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SNUPPS

Interim Justification Position for the Seismic and Environmental Qualification of the Incore Thermocouples, Connectors, Adaptors and Reference Junction Box

(ESE-43 and ESE-44)

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The Class 1E thermocouples, connectors, adaptors, and the reference junction box located inside containment form part of a core exit temperature monitoring system to be qualified for use during and after a design basis LOCA, MSLB or seismic event. In addition to the accident environment to which components inside containment might be subjected, the thermocouple junctions in the reactor vessel are to be qualified for operation in the event that a LOCA might lead to inadequate core cooling (ICC). The DBE conditions to which the components are to be qualified, therefore, include a 384.9°F peak temperature MSLB simulation (the Westinghouse generic profile up to 420°F provides adequate margin for SNUPPS applications) with caustic spray and, for the thermocouple measuring junctions, a 2200°F peak temperature inadequately cooled core simulation (which provides adequate margin over the SNUPPS required peak clad temperature).

The WRD qualification program is presently incomplete. Test sequence steps of accelerated thermal aging, normal radiation and seismic simulation have been completed on the connectors and adaptors but a retest is currently scheduled. The reference junction box has been aged, irradiated, and seismically tested as discussed below. The thermocouple test sequence has been completed. The status of completed testing and the justification for interim operation of the system are provided below.

Thermocouples

The thermocouples, including the measuring junctions and portions of stainless steel sheathed cable located inside the vessel, have been subjected to seismic and LOCA conditions and demonstrated successful performance during and after the dynamic simulations. Accelerated thermal aging was not required because there are no organic materials in the thermocouple and effects of high (normal) irradiation on the mechanical properties were evaluated and determined to not affect satisfactory performance of the sheath.

The seismic simulation test was conducted by shaker table using controlled multi-frequency test inputs. The thermocouples were subjected to five Operating Basis Earthquakes (OBE) and four Safe Shutdown Earthquakes (SSE).

The LOCA vibration simulation test was conducted by shaker table using random multi-frequency test inputs. The thermocouples were subjected to five seconds of random inputs at levels described by the power spectral density (PSD) plot.

Examples of the test response spectra (TRS) shown in Figures 1, 2, and 3 demonstrate adequate envelopment of the appropriate RRS for the OBE, SSE, and PSD test levels, respectively. The OBE RRS is two-thirds of the SSE RRS.

Throughout the test sequence no structural damage was observed and the thermocouples functioned properly.

The thermocouples have also been subjected to a 2200°F peak temperature inadequately cooled core simulation and demonstrated successful performance both during and after the tests.

Connectors

The thermocouple connector assemblies have been subjected to accelerated thermal aging and irradiation (gamma and beta) and seismic simulation. The test program is being repeated because the radiation test dose was not adequate to simulate the required Westinghouse generic post accident dose. Actual test dose applied was 60 mega rads of Gamma and 890 mega rads of Beta. Since SNUPPS requirements are 22.7 mega rads of Gamma and 152 mega rads of Beta the test dose applied did envelope SNUPPS requirements.

The connector components are made of Ryton R-4, designed to tolerate high radiation exposure. Additionally, the metal outer sheath provides some shielding against exposure. Based on these facts, the additional radiation exposure is not anticipated to cause any changes in the previous successful test results.

The seismic simulation test was conducted by shaker table using controlled multi-frequency test inputs. The connectors were subjected to five Operating Basis Earthquakes (OBE) and four Safe Shutdown Earthquakes (SSE).

The LOCA vibration simulation test was conducted by shaker table using random multi-frequency test inputs. The connectors were subjected to five seconds of random inputs at levels described by the PSD plot.

Examples of the test response sepctra (TRS) shown in Figures 4, 5, and 6 demonstrate adquate envelopment of the appropriate RRS for the OBE, SSE, and PSD test levels, respectively. The OBE RRS is two-thirds of the SSE RRS.

Throughout the test sequence no structural damage was observed and the connectors functioned properly.

A confidence test of the effects of a LOCA environment on a new LEMO connector has shown no effect on the accuracy of the thermocouple reading. The confidence test consisted of two separate tests. In the first test two LEMO connectors were connected to two thermocouples at room temperature with a recorder attached to monitor results. One connector was dipped in a solution of 2750 ppm boron adjusted to a pH of 10.7 at 25°C with sodium hydroxide. The other connector was left exposed to a normal atmosphere. During the 24 hour exposure period both channels of output maintained an accurate output. The second test was set up on the same manner except that the thermocouples were placed in a 400°F oven and the connectors were both placed in a dry test vessel. One connector was fitted with Raychem splice material to provide a watertight seal. A 24 hour steam test on the connectors was performed (this would be the same test conditions used for all HELB testing as discussed in estinghouse WCAP 8587 Methodology for Qualifying Westinghouse WRD Supplied NSSS Safety Related Electrical Equipment). During this 24 hour test, again both channels of output maintained an accurate output. These results are considered relevant to the question of performance of aged qualification units because the tendency for moisture to enter the unprotected connectors is the same for both new and aged samples. No evidence exists to suggest that the connectors will be more sensitive to LOCA effects. Pending completion of the entire sequence of connector tests, the results of the LOCA test of new connectors lend confidence of successful performance of the installed connectors. This LEMO connector is the same as those installed at the SNUPPS plants. Refer to SLNRC 84-0034 of February 23, 1984 for additional information.

Adaptors

The thermocouple adaptors interface with SNUPPS supplied organic thermocouple extension cable and consist of Thermoelectric connectors reinforced with Raychem heat shrink tubing to prevent separation. The adaptors have been subjected to the same accelerated thermal aging, irradiation and seismic simulation as the LEMO connectors with successful results. Since the design basis accident sequence has not been performed, a 24 hour confidence test was run on unaged Thermoelectric connectors with heat shrink tubing attached. Two Thermoelectric connectors were connected to thermocouples placed in a 400°F oven. A 24 hour steam test (utilizing the same HELB test conditions as discussed in WCAP 8587) was performed on the connectors. Both channels maintained an accurate output throughout the test except for two periods where the outputs exhibited fluctuations. These fluctuations coincided with oscillations in the chamber pressure due to a malfunctioning control valve. Post-test evaluation indicated that one of the connectors was in poor condition and it is postulated that the pressure oscillations may have caused a differential pressure on the Raychem tubing which expanded it and allowed movement between the connector contacts. Since these rapid pressure oscillations are not typical plant environmental conditions, it is concluded that the tested connectors would have performed through a 24 hour period post accident. This Thermoelectric connector is the same as those installed at the SNUPPS plants.

Splices

The splices which are to be used with the new-style Reference Junction Box are qualified as part of the ESE-44 program. The discussion of the Reference Junction Box below notes that the qualification program required a design change to improve the environmental sealing of the box. The installation of the improved new-style box requires a splice between the mineral insulated cable (which is part of the box) and the organic thermocouple extension cable. The splice consists of an Amp connector bonding the two wire ends, covered by Raychem heat shrink tubing. The entire splice area is surrounded by Dow Corning 738 sealant which is enclosed in a metal outer sheath. The sealant has excellent thermal qualities, (long term exposure to -85°F to 360°F will not degrade its performance), good dielectric properties, and when broken down is not corrosive. A confidence test, consisting of irradiation to 165 Mrads gamma and 1290 Mrads beta plus a 24 hour steam test (utilizing the same HELB test conditions as discussed in WCAP 8587) was performed on two samples of the splice. One splice exhibited an intermittent output which, upon disassembly, proved to be a bad crimp on one wire. The monitoring system for the other splice recorded an unexplainable offset for three minutes during the 24 hour test. Since, upon inspection, both splices appeared satisfactory (with the exception of the bad crimp), the confidence test is judged to have proven the capability of the splice to perform satisfactorily through the entire test sequence.

Due to the nature of the splice and the metho of installation, the splice would not be subjected to any stresses which would cause concern during a seismic event.

Pending completion of the entire sequence of tests on the final connection system, the results of the LOCA test of connectors and adaptors lend confidence of successful performance of the installed equipment. The LEMO cconnector and the Thermoelectric connector tested are the same as those installed at the SNUPPS plants.

Reference Junction Box (Old-Style)

The Reference Junction Box (RJB) has been aged, irradiated and seismically tested successfully. The seismic simulation test was conducted on a shaker table using multi-frequency test inputs. The equipment was subjected to five (5) Operating Basis Earthquake (OBE) and four (4) Safe Shutdown Earthquake (SSE) events. The required SSE level is shown in Figure 8, and the required OBE level is 2/3 SSE. The T/C RJB was mounted to a rigid test fixture utilizing procedures provided in the Technical Manual for the Model (WX-34072 T/C Reference Junction Box). The mounting hardware (mounting blocks and spacers, bolts, nuts, and washers) used for mounting the T/C RJB was supplied with the T/C RJB.

Examples of test response spectra (TRS) shown in Figures 7 and 8 demonstrate adequate envelopment of the appropriate RRS for the OBE and SSE test levels, respectively. Throughout the entire test sequence no structural damage was observed and the RJB functioned properly. However, a problem discovered prior to the LOCA test has altered the test program. During an external pressurization test it was discovered that the NEMA enclosure was not leak tight and would allow steam to enter the box during the LOCA test. Previous tests had revealed that RTD lead wires exposed to a steam environment would result in a substantial drop in the insulation resistance thus affecting the accuracy of the RTD. An attempt was made to seal the entire box with a silicone potting compound and perform a confidence test. If the potting method proved to be successful during the LOCA test, a new box was to be modified with the potting and the test program repeated.

During the confidence test of the potted box the measured insulation resistance dropped substantially on all three RTD's indicating the potting had not sealed the box and that the RTD lead wires were being exposed to steam and caustic spray. However, a review of the data revealed little effect on the accuracy of the system (approximately 1%). WRD is continuing the investigation of the apparent independence of insulation resistance and RTD performance. Present areas of investigation include the significance of data acquisition circuit variations and possible electro-chemical effects resulting from test measurement voltages in the presence of an electrolyte, such as the $H_3BO_3/NaOH$ caustic spray. Similar results are described by N. J. Selley in an "Experimental Approach to Electrochemistry". In conjunction with the investigation, the validity of existing IR measurement techniques used in establishing performance is being evaluated.

The confidence test performed on the potted box demonstrated that the probability of obtaining a true environmental seal on the box by this method was low and was not required for successful performance. After removal of the potting material from the qualification test unit, the LOCA test was repeated and followed by a post-accident simulation. This post-accident simulation was performed for 168 hours at 230°F.

Upon completion of the test program it was realized that because of the inadequate seal it would not be possible to take credit for Beta-shielding. This lack of shielding increased the required TID for the post-accident simulation to meet Westinghouse generic requirements. The test dose administered was adequate to simulate the 40 year normal operating dose prior to a seismic event.

Because of the inadequate seal, a concern has been raised over long term corrosion effects and potential hydrogen buildup to volatile levels due to containment spray reacting with the internal aluminum structure. However, confidence and LOCA testing with steam and chemical spray have not shown evidence of chemical residue in the box which is believed to be due to the rapid equalization of pressure in the box. Therefore, this is a postulated concern not demonstrated to occur during previous qualification testing.

In the interim, the results of testing to date demonstrate acceptable seismic qualification and short term post-accident environmental operation of the existing box design for SNUPPS application.

Reference Junction Box (New-Style)

Attachment 1 is a draft Equipment Qualification Data Package (EQDP) which addresses environmental and seismic qualification of the new-style RJB. The EQDP is considered to be a JIO in accordance with subparagraph (i) (2) of 10 CFR Part 50.49.

OBE

b,e

Figure 1 Test Response Spectrum Run 6, Position 1, Series I

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SSE

b,e

Figure 2 Test Response Spectrum Run 1, Position 4, Series I

TEST DIRECTION 4

ACCELEROMETER A1

RUN 1

LIVE ⊗ TAPE O

T/C LOCA TEST

g2/Hz

b,e

Figure 3 Full level PSD Plot (Series 1 T/C)

b,e

[ ]

FIGURE 4

b,e

FIGURE 5

T/C CONNECTOR TEST

8
2
/
H
z

b,e

FIGURE 6

b,e

Figure 7

b,e

Figure 8

EQDP-ESE-44A
Rev. 0, 12/84

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.

Incore Thermocouple Reference Junction Box

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APPROVED: ______________________________
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SECTION 1 - SPECIFICATIONS

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1.0 PERFORMANCE SPECIFICATIONS

1.1 Electrical Requirements

1.1.1	Voltage:	N/A
1.1.2	Frequency:	DC
1.1.3	Load:	N/A
1.1.4	Electromagnetic Interference:	None
1.1.5	Current:	2.5 mA

1.2 Installation Requirements: Thermocouple Reference Junction Box in accordance with Westinghouse Drawing E-3217 Rev -.

1.3 Auxiliary Devices: Thermocouples (EQDP-ESE-43A)
Thermocouple Connectors (EQDP-ESE-43B and 43C)
Adaptor Cable Splice (EQDP-ESE-44B)

1.4 Preventive Maintenance Schedule: Details of any preventive maintenance schedule, assumed in establishing the qualified life are specified in the instruction manual supplied with the equipment.

1.5 Design Life: forty years (40 yrs.)

1.6 Operating Cycles (Expected number of cycles during design life, including test): Continuous operation

1.7 Performance Requirements for(b): Thermocouple Reference Junction Box

	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	8 hours	Test duration	<24 hrs.	<24 hrs.	Event duration	1 year	1 year	Continuous
1.7.2	Performance requirement	Note c	As normal	No damage	Note c	Note c	As normal	Note c	Note c	As normal

1.8 Environmental Conditions for Same 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
1.8.1	Temperature(°F)	50-120	Included under normal	Ambient	~~Figure 2~~ Included under LOCA	Figure 2	Ambient	~~Figure 2~~ Included under LOCA	Figure 2	Ambient
1.8.2	Pressure (psig)	-0.1/+0.3	Ambient	70	~~Figure 2~~	Figure 2	Ambient	~~Figure 2~~	Figure 2	Ambient
1.8.3	Humidity (% RH)	0-95	95	Ambient	100	100	Ambient	100	100	Ambient
1.8.4	Radiation (R)(d)	$1.7x10^7$ γ	None	None	~~[illegible]~~ Included under Post DBE	~~[illegible]~~	None	$1.2x10^5$ γ $7.8x10^5$ β	$1.3x10^8$ γ $1.3x10^9$ β	None
1.8.5	Chemicals	None	None	None	~~Figure 2~~ Included under LOCA	Figure 2	None	None	None	None
1.8.6	Vibration	Section 2.10	None	None	None	None	None	None	None	None
1.8.7	Acceleration (g)	None	None	None	None	None	Figure 1	None	None	None

Notes: a: [illegible] is the Design Basis Event.

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

c: Accuracy ± 2.5% of measured value.

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1.9 Qualified Life: The demonstrated qualified life for the Thermocouple Reference Junction Box has been (later)

1.10 Remarks: None

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SECTION 2 - QUALIFICATION BY TEST

2.0 TEST PLAN

2.1	Equipment Description:	Thermocouple Reference Junction Box Model WX-34794 Westinghouse Drawing E-3220, Revision -.
2.2	Number Tested:	One Reference Junction Box
2.3	Mounting:	Per section 1.2
2.4	Connections:	Installation Procedure for Class 1E Reference Junction Box, and Plant Interconnect Drawings.
2.5	Aging Simulation Procedure:	Sequential simulation of thermal and radiation aging of organic material as part of the overall test sequence.

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2.6 Service Conditions to be Simulated by Test(1): Thermocouple Reference Junction Box

		Normal	Abnormal	Containment Test	Seismic	HELB	Post-HELB
2.6.1	Temp. (°F)	50-120	Included under normal	None	Ambient	Figure 2	Figure 2
2.6.2	Pressure (psig)	0	Included under normal	Included under HELB	Ambient	Figure 2	Figure 2
2.6.3	Humidity (percent RH)	Ambient	Included under normal	Included under HELB	Ambient	100	100
2.6.4	Radiation (R)	1.65×10^8 γ	Included under normal	None	None	Included under normal	Included under normal
2.6.5	Chemicals	None	None	None	None	Note (a)	None
2.6.6	Vibration	None	None	None	None	None	None
2.6.7	Acceleration (g)	None	None	None	TRS > RRS Figure 1	None	None

Note (a): The spray solution contains 2750 ppm Boron dissolved in water and buffered with sodium hydroxide to maintain a pH of 10.7.

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2.7 Measured Variables: Thermocouple Reference Junction Box

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

2.7.1 Category I - Environment		Required	Not Required
2.7.1.1	Temperature	B,E	A,C,D
2.7.1.2	Pressure	E	A,B,C,D
2.7.1.3	Moisture	-	A,B,C,D,E
2.7.1.4	Gas Composition	-	A,B,C,D,E
2.7.1.5	Vibration	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	C,E	A,B,D
2.7.2.2	Current	-	A,B,C,D,E
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

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		Required	Not Required
2.7.5	Category V - Electrical Characteristics		
2.7.5.1	Insulation Resistance	A,E	B,C,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	-	A,B,C,D,E
2.7.6.2	Torque	-	A,B,C,D,E
2.7.6.3	Time	-	A,B,C,D,E
2.7.6.4	Load Profile	-	A,B,C,D,E

2.7.7 Category VII - Auxiliary Equipment

None

A: Performance Test

B: Aging Test Thermal

C: Seismic Test

D: Radiation Test

E: HELB Test

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2.8 Test Sequence Preferred

This section identifies the 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 Seismic Simulation
2.8.6 Operation (Simulated High Energy Line Break Conditions)
2.8.7 Operation (Simulated Post HELB Conditions)
2.8.8 Inspection

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2.9 Test Sequence Actual

This section identifies the actual test sequence which constitutes the qualification program for this equipment. A justification for anything other than the preferred sequence is provided. The normal operating test condition referred to is a resistance check. This is included to more readily identify effects of the various test conditions on the test equipment. Performance under abnormal operating conditions is covered under Sections 2.8.2 and 2.8.6.

2.9.1 Test Sequence for Reference Junction Box (from Section 2.8):

Step	
2.8.1	Inspection
2.8.2	Operation-Normal Condition (Resistance Check)
2.8.4	Thermal Aging, Thermal Cycling
2.8.2	Resistance Check
2.8.4	Radiation, Normal and Post-Accident
2.8.2	Resistance Check
2.8.5	Seismic Simulation

2.8.2 Resistance Check
2.8.6 High Energy Line Break Simulation
2.8.7 Post HELB Simulation
2.8.2 Resistance Check
2.8.8 Inspection

2.8.3 N/A

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) and Reg. Guide 1.100 (IEEE 344-1975), the capability of the Incore Thermocouple Reference Junction Box to complete its 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

One (1) Reference Junction Box, as described in Section 2.1, was subjected to the test environments of the sequence shown in Section 2.9.1.

2.10.3 Test Summary

2.10.3.1 Normal Environment Testing

The operation of the Reference Junction Box under normal conditions is reflected by the numerous resistance checks performed between each phase of the test sequence and reported in Reference 1.

2.10.3.2 Simulated Aging

The test unit was pre-conditioned to a simulated (later) aged condition prior to subjecting it to the design basis seismic event and high energy line break simulation. The aged condition was achieved by separate phases of accelerated thermal aging, radiation exposure to a total integrated gamma dose equivalent to a (later) normal dose plus the design basis accident dose. Through all the pre-conditioning phases, the outputs were monitored to verify continuous operation.

2.10.3.3 Seismic Tests

The seismic testing reported in Reference 1 was completed on aged equipment employing multi-frequency multi-axis inputs in accordance with Regulatory Guide 1.100 (IEEE 344-1975). Figure 1 shows the Safe Shutdown Earthquake (SSE) required response spectrum (RRS) in the control direction of the shaker table. The Operational Basis Earthquake (OBE) RRS was two-thirds (2/3) of the SSE level. All test response spectra (TRS) curves were plotted against the RRS and were verified to meet or exceed the RRS. However, each plant should compare their actual plant requirements to the principal axis RRS (control direction RRS divided by a factor of $\sqrt{2}$) to assure that sufficient margin exists based on the actual equipment mounting location.

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2.10.3.4 High Energy Line Break/Post HELB Simulation

The Thermocouple Reference Junction Box was subjected to the HELB simulation temperature profile of Figure 2. The testing included simulating a twelve-month period of post-HELB operation.

2.10.4 Conclusion

The qualification status of the Thermocouple Reference Junction Box is demonstrated by the completion of the Design Basis Event condition testing described herein and reported in Reference 1.

2.11 Notes

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. Chang, M. S., Riedl, T. J., "Equipment Qualification Test Report, Thermocouple Reference Junction Box," WCAP-8687, Supplement 2-E44A (Proprietary).

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SECTION 3 - QUALIFICATION BY EXPERIENCE

Westinghouse does not employ operating experience in support of the qualification program for the Thermocouple Reference Junction Box.

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SECTION 4 - QUALIFICATION BY ANALYSIS

Analysis was performed in lieu of simulating by test the actual beta radiation extremes expected during accident operating conditions.

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TABLE 1

ACTUAL QUALIFICATION TEST CONDITION

EQUIPMENT (1) SYSTEM/CATEGORY	LOCATION STRUCTURE/AREA	MANUFACTURER TYPE/MODEL	ABNORMAL/ACCIDENT PARAMETER	ENVIRON. SPEC. (2)	EXTREMES QUALIFIED	OPERABILITY REQ	OPERABILITY DEM	ACCURACY(3) REQ	ACCURACY(3) DEM	QUAL LIFE	QUAL METHOD	QUAL REF	QUAL PROGRAM STATUS
Reference Junction Box/ PAMS/Category a	Containment Bldg./	W-IGTD WX-34794	Temperature		420°F	Post 12 mo.	Same	-	-		Seq. Test	ESE-44	Complete
			Pressure		51 psig								
			Rel.Humidity		100%								
			Radiation		165×10^{6}R(γ) 130×10^{8}R(β)								
			Chemistry		2750 ppm H_3BO_3 NaOH 10.7pH								

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. Accuracy ±2.5% of measured value.

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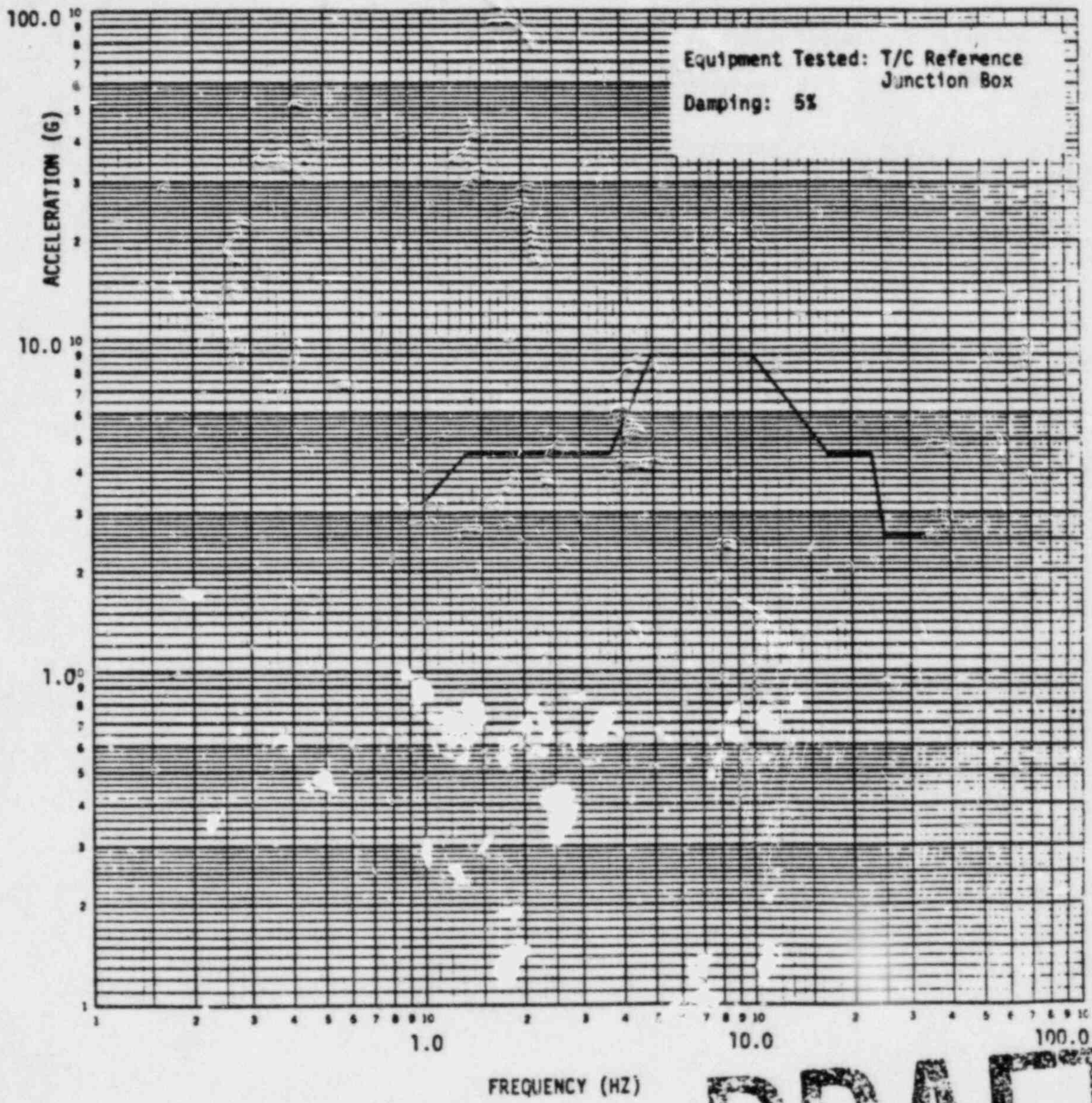

Figure 1. Required Response Spectrum (RRS) For Safe Shutdown Earthquake (SSE) Along Control Accelerometer Axis

Initial 24 Hour Containment Solution of 2750 PPM Boron in a Water Buffered with 0.24% NaOH to Yield a pH of 10.7

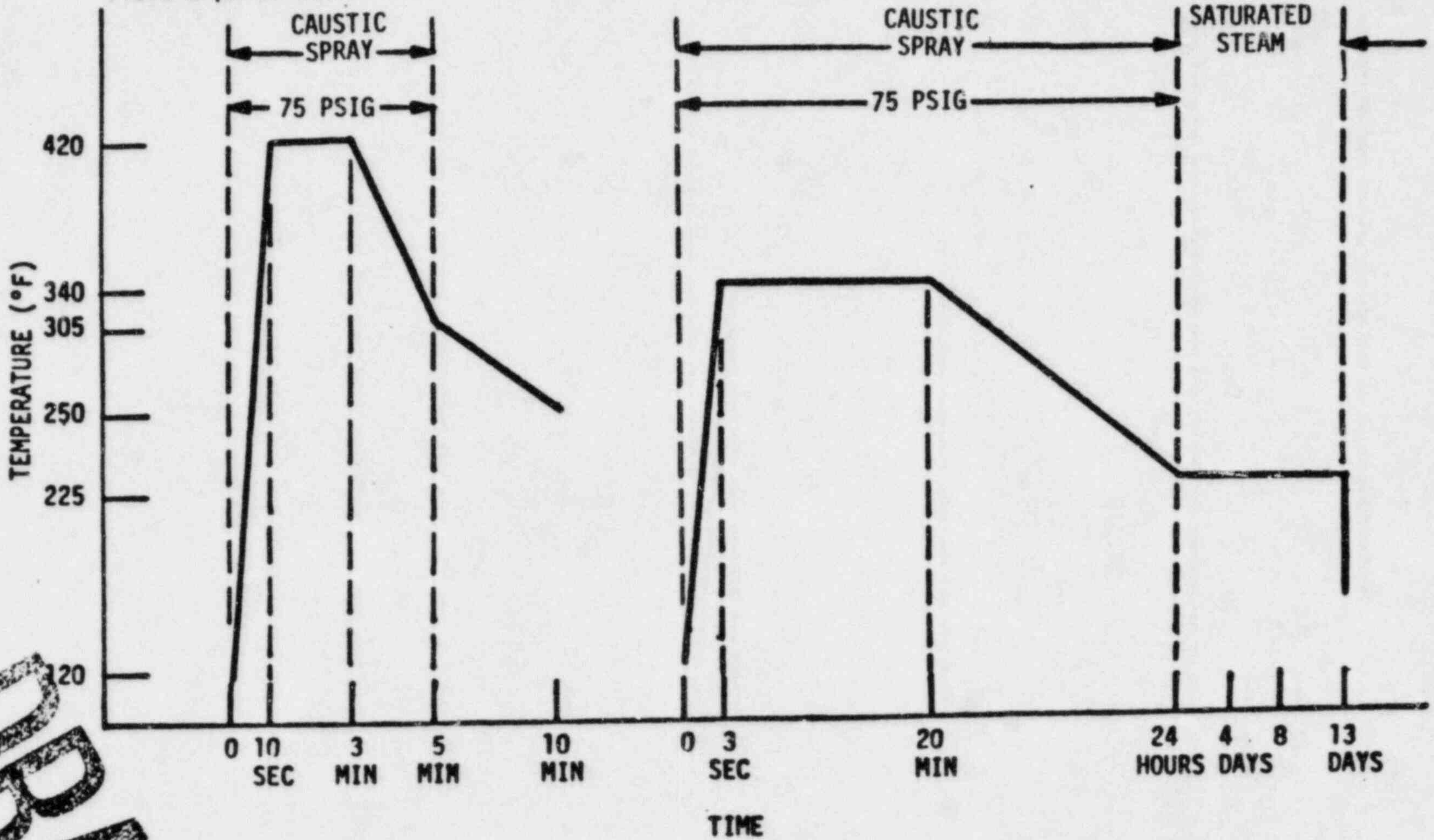

Figure 2. HELB Test Envelope

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