mounting:	As defined in Section 1.2

2.4 Connections: The Pilot Valve and P.I.D. are supplied mounted to the Power Operated Relief Valve. The wiring diagram is depicted on the PORV valve outline drawing and technical manual.

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. (°F)	50-120	Included under normal	Ambient	Ambient	Figs. 2&3	Figs. 2&3
2.6.2	Pressure (psig)	-6.7/+2.3		80	Ambient	Figs. 2&3	Figs. 2&3
2.6.3	Humidity (Percent RH)	10-100 percent		Ambient	Ambient	100 percent	100 percent
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	Fig. 8	None	None

NOTE: (a) The spray solution contains 2500 PPm Boron Buffered with 0.88 percent 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			
	2.7.3.2	Chemical Composition	E	A,B,C,D
	2.7.3.2	Flow Rate	E	A,B,C,D
	2.7.33	Spray	E	A,B,C,D
	1.7.3.4	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 (IEEE-382-1972), the capability of the Garrett Solenoid Operated Pilot Valve and Position Indication Device to complete their safety-related functions described in EQDP Section 1.7 while exposed to the applicable environments defined in EQDP Section 1.8.

2.10.2 Equipment Tested

A sample component from the Generic Design was identified randomly and type tested. Manufacturing processes, production tests and materials of construction for the generic design 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 test valve was randomly selected from a production run for Westinghouse, as specified by Westinghouse equipment Specification G-955186.

2.10.3.2 The valve was initially performance tested in accordance with the manufacturer's applicable Valve Test Procedure and inspected to insure no damage had occurred since manufacture. The valve successfully completed these performance tests and inspection.

2.10.3.3 The solenoid valve was thermally aged in a controlled oven for a time period and at a test temperature equivalent to a qualified life of 40 years. The valve was cycled during thermal aging 1000 times. After thermal aging the valve was cycled an additional 10,000 cycles for a total of 11,000 cycles. The test valve was then placed in a pressure chamber and subjected to an ambient pressure of 85 psig, for 24 hr. to simulate the containment pressure tests occuring during the design life of the equipment.

2.10.3.4 The valve was radiation tested by exposure to a gamma source for a dosage of 2.07×10^8 Rads.

2.10.3.5 The valve was vibration/seismic tested in accordance with the requirements of Figure 1, and Figure 8 was exposed to maximum acceleration single axis sine dwells per IEEE 344-1975.

2.10.3.6 The valve was then tested to envelope the generic HELB and LOCA. Additional post-event testing was also completed to demonstrate the performance of thermal and radiation aged seals for the electrical compartment environments as detailed in Figures 2 and 3.

2.10.3.7 During and after the testing identified in Sections 2.10.3.3 through 2.10.3.6 the valves was 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 the Garrett Pilot Valve and Position Indication Device 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 Garrett Pilot Valve and Position Indication Device for a period of 40 years employing the practices recommended by Reg. Guide 1.89, 1.100 and 1.73. Note: Electrical cover gaskets and thread sealant must be replaced every five years.

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. Snider, J. M. "Equipment Qualification Test Report Garrett (P.O.R.V.) Solenoid Operated Pilot Valve and Position Indication Device (Environmental and Seismic Testing)", WCAP 8687, Supplement 2-E09A (Proprietary).

SECTIONS 3 AND 4 QUALIFICATION BY EXPERIENCE AND/OR ANALYSIS

Westinghouse does not employ operating experience or analysis in support of the qualification program for the Garrett Pilot Valve and Position Indication Device.

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
Pilot Valve ar Position Indication Device/RCS/ Category a	Containment Bldg.	Garrett Pneumatic Division/ Solenoid Operated Pilot Valve and Position Indication Device/3750029 and 3750021	Temperature		520°F	1 yr. Post DBE	1 yr. Post DBE	N/A	N/A	40 yrs.	Seq. Test	HE-9	Completed
			Pressure		70 psig								
			Rel. humidity		100 percent								
			Radiation		2.07×10^8 R(γ)								
			Chemistry		2500 ppm H_3BO_3 NaOH to 10.5 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.

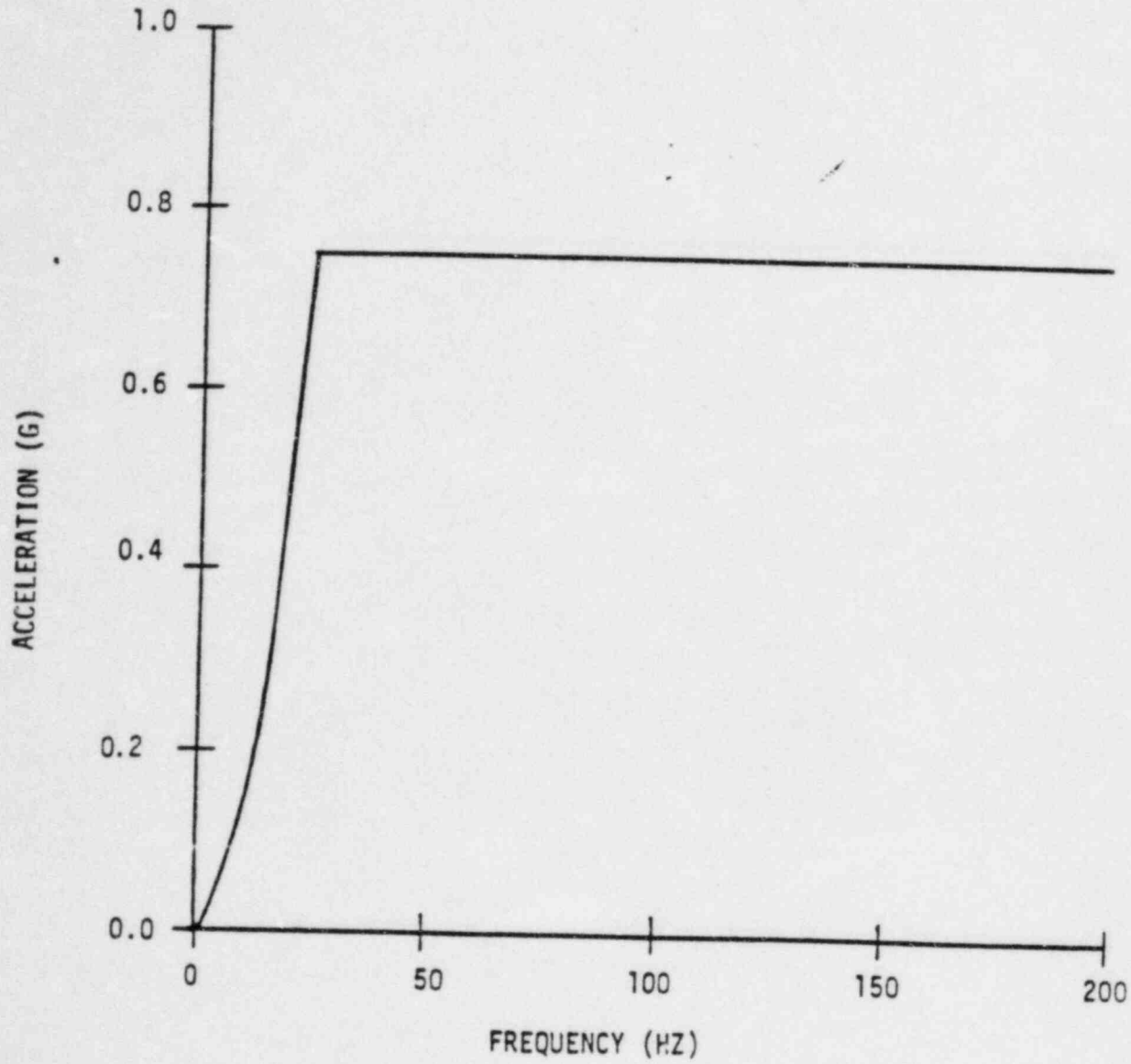

Fig. 1 : Plant Induced Vibration Linear Spectra

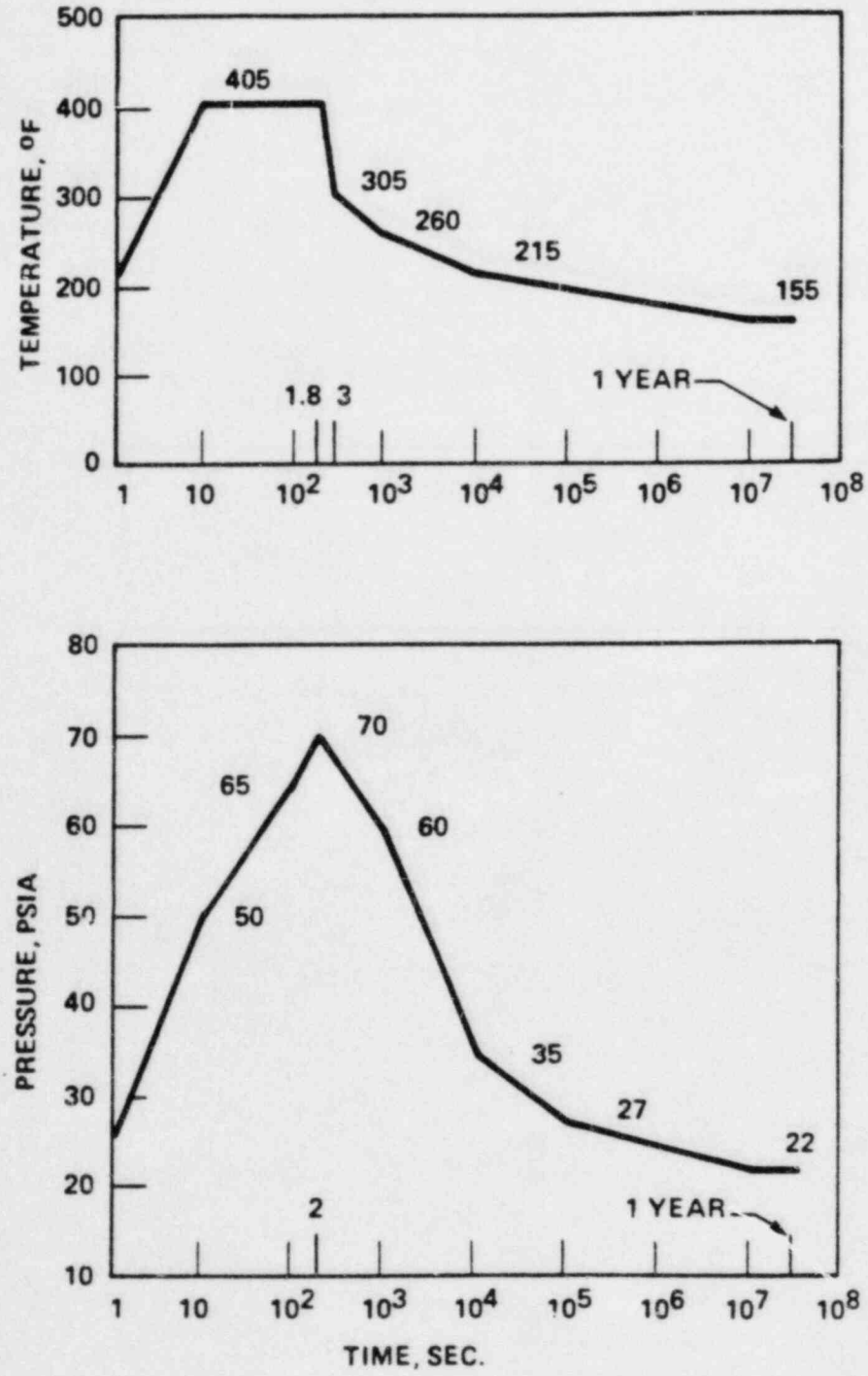

Figure 2 High Energy Line Break

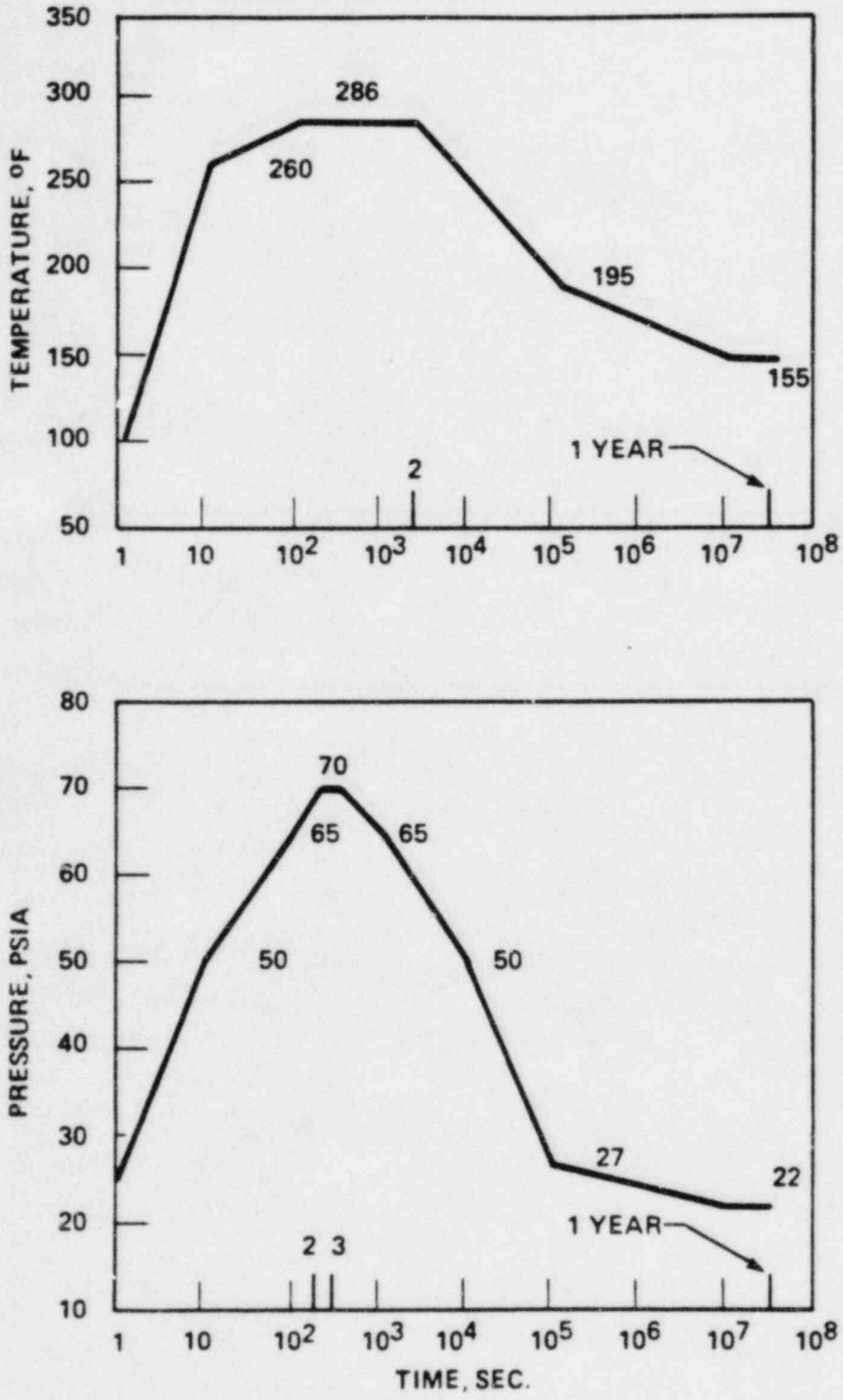

Figure 3 Loss of Coolant Accident Environment

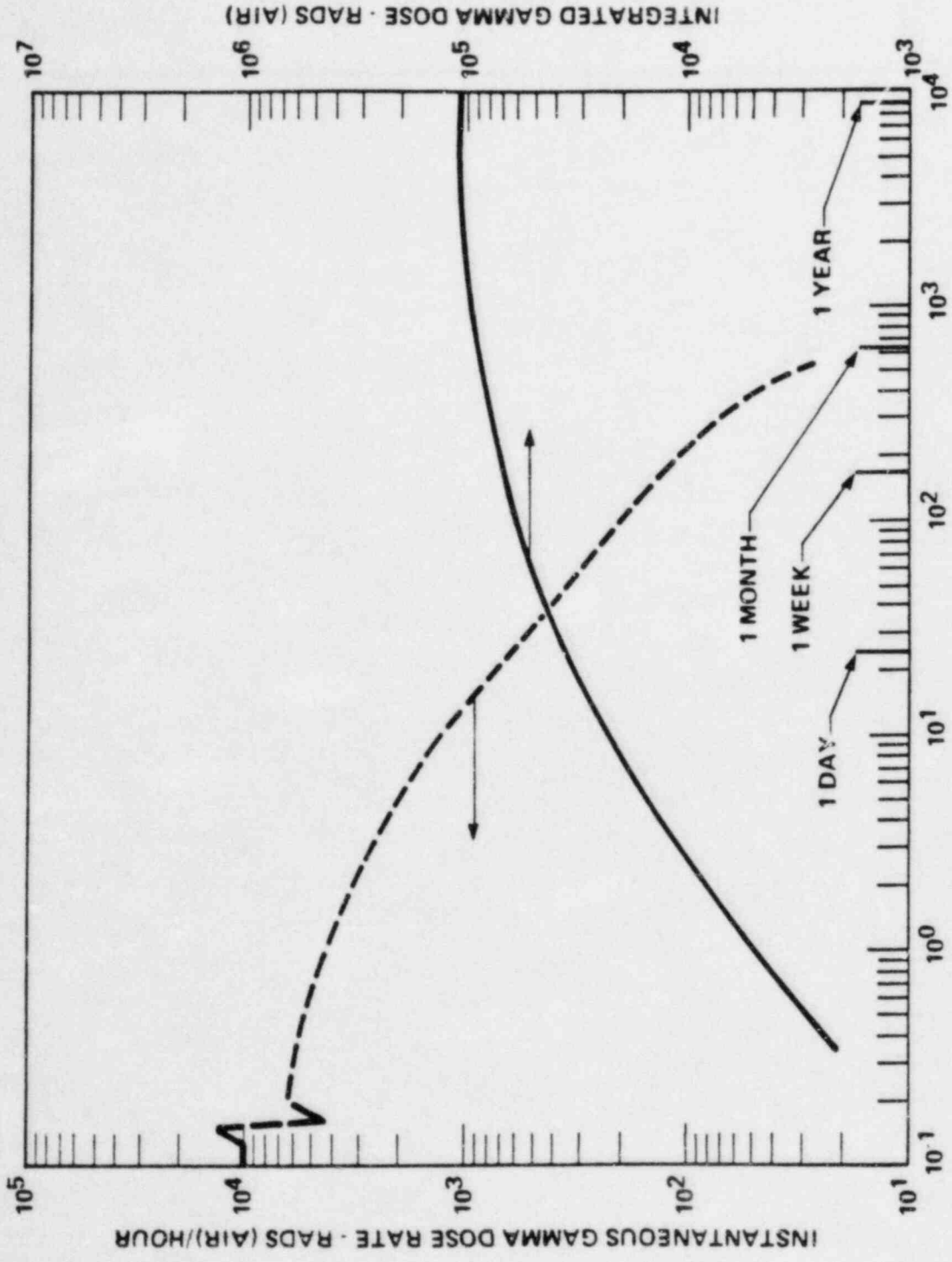

Figure 4 Gamma Dose and Dose Rate Inside the Containment as a Function of Time After a Steam Line Break Accident

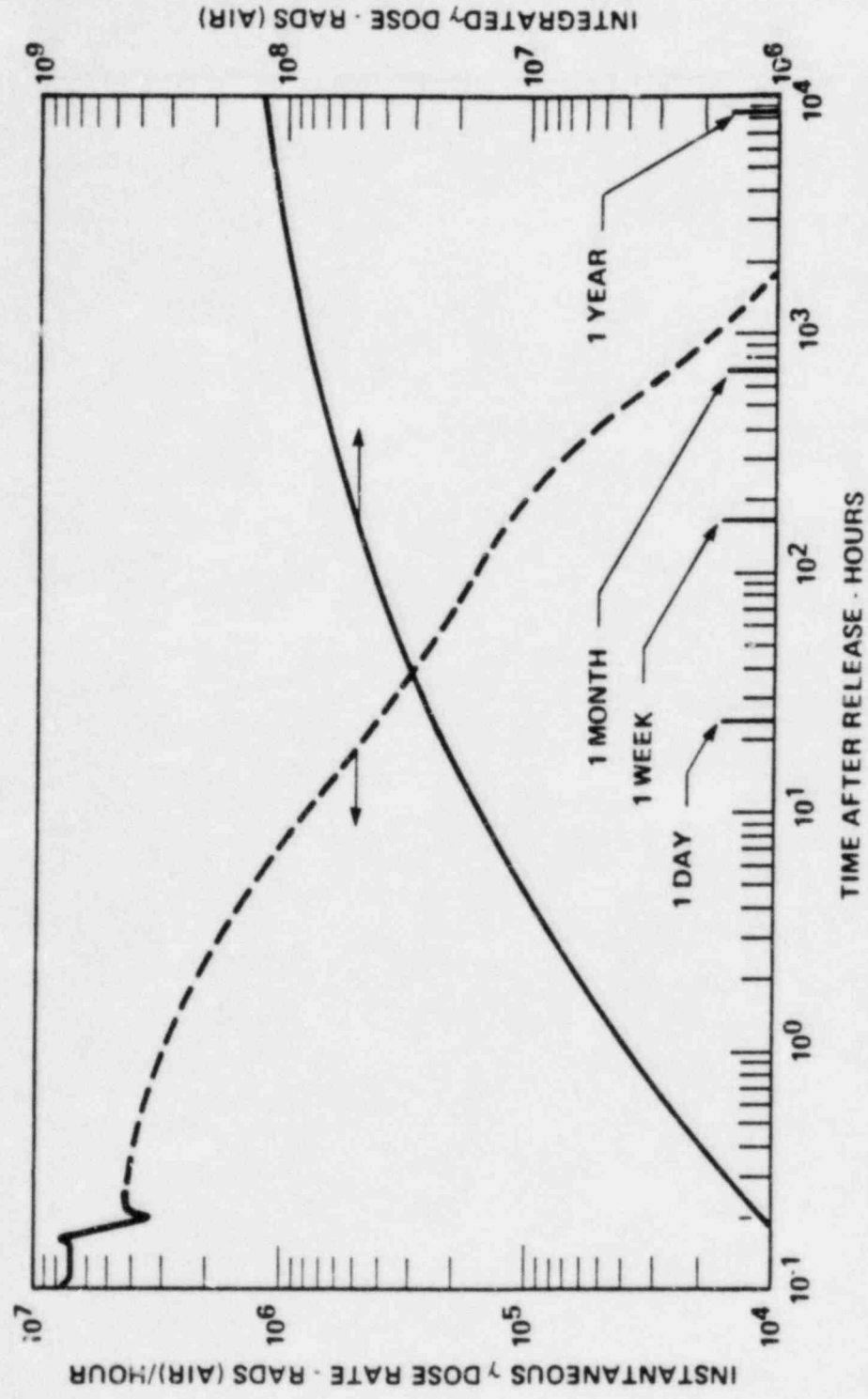

Figure 5 Gamma Dose and Dose Rate Inside the Containment as a Function of Time After LOCA

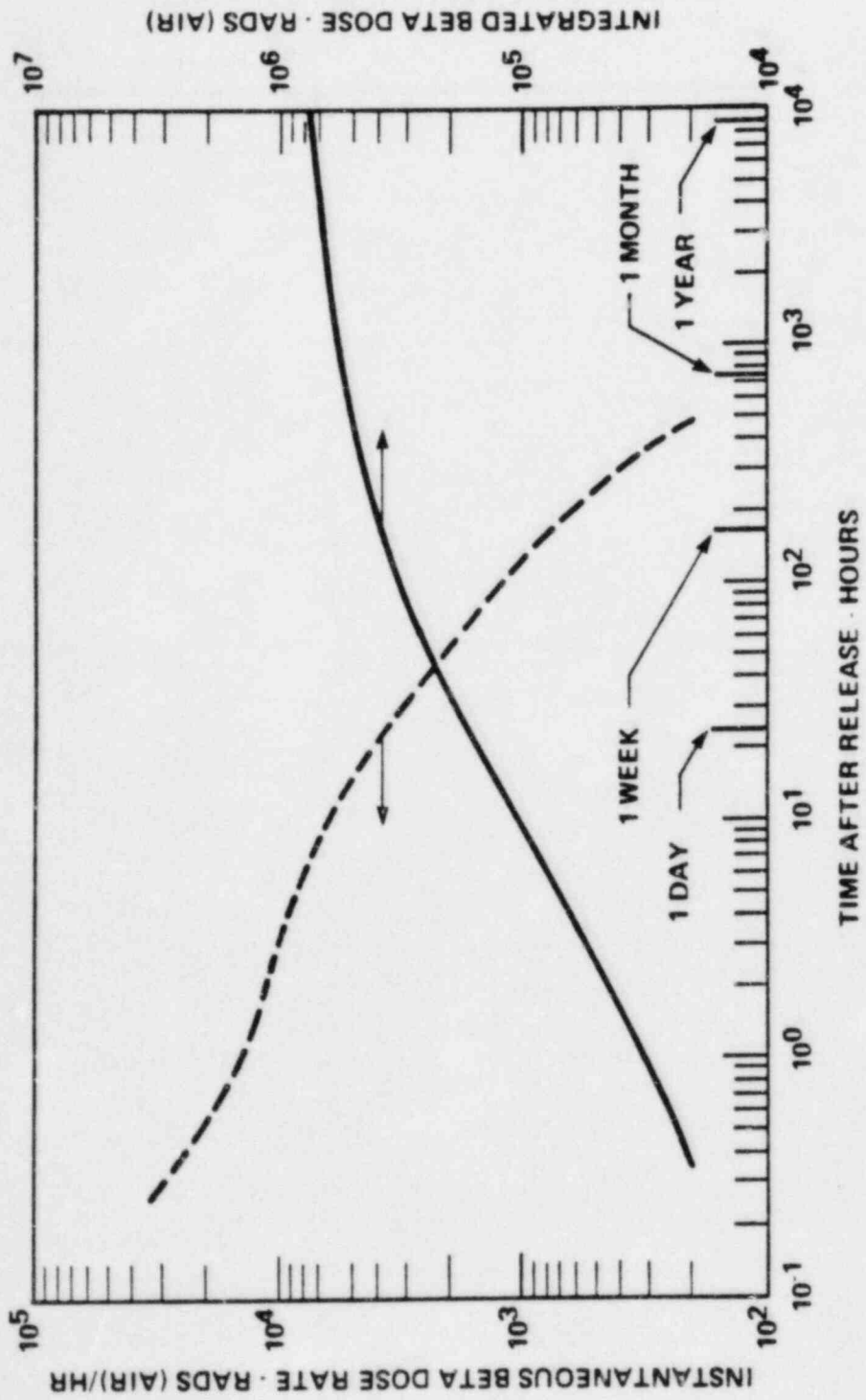

Figure 6 Beta Dose and Dose Rate Inside the Containment as a Function of Time After a Steam Line Break Accident

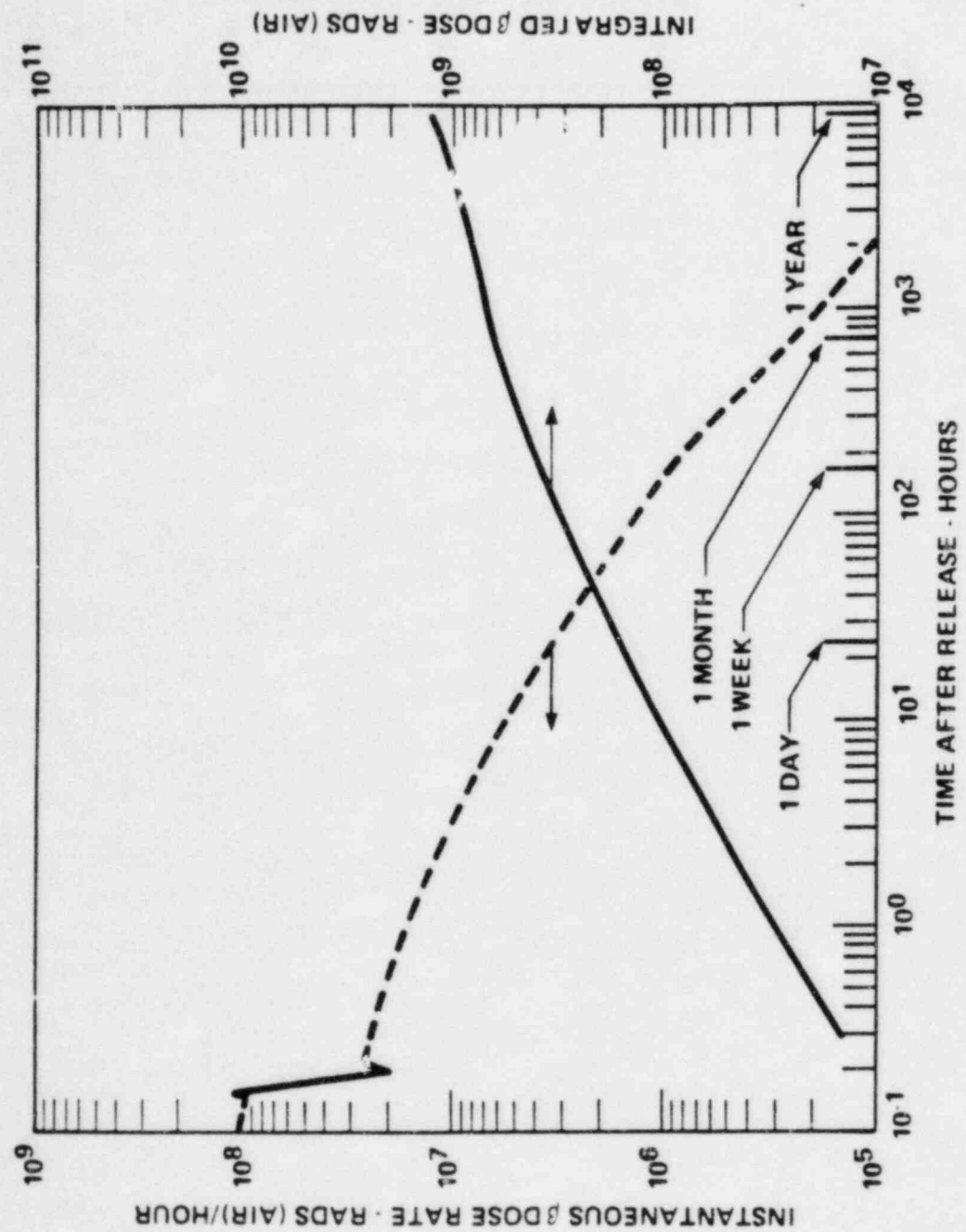

Figure 7 Beta Dose and Dose Rate Inside the Containment as a Function of Time After LOCA