WESTINGHOUSE CLASS 3

EQDP-ESE-47A
Rev. 0, 5/83

DRAFT

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.

Boron Dilution Fix

Source/Intermediate Range Neutron Detector

APPROVED: _____

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EQUIPMENT QUALIFICATION DATA (PART 1 - SPECIFICATIONS)

1.0 PERFORMANCE SPECIFICATIONS

Source and Intermediate Range Detectors
WL-24157 and WL-24159

1.1 Electrical Requirements

1.1.1 Voltage Source: 300-2500 VDC Intermediate 300-1500 VDC
1.1.2 Frequency: N/A
1.1.3 Load: N/A
1.1.4 Electromagnetic Interference: Per Mil-N-19900B
1.1.5 Other: None

1.2 Installation Requirements: W drawing 583F278 and applicable Source and Intermediate Range Technical Manual

1.3 Auxiliary Devices: Source Range and Intermediate Range Drawers, Source Range Pre-amplifier

1.4 Preventative Maintenance Schedule: As a result of the completion of the qualification program, no maintenance is required to support the qualified life defined in Section 1.9

1.5 Design Life: 5 years

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

1.7 Performance Requirements for Function[c][d]: Source and Intermediate Range Detectors

	Condition Parameter	Normal	Abnormal	Containment Test	FLB/SLB	DBE LOCA	Seismic	FLB/SLB	Post DBE LOCA	Seismic
1.7.1	Time requirement	Continuous	12 hrs	N/A	N/A	N/A	Note a	N/A	N/A	Continuous
1.7.2	Performance requirement	Note b	Note b				no damage; Note a,			Note b

1.8 Environmental Conditions for Same Function[c]

1.8.1	Temperature(°F)	65-135	200	N/A	N/A	N/A	Ambient Conditions			Ambient Conditions
1.8.2	Pressure (psig)	-0.1/+0.3	2				Atmospheric			Atmospheric
1.8.3	Humidity (% RH)	0 - 95	95				Ambient			Ambient
1.8.4	Radiation (R)	2.2×10^9 6.3×10^{17} n/cm^2	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				Figure 1			None

Notes a: Detector required to function before and after a seismic event.
b: Accuracy ± 5% linear full scale as measured at NIS output.
c: DBE is the Design Basis Event. Margins are not included in the parameters specified in this section.
d: A separate set of Performance Requirements and Environmental Conditions are specified for Equipment employed in different class 1E functions.

1.9 Qualified Life: The currently demonstrated qualified life is 5 years based on the actual test conditions identified in Table 1.

1.10 Remarks: None

EQUIPMENT QUALIFICATION DATA (PART 2 - QUALIFICATION BY TEST)

2.0 TEST PLAN

Environmental cycling was performed on the Source and Intermediate Range Excore Neutron Detector Assembly in the Westinghouse Industrial and Government Tube Division (WIGTD) temperature and humidity chamber in Horseheads, New York. The portion of the chamber used for this test was a 20 foot length of 8 inch schedule 40 stainless steel pipe. The elevated temperature was generated by heated oil. High humidity was achieved by adding water to the chamber and pressure was adjusted at dwell times using a high pressure air source. Reference 1 provides a more detailed description of the test facility.

Seismic tests were performed at the Westinghouse Advanced Energy Systems Division (WAESD) Seismic Laboratory on the 8'x 8' Magnesium Table. Reference 1 provides a more detailed description of the test facility.

2.1 Equipment Description: NIS Source and Intermediate Range Excore Neutron Detector Assembly

2.2 Number Tested: type test on one (1) each

2.3 Mounting: per Section 1.2

2.4 Connections: triax connectors for each unit tested

2.5 Aging Simulation Procedure

2.5.1 Thermal Aging: Thermal aging is covered under separate test programs as detailed in Reference 1.

2.5.2 Mechanical Aging: N/A

2.5.3 Radiation Aging: Radiation aging is covered under separate test programs as detailed in Reference 1.

2.5.4 Vibration Aging: 5 OBE's

2.6 Service Conditions to be simulated by test[1]: Source/Intermediate Range Excore Neutron Detector Assembly

		Containment					
		Normal	Abnormal	Test	Seismic	HELB	Post-HELB
2.6.1	Temp. (°F)	80° to 135°F sixteen cycles	135° to 200°F four 24 hr. cycles	N/A	Ambient	N/A	N/A
2.6.2	Pressure (psig)	2	2		0		
2.6.3	Humidity (% RH)	95	95		Ambient		
2.6.4	Radiation (R)	None	None		None		
2.6.5	Chemicals	None	None		None		
2.6.6	Vibration	None	None		5 OBE's		
2.6.7	Acceleration (g)	None	None		TRS>RRS Figure 1		

2.7 Measured Variables for Source/Intermediate Range Excore Neutron Detector Assembly

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

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
(List Function and Required Measurements)

A: Operational Test, Normal and Abnormal Conditions

B: Seismic Test

2.8 Test Sequence Preferred[2]

2.8.1 Inspection of Test Item
2.8.2 Operation (Normal Condition)
2.8.3 Operation (Performance Specification Extremes, Section 1)
2.8.4 Simulated Aging[3]
2.8.5 Vibration[4]
2.8.6 Operation (Simulated High Energy Line Break Conditions)[3]
2.8.7 Operation (Simulated Post HELB Conditions)[3]
2.8.8 Disassembly and Inspection

2.9 Test Sequence Actual[2]: Detectors

Step	Justification
2.8 1	
2.8 2	
2.8 3	
2.8 5	
2.8 8	
2.8 4	Aging uses separate test program - not sequential
2.8 6	N/A - Detectors not required to operate during
2.8 7	N/A or after a HELB.

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 Boron Dilution Fix 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

The testing was performed on type WL-23821 Source and Intermediate Range Detector Assembly, WL-23821, S/N-815201.

2.10.3 Features Demonstrated by the Test

Testing demonstrated that the unit would function before during and after abnormal service conditions. Reference 1 summarizes the results of environmental cycling.

The single design basis event considered is a seismic event since the detectors are not required to function during or after a HELB. The unit functioned properly before and after seismic excitation. Reference 1 summarizes the results of seismic tests. At the end of the test sequence, electrical tests, disassembly and inspection resulted in finding no significant degradation.

The Source and Intermediate Range Detectors are not required to perform a function during or after a HELB. It is expected that the detectors would initially short when exposed to the HELB and eventually open. The shorting would be of no concern since the high voltage power supplies are current limited and are not exposed to the HELB. Erratic operation may occur as some components may be damaged. The intermediate range compensating power supply is isolated from primary power by a transformer so failures in this area would be of no concern.

2.10.4 Test Procedures

A number of performance measurements (known as acceptance tests i.e., resistances, leakage currents, capacitances, gamma sensitivity, gamma compensation, neutron sensitivity, background test and thermal neutron sensitivity check) were carried out by Westinghouse IGTD during normal conditions; further detail is given in Reference 1. Simulated service conditions consisting of sixteen 80° to 135°F cycles, four 135° to 200°F (abnormal) cycles, seismic excitation and post environmental tests are

all o_tli_ed in test procedures contained in Reference 1. The purpose of the environmental cycling was to simulate the conditions experienced during 5 years of continuous service. Seismic testing consisted of a resonance search, five OBE's and four SSE's. The post seismic test procedure consisted of a repeat of electrical acceptance tests and disassembly and inspection as described in Reference 1.

2.10.5 Test Data and Accuracy

All electrical test results obtained before and after each test sequence remained within specified acceptance limits. The Detector sensitivities were not expected to change from the beginning to the end of the test program. Any variation within ±5% were considered to be measurement error. The sensitivities of the proportional counter and compensated ionization chamber after the seismic event were within 5% (which is measurement error) of the original sensitivity measurements. Test data met the normal acceptance limits except for a portion during environmental cycling that was not considered to have a significant effect upon operation. A summary of test data and accuracy discussion can be found in Reference 1.

2.10.6 Conclusions

The results of environmental cycling and seismic testing described herein and reported in Reference 1, demonstrate the qualification of the Source and Intermediate Range Excore Neutron Detector Assembly employing the practices recommended by Regulatory Guide 1.89 and 1.100.

2.10.7 References

1. Riling, R. W., Chang, S-M., "Equipment Qualification Test Report, Source/Intermediate Excore Neutron Detector" WCAP-8687, Supplement 2-E47A (Proprietary).

2 11 Part 2 Notes

(1) The generic tests conducted by Westinghouse employ parameters designed to envelope a number of plant applications. Margin will be demonstrated on future plant applications by comparison of the generic Westinghouse qualification parameters to plant specific parameters.

(2) Paragraph 2.8 shows the preferred test sequence as specified in IEEE-323-74. The actual sequence employed is shown in paragraph 2.9 including justification for any deviations from the preferred.

(3) Radiation dose from normal operation and HELB may be combined. If combined, HELB and post-HELB conditions need not include radiation.

(4) Simulated seismic and other vibration seen in service.

WESTINGHOUSE CLASS 3

PART 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 SOURCE AND INTERMEDIATE RANGE NEUTRON DETECTOR ASSEMBLY.

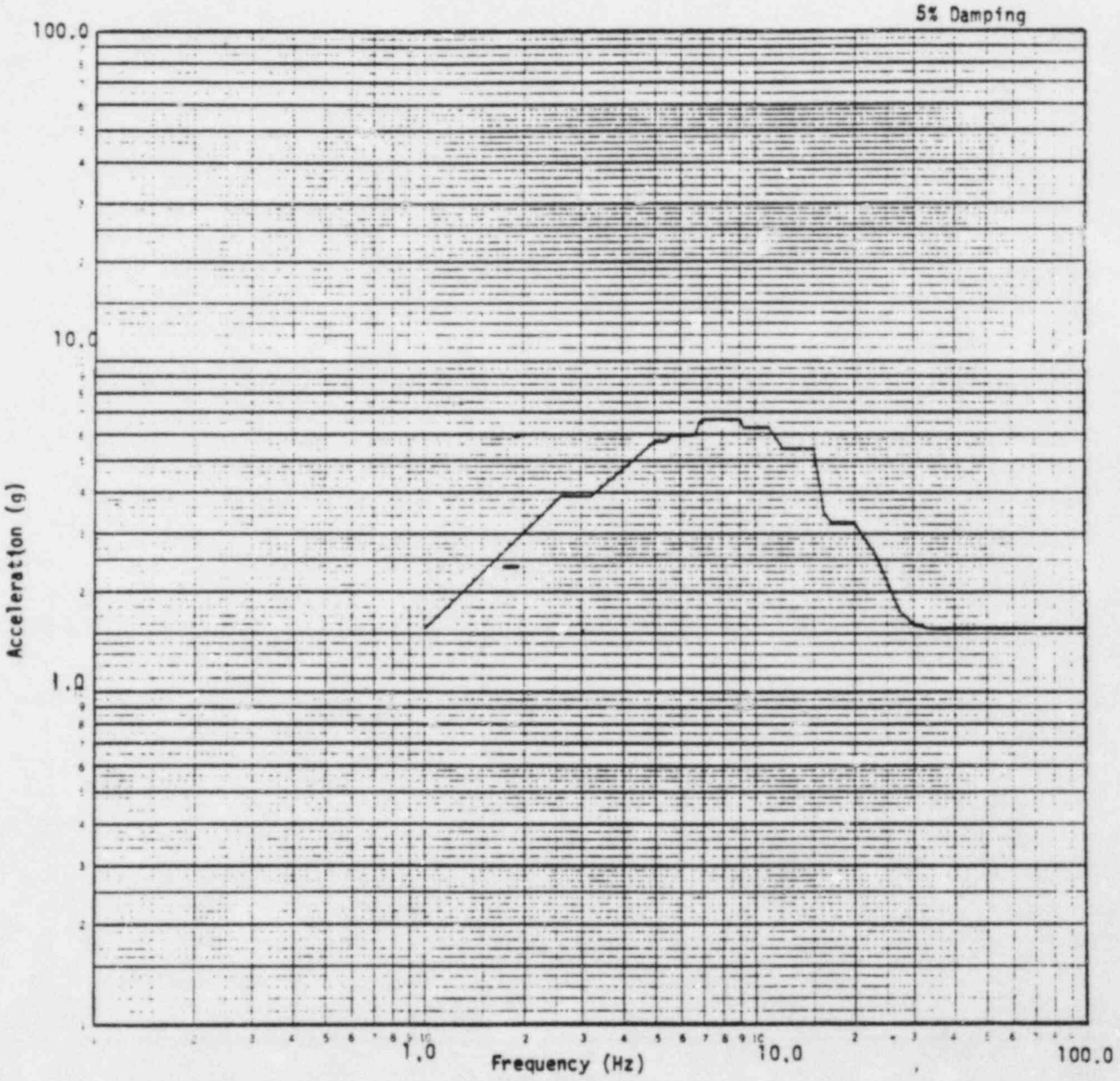

Figure 1: Required Response Spectrum Along the Horizontal Control Axis (SSE)

0936P

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
SOURCE/INTER-MEDIATE RANGE EXCORE NEUTRON DETECTOR	Containment Bldg/Detector Well	W-IGTD WL-24157 WL-24159	Temperature		200°F	Remain Functional	Remain Functional	±5%	±5%	5 yrs.	Sequential test	E47A	Completed
			Pressure		2 psig								
			Relative Humidity(%)		95%								
			Radiation		2.2×10^9 γ								
			Chemistry		6.3×10^{17} n/cm^2								
			Acceleration		Figure 1								

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.

WESTINGHOUSE CLASS 3

SNUPPS
Interim Justification Position for the
Seismic Qualification of the
TC/CCM System
(ESE-56A)

Background

The SNUPPS Thermocouple/Core Cooling Monitor System (TC/CCM) comprises two identical microprocessor-based monitoring assemblies or trains, each monitoring various analog and digital inputs, performing calculations using the information obtained from the inputs, and actuating caution or alarm outputs when preset trip points are exceeded. Each provides relay contact outputs for caution and alarm conditions, along with serial data outputs, to the Technical Support Center (TSC), digital and analog recorders, and a remote digital display. The local and remote control panels have lamps that indicate POWER on; processor RUN, STOP; and system status (NORMAL, CAUTION, and ALARM) conditions. Switches on both the local and remote control panels reset the central processing unit (CPU) and acknowledge alarm or caution outputs. In addition, there are controls for selecting display format and content and, on the local control panel, for testing the system, adjusting setpoints for cautions and alarms, and activating or deactivating selected inputs.

The upper six lines of the remote digital display unit are allocated for thermocouple, RTD and pressure data, and the lower two lines are for core cooling data. Alarm and caution outputs and indications are shared by both functions. If one alarm or caution is active and a second alarm or caution condition occurs, the appropriate relay will cycle and, if the plant annunciator system has the capability, alarm or caution signals will be reflashed to indicate the new alarm or caution condition.

The TC/CCM enables the plant operator to activate necessary manual safety functions following a Condition II, III, or IV event. These safety measures include providing information needed to maintain the plant in a safe shutdown condition, or to proceed to a cold shutdown, consistent with the Technical Specification limits.

Previous Environmental Testing (This equipment is located in mild environment areas of the SNUPPS plants)

The TC/CCM system has been subjected to the complete IEEE 323-1974 and IEEE 344-1975 qualification testing. The TC/CCM system successfully passed temperature and humidity testing and seismic testing. Aging simulation is

addressed in a separate program, as described by Subprogram C of Appendix B to WCAP 8587, currently in progress.

The specific parameters of tests already conducted are as listed below:

Temperature/Humidity Testing: Two twelve hour cycles at 120°F, 35% RH

Two twelve hour cycles at 82°F, 95% RH

Seismic Testing: Tested per IEEE 344-1975 requirements with operability demonstrated before and after each SSE.

TC/CCM Cabinet Electronics:

Current Status: Data is being reviewed; accuracies are being calculated. Repeatability of the data is acceptable. During seismic testing the requirement was for all equipment to function properly before and after each SSE.

Remote Digital Display: (See ESE-46A)

No failures occurred during temperature/humidity testing and seismic SSE test runs in positions 1 and 2. During position 3, a vertical column on the plasma display blanked out and another vertical column became intermittent. During position 4, another vertical column blanked out. This condition continued to exist after the testing had ended and also during subsequent operation of the display.

The display was removed from its panel and sent to the original manufacturer for checkout, test and evaluation. Upon energizing the display the manufacturer reported that the display operated properly with all columns working. The display was then disassembled in an attempt to identify a cause for its intermittent operation. They concluded that certain vibration modes cause fretting of the edge connector contacts and board edge fingers. The fretting produces microscopic particles of oxidized material that act as a

insulator, thereby causing intermittent or open circuits. Based on the nature of the failure which occurred during the third SSE, the testing provides sufficient evidence that the plasma display would perform properly during one SSE. However, to provide additional margin, the manufacturer is developing a lubricant/oxidation inhibitor which would minimize the fretting and also minimize any fretted material from becoming an insulator. If appropriate, this inhibitor will be incorporated into the SNUPPS design.

One additional problem occurred with the PS-2 power supply. Its performance was satisfactory during all seismic testing, however, its output became intermittent at high temperatures during the temperature testing. Further testing is scheduled; however, for SNUPPS this system is in the control room which has Class 1E HVAC and will not experience an abnormal environment.

TC/CCM Digital Printer (See ESE-46B)

No failures occurred during testing. The printer functioned properly throughout with acceptable legibility and accuracy.

Test Schedule

Testing is scheduled for completion, including the submission of the test report by July, 1984.

SNUPPS
Interim Justification Position for the
Seismic Qualification of the
Target Rock Head Vent System Control Module
(HE-10B)
(A draft copy of EQDP-HE-10B is attached in
lieu of analysis; the report
meets all requirements for supporting
qualification of the Head Vent System
Electronic Control Module. This
equipment is located in a mild
environment area).