SUMMARY OF IE BULLETIN 79-01 REVIEW BALANCE OF PLANT (INSIDE & OUTSIDE CONTAINMENT) AND NSSS (INSIDE CONTAINMENT) FOR CLASS IE EQUIPMENT

North Anna Power Station Units 1 & 2
Virginia Electric and Power Company

STONE & WEBSTER ENGINEERING CORPORATION
BOSTON, MASSACHUSETTS

TABLE OF CONTENTS
PART I
QUALIFICATION
BOP

DESCRIPTION	(LOCA)	(MSLB)	PAGE
Cable - 600 V Al Power (General Cable)			
NGB-5 - Triplex 500 MCM	x		5,a
NGB-7 - Triplex 250 MCM	x		5,a
NGB-11 - Triplex #2/0 Awg.	x		5,a
NGB-12 - Triplex #1 Awg.	x		5,a
Cable - 600 V - Cu Power (Okonite)			
NGA-20 - 1/C 250 MCM	x	x	6,a
NGA-21 - 1/C #2/0 Awg.	x	x	6,a
NGB-15 - Triplex #4 Awg.	x	x	6,a
NGB-16 - Triplex #6 Awg.	x	x	6,a
NGB-17 - 3/C #8 Awg.	x	x	6,a
NGB-18 - 3/C #10 Awg.	x	x	6,a
NGB-19 - 3/C #12 Awg.	x	x	6,a
Cable - High Temperature Cu (Cerro Wire)			
NGA-15 - Triplex 250 MCM	x	x	7,a
NGA-17 - Triplex #2/0 Awg.	-	-	7,a
NGA-33 - 6/C (2) #8 & (4) #12 Awg.	-	-	7,a
NGA-61 - 7/C #12 Awg.	-	-	7,a
NGA-34 -4/C #16 Awg.	-	-	7,a
NGB-37 - 2/C #8 Awg.	-	-	7,a
Cable - 600 V Cu Control (Cerro Wire)			
NGA-19 - 2/C #2 Awg.	x	x	8,a
NGA-34 - 1/C #14 Awg.	x	x	8,a
NGA-35 - 2/C #14 Awg.	x	x	8,a
NGA-36 - 3/C #14 Awg.	x	x	8,a
NGA-37 - 5/C #14 Awg.	x	x	8,a
NGA-38 - 7/C #14 Awg.	x	x	8,a
NGA-39 - 9/C #14 Awg.	x	x	8,a
NGA-40 - 12/C #14 Awg.	x	x	8,a
NGA-44 - I/C #12 Awg.	x	x	8,a
NGA- 45 - 2/C #12 Awg.	x	x	8,a

DESCRIPTION	(LOCA)	(MSLB)	PAGE
NGA-47 - 4/C #12 Awg.	x	x	8,a
NGA-49 - 7/C #12 Awg.	x	x	8,a
NGA-57 - 4/C #10 Awg.	x	x	8,a
NGA-77 - 4/C #10 Awg.	x	x	8,a
NGB-43 - 2/C #8 Awg.	x	x	8,a
NGB-44 - 2/C #6 Awg.	x	x	8,a
NGB-45 - 4/C #6 Awg.	x	x	8,a
Cable - 300 V Cu Instrument (BIW)			
NGA-67 - 19/C #16 Awg.	x	x	9,a
NGA-68 - 12/C #16 Awg.	x	x	9,a
NGA-69 - 2/C #16 Awg.	x	x	9,a
NGA-70 - 18/C #16 Awg.	x	x	9,a
NGB-35 - 2/C #16 Awg.	x	x	9,a
NGB-39 - 3/C #16 Awg.	x	x	9,a
NGB-40 - 4/C #16 Awg.	x	x	9,a
NGB-55 - 45/C #16 Awg.	x	x	9,a
Cable - Thermocouple Extension Wire (Cerro Wire)			
NGB-68 - 1 pair #16 Cu-Const	x	x	10,a
NGB-69 - 1 pair #16 Ir-Const	x		10,a
Cable - 5KV Al Power (Okonite)			
NGA-3 - Triplex 1000 MCM	-		11,a
NGA-4 - 3/C 500 MCM	x		11,a
NGA-14 - Triplex 4/0	-		11,a
NGA-13 - 3/C #4/0 Awg.	-		11,a
Cable - 600 V Al Power (Okonite)			
NGB-5 - Triplex 500 MCM	x		12,a
NGB-7 - Triplex 250 MCM	x		12,a
NGB-11 - Triplex #2/0 Awg.	x		12,a
NGB-12 - Triplex #1 Awg.	x		12,a

DESCRIPTION	(LOCA)	(MSLB)	PAGE
Cable - 300 V Cu Instrument (Cerro)			
NGA-67 - 19/C #16 Awg.	x	x	13,a
NGA-68 - 12/C #16 Awg.	x	x	13,a
NGA-70 - 18/C #16 Awg.	x	x	13,a
NGB-35 - 2/C #16 Awg.	x	x	13,a
NGB-39 - 3/C #16 Awg.	x	x	13,a
Cable-Thermocouple (BIW)			
NGB-68 - 1 pair #16 Awg. Cu-Const	x	x	14,a
Cable - Triaxial (BIW)			
NGA-72 - Triax	x		15,a
Cable - 600 V Cu Power Cable - Heat Tracing (Okonite)			
NGB-01 - 2/C #10 Awg.	x		16,a
Chiller Room Sump Pump Motors			
DB-P-10A		x	17 b,c
Fan Motors and Motor-Operated Valve			
HV-F-40A, 40B	x	-	18,a
HV-F-71A, 71B	x	-	18 b,c
HV-F-24	-	x	2 b,c,
MOV-HV-115-1,2	-	x	17,a
MOV-HV-116-1,2	-	x	17,a

DESCRIPTION	(LOCA)	(MSLB)	PAGE
Level Transmitter			
LT-RS-151A, B	x		20,a
LT-RS-251A, B	x		20,a
Motor Control Centers			
1-EP-MC-19 (1H1-2N)	x		22,a
1-EP-MC-20 (1H1-2S)	x		22,a
1-EP-MC-21 (1J1-2N)	x		22,a
1-EP-MC-22 (1J1-2S)	x		22,a
2-EP-MC-19 (2H1-2N)	x		22,a
2-EP-MC-20 (2H1-2S)	x		22,a
2-EP-MC-21 (2J1-2N)	x		22,a
2-EP-MC-22 (2J1-2S)	x		22,a
Motor Operated Valves			
MOV-QS-101A, B, C, D	x		23 b,c
MOV-RS-155A, B	x		23 b,c
MOV-156A, B	x		23 b,c
MOV-SW-103A, B, C, D	x		23,a
MOV-SW-104A, B, C, D	x		23 a
MOV-SW-108A, B	x		23,a
MOV-SW-113A, B	x		23,a
MOV-QS-201A, B, C, D	x		23,a
MOV-RS-255A, B	x		23.b,c
MOV-RS-256A, B	x		23.b,c
MOV-SW-203A, B, C, D	x		23,a
MOV-SW-204A, B, C, D	x		23,a
MOV-SW-208A, B	x		23,a
MOV-SW-213A, B	x		23,a
Penetrations			
Type IA-Instrument	x	x	24,a,25,a
Type IB-Control	x	x	24,a,25,a
Type IC, IIA, IIB, IIC, IID, IIE-Low Voltage Power	x	x	24,a,25,a
Type III-Triaxial	x	-	24,a
Type IV-Thermocouple	x	-	24,a
Penetration Splices	x	x	26,a,27,a
Terminal Blocks (Polysulfone)	x	x	19,a

DESCRIPTION	(LOCA)	(MSLB)	PAGE
Recirculation Spray Pump Motors (Inside)			
RS-P-1A	x	x	28,a,29,a
RS-P-1B	x	x	28,a,29,a
Recirculation Spray Pump Motors (Outside)			
RS-P-2A	x		23,d,e
RS-P-2B	x		23,d,e
Solenoid Operated Valves			
ASCO #HT8344 A71		x	36,a
ASCO #HT8321A5	x		30,a
ASCO #HT830281U	x	x	35,a,37,a
ASCO #THT8320A102	x	x	40,a
ASCO #FT83201A101	x	x	38,a
ASCO #HT8349A11	x	x	36,a
Limit Switches For Use On:			
MODEL # EA-180	x		21,a
Switchgear - 480 V			
1-EE-SS-03	x		31,a
1-EE-SS-04	x		31,a
2-EE-SS-03	x		31,a
2-EE-SS-04	x		31,a
Switchgear Transformers - 480 V			
1-EE-ST-01	x		31,a
1-EE-ST-02	x		31,a
2-EE-ST-01	x		31,a
2-EE-ST-02	x		31,a

DESCRIPTION	(LOCA)	(MSLB)	PAGE
Terminal Blocks			
Connectron Type:			
NSE-3	x	x	32,a
NSS-3	x	x	32,a
PSU's	x	x	32,a
General Electric Type:			
EB5	x	x	32,a
EB25	x	x	32,a
Marathon Series:			
200	x	x	32,a
1500	x	x	32,a
Thermo-Electric			
3225's	x	x	32,a
Westinghouse Type			
TBAL	x	x	32,a
Terminating Material			
Okonite Tape - T-35	x	x	33,a
Okonite Tape - T-95	x	x	33,a
Raychem Heat Shrink			
WCSF-N	x	x	34,a
HVI	-		39,a
HVMC	-		39,a
Radiation Monitoring Pump Motor			
1-SW-P-5,6,7,8	-		41,a
2-SW-P-5,6,7,8	-		41,a

TABLE OF CONTENTS
PART II
QUALIFICATION
NSSS
INSIDE CONTAINMENT

DESCRIPTION	(LOCA)	(MSLB)	PAGE
Limit Switches for Valves as denoted			
HCV-1200 A,B,C	x	x	W-4,a
HCV-2200 A,B,C	x	x	W-4,a
TV- 1842, 2842	x	x	W-4,a
Position Switch for Valves as denoted			
HCV-1201, 2201			W-5,a
Motor Operated Valves			
MOV-1380, 2380	x	x	W-6,a
Pressurizer Pressure Transmitters			
PT- 1455, 2455	x	x	W-7,a
PT- 1456, 2456	x	x	W-7,a
PT- 1457, 2457	x	x	W-7,a
RCS Pressure Transmitters (wide range)			
PT-1402, 2402	x	x	W-8,a
Solenoid Operators			
HCV-1200 A,B,C	x	x	W-9,a
HCV-2200 A,B,C	x	x	W-9,a
LCV-1460 A,B	x	x	W-10,a
LCV-2460 A,B	x	x	W-10,a
TV- 1842, 2842	x	x	W-10,a
HCV-1201, 2201	x	x	W-10,a

DESCRIPTION	(LOCA)	(MSLB)	PAGE
RCS Temperature Elements (Wide Range)			
TE-1410, 2410		x	W-11,a
TE-1413, 2413		x	W-11,a
TE-1420, 2420		x	W-11,a
TE-1423, 2423		x	W-11,a
TE-1430, 2430		x	W-11,a
TE-1433, 2433		x	W-11,a
RCS Temperature Elements (Narrow Range)			
TE-1412 B, D		x	W-12,a
TE-1422 B, D		x	W-12,a
TE-1432 B, D		x	W-12,a
TE-2412 B, D		x	W-12,a
TE-2422 B, D		x	W-12,a
TE-2432 B, D		x	W-12,a

GENERAL DEFINITIONS

1. Operability Requirements: Time and temperature conditions at which the equipment may be required to function, after the initial 60 minute transient period.

2. Operability Demonstrated: That testing done by the manufacturer for the stated time and temperature conditions, demonstrating tne adequacy of the equipment to operate during post accident conditions. The adequacy was determined based on use of the "10 degree centigrade" rule when evaluating the test data.
Pre-test thermal aging was not considered.

NOTES

1. Radiation dose is sum of 40 year dose plus 120 day LOCA.

2. Adequacy was determined based on use of the "10 degree centigrade" rule when evaluating the test data. Ref. IEEE Publication 117 and 275.

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-247/1247
Control & Relay Room A/C chillers
Westinghouse:

1-HV-E-4A, B, C
2-HV-E-4A, B, C

Model #PCO[illegible]W

Chiller room, Service building

DESCRIPTION OF ENVIRONMENT

MSLB in Turbine bldg.

1. High ambient temperature 211°F for duration of steam discharge in vicinity of chiller room air intakes - 30 minutes.

2. High ambient moisture content saturated steam 100% RH for duration of steam discharge 30 minutes.

Normal Environment

70° to 104°F
Motors & pumps will keep temperature above 70°F

Area has temperature monitors.

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

MSLB
None

Normal Environment

120°F

OPERABILITY REQUIREMENT

MSLB

30 minutes - 211°F & 100% RH

Normal Environment

104°F

OPERABILITY DEMONSTRATED

MSLB

None

Normal Environment

120°F

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
MSLB	[illegible]	MSLB
None	None	A. Deficiencies: Equipment not qualified for exposure to: 1) High ambient temperature 211°F 2) Saturated atmosphere, 100% R.H.
Normal Environment	Normal Environment	B. Solutions: There are three possible solutions as discussed below: a. Include the chiller room inside the control room pressure boundary and eliminate its communication with the turbine building. This involves determining if the compressed air system is adequate to maintain pressure with the chiller room included. Additional ducting must be added to provide cooling to the chiller room. Structural modifications to block openings to turbine building and modify door to be a pressure barrier. b. Replace unqualified equipment with qualified equipment. c. Use equipment in unaffected unit to maintain control room environment.
Industrial Standard NEMA MG 1	Specification NAS-314	Normal Environment None

EQUIPMENT DESCRIPTION & MARK NO.

P.O. RA-270/1270
In-Line Pumps - Air Conditioning
- Bingham-Williamette Company:

1-HV-P-20A, B, C
1-HV-P-22A, B, C
2-HV-P-20A, B, C
2-HV-P-22A, B, C
Model 20's #773B581047
22's #773B581031

Motor with type "B" insulation.

Chiller room, Service building

DESCRIPTION OF ENVIRONMENT

MSLB in Turbine bldg.

1. High ambient temperature 211°F for duration of steam discharge in vicinity of chiller room air intakes 30 minutes.

2. High ambient moisture content saturated steam 100% RH for duration of steam discharge 30 minutes.

Normal Environment

70° to 104°F
Motor and pump will keep temperature above 70°F. Area has temperature monitors.

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

MSLB

None

Normal Environment

104°F

OPERABILITY REQUIREMENTS

MSLB

30 minutes - 211°F & 100% RH

Normal Environment

104°F

OPERABILITY DEMONSTRATED

MSLB

None

Normal Environment

104°F

ACCURACY REQUIREMENTS

None

MANNER OF QUALIFICATION

MSLB

None

Normal Environment

Industrial Standard
NEMA MG 1

QUALIFICATION DOCUMENT

MSLB

None

Normal Environment

Specification NAS-315

QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS

MSLB

A. Deficiencies:

Equipment not qualified for exposure to:

1) High ambient temperature 211°F
2) Saturated atmosphere, 100% R.H.

B. Solutions:

There are three possible solutions as discussed below:

a. Include the chiller room inside the control room pressure boundary and eliminate its communication with the turbine building. This involves determining if the compressed air system is adequate to maintain pressure with the chiller room included. Additional ducting must be added to provide cooling to the chiller room. Structural modifications to block openings to turbine building and modify door to be a pressure barrier.
b. Replace unqualified equipment with qualified equipment.
c. Use equipment in unaffected unit to maintain control room environment.

Normal Environment

None

EQUIPMENT DESCRIPTION & MARK NO.

Air Conditioning Self-Cleaning Strainers - Elliot Company:

P.O. NA 299/1299
1-HV-S-1A & B
2-HV-S-1A & B

Model #ECA

Chiller Rm. Service Bldg.

DESCRIPTION OF ENVIRONMENT

MSLB in Turbine bldg.

1. High ambient temperature 211°F for duration of steam discharge in vicinity of chiller room air intakes.

2. High ambient moisture content saturated steam, 100% R for duration of steam discha

Normal Environment
70°F to 104°F
Motors and pumps will keep temperature above 70°F

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

MSLB in Turbine bldg.

None

Normal Environment

104°F

OPERABILITY REQUIREMENTS

MSLB in Turbine bldg.

30 minutes - 211°F & 100% RH

Normal Environment

70°F - 104°F

OPERABILITY DEMONSTRATED

MSLB in Turbine bldg.
None

Normal Environment
104°F

ACCURACY REQUIREMENT

Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTION
MSLB in Turbine bldg.	MSLB in Turbine bldg.	MSLB in Turbine bldg.
None	None	A. Deficiencies: 1. High ambient temperature 211°F 2. Saturated atmosphere B. Solutions: There are three possible solutions as discussed below: a. Include the chiller room inside the control room pressure boundary and eliminate its communication with the turbine building. This involves determining if the compressed air system is adequate to maintain pressure with the chiller room included. Additional ducting must be added to provide cooling to the chiller room. Structural modifications to block openings to turbine building and modify door to be a pressure barrier. b. Replace unqualified equipment with qualified equipment. c. Use equipment in affected unit to maintain control room environment.
Normal Environment	Normal Environment	Normal Environment
Industrial Standards ASME - VIII ASME - IX	Specification #NAS-316	None

EQUIPMENT DESCRIPTION & MARK NO.

Propeller Fan - Aerovent Fan Company, Incorporated

P.O. NA 241/1241
1-HV-F-24
2-HV-F-24
Model #7-216

Ins. Class F

Chiller rm, Service bldg.

DESCRIPTION OF ENVIRONMENT

MSLB in Turbine bldg.

1. High ambient temperature 211°F for duration of steam discharge in vicinity of chiller room air intakes

2. High ambient moisture content saturated steam, 100% RH for duration of steam discharge.

Normal Environment

70°F to 104°F
Motors and pumps will keep temperature above 70°F

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

MSLB in Turbine bldg.

1. High ambient temperature 211°F at saturated atmosphere

Normal Environment

120°F

OPERABILITY REQUIREMENTS

MSLB in Turbine bldg.

30 minutes - 211°F and 100% RH

Normal Environment

104°F

OPERABILITY DEMONSTRATED

MSLB in Turbine bldg.

30 minutes - 211°F & 100% RH

Normal Environment

120°F

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTION
MSLB in Turbine bldg.	MSLB in Turbine bldg. TLX-3-29-79 - W.B. Schumacher to J.E. Krechting	MSLB
Vendor's reply to TLX inquiry		None
Normal Environment	Normal Environment	Normal Environment
Industrial Standards	Specification #NAS 197A	None
ANSI B31.7 ANSI B10.10 ANSI B16.5		

EQUIPMENT DESCRIPTION & MARK NO.	DESCRIPTION OF ENVIRONMENT	ENVIRONMENT TO WHICH EQUIPMENT IS QUALIFIED
... or Operated Valves - Fisher Governor Company - Continental Division - Field P.O. - Natkin #8514-A-2008, located in charcoal filter duct from chiller room. MOV-HV-104-1 & 2 MOV-HV-118-1 & 2 MOV-HV-204-1 & 2 MOV-HV-218-1 & 2 NOTE: Upon further investigation it was found that the electrical components of the above valves are within the control room pressure boundary and therefore will see no changing environment due to an accident.	No changing environment.	

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-255/1255
5 KV alum. power cable
(General Cable)

NGA-3	Triplex 1000 MCM
NGA-4	3/c 500 MCM alum. armor
NGA-6	3/c 1250 MCM alum. armor
NGA-5	3/c 1250 MCM st. armor
NGA-10	1/c 2000 MCM
NGA-12	3/c 1000 MCM alum. armor
NGA-13	3/c 4/o AWG. alum armor
NGA-14	Triplex 4/o AWG.
NGA-9	1/c 1500 MCM

Jacket: Neoprene
Insulation: Ethylene Propylene Rubber

Outside Containment

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

1×10^6 rads (based on 120 day LOCA). In addition the 40 year radiation dose of 4×10^4 rads must be considered for a total possible radiation dose of 1.04×10^6 rads.

Normal Environment

40 to 120°F

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

2×10^8 rads

Normal Environment

40 to 120°F

OPERABILITY REQUIREMENTS

Loss of Coolant Accident (LOCA)

$1.04 \quad 10^6$ rads

Normal Environment

40 to 120°F

OPERABILITY DEMONSTRATED

Loss of Coolant Accident (LOCA)

2×10^8 rads

Normal Environment

Less than or equal to 104°F

ACCURACY REQUIREMENTS

Not Required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA	LOCA	LOCA
Test	General Cable Letter dated 12-22-71	A. Deficiencies:
Normal Environment	Normal Environment	Qualification Document is in letter form (i.e., no formal test report data with approved signature and date) and does not address: 1) Accuracy of variables and test data 2) Test monitoring sensors 3) Test facility
Industrial Standard IPCEA S-19-81	Specification NAS-108	B. Solutions: 1) Accuracy of instrument even though not stated, would commonly be ±1% 2) Test monitoring sensors, even though not identified, are assumed to comply with Industrial Standards for their type of application. 3) Location of test facility, even though not noted could be obtained from Vendor Records. The letter is a summary of the nuclear incident environment tests performed on similar constructed cables, which General Cable has stated are applicable.
		Normal Environment
		A. Deficiencies: Normal ambient temperature may exceed cables maximum continuous ambient temperature.
		B. Solution: a) Maximum temperature is of short duration. b) Cables that are used in CAT IE circuits are not carrying full derated current continuously. Their load is in the range of 50 to 75% of derated full load current with the exception of emergency diesel generator which doesn't operate continuously during plant life.

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-256/1256
600 V Alum. Power Cable
(General Cable)

NGB-5	Triplex	500 MCM
NGB-7	Triplex	250 MCM
NGB-11	Triplex	2/0 AWG.
NGB-12	Triplex	#1 AWG.

Jacket: Neoprene
Insulation: Ethylene Propylene Rubber

Inside and Outside Containment

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

280°F	0 to 30 min
Reduce from 280°F to 150°F	30 to 60 min
150°F	>60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	>60 min

7.2×10^7 rads(1)
Spray: 0-4 hrs. Solution of boric acid (2000-2100 ppm boron) buffered to a pH of 8.5 to 11 with NaOH, >4 hrs similar solution with a pH of 7 to 9.

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

Loss of Coolant Accident (LOCA)

Irradiated to		$.55 \times 10^8$ rads
100 psig	@ 340°F	for 4 hrs.
62 psig	@ 310°F	for 1 hr.
20 psig	@ 260°F	for 43 hrs.
2.5 psig	@ 260°F	for 5 days

Spray: Throughout test cycle solution consisting of a 2000 ppm solution of boron as boric acid buffered with NaOH to a pH of 9.0
Irradiated an additional 1.45×10^8 rads bringing the total exposure to 2×10^9 rads.

OPERABILITY REQUIREMENTS

Loss of Coolant Accident (LOCA)

120 day @ 150°F

OPERABILITY DEMONSTRATED (2)

LOCA
163 hr @ 260°F

Post LOCA thermal aging is equivalent to 490 days @ 150°F

ACCURACY REQUIREMENTS

LOCA
Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA	LOCA	LOCA
Test - Sequential	General Cable Letter dated 12-22-71	A. Deficiencies: Qualification Document is in letter form (i.e., no formal test report with approved signature and date) does not address: 1) Accuracy of variables and test data 2) Test monitoring sensors 3) Test facility B. Solutions: 1) Accuracy of instrument even though not stated, would commonly be ±1% 2) Test monitoring sensors, even though not identified, are assumed to comply with Industrial Standards for their type of application. 3) Location of test facility, even though not noted could be obtained from Vendor Records. The letter is a summary of the nuclear incident environment tests performed on cables of a similar construction, which General Cable has stated are applicable.

EQUIPMENT DESCRIPTION & MARK. NO.

P.O. NA-128/1128
600 V. Cu. Power Cable
Okonite

NGA-20	1/c 250 MCM
NGA-21	1/c 2/0 AWG
NGB-15	Triplex #4 AWG
NGB-16	Triplex #6 AWG
NGB-17	3/c #8 AWG
NGB-18	3/c #10 AWG
NGB-19	3/c #12 AWG

Jacket: Neoprene
Insulation: Ethylene Propylene Rubber

Inside and Outside Containment

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

280°F	0 to 30 min
Reduce from 280°F to 150°F	30 to 60 min
150°F	>60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	>60 min

7.2×10^7 rads (1)

Spray: 0-4 hr Solution of boric acid (200-2100 ppm boron) buffered to a pH of 8.5 to 11 with NaOH > 4 hr Similar solution with a pH of 7 to 9.

Main Steam Line Break (MSLB)

430°F	0 to 2 min
280°F	2 to 60 min
150°F	>60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	>60 min

3×10^7 rads

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

Loss of Coolant Accident (LOCA)

Aged 168 hr @ 121°C
Irradiated to 2×10^8 rads

PWR exposure:

80 psig @ 324°F	For 4 hr
16 psig @ 252°F	For 7 days

Spray: 10,000 ppm boric acid buffered with NaOH to a pH of 10.5 throughout the PWR exposure period.

Boiling Water Reactor Exposure (BWR)

A series of transient cycles each consisting of a rise to a specified press and temp for a specified time and a gradual return to initial conditions. Following transient cycles 100 day exposure to live steam 0 psig, 212°F

BWR exposure includes a transient cycle at 104 psig at 345°F for 3 hr and 20 min.

MSLB

Same as "Description of Environment"

OPERABILITY REQUIREMENTS

LOCA

120 days @ 150°F

MSLB

120 days @ 150°F

OPERABILITY DEMONSTRATED (2)

LOCA

304°F - 3 hr 20 min
346°F - 4 hr 27 min
256°F - 1 day
212°F - 100 days
259°F - 10 hr
324°F - 4 hr
252°F - 7 days

Post LOCA thermal aging is greater than 2.9 years @ 150°F

MSLB

See above

ACCURACY REQUIREMENTS

LOCA & MSLB

Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA Test - Sequential	LOCA Okonite's Engineering Report No. 141 dated 2/29/72 Additional Supporting Documents Outline of Franklin Institute Research Laboratory report F-C3694 IEEE Transaction Paper T 74 044 4	LOCA A. Deficiencies: Qualification document does not address: 1) Accuracy of variables and test data 2) Test monitoring sensors 3) Test facility B. Solution: 1) Accuracy of instrument even though not stated would commonly be ±1%. 2) Test monitoring sensors, even though not identified, are assumed to comply with Industrial Standards for their type of application. 3) Location of test facility even though not noted could be obtained from vendor's records. Additional supporting documents indicate that some tests were performed at Franklin Institute.
MSLB Test - Analysis Maximum calculated surface temperature during limiting MSLB is 335°F which does not exceed qualification temperature of 345°F given in BWR exposure portion of LOCA qualification.	MSLB FSAR Section 3C and response to Comment 7.17 (Note to be revised to include this item).	MSLB Qualification based on independent test and analysis. Each of the qualification parameters (obtained from independent test and analysis) exceeds the corresponding MSLB requirements. Amend FSAR as stated in "Qualification Document".

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-359/1359
High Temperature Cable
Cerro Wire and Cable Company

*NGA-15	Triplex 250 MCM
NGA-17	Triplex #2/0 AWG
NGA-33	6/c 2-#8 and 4-#12 AWG
NGA-61	7/c #12 AWG
NGB-34	4/c #16 AWG
NGB-37	2/c #8 AWG

NGA 15, 17 & NGB 37
Jacket: Asbestos Braid
Insulation: Silicone Rubber

NGA 33, 61 & NGB 34
Jacket: Silicone Rubber
Insulation: Silicone Rubber

Inside Containment

*NGA-15 is required for the inside recirc spray pumps. All other items are not required for post accident operation.

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

280°F	0 to 30 min
Reduce from 280°F to 150°F	30 to 60 min
150°F	> 60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	> 60 min

7.2×10^7 rads (1)

Spray: 0-4 hr Solution of boric acid (2000-2100 ppm boron) buffered to a pH of 8.5 to 11 with NaOH >4 hr
Similar solution with a pH of 7 to 9

MSLB

430°F	0 to 2 min
280°F	2 to 60 min
150°F	> 60 min
45 psig to 0 psig	30 to 60 min
0 psig	> 60 min

3×10^7 rads

ENVIRONMENT TO WHICH EQUIPMENT IS QUALIFIED

LOCA

Irradiated to 2×10^8 rads, 50 psig, and 276°F for 12 hr

Spray: Last 2 hr of 12 hr period with a solution of borated water containing approximately 1,720 ppm of boron as boric acid.

Reduced to 5 psig and 164°F over an unspecified time with spray continuing

160°F at 5 psig for the remainder of the 7 day period without spray

F-C2750 indicates that in an earlier test, the spray was buffered with NaOH to pH of 9

MSLB

Same as "Description of Environment"

OPERABILITY REQUIREMENTS

LOCA

120 days @ 150°F

MSLB

120 days @ 150°F

OPERABILITY DEMONSTRATED

LOCA

276°F for 12 hr
160°F for 7 days

Post LOCA thermal aging is equivalent to 65 days @ 150°F.

MSLB

See above

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA	LOCA	LOCA
Test - Sequential	Franklin Institute Research Laboratory (FIRL), Report F-C2857 Cerro's Supplement to FIRL, Report F-C2857 FIRL, Report F-C2750 Cerro's Supplement to FIRL, Report F-C2750	A. Deficiencies: Qualification documents do not address: 1) Accuracy of test data and variables 2) Test monitoring sensors 3) 276°F, 0 to 30 min vs 280°F 4) 1,750 ppm boron vs 2,000 ppm 5) Long-term post-accident operabilities not demonstrated B. Solutions: 1) Accuracy of instrument, even though not stated, would commonly be ±1%. 2) Test monitoring sensors, even though not identified, are assumed to comply with Industrial Standards for their type of application. 3) The above 276°F through first 30 min is within tolerance of the LOCA temp transient profile - FSAR Fig. 6.2-82 (Amendment No. 65) 4) The cable jacket is of an asbestos braid which has been shown to be resistant to all diluted alkaline solutions. Therefore, we believe that since the LOCA spray is in the range of a diluted alkaline solution, it should have no significant effect on the cable. 5) The cable (NGA-15) insulation is rated for 125°C conductor temperature at rated ampacity, it can be shown by standard industry practices that the cable is capable of operating in a 150°F ambient continuously.
Main Steam Line Break (MSLB) Temperature - Analysis Maximum calculated surface temperature during limiting MSLB is 335°F which does not exceed qualification temperature of 460°F given in Rockbestos' (formerly Cerro) letter dated 4/25/77.	MSLB FSAR Section 3C and response to Comment 7.17 Rockbestos' letter dated 4/25/77 LOCA qualification documents	MSLB Each of the qualification parameters (obtained from independent test and analysis) exceeds the corresponding MSLB requirements.
Pressure and Radiation - Test Refer to LOCA Qualification		

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-312/13/2
600 V Control Cable
Cerro Wire and Cable Company

NGA-19	2/c #2 AWG
NGA-34	1/c #14 AWG
NGA-35	2/c #14 AWG
NGA-36	3/c #14 AWG
NGA-37	5/c #14 AWG
NGA-38	7/c #14 AWG
NGA-39	9/c #14 AWG
NGA-40	12/c #14 AWG
NGA-44	1/c #12 AWG
NGA-45	2/c #12 AWG
NGA-47	4/c #12 AWG
NGA-49	7/c #12 AWG
NGA-57	4/c #10 AWG
NGA-77	4/c #10 AWG
NGB-43	2/c #8 AWG
NGB-44	2/c #6 AWG
NGB-45	4/c #6 AWG

Jacket: Neoprene
Insulation: Cross-linked Polyethylene

Inside and Outside Containment

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

280°F	0 to 30 min
Reduce from 280°F to 150°F	30 to 60 min
150°F	> 60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	> 60 min

7.2×10^7 rads (1)

Spray:
0-4 hr Solution of boric acid (2,000-2100 ppm boron) buffered to a pH of 8.5 to 11 with NaOH

> 4 hr similar solution with a pH of 7 to 9.

MSLB

430°F	0 to 2 min
280°F	2 to 60 min
150°F	> 60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	> 60 min
3×10^7 rads	40 yr. dose

OPERABILITY REQUIREMENTS

LOCA & MSLB

120 days @ 150°F

OPERABILITY DEMONSTRATED(2)

LOCA

270°F for 12 hr
150°F for 6 days

Post LOCA thermal aging is equivalent 71 day @ 150°F

MSLB

242°F for 395 hr

Post MSLB thermal aging is equivalent to 2 yrs. @ 150°F.

ACCURACY REQUIREMENTS

Not required

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

Irradiated to 2×10^8 rads
50 psig and 276°F for 12 hr
Spray: Last 2 hr of 12 hr period with a solution of borated water containing approximately 1,720 ppm of boron as boric acid.

Reduce to 5 psig and 164°F over an unspecified time with spray continued.

160°F at 5 psig for the remainder of the 7 day period with no spray.

MSLB

Thermally aged for 1300 hr @ 150°C
Irradiated at a rate 0.30×10^6 rads per hr for total dose of 2.01×10^8 rad.

Spray: Solution of 6200 ppm Boron and hydrazine solution maintained at a pH value of between 8.6 and 10.0 for 399 hr

376°F @ 58 psig	0 to 13 min
376°F @ 62 psig	13 to 15 min
366°F @ 62 psig	15 to 20 min
337°F @ 60 psig	20 to 25 min
Reduce from 337°F @ 60 psig to 242°F	25 min to 3.6 hr

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA	LOCA	LOCA
Test - Sequential	Franklin Institute Research Laboratory Report F-C2857 Cerro's Supplement to F.I.R.L. Report F-C2857	A. Deficiencies: 1) Accuracy of test data and variables 2) Test monitoring sensors 3) 1,720 ppm boron vs 2,000-2100 ppm 4) 276°F 0 to 30 min vs 280°F B. Solutions: 1) Accuracy of instrument even though not stated would commonly be ±1% 2) Test monitoring sensors, even though not identified, are assumed to comply with Industrial Standards for their type of application. 3) The cable jacket is of a neoprene material which was shown to be resistant to all diluted alkaline solutions. Therefore we believe that since the LOCA spray is in the range of a diluted alkaline solution it should have no significant effect on the cable. 4) The above 276°F through first 30 min is within tolerance of the LOCA temp. transient profile - FSAR Fig. 6.2-82 (Amendment #65)
MSLB	MSLB	MSLB
Test - Sequential	Rockbestos Company Report 13-10407-E)S8-13-2 Test was performed on cable of a similar construction as that supplied in P.O. NA-312/1312 FSAR Section 3C and response to Comment 7.17 (Note to be revised to include this item).	A. Deficiencies: 1) Accuracy of test data and variables 2) Test Monitoring Sensors 3) Qualification temp. is below propose accident temp. 430°F for 2 min vs 376°F for 13 min B. Solutions: 1) Accuracy of instrument even though not stated would be ±1% 2) Test monitoring sensors, even though not identified, are assumed to comply with Industrial Standards for their type of application. 3) Surface temp. will reach a maximum of 355°F after 2 min @ 430°F therefore we meet the temp. requirements.

EQUIPMENT DESCRIPTION & MARK NO.

P.O.NA-265/1265
300 V Instrument Cable
(Boston Insulated Wire and Cable)

NGA-67	19/c	No.	16 AWG
NGA-68	12/c	No.	16 AWG
NGA-69	2/c	No.	16 AWG
NGA-70	18/c	No.	16 AWG
*NGB-35	2/c	No.	16 AWG
*NGB-39	3/c	No.	16 AWG
*NGB-40	4/c	No.	16 AWG
NGB-55	45/c	No.	16 AWG

Jacket: Neoprene

Insulation: Cross-linked Polyethylene

Inside and Outside Containment

*Denote cables that are used inside containment on class IE circuits.

DESCRIPTION OF ENVIRONMENT

LOCA

280°F	0 to 30 min
Reduce from 280°F to 150°F	30 to 60 min
150°F	> 60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	> 60 min

7.2×10^7 rads (1)
Spray: 0-4 hrs solution of boric acid (200-2100 ppm boron) buffered to a pH of 8.5 to 11 with NaOH> 4 hrs similar solution with a pH of 7 to 9

MSLB

430°F	0 to 2 min
280°F	2 to 60 min
150°F	> 60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	> 60 min

3×10^7 rads

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

Irradiated to 1×10^8 rads
280°F at 45 psig 60 min
205°F at 0 psig 24 hrs
Spray: Throughout 25 hr period with a solution of 0.20 molar boron as boric acid with the pH adjusted to 8-8.5 with a 0.019 molar solution of NaOH

MSLB

Same as "Description of Environment"

OPERABILITY REQUIREMENTS

LOCA
120 days @ 150°F

MSLB

120 days @ 150°F

OPERABILITY DEMONSTRATED (2)

LOCA
280°F for 60 min
205°F for 24 hrs

Post LOCA thermal aging is not equivalent to operating requirements

MSLB

See above

ACCURACY REQUIREMENTS

See above

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA	LOCA	LOCA
Test - Sequential	B.I.W. Letters dated 1-17-72 12-14-71	A. Deficiencies: 1. Accuracy of variables and test data 2. Test monitoring sensors 3. Test facility 4. 8-8.5 pH vs 8.5-11 pH 5. Time, temperature envelope not sufficient B. Solutions: 1. Accuracy of instrument even though not stated would commonly be ±1% 2. Test monitoring sensors, even though not identified, are assumed to comply with Industrial Standards for their type of application. 3. Location of test facility, even though not noted, can be obtained from Vendor records. 4. The cable jacket is of a neoprene material which was shown to be resistant to all diluted alkaline solutions. Therefore, we believe that since the LOCA spray is in the range of a diluted alkaline solution it should have no significant effect on the cable. 5. This instrument cable has the same Jacket & insulation as the 600v Control Cable. P.). NA 312/1312 page 8A which surpassed operability requirements. We will get further test data.
MSLB	MSLB	
Temperature - Analysis Maximum calculated surface temperature during limiting MSLB is 343°F which does not exceed qualification temperature of 460°F given in B.I.W. letter dated 10 12-76. Pressure and Radiation - Test refer to LOCA qualification	FSAR Section 3C and response to comment 7.17 B.I.W. letter dated 10-12-76 LOCA Qualification documents	

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-252
Thermocouple Extension Wire
(Cerro Wire and Cable)

NGB-68	1 pair No. 16 Copper-Constantan
NGB-69	1 pair No. 16 Iron-Constantan

Jacket: Neoprene
Insulation: Silicone Rubber

Inside and Outside Containment

NOTE:

Under further investigation it was found that these cable are not used in the systems that are required to mitigate a Design Basis Accident.

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

280°F	0 to 30 min
Reduce from 280°F to 150°F	30 to 60 min
45 psig	> 60 min
Reduce from 45 to 0 psig	0 to 30 min
0 psig	30 to 60 min
7.2×10^7 rads (1)	> 60 min

Spray: 0-4 hrs Solution of boric acid (2000-2100 ppm boron) buffered to a pH of 8.5 to 11 with NaOH > 4 hrs similar solution with a pH of 7 to 9

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

Irradiated to 2×10^8 rads
50 psig at 276°F 12 hrs

Spray: Last 2 hrs of 12 hr period solution of borated water containing approximately 1720 ppm of boron as boric acid.
Reduce to 5 psig and 164°F over an unspecified time with spray continued. 160°F at 5 psig for the remainder of 7 day period without spray. F-C2750 indicates that in an earlier test the spray was buffered with NaOH to a pH of 9.

OPERABILITY REQUIREMENTS

Not required

OPERABILITY DEMONSTRATED

Not required

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA Test- Sequential	LOCA Franklin Institute Research Laboratory Report F-C2857 Cerro's Supplement to F.I.R.L. Franklin Insitute Research Laboratory Report F-C2750 Cerro's Supplement to F.I.R.L. Report F-C2750	LOCA A. Deficiencies: 1. Accuracy of variables and test data 2. Test monitoring sensors 3. 276°F for 0 to 30 min is below environment of 280°F for 30 min 4. Test solution is 1750 ppm boron vs 2000-2100 ppm boron. B. Solutions: 1. Accuracy of instrument even though not stated would commonly be ±1%. 2. Test monitoring sensors, even though not identified, are assumed to comply with Industrial Standards for their type of application. 3. 276°F for first 30 min is within tolerance of the LOCA temperature transient profile - FSAR Fig. 6.2-82 (Amendment No. 65) 4. F-C2750 indicates that in an earlier test the spray was buffered with NaOH to a pH of 9 Furthermore, cable jacket is of a neoprene material which has been shown to be resistant to all diluted alkaline solutions. Therefore we believe that since the LOCA spray is in the range of a diluted alkaline solution it should have no significant effect on the cable.

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-375/1375
5 Kv Alum. Power Cable
(Okonite)

NGA-4	3/c 500 MCM
NGA-14	Triplex 4/0 AWG
NGA-3	Triplex 1000 MCM
NGA-13	3/c #4/0 AWG

Jacket: Neoprene
Insulation: Cross-Linked Polyethylene

Outside Containment

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

7.2×10^7 rads (1)

Normal Environment

40° - 120°F
Area has temperature monitors & class IE redundant ventilation system.

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

Loss of Coolant Accident (LOCA)

2×10^8 rads

Normal Environment
Ambient temperature less than 104°F

OPERABILITY REQUIREMENT

Loss of Coolant Accident(LOCA)

7.2×10^7 rads

Normal Environment

104°F

OPERABILITY DEMONSTRATED

Loss of Coolant Accident (LOCA)

2×10^8 rads

Normal Environment

104°F

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION

LOCA

Test

Normal Environment

Industrial Standards, IPCEA
S-19-81

QUALIFICATION DOCUMENT

LOCA

Okonite's Engineering Report

Additional Supporting Documents

Outline of Franklin Institute
Research Laboratory Report
F-C3694

IEEE Transaction Paper T74 044 4

Normal Environment

Specification NAS-108

QUALIFICATION DEFICIENCIES
AND RECOMMENDED SOLUTIONS

LOCA

A. Deficiencies:

Qualification document does not address:

1) Accuracy of variables and test data.
2) Test monitoring sensors, retention of records (i.e. traceability of instrumentation)
3) Test facility

B. Solutions:

1) Accuracy of test data and variables even though not addressed would commonly have been made with instruments having accuracies of ±1%.
2) Test monitoring sensors, even though not addressed can be assumed to be of typical types.
3) Test facility could be determined from vendor records.

Normal Environment

A. Deficiencies:

Normal ambient temperature may exceed cable maximum continuous ambient temperature.

B. Solution:

a) Maximum temperature is of short duration.
b) Cable that are used in Cat IE circuit are not carrying full rated current continuously. Their load is in the range of 50 to 75% of derated full load current with the exception of emergency diesel generator which is intermittent duty.

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-384/1384
600 V Aluminum Power Cable
Okonite

NGB-5	Triplex	500 MCM
NGB-7	Triplex	250 MCM
NGB-11	Triplex	#2/0 AWG.
NGB-12	Triplex	# 1 AWG.

Jacket: Neoprene
Insulation: Ethylene Propylene Rubber

Inside and Outside Containment

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

280°F	0 to 30 min
Reduce from 280°F to 150°F	30 to 60 min
150°F	> 60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	> 60 min

7.2×10^7 rads (1)

Spray: 0-4 Solution of boric acid (2,000-2,100 ppm boron) buffered to a pH of 8.5 to 11 with NaOH. >4 hr Similar solution with a pH of 7 to 9.

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

Aged 168 hr at 121°C.
Irradiated to 2×10^8 rads

PWR Exposure:

324°F at 80 psig	0 to 4 hr
252°F at 16 psig	for 7 days

Spray: 0-4 hr Solution of boric acid with NaOH to a pH of 10.5 thoughout the PWR exposure period.

Boiling Water Reactor Exposure:
A series of transient cycles each consisting of a rise to a specified pressure and temperature for a specified time and a gradual return to intial condition. Following transient cycles 100 day exposure to live steam 0 psig @ 212°F.

OPERABILITY REQUIREMENTS

LOCA
120 days @ 150°F

OPERABILITY DEMONSTRATED (2)
LOCA
304°F - 3 hr. 20 min
346°F - 4 hr. 27 min
256°F - 1 day
212°F - 100 days
259°F - 10 hrr
324°F - 4 hrs
252°F - 7 days

Post LOCA thermal aging is greater than 2.9 years @ 150°F

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION

LOCA

Test - Sequential

QUALIFICATION DOCUMENT

LOCA

Okonite's Engineering Report
No. 141 dated February 29, 1972

Additional supporting Documents

Outline of Franklin Institute
Research Laboratory Report F-C3694

IEEE Transaction Paper T 74 044 4

QUALIFICATION DEFICIENCIES
AND RECOMMENDED SOLUTIONS

LOCA

A. Deficiencies

Qualification Document does not address:

1) Accuracy of variables and test data
2) Test monitoring sensors
3) Test facility

B. Solutions:

1) Accuracy of instrument even though not stated would commonly be ±1%
2) Test monitoring sensors, even though not identified, are assumed to comply with Industrial Standards for their type of application.
3) Test facility, even though not identified, could be determined from vendor's records. (Additional supporting document indicates that some tests were performed at Franklin Institute.)

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-392/1392
300 V Instrument Cable
(Cerro Wire and Cable)

NGA-67	19/c No. 16 AWG
NGA-68	12/c No. 16 AWG
NGA-70	10/c No. 16 AWG
NGB-35	2/c No. 16 AWG
NGB-39	3/c No. 16 AWG

Jacket: Neoprene
Insulation: Flame Retardant Cross-linked Polyethylene

Inside and Outside Containment

DESCRIPTION OF ENVIRONMENT

LOCA

280°F	0 to 30 min
Reduce from 280°F to 150°F	30 to 60 min
150°F	> 60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	> 60 min

7.2×10^7 rads (1)

Spray: 0-4 hr solution of boric acid (2000-2100 ppm boron) buffered to pH of 8.5 to 11 with NaOH > 4 hr similar solution with a pH of 7 to 9

MSLB

430°F	0 to 20 min
280°F	2 to 60 min
150°F	> 60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	> 60 min

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

Aged 1300 hr @ 150°C
Irradiated to 2×10^8 rads

280°F @ 70 psig	0 to 10 sec
Rise to 346°F @ 113 psig	10 sec to 5 min
Reduce to 140°F	5 min to 3 hr
280°F @ 70 psig	5 hr to 5 hr & 10 sec
Rise to 346°F	5 hr + 10 sec to 5 hr + 5 min
346°F @ 113 psig	5 hr & 5 min to 8 hr
335°F @ 93 psig	8 hr to 11 hr
315°F @ 69 psig	11 hr to 15 hr
256°F @ 28 psig	15 hr to 4 days
212°F @ 0 psig	4 days to 30 days

Spray:
1st 24 hr of 30 day period - solution of the following composition:
0.28 molar H_3BO_3
0.064 molar $Na_2B_2O_3$
NaOH to make pH between 9-11
Following above 30 day LOCA period, an additional period of 100 days at 200°F.

MSLB

Same as "Description of Environment"

OPERABILITY REQUIREMENTS

LOCA

150°F for 120 days

MSLB

140°F for 120 days

OPERABILITY DEMONSTRATED(2)

LOCA

212°F for 30 days

Post LOCA thermal aging is equivalent to 320 days @ 150°F.

MSLB

See above

ACCURACY REQUIREMENTS

MSLB

Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA Test - Sequential	LOCA Rockbestos (formerly Cerro) Letter dated 2-21-79 and its attached report	LOCA A. Deficiencies: Qualification docum nt does not address: 1. Accuracy of variables and test data 2. Test monitoring sensors retention of records (traceability of instrumentation) 3. Test facility NOTE: Dosimeters are addressed B. Solution 1. Accuracy of instrument even though not stated would commonly be ±1%. 2. Test monitoring sensors, even though not identified, are assumed to comply with Industrial Standards for their type of application 3. Test facility could be determined from Vendor's records
MSLB Temperature Analysis Maximum calculated surface temperature during limiting MSLB is 343° which does not exceed qualification temperature of 460° given in Rockbestos (formerly Cerro) letter dated 4-25-77 Pressure and Radiation - Test Refer to LOCA Qualification	MSLB FSAR Section 3C and response to comment 7.17 Rockbestos letter dated 4-25-77 LOCA qualification document	MSLB Qualification based on independent test and analysis. Each of the qualification parameters (obtained from independent test and analysis) exceeds the corresponding MSLB requirements

EQUIPMENT DESCRIPTION & MARK NO.

P O NA 408/1408
Thermocouple Extension Wire
Boston Insulated Wire & Cable

NGB-68 1 pair #16 Copper-Constantan

Jacket: Neoprene
Insulation: Cross-linked Polyethylene

Inside Containment

NOTE:

Under further investigation it was found that this cable is not used in systems that are required to mitigate a Design Basis Accident.

DESCRIPTION OF ENVIRONMENT

LOCA

280°F	0 to 30 min
Reduce from 280°F to 150°F	30 to 60 min
150°F	>60 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	>60 min

7.2×10^7 rads(1)

Spray: 0-4 hrs Solution of boric acid (2000-2100 ppm boron) buffered to a pH of 8.5 to 11 with NaOH > 4 hr Similar solution with a pH of 7 to 9.

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

Irradiated to 1×10^8 rads

280°F at 45 psig	60 min
205°F at 0 psig	24 hrs

Solution of 0.20 molar boron as boric acid with the pH adjusted to 8-8.5 with a 0.019 molar solution of NaOH for 25 hr period.

OPERABILITY REQUIREMENTS

LOCA

None

OPERABILITY DEMONSTRATED

LOCA

Not required

ACCURACY REQUIREMENTS

LOCA

Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA Test - Sequential	LOCA B.I.W. letters dated: 2-7-75 1-17-72 12-14-71	LOCA A. Deficiencies: Qualification document does not address: 1) Accuracy of variables and test data 2) Test monitoring sensors retention of records (i.e., traceability of instrumentation) 3) Test facility 4) 0.2 molar boron solution vs 2000-2100 ppm boron. B. Solutions: 1) Accuracy of test data and variables, even though not addressed, would commonly have been made with instruments having accuracy of ±1%. 2) Test monitoring sensors, even though not identified, are assumed to comply with Industrial Standards for their type of application. 3) Test facility could be determined from vendor records. 4) The cable jacket is of a neoprene material which was shown to be resistant to all diluted alkaline solutions. Therefore we believe that since the LOCA spray is in the range of a diluted alkaline solution it should have no significant affect on the cable.

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-422/1422
Triaxial Cable
(Boston Insulated Wire & Cable)

NGA-72 Triax

Jacket: Hypalon
Insulation: Cross-linked Polyethylene

Inside and Outside Containment

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

280°F	0 to 30 min
Reduce from 280°F to 150°F	30 to 60 min
150°F	>60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	>60 min

7.2×10^7 rads (1)

Spray: 0-4 hr. Solution of boric acid (2,000-2100 ppm boron) buffered to a pH of 8.5 to 11 with NaOH. > 4 hr Similar solution with a pH of 7 to 9.

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

Irradiated to 2×10^8 rads	
300°F @ 60 psig	0 to 15 min
Reduce to 252°F @ 16 psig	15 to 45 min
252°F @ 16 psig	45 min to 13 day

Spray: Throughout 13 day period. A solution of 2,000 ppm boric acid buffered to a pH of 8 to 8.5 with NaOH.

Following above, an additional 17 days exposure to 200°F @ 0 psig.

OPERABILITY REQUIREMENTS

Loss of Coolant Accident (LOCA)

120 days @ 150°F

OPERABILITY DEMONSTRATED(2)

Loss of Coolant Accident (LOCA)

13 days @ 252°F
17 days @ 200°F

Post LOCA thermal aging is equivalent to 2.1 years @ 150°F

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA	LOCA	LOCA
Sequential	B.I.W.'s Engineering Comments No. 26665-EP Rev. 4 (specifically Test No. 75C008)	A. Deficiencies Qualification document does not address: 1) Accuracy of variables and test data 2) Test monitoring sensors 3) Test facility 4) 275°F at 30 min mark vs 280°F 5) 35 psig at 30 min mark vs 45 psig 6) pH of 8 to 8.5 vs pH of 8.5 to 11 B. Solutions 1) Accuracy of instrument even though not stated would commonly be ±1%. 2) Test monitoring sensors, even though not identified, are assumed to comply with Industrial Standards for their type of application. 3) Test facility, even though not identified, could be determined Vendor's records. 4) 275°F at 30 min mark is within tolerance of the LOCA temperature transient profile FSAR Fig. 6.2-82 (Amendment No. 65). 5) 35 psig at 30 min mark is within tolerance of the LOCA pressure transient profile FSAR Fig. 6.2-63 (Amendment No. 65). 6) The cable jacket is of a hypalon material which was shown to be resistant to all diluted alkaline solutions. Therefore, we believe that since the LOCA spray is in the range of a diluted alkaline solution it should have no significant effect on the cable.

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-404/1404
600 V. Cu. Power Cable-Heat Tracing
(Okonite)

NGB-01 2/c #10 AWG

Jacket: Hypalon
Insulation: Cross-linked Polyethylene

Inside and Outside Containment

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

280°F	0 to 30 min
Reduce from 280°F to 150°F	30 to 60 min
150°F	> 60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	> 60 min

7.2×10^7 rads(1)
Spray: 0-4 hr Solution of boric acid (2,000-2100 ppm boron) buffered to a pH of 8.5 to 11 with NaOH. > 4 hr Similar solution with a pH of 7 to 9.

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

Aged 14 days at 250°F
Irradiated to $.5 \times 10^8$ rads and aged at 240°F for 7 days
For 31 day period

280°F/70 psig	0 to 10 sec
Rise to 346°F/113 psig	10 sec to 5 min
346°F/113 psig	5 min to 3 hr
Reduce to 140°F	3 hr to 5 hr
280°F/70 psig	5 hr to 5 hr and 10 sec
Rise to 346°F/113 psig	5 hr and 10 sec to 5 hr and 5 min
346°F/113 psig	5 hr and 5 min to 8 hr
335°F/95 psig	8 hr to 11 hr
315°F/69 psig	11 hr to 15 hr
265°F/28 psig	15 hr to 4 day
212°F/0 psig	4 day to 31 day

Spray: Continuously for 31 day period solution of 2,000 ppm boron as boric acid buffered with NaOH to a pH to 9-11. Irradiated to 1.5×10^8 rads during the 31 day period. Total 2×10^8 rads.

OPERABILITY REQUIREMENTS

Loss of Coolant Accident(LOCA)

120 days @ 150°F

OPERABILITY DEMONSTRATED (2)

Loss of Coolant Accident (LOCA)

27 days @ 212°F

Post LOCA thermal aging is equivalent to 291 days @ 150°F

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA	LOCA	LOCA
Sequential	Franklin Institute Research Laboratory Report F-C3694	A. Deficiency: Qualification document does not address: 1) Accuracy of test data and variables
	Additional Supporting Data	B. Solution:
	IEEE Transaction Paper T 74 044 04	1) Accuracy of test data and variables, even though not addressed, would commonly have been made with instruments having accuracies of ±1%

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-299/1299

Motor Operated Valves - Elliot Company:

1-MOV-HV-115-1,2
1-MOV-HV-116-1,2
2-MOV-HV-115-1,2
2-MOV-HV-116-1,2

Model #MAR-25

Chiller Room, Service Building

DESCRIPTION OF ENVIRONMENT

MSLB in Turbine Building

1. High ambient temperature 211°F for duration of steam discharge in vicinity of chiller room air intakes - 30 min

2. High ambient moisture content saturated steam, 100% RH for duration of steam discharge 30 min

Normal Environment

70° to 104°F
Motors and pumps will keep temperature above 70°F

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

MSLB in Turbine Building

None

Normal Environment

104°F

OPERABILITY REQUIREMENTS

MSLB in Turbine Building

30 min - 211°F and 100% RH

Normal Environment

104°F

OPERABILITY DEMONSTRATED

MSLB in Turbine Building

None

Normal Environment

None

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
Main Steam Line Break (MSLB) in Turbine Building	MSLB in Turbine Building	MSLB in Turbine Building
None	None	A. Deficiencies: 1) High ambient temperature 211°F 2) Saturated atmosphere
Normal Environment	Normal Environment	B. Solution: Substitute EPT liner to withstand 310°F There are three possible solutions as discussed below: a. Include the chiller room inside the control room pressure boundary and eliminate its communication with the turbine building. This involves determining if the compressed air system is adequate to maintain pressure with the chiller room included. Additional ducting must be added to provide cooling to the chiller room. Structural modifications to block openings to turbine building and modify door to be a pressure barrier. b. Replace unqualified equipment with qualified equipment. c. Use equipment in unaffected unit to maintain control room environment.
None	Specification NAS-316	Normal Environment None

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-421/1421
Chiller Room Sump Pumps -
Johnston Pump Company:
1-DB-P-10A
2-DB-P-10A

Model # Type NGZV

Chiller rm, Service bldg.

DESCRIPTION OF ENVIRONMENT

MSLB in Turbine bldg.

1. High ambient temperature 211°F for duration of steam discharge in vicinity of chiller room air intakes 30 minutes.

2. High ambient moisture content - saturated steam, 100% RH for duration of steam discharge 30 minutes.

Normal Environment

70° to 104°F
Motors and pumps will keep temperature above 70°F.

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

MSLB in Turbine bldg.

1. High ambient temperature 211°F at saturated atmosphere

Normal Environment

104°F

OPERABILITY REQUIREMENTS

MSLB in Turbine Building

30 minutes - 211°F & 100% RH

Normal Environment

104°F

OPERABILITY DEMONSTRATED

MSLB in Turbine Building

None

Normal Environment

104°F

ACCURACY REQUIREMENTS

None

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
MSLB in Turbine bldg. Vendor reply to TLX inquiry Normal Environment Industrial Standards IEEE 112A ANSI B3. 15 ANSI B3. 16 ASME PTC 8.2 NEMA MG1	MSLB in Turbine bldg. TLX 3-28-79 - John Anderson to J.E. Krechting Normal Environment Specification NAS-427	MSLB in Turbine bldg. A. Deficiencies 1. High ambient temperature 211°F 2. Saturated atmosphere B. Solutions: Substitute EPT liner to withstand 310°F There are three possible solutions as discussed below: a. Include the chiller room inside the control room pressure boundary and eliminate its communication with the turbine building. This involves determining if the compressed air system is adequate to maintain pressure with the chiller room included. Additional ducting must be added to provide cooling to the chiller room. Structural modifications to block openings to turbine building and modify openings to turbine building and modify door to be a pressure barrier. b. Replace unqualified equipment with qualified equipment. c. Use equipment in unaffected unit to maintain control room environment. Normal Environment None

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-296/1296
Centrifugal Fans - Buffalo
Forge Co.
1-HV-F-40A, B
2-HV-F-40A, B

Model 680B101G57
Auxiliary bldg.

DESCRIPTION OF ENVIRONMENT

LOCA

1. Radiation zone IV 40 yr dose +
LOCA dose = 880 + 160 = 1040 rads

Normal Environment

50^{o}F to 120^{o}F
area has temperature monitors

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

Radiation dose of 7×10^{4} rads

Normal Environment
50^{o} to 120^{o}F

OPERABILITY REQUIREMENTS

LOCA

1.04×10^{3} rads

Normal Environment

50^{o}F to 120^{o}F

OPERABILITY DEMONSTRATED

LOCA

7×10^{4} rads

Normal Environment

50^{o} to 120^{o}F

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA	LOCA	LOCA
Vendor's reply to TLX inquiry	TLX-3-29-79 W.B. Shumacher J.E. Krechting	None
Normal Environment	Normal Environment	Normal Environment
Industrial Standard NEMA MG1	Specification #MAS-308	None

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA 201/1201

1-HV-F-71A, B
2-HV-F-71A, B

Axial Flow Fans- Joy Mfg. Co.

Model#600263-5533

Safeguards bldg.

DESCRIPTION OF ENVIRONMENT

LOCA

1. Radiation 40 yr dose - 1×10^6 rads

Normal Environment

$70^{\circ}F$ to $120^{\circ}F$
area has temperature monitors

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

None

Normal Environment

$120^{\circ}F$

OPERABILITY REQUIREMENTS

LOCA

1×10^6 rads

Normal Environment

$70^{\circ}F$ to $120^{\circ}F$

OPERABILITY DEMONSTRATION

LOCA

None

Normal Environment

$70^{\circ}F$ to $120^{\circ}F$

ACCURACY REQUIREMENTS

Not Required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA	LOCA	LOCA
None	None	Deficiencies
		Equipment not qualified for exposure to:
		1. Radiation - 1×10^6 rads
Normal Environment	Normal Environment	Solutions:
Industrial Standard	Specification #NAS-218	Replace drivers with qualified motors
NEMA MG1		Replace motors have been purchased capable of withstanding the radiation dose of 1×10^6 rads.
		Normal Environment
		None

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA 313/1313
Reactor Containment Electrical
Penetration - CONAX
Polysulfone Terminal Blocks
Connectron Inc.
Model N553 polysulfone

Inside Containment

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

280°F	0 to 30 min
Reduce from 280°F to 150°F	30 to 60 min
150°F	> 60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
4.2×10^7 rads (1)	

Spray = 0 to 4 hours solution of boric acid (2000-2100 ppm boron) buffered to a pH of 8.5 to 11.0 with NaOH. Beyond 4 hours similar solution with a 7 to 9.

Main Steam Line Break (MSLB)

430°F	0 to 2 min
280°F	2 to 60 min
150°F	> 60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	> 60 min
3×10^7 rads	40 yr dose

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

Radiation: 2.5×10^7 rads minimum

253°F	@ 25 psig	0 to 30 sec
282°F	@ 45 psig	30 to 60 sec
285°F	@ 45 psig	60 to 90 sec
298°F	@ 57.5 psig	90 to 120 sec
282°F	@ 48 psig	2.5 to 4 min
289°F	@ 49 psig	4 to 5 min
300°F	@ 56 psig	5 to 10 min
293°F	@ 47 psig	10 to 15 min
297°F	@ 47 psig	15 to 30 min

Range

Thermal aging 300°F for 74 hr

Spray:

Solution boron 1,900 ppm
Buffered to 7.7 pH at a
+ 190°F, 10 gpm ofr 30 min.
140°F @ psig for 240 hr

OPERABILITY REQUIREMENTS

LOCA
120 days 150°F

MSLB

120 days @ 150°F

OPERABILITY DEMONSTRATED (2)

LOCA & MSLB

L.V.P./C/I
255°F - 190 hr

Post LOCA thermal aging is equivalent to 429 days @ 150°F

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
Test	Conax Corp. Test Report IPS-107 Conax letter "Qualification of Electric Penetrations" No. IPS-411, P/N 7280-10001-01, IPS-369, IPS-325 dated 1/5/80 Letters from Union Carbide, Belgium, N. J., dated 12/19/67, New Jersey, dated 1/22/68	Qualification document does not address: 1) Accuracy of variables and test data 2) Test monitoring sensors, retention of records (i.e. traceability of instrumentation) 3) Test facility 4) Test solution - 1,900 ppm boron vs 2,000-2100 Solutions 1) Accuracy of test data and variables even though not addressed would commonly have been made with instruments having accuracies of ±1%. 2) Test monitoring sensors, even though not addressed can be assumed to be of typical types 3) Test facility could be determined from vendor records. 4) The terminal block is of a polysulfone meterial which has been shown to be resistant to all diluted alkaline solutions. Therefore, we believe that since the LOCA spray is in the range of a diluted alkaline solution, it should have no significant effect on the terminal blocks.
Test		

EQUIPMENT DESCRIPTION & MARK NO.

Specification NAS-90-22
P.O. No. NA-333/1333

Level transmitters
Gems #XM-29400
LT-RS151A, B
LT-RS251A, B

Gems Sensor Division
Delaval Turbine

Inside Containment

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

280°F	0 to 30 min
Reduce from 280°F to 150°F	30 to 60 min
150°F	> 60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	> 60 min

7.2×10^7 rads (1)

Spray - 0 to 4 hours solution of boric acid (2000-2100 ppm boron) buffered to a pH of 8.5 to 11.0 with NaOH. Beyond 4 hours similar solution with a 7 to 9.

Main Steam Line Break (MSLB)

430°F	0 to 2 min
280°F	2 to 60 min
150°F	> 60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	> 60 min
3×10^7 rads	40 yr dose

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

282±1°F	0 to 60 min
280 – 150°F	> 60 to 180 min
150°F	180 min to 14 days
45 psig	0 to 60 min
45 0 psig	> 60 to 150 min
13.5 psig	150 min to 14 days

Radiation Exposure 2×10^8 rads

Spray - 15,000 ppm boric acid buffered to a pH of 10.5 with NaOH solution for 4 hours. Spray density = 0.15 gpm per ft^2.

MSLB

As above

OPERABILITY REQUIREMENTS

LOCA & MSLB

120 days @ 150°F

OPERABILITY DEMONSTRATED

LOCA & MSLB

After test, transmitter functioned properly. Manufacturers normal environment is rated to 300°F.

ACCURACY REQUIREMENTS

LOCA & MSLB

± 5% of range

ACCURACY DEMONSTRATED

LOCA & MSLB

1.3% after test

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA & MSLB	LOCA & MSLB	LOCA
Test - Sequential Radiation and Environmental Exposure. Spray Exposure performed on a separate instrument.	Franklin Institute Research Laboratories (FIRL) Report F-C3834 Isomedix Inc. Test Report dated Nov. 1975.	None MSLB A. Deficiencies: Test Temperature of 282°F is below accident temperature of 430°F B. Solution: As measured by thermocouple on circuit board, internal components reached qualification temperature 282°F only after 27 minute exposure to 450°F. Actual req'd exposure at 450°F is 2 minutes, therefore, qualification is satisfactory.

EQUIPMENT DESCRIPTION & MARK NO.

NAMCO Model EA - 180
Limit Switches
Located on the following
Control Valves

TV-BD 100B, D, F	Steam gen blowdown
TV-CC 101B	R.C.P. Therm barrier
TV-CC 102B, D, F	R.C.P. Return header
TV-CC 105A, B, C	Cont. Recirc Air Coils
TV-DA 100B	React cont sump pp disch
TV-DG 100B	Pri Drn. xfer pp disch
TV-RM 100C	Limit sw on tv rm 100C
TV-VG 100B	Pri drn xfer tk vent
TV-SS 100A	Pressure liquid space
TV-SS 101A	Pressure vapor space
TV-SS 102A	Primary coolant cold leg
TV-SS 104A	Press. relief tank gas sp
TV-SS 106A	Primary coolant hot leg
TV-SS 112A	St gen surface sample
TV-BD 200B, D, F	Steam gen blowdown
TV-CC 201B	R.C.P. Therm barrier
TV-CC 202B, D, F	R.C.P. Return header
TV-CC 205A, B, C	Cont. Recirc Air Coils
TV-DA 200B	React cont sump pp disch
TV-DG 200B	Pri drn. xfer pp disch
TV-RM 200C	Limit sw on tv rm 200C
TV-VG 200B	Pri drn xfer tk vent
TV-SS 200A	Pressure liquid space
TV-SS 201A	Pressure vapor space
TV-SS 202A	Primary coolant cold leg
TV-SS 204A	Press relief tank gas sp
TV-SS 206A	Primary Coolant hot Leg
TV-SS 212A	St gen surface sample

Inside Containment

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

280°F	0 to 30 min
Reduce from 280°F to 150°F	30 to 60 min
150°F	>60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	>60 min

7.2×10^7 rads(1)
Spray: 0-4 hrs solution of boric acid (2000-2100 ppm boron) buffered a pH of 8.5 to 11 with NaOH>4 hr similar solution with a pH of 7 to 9

Main Steam Line Break (MSLB)

430°F	0 to 2 min
280°F	2 to 60 min
150°F	>60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	>60 min

3×10^7 rads

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED
LOCA

Heat aging @ 200°F for 200 hrs, mechanical aging 100,000 cycles under electrical load

340°F	0 to 3 hr
Reduce from 340°F to 120°F	3 to 5 hr
SEQUENCE REPEATED	
250°F	to 3.5 days
200°F	3.5 to 30 days
70 psi	0 to 8 hrs
10 psi	8 hrs to 30 days

Radiation Exposure 2.04×10^8 rads

Spray: Boric acid and water buffered to a pH of 10-11 with NaOH solution for 4 days, water spray for 26 days, spray density = .015 gpm/ft^2

MSLB

Maximum surface temperature is 285°F per ESG calculation 11712-ES-197-0 dated 3-16-78 and is well below qualification temperature
Radiation Exposure see LOCA Test.

OPERABILITY REQUIREMENTS

LOCA & MSLB

Valve to close within 60 seconds of isolation signal; switches shall not fail so as to reopen valves.

OPERABILITY DEMONSTRATED
LOCA & MSLB
Limit switches shown to operate after sequential testing.

ACCURACY REQUIREMENTS
Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA Sequential Test	LOCA Report Entitled: "Qualification of NAMCO controls limit switch Mode EA-180 to IEEE Standards 344 ('75) 323 ('74) and 382 ('72)" dated 3-3-78 and revised 4-7-78	A. Deficiencies: 1) Accuracy of variables and test data 2) Test monitoring sensors 3) Test facility B. Solutions: 1) Accuracy of instrument even though not stated would commonly be ±1% 2) Test monitoring sensors, even though not identified, are assumed to comply with Industrial Standards for their type of application 3) Test facility, even though not identified, could be determined from vendor's records.
MSLB Calculation	MSLB ESG Calculation 11712-ES-197-0 dated 3-16-78	

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-176/1176
Motor control Centers
(Klockner Moeller)
MCC-2H1-2N
MCC-2H1-2S
MCC-2J1-2N
MCC-2J1-2S
MCC-1H1-2N
MCC-1H1-2S
MCC-1J1-2N
MCC-1J1-2S

Auxilary Building

DESCRIPTION OF ENVIROSMENT

Loss of Coolant Accident (LOCA)
1 x 10^6 rads (based on 120 day LOCA). In addition, the 40 year rads must be considered for a total possible radiation dose of 1.04 x 10^6 rads.

Normal Environment

70° - 120°F
Area has temperature monitors & class IE redundant ventilation system.

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

Minimum total integrated dose of 1.4 x 10^6 rads of gamma source radiation.

Normal Environment

Equipment rating 32 - 104°F

OPERABILITY REQUIREMENTS

Loss of Coolant Accident (LOCA)

1.04 x 10^6 rads

Normal Environment

$70^{\circ}$to 120°F

OPERABILITY DEMONSTRATED

Loss of Coolant Accident (LOCA)

1.4 x 10^6 rads

Normal Environment

32-104°F

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION

Test

Normal Environment

Industrial Standards
NEMA ICS(1974)
Sect. 1-108.

QUALIFICATION DOCUMENT

LOCA

Klockner-Moeller Letter dated
3/16/79

Normal Environment

Specification NAS-213

QUALIFICATION DEFICIENCIES
AND RECOMMENDED SOLUTIONS

LOCA

A. Deficiencies:

Qualification document is in letter form (i.e. no formal test report with approved signature and date) and does not address:

1) Accuracy of variables and test data
2) Test monitoring sensors
3) Test facility

B. Solutions:

1) Accuracy of instruments even though not stated would commonly be ±1%.
2) Test monitoring sensors, even though not identified, are assumed to comply with Industrial Standards for their type of application.
3) The letter is a summary of the radiation exposure test successfully completed on sample electrical components used in the listed MCC's. Certified data is available from Klockner-Moeller Corp. Fairfield, NJ.

Normal Environment

A. Deficiencies:

Normal ambient temperature may exceed MCC maximum operational temperature.

B. Solution:

Area is equipped with an ambient temperature monitor that will signal at 101°F and alarm at 104°F.

EQUIPMENT DESCRIPTION & MARK NO.	DESCRIPTION OF ENVIRONMENT	OPERABILITY REQUIREMENTS
Motor Operated Valves Limitorque Corp P.O. No. 194/1194 Flanged & Wafer Type Butterfly Valves MOV-SW-108A, B MOV-SW-208A, B MOV-SW-113A, B (Component Cooling Heat Exchanger Iso.) Model SMB-0015 MOV-SW-213A, B (Fuel Pool Cooler Isolation) Model SMB-000-2 Auxiliary Bldg. MOV-SW-103A,B,C,D MOV-SW-203A,B,C,D MOV-SW-104A,B,C,D MOV-SW-204A,B,C,D (Recirc. Spray Heat Exch. ISO) Q.S.P.H	Loss of Coolant Accident (LOCA) 5.4×10^6 rads (based on 120 day LOCA) including the 40 yr dose. Normal Environment 50° to 120°F ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED LOCA 40 yr integrated - 2×10^8 rads Normal Environment 120°F continuous	LOCA 5.4×10^6 rads Normal Environment 120°F OPERABILITY DEMONSTRATED LOCA 2×10^8 rads Normal Environment 120°F continuous ACCURACY REQUIREMENTS Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA 2.0×10^8 rads gamma radiation at Isomedix, Inc. Parsippany, NJ.	LOCA Limitorque Report No. 80003	LOCA None
Normal Environment Industrial Standard USAS	Normal Environment Limitorque VLVCO Nuclear Qualification for Safety Related Services NQDS 11/1/79	Normal Environment None

EQUIPMENT DESCRIPTION & MARK NO.

P.O. No. 242/1242, S.S. Valves 2 1/2" and larger, Limitorque Corp.
MOV-QS-101A, B, C, D
MOV-QS-201A, B, C, D
(Containment Iso.)

MOV-RS-155A, B
MOV-RS-255A, B
(Containment Iso. Suction)
Model SMB-0-7-1/2"

MOV-RS-156A, B
MOV-RS-256A, B
(Containment Iso. Suction)

Model SMB-0-40
Safeguards Building

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)
LOCA

1×10^6 rads (based on 120 days LOCA). In addition, the 40 year radiation dose of 4×10^4 rads must be considered for a total possible radiation dose of 1.04×10^6 rads.

Normal Environment

70° to 120°F

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

40 yr integrated - 2×10^8 rads

Normal Environment

120°F continuous

OPERABILITY REQUIREMENTS

LOCA

1.04×10^6 rads

Normal Environment

120°F

OPERABILITY DEMONSTRATED

LOCA

2×10^8 rads

Normal Environment

120°F continuous

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA	LOCA	LOCA
2.0×10^8 rads gamma radiation at Isomedix, Inc. Parsippany, N.J.	Limitorque Report No. B0003	None
Normal Environment	Normal Environment	Normal Environment
Industrial Standard USAS	Limitorque VLVCO Nuclear Qualification for Safety Related Services NQDS 11/1/79	None

EQUIPMENT DESCRIPTION & MARK NO.

Pump Motors

F.C. No. 127/1127, Recirculation Spray Pumps, General Electric

1-RS-P-2A, B
2-RS-P-2A, B

Model 5K6328XC264A
Safeguards Building

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

1×10^6 rads (based on 120 days LOCA). In addition, the 40 year radiation dose of 4×10^4 rads must be considered for a total possible radiation dose of 1.04×10^6 rads.

Normal Environment

70^0 to 120^0F
Class IE redundant ventilation system

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

1×10^8 rads

Normal Environment

120^0F

OPERABILITY REQUIREMENTS

LOCA

1.04×10^6 rads

Normal Environment

120^0F

OPERABILITY DEMONSTRATED

LOCA

1×10^8 rads

Normal Environment

120^0F

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION

LOCA

Unknown

Normal Environment

Industrial Standards

NEMA MG1 & IEEE 112A

QUALIFICATION DOCUMENT

LOCA

Letter from Vendor C. Bell (GE)
March 10, 1979

Specification NAS#44

Normal Environment

Specification NAS-44

QUALIFICATION DEFICIENCIES
AND RECOMMENDED SOLUTIONS

LOCA

A. Deficiencies:

Qualification document is in letter form (i.e. no formal test report with approved signature and date) and does not address:

1. Accuracy of variables and test data
2. Test monitoring sensors
3. Test facility

B. Solutions:

1. Accuracy of instrument even though not stated would commonly be ±1%.

2. Test monitoring sensors, even though not identified, are assumed to comply with Industrial Standards for their type of application.

3. Test facility, even though not identified, could be determined from Vendor's records.

Normal Environment

None

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-313/1313
Reactor Containment Electrical Penetrations -
Comax Corp.
Item 1 of 2

Pentration Assemblies

Type IA - Instrumentation
IB - Control
IC, IIA, IIB, IIC, IID and IIE - Low Voltage Power
III - Triaxial
IV - Thermocouples

Inside & Outside Containment

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

280°F	0 to 30 min
Reduce from 280°F to 150°F	30 to 60 min
150°F	> 60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min

4.2×10^7 rads (1)

Spray:
0-4 hrs solution of boric acid (2,000-2100 ppm boron) buffered to a pH of 8.5 to 11.0 with NaOH beyond 4 hrs similar solution with a pH of 7 to 9.

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

Pressure and Temperature

Pressure 45 psig @ 280°F	0 to 30 min
Decrease from 45 psig to 0 psig and 280°F to 245°F	0 to 30 min 30 to 60 min
150°F + 20°F @ 0 psig	1 hr to 10 days

or

150°F - 40°F @ 0 psig

Radiation

1×10^8 rads gamma radiation minimum

Chemical Spray:
From 0-30 min. No chemical spray was introduced from 30 min to 10 days assembly was subjected to spray solution: boron content was .23 molar as H_3BO_3
NaOH = 5.0 to 8.0

OPERABILITY REQUIREMENTS

LOCA
120 days @ 150°F

OPERABILITY DEMONSTRATED (2)

LOCA

L.V.P./C/I
255°F-190 hrs

Post LOCA thermal aging is equivalent to 429 days @ 150°F

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION

LOCA

Penetration assemblies were tested by using a prototype with characteristics pertinent to each individual type. This was first exposed to radiation then pressure and temperature and finally chemical spray.

QUALIFICATION DOCUMENT

LOCA

Conax report "Maximum Emergency Environmental Test Report for Electrical Penetration Assemblies" No. IPS-73.4 dated 5/13/75

Radiation Test almaraz service test conax report IPS-137.

Conax letter "Qualification of Electric Penetrations" No. I PS-411, P/N 7280-10001-01, IPS-369, IPS-325 dated 1/5/80

QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS

LOCA

A. Deficiencies:

1) pH of chemical spray was 5 to 8 for duration, not 8.5 to 11.0 for first 4 hr or 7.0 to 9.0 for remainder

2) Temperature range was 146° to 170° from 1 hr to end not 150°

3) No calibration information or instrument error range was given.

B. Solutions:

1) The electrical penetration assemblies are fabricated from the following non-metallic materials; polyimides and polysulfone. These materials have been shown to be resistant to all diluted alkaline solutions. Therefore we believe that since the LOCA spray is in the range of a diluted alkaline solution it should have no significant effect on the penetration assemblies.

2) Very short duration of temp. below 150° when compared to total test duration makes this item acceptable.

3) Typical instrument accuracy can be expected to be ±1%, tolerance on the pressure and temperature curves used will allow for this accuracy.

EQUIPMENT DESCRIPTION & MARK NO.

P.O NA-313/1313
Reactor Containment Electrical Penetrations
Conax Corp.
Item 1 of 2
- Penetration Assemblies
- Type IA - Instrumentation
- Type IB - Control
- Type IC, IIA, IIB, IIC, IID and IIE - Low Voltage Power

Inside and Outside Containment

DESCRIPTION OF ENVIRONMENT

Main Steam Line Break (MSLB)

430°F	0 to 2 min
280°F	2 to 60 min
150°F	> 60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	> 60 min
3.4×10^4	40 yr dose

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

MSLB

280°F	0 to 30 min
Range 230°F to 220°F	30 to 60 min
Range 245°F to 146°F	60 to 1300 hr
Range 67 to 56 psig	0 to 30 min
0 psig	30 min

2.3×10^7 rads gamma radiation minimum

NOTE 1 - Temperature qualification by analysis per Qualification Document #2.

OPERABILITY REQUIREMENTS

MSLB

120 days @ 150°F

OPERABILITY DEMONSTRATED (2)

MSLB

L.V.P./c/I
@ 255°F @ 190 hrs

Post LOCA thermal aging is equivalent to 429 days @ 150°F

[illegible]CY REQUIREMENTS

MANNER OF QUALIFICATION

MSLB

Penetration assemblies were tested by using a prototype with characteristics pertinent to each individual type. This was first exposed to radiation then pressure and temperature.

QUALIFICATION DOCUMENT

MSLB

1. CONAX Report "Maximum Emergency Environmental Test Report for Electrical Penetration Assemblies, " No. IPS-73.4 dated May 13, 1975.

2. FSAR Appendix 3 C "Safety Related Equipment Temperature Transients During the Limited Main Steam Line Break" and NRC Comment 7.17 of the same subject.

Conax letter "Qualification of Electric Penetrations" No. IPS-411, P/N 7280-10001-01, IPS-369, IPS-325 dated 1/580

QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS

MSLB

A. Deficiencies:

1) Pressure excursion was maintained for 30 min duration not 60 min.

2) During the text in QualificationDocument #1, no accuracy was stated for the instruments used.

B. Solutions:

1) Pressure should have no significant effect on the splicing material.

2) Typical instrument accuracy can be expected to be ±1%, tolerances on the pressure and temperature curves used will allow for this accuracy.

EQUIPMENT DESCRIPTION & MARK NO.

Item 2 of 2
P.O. No. NA-313/1313
Splices (Field and Factory)

Conax Corp (Supplier)
Kapton Insulation
Inside & Outside Containment

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

280°F	0 to 30 min
Reduce from 280°F to 150°F	30 to 60 min
150°F	> 60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	> 60 min

4.2×10^7 rads (1)
Spray:
0 to 4 hrs solution of boric acid (2,000-2100 ppm boron) buffered to a pH of 8.5 to 11.0 with NaOH beyond 4 hrs similar solution with a pH of 7 to 9.

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA
Spray - From 0+ -240 hr spray continuously with a solution of the following contents:
Boron content = .23 molar (1,900 PPM)
NaOH content = 10^{-4} to 4×10^{-2} MOlAl
pH = 7.7 to 7.8

280°F @ 45+ psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
Reduce from 280°F to 144°F	
Raised from 140°F	30 to 60 min
150°F	1 to 240 hrs

10×10^7 rads gamma radiation, minimum

OPERABILITY REQUIREMENTS

Loss of Coolant Accident (LOCA)

120 days @ 150°F

OPERABILITY DEMONSTRATED(2)

Loss of Coolant Accident (LOCA)

10 days @ 146°F

Post LOCA operations do not meet operability requirements.

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION

LOCA

Splices were made using various representative cable types and sizes which had been attached to a prototype penetration assembly. The prototype was first subjected to radiation exposure, then temperature, pressure and chemical spray concurrently.

QUALIFICATION DOCUMENT

LOCA
Conax Report "Test Procedure and Report on Electrical Terminations Subjected to Design Basis Accident Environment " No. IPS-107 dated

Radiaction: Alsaraz Service Test
Conax Report I[illegible]137

Conax letter " Qualification of Electric Penetrations"
No. IPS-411, P/N 7280-10001-01, IPS-369, IPS-325 dated 1/5/80

QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS

LOCA

A. Deficiencies:

1) Chemical spray solution had pH of 7.7 to 7.8 not 8.5 to 11.0 for first 4 hr.
2) Temperature below 150° to 140°+ on various occasions during test
3) The instruments and/or monitors used were not identified, also accuracy or error range was not stated.
4) Time, temperature envelope not adequate

B. Solutions:

1) The Penetration splicing material is a polyolefin material which has been shown to be resistant to all diluted alkaline solutions. Therefore we believe that since the LOCA spray is in the range of a diluted alkaline solution it should have no significant effect on the splice material.

2) Overall temp was within test tolerances.

3) Typical instrument accuracy can be expected to be ±1%, tolerance on the pressure and temp. curves will allow for this accuracy.

4) The splices are qualified for 120 days @ 150°F per Conax letter "Qualification of Electrical Penetrations," No. IPS-411, P/N 7280-10001-01, IPS-369, IPS-325, dated 1/5/80.

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-313/1313
Reactor Containment Electrical
Penetrations - CONAX
Item 2 of 2
Splices (field and factory)

Conax Corp. (Supplier)
Kapton Insulation
Inside & Outside Containment

DESCRIPTION OF ENVIRONMENT

Main Steam Line Break (MSLB)

430°F	0 to 2 min
280°F	2 to 60 min
150°F	>60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	>60 min
3.4×10^4 rads	40 yr dose

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

MSLB

Raise from 109°F to 253°F	0 to 30 sec
Raise from 253°F to 290°F	1 to 2 min
282°F	2 to 30 min
Range 144°F to 294°F	30 to 60 min
Range 140°F to 150°F	>60 min to 240 hr
0 to 24 psig	0 to 30 sec
45+ psig	1 to 30 min
0 psig	30 min to 240 hr

2.5×10^7 rads gamma radiation minimum

OPERABILITY REQUIREMENTS

120 days @ 150°F

OPERABILITY DEMONSTRATED (2)

MSLB
L.V.P./c/I
255°F - 190 hrs
Post LOCA thermal aging is equivalent to 429 days @ 150°F

ACCURACY REQUIREMENTS

MSLB

Not required

MANNER OF QUALIFICATION

MSLB

Splices were made on various representative cable types and sizes which had been attached to a prototype penetration assembly. The prototype was first subjected to radiation exposure, then temperature and pressure, concurrently.

QUALIFICATION DOCUMENT

MSLB

1. CONAX Report "Test Procedure and Report on Electrical Terminations Subjected to Design Basis Accident Environment " No. IPS-107 dated October 5, 1973.

2. FSAR Appendix 3C "Safety Related Equipment Temperature Transients During the Limited Main Steam Line Break" and NRC Comment 7.17 of the same subject.

   Conax letter "Qualification of Electric Penetrations: No.IPS-411, P/N 7280-10001-01, IPS-369, IPS-325 dated 1/5/80.

QUALIFICATION DEFICIENCIES AND RECOMMENCED SOLUTIONS

MSLB

A. Deficiencies :

1. Pressure excursion was maintained for 30 min duration not 60 min

2. The instruments and/or monitors used were not identified in Qualification Document #1, also accuracy or error range was not stated.

A. Solutions:

1. During the LOCA test the pressure was held for the required time period.

2. Test monitoring sensors, even though not identified, are assumed to comply with Industrial Standards for their type of application. Typical instrument accuracy can be expected to be ±1%. Tolerances on the pressure and temperature curves used will allow for this accuracy.

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-355/1355

Inside Recirc. Spray Pump Motor
General Electric - 300 hp, 460 v,
1.15 S.F., Class H insulation,
Model: 5K6319XJ1B

1-RS-P-1A, B
1-RS-P-1A, B

Inside Containment

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

280°F	0 to 30 min
Reduce from 280°F	
150°F	30 to 60 min
150°F	>60 min
45 psig	0 to 30 min
Reduce from 45	
50 0 psig	30 to 60 min
0 psig	>60 min

7.2×10^7 rad (1)

Spray: 0 to 4 hr solution of boric acid (2000-2100 ppm boron) buffered to a pH of 8.5 to 11.0 with NaOH. Beyond 4 hrs similar solution with a pH of 7 to 9.

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

Loss of Coolant Accident (LOCA)

Pressure and Temperature - 45 psig at 275-280°F from 0-30 min. Pressure was reduced to 0° psig at 100°F within next 30 min. During this 60 min. steam exposure motor was sprayed with chemical solution at 20 gpm. Motor was at full load throughout. Four cycles were run as described above, stopping motor between each cycle to take readings. At the fifth cycle till end of 7 days, temp. reduced to 150°F at 0 psig and spayed continuously with chemical solution.

Radiation - Motor was exposed to an equivalent dose of 2×10^8 rads at a dose rate of $< 0.5 \times 10^6$ rads/hr.

Chemical Spray - Spray continuously 0-7 days with a water solution of boric acid, lithium hydroxide, and sodium hydroxide with the following concentrations:

Boron - 0.23 molar (as boric acid)
Lithium hydroxide - 1.0×10^{-4} molal
Sodium hydroxide - 1.0×10^{-3} molal

The above will result in a pH of 5.5 to 6.5

OPERABILITY REQUIREMENTS

120 days @ 150°F

OPERABILITY DEMONSTRATED (2)

130°F - 750 days

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA	LOCA	LOCA
Motor was tested sequentially by first subjecting it to the cumulative radiation dose and then the steam/-chemical spray with elevated temperature and pressure.	Topical Report on G.E. Vertical Induction Motors Inside Containment Recirculation Spray Pump Motors - Surry Power Station - Second Addendum to Cover Heat Aging, Radiation Exposure, Vibration, Steam/Chemical Spray Exposure Qualification Tests - Docket Number 50-280 and 50-281 by M.W. Sheets, Vertical Motor Products Section General Electric Company, San Jose, California June 12, 1973 (pages 36 to 64)	A. Deficiencies 1. Accuracy not stated in test report for pressure and flow. 2. No accuracy given for any data gathering instruments used. 3. Test report is not dated on signature page. 4. Chemical spray pH levels in test do not agree with design levels. 5. Temperature varied from 275-280°F. B. Solutions: 1. The actual max pressure taken from the LOCA pressure transient profile (FSAR Fig. 2.4-1) is 36 psig. 45 psig is a conservative value and the test pressure accuracy is considered to be within ±9 psig. 2. Accuracy of instruments, even though not stated, would commonly be ±1%. 3. Test report, even though not dated on signature page, is dated on cover sheet. 4. Lower pH levels (5.5 to 6.5) maintained during motor test have been reviewed with regard to motor materials and it has been determined that the higher design pH levels would not have any additional effect. 5. Temperature variation of 275°F to 280°F falls within the tolerance (265-280°F) of the LOCA temperature transient profile (FSAR Fig. 2.4-2).

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-355/1355

Inside Recirc. Spray Pump Motor
General Electric - 300 hp, 460 v.
1.15 S.F., Class H insulation,
Model: 5K6319XJ1B
1-RS-P-1A,B
2-RS-P-1A,B

Inside Containment

DESCRIPTION OF ENVIRONMENT

Main Steam Line Break (MSLB)

430°F	0 to 2 min
280°F	2 to 60 min
150°F	>60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	>60 min
3×10^7 rads	40 yr. dose

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

Main Steam Line Break (MSLB)

Temperature - Motor was qualified to the design environment by analysis.

Pressure - See LOCA qualification for this motor.

Radiation - Motor was exposed to an equivalent dose of 2×10^6 rads at a dose rate of $< 0.5 \times 10^6$ rad/hr.

OPERABILITY REQUIREMENTS

120 days @ 150°F

OPERABILITY DEMONSTRATED (2)

130°F - 750 days

ACCURACY REQUIREMENTS

Not Required

MANNER OF QUALIFICATION

MSLB

The motor was qualified by utilizing the LOCA qualification test results i.e., radiation exposure, temperature, pressure. A heat transfer calculation was performed (Ref. FSAR, Section 3C) to obtain the maximum surface temperature that will be experienced during a MSLB. This value (271°F) was then compared to the value (280°F) that the motor was tested for. Since the motor was qualified for the LOCA at a temperature of 280°F, the lower surface temperature of 271°F proved the acceptable operation of the motor during a MSLB.

QUALIFICATION DOCUMENT

MSLB

1. Final Safety Analysis Report - Section 3C, (pages 1 to 21)

2. Topical Report on GE Vertical Induction Motors - Inside Containment Recirculation Spray Pump Motors - Surry Power Station - Second Addendum to Cover Heat Aging, Radiation Exposure, Vibration, and Steam/Chemical Spray Exposure Qualification Test - Docket Number 50-280 and 50-281 by M.W. Sheets, Vertical Motor Products Section, General Electric Company - San Jose, California June 12, 1973 (pages 36 to 64)

QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS

MSLB

A. Deficiencies:

1. Accuracy not stated in test report for pressure.

2. Test report is not dated on signature page.

3. Pressure was maintained at 40 psig for 30 min and not 60 min.

B. Solutions:

1. The actual max. design pressure is 40 psig. These motors were tested for 45 psig (ref. LOCA qualification for these motors). 40 psig is a conservative value and test pressure accuracy within ±5 psig from 45 psig tested would be reasonable to assume.

2. Test report even though not dated on the signature page is dated on the cover sheet.

3. In the G.E. LOCA test, the motor was tested for five cycles at 45psig for a period of 30 min per cycle. Therefore, the 60 min MSLB requirement at 40 psig was exceeded.

EQUIPMENT DESCRIPTION & MARK NO.		DESCRIPTION OF ENVIRONMENT	OPERABILITY REQUIREMENTS
Solenoid Operated Valves Automatic Switch Co., Model #HT8321A5		Loss of Coolant Accident (LOCA)	LOCA
		1 x 10^6 rads (based on LOCA). In addition, the 40 yr radiation dose of 4 x 10^4 rads must be considered for a total possible radiation dose of 1.04 x 10^6 rads.	SOV will perform its function of closing the isolation valve within 60 sec of receiving signal.
SOV-BD-100A,C,E	Steam Generator Blowdown 150 Isol Vlv		
SOV-CC-100A,C,E	Containment Recirc Air Clr Outlet - Outside Cont		
SOV-CC-100A	RCP Therm Barrier Return Hdr		
SOV-CC-102A,C,E	RCP Coolers Return Hdr		
SOV-CC-103A,B	RHR Heat Exchange Return		
SOV-CC-104A-1,2	RCP Coolers Inlet - Outside Cont A	Normal Environment	Normal Environment
SOV-CC-104B-1,2	RCP Coolers Inlet - Outside Cont B		
SOV-CC-104C-1,2	RCP Coolers Inlet - Outside Cont C	50° to 120°F	120°F
SOV-CV-150A,B,C,D	Containment Vac Pump Suction		
SOV-DG-100A	Pri Drn Xfer Pp		
SOV-RM-100A	Radiation Monitor		
SOV-SI-100A,B	Nitrogen Supply Line	ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED	OPERABILITY DEMONSTRATED
SOV-SI-101A,B	Nitrogen Supply Line		
SOV-VG-100A	Pri Drn Xfer Tk Vent	LOCA	LOCA
SOV-BD-200A,C,E	Steam Generator Blowdown Isol Vlv		
SOV-CC-200A,B,C	Containment Recirc Air Clr Outlet - Outside Cont	Valves not specifically tested to 1.6 x 10^8 rad integrated dose. When exposed to 5 x 10^7 rad, leakage developed which exhausted the pressure vessel. Solenoid valves will have achieved their safety-related function within 60 sec of an initiation signal. The long-term failure mode will not reintroduce air to a control valve, therefore, the valve will maintain its fail-safe position.	SOV performed required safety function after receiving radiation dose.
SOV-CD-201A	RCP Therm Barriers Return Hdr		
SOV-CC-202A,C,E	RCP Coolers Return Hdr		
SOV-CC-203A,B	RHR Heat Exchanger Return		
SOV-CC-204A-1,2	RCP Coolers Inlet - Outside Containment		
SOV-CC-204B-1,2	RCP Coolers Inlet - Outside Containment		
SOV-CC-204C-1,2	RCP Coolers Inlet - Outside Containment		
SOV-CV-250A,B,C,D	Containment Vac Pump Suction		
SOV-DA-200A	RC Sump Pump Disch		
SOV-DG-200A	Pri Drain Xfer Pump Disch		
SOV-RM-200A	Radiation Monitor		
SOV-SI-200A,B	Nitrogen Supply Line		
SOV-SI-201A,B	Nitrogen Supply Line		
SOV-VG-200A	Pri Drn Xfer Tk Vent	Normal Environment	Normal Environment
		32° to 176°F	176°F
Auxiliary Building			
			ACCURACY REQUIREMENTS
			Not required

MANNER OF QUALIFICATION

LOCA
Test

Normal Environment

Underwriter's Laboratory

QUALIFICATION DOCUMENT

LOCA
Franklin Institute Research Laboratories (FIRL) Test Report F-C4539, Catalog #30, Westinghouse letter

NS-SS77060

Normal Environment

ASCO Catalog #30 page 8

QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS

LOCA

A. Deficiencies:

Failed during radiation exposure.

B. Solutions:

When exposed to a radiation dose of 5×10^7 rads, some plastic inards of the SOV did disintegrate causing the valve to leak. However, the valve was able to exhaust its accumulated pressure and perform its safety function. (W Letter NS-SS77060)

Normal Environment

None

EQUIPMENT DESCRIPTION & MARK NO.

P.O. No. NA-68/1088
480 V Switchgear
2-EE-SS-03 (2H1)
2-EE-SS-04 (2J1)
2-EE-ST-01 (2H1)
2-EE-ST-02 (2J1)
1-EE-SS-03 (1H1)
1-EE-SS-04 (1J1)
1-EE-ST-01 (1H1)
1-EE-ST-02 (1J1)

ITE IMPERIAL CORP.
Rod Control Room, Auxiliary Bldg.

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)
1×10^{6} rads (based on 120 days LOCA). In addition, the 40 year radiation dose of 4×10^{4} rads must be considered for a total possible radiation dose of 1.04×10^{6} rads.

Normal Environment

70 to 120°F
Area has temperature monitors & class IE redundant ventilation system.

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

Loss of Coolant Accident

Later

Normal Environment

-22° to 104°F

OPERABILITY REQUIREMENTS

Loss of Coolant Accident (LOCA)

1.04×10^{6} rads

Normal Environment

70°-120°F

OPERABILITY DEMONSTRATED

Loss of Coolant Accident (LOCA)

Later

Normal Environment

-22° to 104°F

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
Loss of Coolant Accident	Loss of Coolant Accident	LOCA
Tested	Later	Later
Normal Environment	Normal Environment	Normal Environment
Industrial Standard ANSI C37.20 Sec 3.1	Specification NAS-34	A. Deficiencies: Normal ambient temperature may exceed switchgear's maximum operational temperature. B. Solution: Area is equipped with an ambient temperature monitor that will signal at 101°F and alarm at 104°F.

EQUIPMENT DESCRIPTION & MARK NO.

Marathon Series 200 and 1500 Terminal Blocks (Phenolic)

Connectron Type NSB-1, NSB-3, and PSU's Terminal Blocks (Nylon)

Thermo-electric Terminal Block No. 3225 (Thermosetting Phenolic)

GE Terminal Blocks EB5 and EB25 (Phenolic)

Westinghouse Type TEAL Terminal Blocks (Nylon)

Outside Containment

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

1×10^6 rads (based on 120 days LOCA) In addition, the 40 yr radiation dose of 4×10^4 rads must be considered for a total possible radiation dose of 1.04×10^6 rads.

Exceptions:

a) Auxiliary Building Pipe Tunnel El 244'-6" maximum radiation dose 7×10^6 rads (1)

b) Safeguards Building maximum radiation dose 5×10^6 rads (1)

Normal Environment

Most severe temperature will occur, for Cat 1E systems in Main Stream Valve House 40-120°F

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

Unfilled phenolic can withstand a gamma exposure dose of over 10^8 rads and show minimal effects due to radiation.

Nylon can withstand a gamma exposure dose of over 10^6 rads

Normal Environment

This temperature range is well within the normal continuous service temperature.

OPERABILITY REQUIREMENTS

LOCA

1.04×10^6 rads

Normal Environment

40°F-120°F

OPERABILITY DEMONSTRATED

LOCA

Phenolic 1×10^8 rads
Nylon 1×10^6 rads

Normal Environment

120°F

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION

LOCA

Terminal Block material was compared with identical material for the effects high level radiation.

Normal Environment

Industrial Standards
Underwriter's Lab

QUALIFICATION DOCUMENT

LOCA

REIC Report No. 21 Radiation Effect Information Center, Columbus, Ohio. Buchanan Product Manual Insert 2.1 Rev. 8/23/76

Normal Environment

UNDERWRITERS LAB

QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS

LOCA

A. Deficiencies:

1) Exact spec. of material is not available from most mfr.

2) Nylon terminal blocks, which are located in the auxiliary building pipe tunnel & safeguards building, may not withstand the radiation level above 1 x 10^9 rads.

B. Solutions:

1) The general makeup by phenolic or nylon will not vary enough to effect the test results.

2) Nylon terminal blocks will be replaced with phenolic or polysulfone in the pipe tunnel and safeguards building.

EQUIPMENT DESCRIPTION & MARK NO.

Okonite Termination Tape Field Purchased

T-95 Insulating Tape
T-35 Jacketing Tape

Inside Containment

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

280°F	0 to 30 min
Reduce from 280°F to 150°F	30 to 60 min
150°F	> 60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	> 60 min

7.2×10^7 rads (1)
Spray: 0-4 hr solution of boric acid (2000-2100 ppm boron) buffered to a pH of 8.5 to 11 with NaOH> 4 hr Similar solution with a pH of 7 to 9

Main Steam Line Break (MSLB)

430°F	0 to 2 min
280°F	2 to 60 min
150°F	> 60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	> 60 min

3×10^7 rads

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

Aged 168 hr at 121°C
Irradiated to 2×10^8 rads

PWR Exposure:
80 psig @ 324°F for 4 hours
16 psig @ 252°F for 7 days
Spray 10,000 ppm boric acid buffered with NaOH to a pH of 10.5 throughout the PWR exposure period.

BWR Exposure:
A series of transient cycles each consisting of a rise to a specified press. and temp. for a specified time and a gradual return to initial conditions. Following transient cycles 100 day exposure to live steam 0 psig, 212°F

MSLB

Same as "Description of Environment"

OPERABILITY REQUIREMENTS

LOCA & MSLB

120 days @ 150°F

OPERABILITY DEMONSTRATED (2)

LOCA & MSLB

212°F for 100 days
Post LOCA thermal aging is equivalent to 2.9 years @ 150°F

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA Test - Sequential	LOCA Okonite's Engineering Report No. 141 dated February 29, 1972	LOCA A. Deficiencies: Qualification document does not address 1) Accuracy of variables and test data 2) Test monitoring sensors 3) Test facility B. Solutions: 1) Accuracy of instrument even though not stated would commonly be ±1% 2) Test monitoring sensors, even though not identified, are assumed to comply with Industrial Standards for their type of application. 3) Test facility, even though not identified, could be determined Vendor's records.
MSLB Temperature - Analysis Maximum calculated surface temperature during limiting MSLB is 270°F which does not exceed qualification temperature of 324°F given in Okonite Engineering Report No. 141. Pressure and Radiation - Test Refer to LOCA qualification	MSLB S&W Calculation ES-189 "Equipment Temperature Transient for Okonite Tape Splices"	MSLB Same as above

EQUIPMENT DESCRIPTION & MARK NO.

Raychem heat shrinkable field splicing material WCSF type coated with Type-N adhesive

Inside Containment

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

280°F	0 to 30 min
Reduce from 280°F to 150°F	30 to 60 min
150°F	> 60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	> 60 min

7.2×10^7 rads (1)

Spray: 0-4 hrs solution of boric acid (2000-2100 ppm boron) buffered to a pH of 8.5 to 11 with NaOH>4 hr similar solution with a pH of 7 to 9

Main Steam Line Break (MSLB)

430°F	0 to 2 min
280°F	2 to 60 min
150°F	> 60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	> 60 min

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA & MSLB

Irradiated by cobalt-60 gamma source at 0.27 Mrads/hr to total dose of 200 Mrads.

360°F @ 70 psig	5 hr
320°F @ 70 psig	6 hr
250°F @ 21 psig	24 hrs

and 0.2% Boric acid spray buffered to a PH of to

221°F @ 2.5 psig	12 days
212°F @ 2.0 psig	100 days

OPERABILITY REQUIREMENTS

LOCA

120 days @ 150°F

MSLB

120 days @ 150°F

OPERABILITY DEMONSTRATED(2)

LOCA

212°F for 100 days

Post LOCA thermal aging is greater than 2.9 years @ 150°F

MSLB

See above

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA & MSLB	LOCA & MSLB	
Combined thermal and radiation aging period followed by a simultaneous exposure to steam, chemical spray and gamma radiation	Raychem Technical Report F-C4033	None

EQUIPMENT DESCRIPTION & MARK NO.

Solenoid Operated Valves Automatic Switch Co., Model #HT8302811U

SOV-BD-100B,D&F	Stm Gen Blowdown Isol Vlv
SOV-CC-101B	RCP Thermal Barrier Return Hdr
SOV-CC-102B,D&F	RCP Coolers Return Hdr
SOV-CC-105A,B&C	Cont Recirc Air Clr Outlet & Ins Cont
SOV-DA-100B	Cont Sump Pp Disch Isol Vlv
SOV-DG-100B	Pri Drn Xfer Pp Disch Isol Vlv
SOV-SS-100A	Press Liquid Space Cont Isol Vlv
SOV-SS-101A	Press Vapor Space Samp Cont Isol Vlv
SOV-SS-102A	Pri Coolant Cold Leg Sample Cont Isol Vlv
SOV-SS-104A	Press Relief Tk Gas Space Cont Isol Vlv
SOV-SS-106A	Pri Coolant Hot Leg Sample Cont Isol Vlv
SOV-SS-112A	Stm Gen Sample Cont Isol Vlv
SOV-VG-100B	Pri Drn Xfer Tk Vent
SOV-BD-200B,D&F	Stm Gen Blowdown Isol Vlv
SOV-CC-201B	RCP Thermal Barrier Return Hdr
SOV-CC-202B,D&F	RCP Coolers Return Hdr
SOV-CC-205A,B&C	Cont Recirc Air Clr Outlet & Ins Cont
SOV-DA-200B	Cont Sump Pp Disch Isol Vlv
SOV-DG-200B	Pri Drn Xfer Pp Disch Isol Vlv
SOV-SS-200A	Press Liquid Space Cont Isol Vle
SOV-SS-201A	Press Vapor Space Sample Cont Isol Vlv
SOV-SS-202A	Pri Coolant Cold Leg Sample Cont Isol Vlv
SOV-SS-204A	Press Relief Tk Gas Space Cont Isol Vlv
SOV-SS-206A	Pri Coolant Hot Leg Sample Cont Isol Vlv
SOV-SS-212A	Stm Gen Sample Cont Isol Vlv
SOV-VG-200B	Pri Drn Xfer Tk Vent

Inside Containment

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

280°F	0 to 30 min
Reduce from 280°F to 150°F	30 to 60 min
150°F	>60 min
45 psig	0 to 20 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	>60 min
7.2×10^7 rads (1)	

Spray:

0-4 hr - Solution of boric acid (2000-2100 ppm boron) buffered to a pH of 8.5 to 11 with NaOH
>4 hr similar solution with a pH of 7 to 9

Main Steam Line Break (MSLB)

45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	>60 min
3×10^7 rads	

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

460°F	0 to 2 min
Reduce from 460°F to 340°F	2 to 8 min
Reduce from 340°F to 240°F	8 to 35 min
150°F	52 min to 14 days
129 psia	0 to 2 min
118 psia	2 to 32 min
Reduce from 118 to 25 psia	32 to 34 min
13.5 psia	52 min to 14 days

Radiation exposure 5×10^7 rads

MSLB

Encompassed by above LOCA test

OPERABILITY REQUIREMENTS

LOCA & MSLB

SOV will perform its function of closing isolation valve within 60 sec of receiving signal. Failure of SOV will not cause valve to reopen.

OPERABILITY DEMONSTRATED

LOCA & MSLB

Functioned properly for 14 days at 150°F after 50 Mrad radiation exposure.

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA & MSLB	LOCA & MSLB	LOCA & MSLB
Sequential Test Radiation followed by Environmental Exposure	Franklin Institute Research Laboratories (FIRL) Test Report F-C4539	A. Deficiencies: 1) Valves were not subjected to a chemical spray 2) Radiation exposure during test is below accident dose of 4.2×10^7 rads plus 40 yr dose of 3×10^7 rads. B. Solutions: 1) Valves not subject to spray since valves will have performed their intended function prior to initiation of spray. 2) Replace valves inside the crane wall prior to 10.67 yr exposure. Take radiation reading for rate of dose during plant operation. These measurements will provide a more accurate exposure rate and, thereby, increase or decrease the period of replacement.

EQUIPMENT DESCRIPTION & MARK NO.

Solenoid Operated Valves, Automatic Switch Co.

Model #HT8344A71

SOV-MS-111A,B, Aux. Feed Pump Turb Drive

Model #HT8349A11

SOV-MS-211A,B, Aux. Feed Pump Turb Drive

Main Steam Valve Building

DESCRIPTION OF ENVIRONMENT

Main Steam Line Break (MSLB)

See Deficiencies and Solutions

Normal Environment

40° to 120°F
Area has temperature monitors.

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

MSLB

See Deficiencies and Solutions

Normal Environment

Type HT suitable for ambient temperature as high as 176°F

OPERABILITY REQUIREMENTS

MSLB

SOV will perform its function of closing isolation valve within 60 sec of receiving signal.

Normal Environment

120°F

OPERABILITY DEMONSTRATED

MSLB

a) SOV will have performed its function prior to failure.

b) Failure of SOV will not cause valve to reopen.

Normal Environment

176°F

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION

MSLB

None

Normal Environment

Underwriters Laboratories

QUALIFICATION DOCUMENT

MSLB

None

Normal Environment

ASCO Catalog #30, Page 8

QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS

MSLB

A. Deficiencies:

SOV's will not withstand the MSLB temperature.

B. Solution:

SOV's will have completed their operation before temperature causes it to fail.

EQUIPMENT DESCRIPTION & MARK NO.

Solenoid Operated Valves Automatic
Switch Co., Model #HT8302B1U

SOV-DA-100A	R.C. Sump Pp Discn
SOV-SS-100B	Pressure Liquid Space Isol Vlv
SOV-SS-102B	PRI Coolant Cold Leg Sample Isol Vlv
SOV-SS-104A,B	Press Relief TK Gas Space Sample Isol Vlv
SOV-SS-106B	PRI Coolant Hot Leg Sample Isol Vlv
SOV-SS-112B	Steam Generator Sample Isol Vlv
SOV-SS-200B	Pressure Liquid Space Isol Vlv
SOV-SS-202B	PRI Coolant Cold Leg Sample Isol Vlv
SOV-SS-204A,B	Press Relief TK Gas Space Sample Isol Vlv
SOV-SS-206B	PRI Coolant Hot Leg Sample Isol Vlv
SOV-SS-212B	Steam Generator Sample Isol Vlv

Auxiliary Building

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

1×10^6 rads (based on 120 day LOCA). In addition, the 40 yr radiation dose of 4×10^4 rads must be considered for a total possible radiation dose of 1.04×10^6 rads.

Normal Environment

50° to 120°F

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

Radiation exposure 5×10^7 rads

Normal Environment

Type HT suitable for ambient temperature as high as 176°F

OPERABILITY REQUIREMENTS

LOCA

SOV will perform its function of closing isolation valve within 60 sec of receiving signal.

Normal Environment

120°F

OPERABILITY DEMONSTRATED

LOCA

Functioned properly for 14 days at 150°F after 50 Mrad radiation exposure and will not misoperate if SOV fails due to radiation.

Normal Environment

176°F

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA	LOCA	LOCA
Test	Franklin Institute Research Laboratories (FIRL) Test Report F-C4539	None
Normal Environment	Normal Environment	Normal Environment
Industrial Standard Underwriter's Laboratory	ASCO, Catalog #30 , page 8	None

EQUIPMENT DESCRIPTION & MARK NO.

Solenoid Operated Valve
Automatic Switch Co.

Model #FT8320lA102

SOV-SS-103A,B	RHR Outboard Isol Vlv
SOV-SS-203A,B	RHR Outboard Isol Vlv

Auxiliary Building

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

1×10^6 rads (based on 120 day LOCA). In addition, the 40 yr radiation dose of 4×10^4 rads must be considered for a total possible radiation dose of 1.04×10^6 rads.

Normal Environment

50° to $120^{\circ}F$

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

None

Normal Environment

Type FT is suitable for ambient temperature as high as $140^{\circ}F$.

OPERABILITY REQUIREMENTS

LOCA

SOV will perform its function of closing isolation valve within 60 sec of receiving signal.

Normal Environment

$120^{\circ}F$

OPERABILITY DEMONSTRATED

LOCA

None

Normal Environment

$140^{\circ}F$

ACCURACY REQUIREMENT

Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA	LOCA	LOCA
None	None	SOV will perform its function of closing isolation valve within 60 sec. of receiving signal. Failure of of SOV will not reopen valve.
Normal Environment	Normal Environment	Normal Environment
Industrial Standard Underwriter's Laboratory	ASCO Catalog #30, Page 8	None

EQUIPMENT DESCRIPTION & MARK NO.

Raychem high voltage terminations
HVT

Raychem high voltage motor connectors
HVMC

Raychem Inc.

Outside Containment

DESCRIPTION OF ENVIRONMENT

LOCA

1×10^{7} rads (based on 120 day LOCA).
In addition, the 40 year radiation dose of 4×10^{4} rads must be considered for a total possible radiation dose of 1.04×10^{7} rads.

Normal Environment

$40 - 120^{o}F$

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

Terminations & Connectors
Irradiation of the materials in a cobalt - 60 gamma source at 0.50 Mrads per hour to a total dose of 2×10^{8} rads.

Normal Environment

Terminations & Connectors
Continuous operation
-60 to 125^{o}

OPERABILITY REQUIREMENTS

LOCA

1.04×10^{7} rads

Normal Environment

$40\text{-}120\ ^{o}F$

OPERABILITY DEMONSTRATED

LOCA

2×10^{8} rads

Normal Environment

$-60\text{-}125^{o}F$

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION

LOCA

Test: Thermal aging followed by irradiation for HVT and HVMC

Normal Environment

Industrial Standards
ASTM D476
IEEE 48

QUALIFICATION DOCUMENT

LOCA
Raychem Report #71100 Revision 1

Letter from Raychem dated 4/24/79
and EPSERT PRO Raychem Report
RT1508/1

Normal Environment

Raychem HVT catalog U-012 dated June 1976

QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS

LOCA

A. Deficiencies:

1) Accuracy of variables and test data
2) Test monitoring sensors
3) Test facility

B. Solutions:

1) Accuracy of instrument even though not stated would commonly be ±1%

2) Test monitoring sensors, even though not identified, are assumed to comply with Industrial Standards for their type of application

3) Test facility, even though not identified, could be determined from Vendor's records.

Normal Environment

None

EQUIPMENT DESCRIPTION AND MARK NO.

Solenoid Operated Valves
Automatic Switch Co.
Model THT8320A102

SOV-LM100A Cont. Press Taps
SOV-LM100B Cont. Press Taps
SOV-LM100C Cont. Press Taps
SOV-LM100D Cont. Press Taps
SOV-LM100E Cont. Press Taps
SOV-LM100F Cont. Press Taps
SOV-LM100G Cont. Press Taps
SOV-LM100H Cont. Press Taps

SOV-LM200A Cont. Press Taps
SOV-LM200B Cont. Press Taps
SOV-LM200C Cont. Press Taps
SOV-LM200D Cont. Press Taps
SOV-LM200E Cont. Press Taps
SOV-LM200F Cont. Press Taps
SOV-LM200G Cont. Press Taps
SOV-LM200H Cont. Press Taps

Auxiliary Bldg.

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

1×10^5 rads (base on 120 day LOCA). In addition, the 40 yr. radiation dose of 4×10^4 rads must be considered for a total possible radiation dose of 1.04×10^6 rads.

Normal Environment

50° to 120°F

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA
None
Normal Environment

Type THT suitable for ambient temperature as high as 17°F

OPERABILITY REQUIREMENTS

LOCA

SOV will perform its function of closing isolation valve within 10 sec. of receiving signal.

Normal Environment

120°F

OPERABILITY DEMONSTRATED

LOCA

None

Normal Environment

17°F

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA	LOCA	LOCA
None	None	SOV will perform its function of closing isolation valve within 60 sec of receiving signal. Failure of SOV will not reopen valve.
Normal Environment	Normal Environment	Normal Environment
Industrial Standard Underwriter's Laboratory	ASCO catalog #30, page 8	None

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-83/1063

Radiation Monitoring Pump Motor
Marathon Electric
Class A Insulation

Model #[illegible]

1-SW-P-5,6,7,8
2-SW-P-5,6,7,8

Main Steam Valve House

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

5.4×10^6 (1)

Normal Environment

120°F

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

None

Normal Environment

104°F

OPERABILITY REQUIREMENTS

LOCA

5.4×10^6

Normal Environment

120°F

OPERABILITY DEMONSTRATED

LOCA

None

Normal Environment

104°F

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA	LOCA	LOCA
None	None	A. Deficiencies: No nuclear qualification B. Solutions: 1) Replace motor 2) Shield motor
Normal Environment	Normal Environment	Normal Environment
Industrial Standard NEMA-Mil	Specification NAS-184	A. Deficiencies: High ambient temperature B. Solutions: 1) Replace motor 2) Provide area with ambient temperature monitor that will signal at 101°F and alarm at 104°F

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA 10/1010
Nuclear Steam Supply System
Westinghouse Electric Comp.

Steam Generator Flow Transmitters

FT-1474, 2474
FT-1475, 2475
FT-1484, 2484
FT-1485, 2485
FT-1494, 2494
FT-1495, 2495

Rosemount Model 1152DP6A

Inside Containment

DESCRIPTION OF ENVIRONMENT

LOCA

280°F	0 to 30 min
Reduce from 280°F to 150°F	30 to 60 min
150°F	> 60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	> 60 min

4.2 x 10^7 rads

Spray: 0-4 hrs solution of boric acid (2000-2100 ppm boron) buffered to a pH of 8.5 to 11 with NaOH > 4 hrs similiar solution with a pH of 7 to 9.

MSLB

430°F	0 to 2 min
280°F	2 to 60 min
150°F	> 60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	> 60 min

3 x 10^7 rads

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

350°F	0 to 10 min
316°F	10 min to 1 hr
303°F	1 hr - 8 hr
230°F	8 hr - 50 hr
60 psig	0 - 10 min
70 psig	10 min - 7 hr
55.4 psig	1 hr - 8 hr
6 psig	8 hr - 50 hr

5 x 10^6 rads

Spray: None

MSLB

See above

OPERABILITY REQUIREMENTS

120 days @ 150°F

OPERABILITY DEMONSTRATED (2)

124 days @ 150°F

ACCURACY REQUIREMENTS

± .5%

ACCURACY DEMONSTRATED

± . 25%

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA & MSLB Test	LOCA Rosemount Test Report #117415 MSLB Rosemount Test Report #117415 FSAR Section 3C and response to comment 7.17	LOCA A. Deficiencies: 1) Accuracy of variables and test data 2) Test monitoring sensors 3) Radiation level B. Solutions: 1) Accuracy of instrument even though not stated would commonly be ±1%. 2) Test monitoring sensors, even though not identified, are assumed to comply with Industrial Standards for their type of application. 3) Transmitters are good for 40 yr. radiation dose plus 200 hrs. into a LOCA. Optimum solution is still being investigated. MSLB A. Deficiencies: 1) See items 1 & 2 for LOCA. 2) Temperature envelope B. Solutions: 1) See items 1 & 2 for LOCA 2) Qualification test of 350°F for ten minutes, 316°F for one hour whereas the environment is 430°F for two minutes, then dropping to 280°F after two minutes. The temperature environment does not exceed qualified limits due to thermal inertia and internal temperature. See calculation # ZS-169

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-10/1010

Nuclear Steam Supply System

Westinghouse Electric Corp.

Pressurizer Level Transmitter

LT-1459
LT-1460
LT-1461
LT-2459
LT-2460
LT-2461

Barton 386/752*

Inside Containment

*386/752 is prototype of 764.
Lot 1 testing is applicable to prototype.

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

280°F	0-30 min
Reduce from 280°F to 150°F	30-60 min
150°F	>60 min
45 psig	0-30 min
Reduce from 45 to 0 psig	30-60 min
0 psig	>60 min

7.2×10^7 rads (1)

Spray: 0.4 hr solution of boric acid (2000-2100 ppm boron) buffered to a pH of 8.5 to 11 with NaOH
>4 hr similar solution with a pH of 7 to 9.

Main Steam Line Break (MSLB)

430°F	0 to 2 min
280°F	2 to 60 min
150°F	>60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	>60 min

3×10^7 rads

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

0 to 280°F	0-3 sec
280°F @ 75 psig	3-1200 sec
280°F-220°F	20 min to 24 hr
220°F	1 to 15 days

Radiation: 5×10^7 rads

Spray: 1.14 wt % boric acid and 0.17 wt % NaOH dissolved in water for 24 hr

MSLB

380°F @ 75 psig
100% RH

Radiation: 1.13×10^5 rads

OPERABILITY REQUIREMENTS

LOCA

120 days @ 150°F

OPERABILITY DEMONSTRATED (2)

LOCA

212 days @ 150°F

ACCURACY REQUIREMENTS

±10% for ≤ 5 min

ACCURACY REQUIREMENTS

0 to 5 min <5%
Max. error 5 min. to 4 months 17%

MANNER OF QUALIFICATION

LOCA

Test - Sequential

QUALIFICATION DOCUMENT

LOCA

Westinghouse Electric Corp.

NS-TMA-1950

Anderson to Stolz

NS-TMA-2120

Anderson to Stolz

Test

QUALIFICATION DEFICIENCIES
AND RECOMMENDED SOLUTIONS

LOCA

A. Deficiencies:

Radiation level to which equipment was qualified is below that of 40 yr plus LOCA dose.

B. Solutions:

LOCA equipment was qualified for a level of 5×10^7 rads. This means that equipment will be able to withstand the LOCA dose of 4.2×10^7 rads with a 8×10^5 rads level for normal life. Therefore, since the 40 yr life is 3×10^7 rads and this is a fairly constant rate, the equipment is qualified for greater than 10 yr. We will either obtain further qualification data or replace equipment before the 10th yr.

MSLB

A. Deficiencies:

Qualified to 300°F MSLB, peak temperature is 430°F.

B. Solutions:

Temperature qualification is acceptable since temp reduced to 280°F after 2 min, due to thermal inertia, internal temperature rise stays within qualified limits. See Temperature Calculation #NS- 169

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA 10/1010
Nuclear Steam Supply System
Westinghouse Electric Corp.

Steam Generator Level
(Narrow Range) transmitter

LT-1474, 2474
LT-1475, 2475
LT-1476, 2476
LT-1484, 2484
LT-1485, 2485
LT-1486, 2486
LT-1494, 2494
LT-1495, 2495
LT-1496, 2496

Rosemount #115DP4A

Inside Containment

DESCRIPTION OF ENVIRONMENT

LOCA

280°F	0 to 30 min
Reduce from 280°F to 150°F	30 to 60 min
150°F	> 60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	> 60 min

7.2×10^7 rads (1)

Spray: 0-4 hrs solution of boric acid (2000-2100 ppm boron) buffered to a pH of 8.5 to 11 with NaOH > 4 hrs similar solution with a pH of 7 to 9.

MSLB

430°F	0 to 2 min
280°F	2 to 60 min
150°F	> 60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	> 60 min

3×10^7 rads

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

350°F	0 to 10 min
316°F	10 min to 1 hr
303°F	1 hr to 8 hrs
230°F	8 hr to 50 hrs
60 psig	0 to 10 min
70 psig	10 min to 7 hrs
55.4 psig	1 hr to 8 hrs
0 psig	8 hr to 50 hr

5×10^6 rads

Spray: None

MSLB

See above

OPERABILITY REQUIREMENTS

120 days @ 150°F

OPERABILITY DEMONSTRATED (2)

124 days @ 150°F

ACCURACY REQUIREMENTS

± .5%

ACCURACY DEMONSTRATED

± .25%

MANNER OF QUALIFICATION

LOCA & MSLB

Test

QUALIFICATION DOCUMENT

LOCA

Rosemount Report
117415

MSLB

Rosemount Report
117415

FSAR section 3C
and response to comment 7.17

QUALIFICATION DEFIENCIES
AND RECOMMENDED SOLUTIONS

LOCA

A. Deficiencies:
1) Accuracy of variables and test data
2) Test monitoring sensors
3) Radiation level

B. Solutions:

1) Accuracy of instrument even though not stated would commonly be ±1%.
2) Test monitoring sensors, even though not identified, are assumed to comply with Industrial Standards for their type of application.
3a) Transmitters were operational at 5×10^6 rads, need further testing to assure compliance to the 7.2×10^7 rads. The results of the existing testing indicate that radiation does not adversely effect the transmitter.
3b) Replace with qualified transmitters.

MSLB

A. Deficiencies:
1) See items 1 & 2 for LOCA.
2) Temperature envelope

B. Solutions:

1) See items 1 & 2 for LOCA
2) Qualification test of 350°F for ten minutes, 316°F for one hour whereas the environment is 430°F for two minutes, then dropping to 280°F after two minutes. The temperature environment does not exceed qualified limits due to thermal inertia and internal temperature. Calculation #85-119

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-10/1010

Nuclear Steam Supply System

Westinghouse Electric Corp.

Limit Switches for Valves

HCV-1200A,B,C - Regen H. Outlet
HCV-2200A,B,C - Regen H. Outlet
TV-1842 - Containment Isolation
TV-2842 - Containment Isolation

NAMCO EA-180

Inside Containment

DESCRIPTION OF ENVIRONMENT

Loss of Coolant (LOCA)

280°F	0-30 min
Reduce from 280°F to 150°F	30-60 min
150°F	>60 min
45 psig	0-30 min
Reduce from 45 to 0 psig	30-60 min
0 psig	>60 min

7.2×10^7 rads (1)

Spray:

0-4 hr solution of boric acid (2000-2100 ppm boron) buffered to a pH of 8.5 to 11 with NaOH
>4 hr similar solution with a pH of 7 to 9.

Main Steam Line Break (MSLB)

430°F	0 to 2 min
280°F	2 to 60 min
150°F	>60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	>60 min

3×10^7 rads

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

Heat aging @ 200°F for 200 hr, mechanical aging 100,000 cycles under electrical load

340°F	0 to 3 hr
Reduce from 340°F to 120°F	3 to 5 hr

SEQUENCE REPEATED

250°F	to 3.5 days
200°F	3.5 to 30 days
70 psi	0 to 8 hr
10 psi	8 hr to 30 days

Radiation Exposure 2.04×10^8 rads

Spray: Boric acid and water buffered to a pH of 10-11 with NaOH solution for 4 days, water spray for 26 days, spray density = .015 gpm/ft^2

MSLB

Maximum surface temperature is 285°F per ESG calculation 11712-ES-197-0, dated 3/16/78, and is well below qualification temperature.

Radiation Exposure - See LOCA test

OPERABILITY REQUIREMENTS

LOCA & MSLB

Valve to close within 60 sec of isolation signal. Switches shall not fail so as to reopen valves.

OPERABILITY DEMONSTRATED

LOCA & MSLB

Limit switches shown to operate after sequential testing.

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION

LOCA

Sequential Test

QUALIFICATION DOCUMENT

LOCA

Report entitled:

"Qualification of NAMCO controls limit switch Mode EA-180 to IEEE Standards 344 ('75), 323 ('74), and 382 ('72)," dated 3/3/78 and revised 4/7/78

QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS

LOCA

A. Deficiencies:

1) Accuracy of variables and test data
2) Test monitoring sensors
3) Test facility

B. Solutions:

1) Accuracy of instrument, even though not stated, would commonly be ±1%.

2) Test monitoring sensors, even though not identified, are assumed to comply with industrial standards for their type of application.

3) Test facility, even though not identified, could be determined from vendor's records.

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA 10/1010

Nuclear Steam Supply System

Westinghouse Electric Corp.

Valve Position Switch

HCV-1201 Ex Letdown
HCV-2201 Ex Letdown

NAMCO D-2400X

Inside Containment

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

280°F	0-30 min
Reduce from 280°F to 150°F	30-60 min
150°F	>60 min
45 psig	0-30 min
Reduce from 45 to 0 psig	>60 min

7.2×10^7 rads (1)

Spray:

0-4 hr solution of boric acid (2000-21000 ppm boron) buffered to a pH of 8.5 to 11 with NaOH
>4 hr similar solution with a pH of 7 to 9.

Main Steam Line Break (MSLB)

430°F	0 to 2 min
280°F	2 to 60 min
150°F	>60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	>60 min

3×10^7 rads

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

Not qualified

MSLB

Not qualified

OPERABILITY REQUIREMENTS

LOCA & MSLB

120 days @ 150°F

OPERABILITY DEMONSTRATED

LOCA & MSLB

Not qualified

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION

LOCA & MSLB

None

QUALIFICATION DOCUMENTS

LOCA & MSLB

None

QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS

LOCA & MSLB

A. Deficiencies

1) NAMCO D-2400X not qualified for accident environment.

B. Solutions:

Limit switches provided for indication only and do not perform a safety funciton. Thus no requirements to be qualified for accident environment.

EQUIPMENT DESCRIPTION & MARK NO.

P.O. No. NA 10/1010
Nuclear Steam Supply System
Westinghouse Electric Corp.

RCP Sealwater
Return

MOV-1380
MOV-2380
Limitorque

Inside Containment

DESCRIPTION OF ENVIRONMENT

LOCA

280°F	0 to 30 min
Reduce from 280°F to 150°F	30 to 60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	> 60 min

7.2×10^7 rads (1)

Spray: 0-4 hrs solution of boric acid (2000-2100 ppm boron) buffered to a pH of 8.5 to 11 with NaOH; 4 hrs similiar solution with a pH of 7 to 9.

MSLB

430°F	0 to 2 min
280°F	2 to 60 min
150°F	> 60 min
45 psig	0 to 60 min
0 psig	> 60 min

3×10^7 (rads)

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA
Peak temp. 340°F

55 psig

2×10^8

2500 ppm boric acid buffered with .24% NaOH.

MSLB

— as above

OPERABILITY REQUIREMENTS

120 days @ 150°F

OPERABILITY DEMONSTRATED (2)

206 days @ 150°F

ACCURACY REQUIREMENTS

Not required.

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES & RECOMMENDED SOLUTIONS
LOCA & MSLB	NCAP-7744	LOCA
Test	NS-CE-092	None

MSLB

A. Deficiencies:

Temperature envelope

B. Solutions

In accordance with 79-01B "Guidelines for Evaluating Environment Qualification" page7, paragraph 4.2.1, "Equipment qualified for a LOCA environment is qualified for a MSLB environment.....".

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-10/1010

Nuclear Steam Supply System

Westinghouse Electric Corp.

Pressurizer Pressure Transmitters

PT-1455
PT-1456
PT-1457
PT-2455
PT-2456
PT-2457

Barton 763 (Lot 1)

Inside Containment

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

LOCA

280°F	0-30 min
Reduce from 280°F to 150°F	30-60 min
150°F	>60 min
45 psig	0-30 min
Reduce from 45 to 0 psig	30-60 min
0 psig	>60 min

7.2×10^7 rads (1)

Spray: 0.4 hr solution of boric acid (2000-2100 ppm boron) buffered to a pH of 8.5 to 11 with NaOH >4 hr similar solution with a pH of 7 to 9.

Main Steam Line Break (MSLB)

430°F	0 to 2 min
280°F	2 to 60 min
150°F	>60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	>60 min

3×10^7 rads

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

0 to 280°F	0-3 sec
280°F @ 75 psig	3-1200 sec
280°F to 220°F	20 min - 24 hr
220°F	1 to 15 days

Radiation: 5×10^7 rads - Gamma

Spray: 1.14 wt % boric acid and 0.17 wt % NaOH dissolved water for 24 hr

MSLB

380°F @ 75 psig
100% RH

Radiation: 1.13×10^5 rads - Gamma

OPERABILITY REQUIREMENTS

LOCA & MSLB
120 days @ 150°F

OPERABILITY DEMONSTRATED (2)

LOCA & MSLB

212 days @ 150°F

ACCURACY REQUIREMENTS

±10% for ≤5 min
5 min to 4 months
±25%

ACCURACY DEMONSTRATED

≤5% for 5 min max.
Error 5 min to 4 months
1%

MANNER OF QUALIFICATION

Test - Sequential

QUALIFICATION DOCUMENT

Westinghouse Electric Corp.

NS-TMA-1950

Anderson to Stolz

NS-TMA-2120

Anderson to Stolz

(Test)

QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS

LOCA

A. Deficiencies:

Radiation level to which equipment was qualified is below that of 40 yr plus LOCA dose.

B. Solutions:

LOCA equipment was qualified for a level of 5×10^7 rads. This means that equipment will be able to withstand the LOCA dose of 4.2×10^7 rads with a 8×10^6 rads level for normal life. Therefore, since the 40 yr life is 3×10^7 rads and this is a fairly constant rate, the equipment is qualified for greater than 10 yr. We will either obtain further qualification data or replace equipment before the 10th yr.

MSLB

A. Deficiencies:

Qualified to 380°F MSLB, peak temperature is 430°F.

B. Solutions:

Temperature qualification is acceptable since temp reduced to 280°F after 2 min, due to thermal inertia, internal temperature rise stays within qualified limits. See Temperature Calculation #ES- 169

EQUIPMENT DESCRIPTION & MARK NO.

P O NA-10/1010
Nuclear Steam Supply System
Westinghouse Electric Corp
RCS Wide Range Pressure Transmitters
PT-1402
PT-2402

Version 393 (Prototype of 7?3)

Inside Containment

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

LOCA

280°F	0 to 30 min
Reduce from 280°F to 150°F	30 to 40 min
150°F	>40 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 40 min
0 psig	>40 min

7.2×10^7 rads (1)

Spray: 0.4 hr solution of boric acid (2000-2100 ppm boron) buffered to a pH of 8.5 to 11 with NaOH > 4 hr similar solution with a pH of 7 to 9.

Main Steam Line Break (MSLB)

430°F	0 to 2 min
280°F	2 to 40 min
150°F	>40 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 40 min
0 psig	>40 min

3×10^7 rads

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

0 to 280°F	0 to 3 sec
280°F @ 75 psig	3 to 1200 sec
280°F to 220°F	20 min to 24 hrs
220°F	1 to 15 days

Radiation: 5×10^7 rads - Gamma

Spray: 1.14 wt % boric acid and 0.17 wt % NaOH dissolved water for 24 hr.

MSLB

380°F @ 75 psig
100% RH

Radiation: 1.13×10^5 rads - Gamma

OPERABILITY REQUIREMENTS

LOCA & MSLB

120 days @ 150°F

OPERABILITY DEMONSTRATED (2)

LOCA & MSLB

212 days @ 150°F

ACCURACY REQUIREMENTS

±10% for ≤ 5 min
5 min to 4 months
±25%

ACCURACY DEMONSTRATED

5% for 5 min. max.
Error 5 min. to 4 months
17%

MANNER OF QUALIFICATION

Test - Sequential

QUALIFICATION DOCUMENT

Westinghouse Electric Corp.

NS-TMA-1950

Anderson to Stolz

NS-TMA-2120

Anderson to Stolz

(Test)

QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS

LOCA

A. Deficiencies:

Radiation level to which equipment was qualified is below that of 40 yr plus LOCA dose.

B. Solutions:

LOCA equipment was qualified for a level of 5×10^7 rads. This means that equipment will be able to withstand the LOCA dose of 4.2×10^7 rads with a 8×10^5 rads level for normal life. Therefore, since the 40 yr life is 3×10^7 rads and this is a fairly constant rate, the equipment is qualified for greater than 10 yr. We will either outain further qualification data or replace equipment before the 10th yr.

MSLB

A. Deficiencies:

Qualified to 380°F MSLB, peak temperature is 430°F.

B. Solutions:

Temperature qualification is acceptable since temp. reduced to 280°F after 2 min, due to thermal inertia, internal temperature rise stay within qualified limits. See Temperature Calculation #ES-169.

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-10/1010

Nuclear Steam Supply

Westinghouse Electric Corp.

Solenoid Operator Regen Hx Outlet

HCV-1200A
HCV-1200B
HCV-1200C
HCV-2200A
HCV-2200B
HCV-2200C

ASCO #HT8300B64RU

Inside Containment

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

280°F	0-30 min
Reduce from 280°F to 150°F	30-60 min
150°F	>60 min
45 psig	0-30 min
Reduce from 45 to 0 psig	30-60 min
0 psig	>60 min

7.2×10^7 rads (1)

Spray:

0-4 hr solution of boric acid (2000-2100 ppm boron) buffered to a pH of 8.5 to 11 with NaOH
>4 hr similar solution with a pH of 7 to 9.

Main Steam Line Break (MSLB)

430°F	0 to 2 min
280°F	2 to 60 min
150°F	>60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	>60 min

3×10^7 rads

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA

460°F	0 to 2 min
Reduce from 460°F to 340°F	2 to 8 min
Reduce from 340°F to 240°F	8 to 35 min
150°F	52 min to 14 days
129 psia	0 to 2 min
118 psia	2 to 32 min
Reduce from 118 to 25 psia	32 to 34 min
13.5 psia	52 min to 14 days

Radiation Exposure 5×10^7 rads

MSLB

Encompassed by above LOCA test

OPERABILITY REQUIREMENTS

LOCA & MSLB

120 days @ 150°F

OPERABILITY DEMONSTRATED

LOCA & MSLB

Functioned properly for 14 days at 150°F after 50 Mrad radiation exposure.

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION

LOCA & MSLB

Sequential Test

QUALIFICATION DOCUMENTS

LOCA & MSLB

Franklin Institute Research Laboratories (FIRL), Test Report F-C4539

QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS

LOCA & MSLB

A. Deficiencies:

1) Valves were not subjected to a chemical spray

2) Radiation exposure during test is below accident dose of 4.2×10^7 rads plus 40 yr dose of 3×10^7 rads.

3) Time, temperature envelope is not adequate.

B. Solutions:

1) Valves not subject to spray since valves will have performed their intended function prior to initiation of spray.

2) Replace valves inside the crane wall prior to 10.67 yr exposure. Take radiation reading for rate of dose during plant operation. These measurements will provide a more accurate exposure rate.

3) SOV will perform its function within 60 sec of receiving signal and will not misoperate if SOV fails due to temperature.

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-10/1010

Nuclear Steam Supply System

Westinghouse Electric Corp.

Solenoid Operated Valves

LCV-1460A,B - Letdown Line Loop 1 & 2
LCV-2460A,B - Letdown Line Loop 1 & 2

TV-1842 - Containment Isolation
TV-2842 - Containment Isolation

HVC-1201- Excessive Letdown Hx Outlet
HVC-1201- Excessive Letdown Hx Outlet

ASCO HT-831654

Inside Containment

DESCRIPTION OF ENVIRONMENT

Loss of Coolant Accident (LOCA)

260°F	0-30 min
Reduce from 280°F to 150°F	30-60 min
150°F	>60 min
45 psig	0-30 min
Reduce from 45 to 0 psig	>60 min

7.2×10^7 rads (1)

Spray: 0.4 hr solution of boric acid (2000-2100 ppm boron) buffered to a pH of 8.5 to 11 with NaOH
>4 hr similar solution with a pH of 7 to 9.

Main Steam Line Break (MSLB)

430°F	0 to 2 min
280°F	2 to 60 min
150°F	>60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	>60 min

3×10^7 rads

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

LOCA & MSLB

None

OPERABILITY REQUIREMENTS

120 days @ 150°F

OPERABILITY DEMONSTRATED

None

ACCURACY REQUIREMENTS

Not required

MANNER OF QUALIFICATION	QUALIFICATION DOCUMENT	QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS
LOCA & MSLB	LOCA & MSLB	LOCA & MSLB
None	None	A. Deficiencies: No qualification B. Solutions: Westinghouse Electric Corp. Refer to NS-CR-755, dated August 15, 1975 "Fail Mode Analysis for Safety-related Solenoid Valves in an Accident Environment" submitted to NRC.

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-10/1010

Nuclear Steam Supply System

Westinghouse Electric Corp

RCS Temp
Wide Range RTD

TE- 1410 2410
TE- 1413 2413
TE- 1420 2420
TE- 1423 2423
TE- 1430 2430
TE- 1433 2433

Rosemount 176KS

Inside Containment

DESCRIPTION OF ENVIRONMENT

Main Steam Line Break (MSLB)

430°F	0 to 2 min
260°F	2 to 60 min
150°F	>60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	>60 min

3×10^7 rads

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

MSLB

>320°F @ 66 psig

Radiation 1×10^8 rads

OPERABILITY REQUIREMENTS

Two weeks post MSLB

OPERABILITY DEMONSTRATED

Two weeks post MSLB

ACCURACY REQUIREMENTS

±0.2%

ACCURACY DEMONSTRATED

±0.2%

MANNER OF QUALIFICATION

MSLB

Comparison to
Rosemount 176KF

QUALIFICATION DOCUMENT

MSLB

WCAP-9157

QUALIFICATION DEFICIENCIES
AND RECOMMENDED SOLUTIONS

MSLB

A. Deficiencies

1) Qualified to > 320°F peak
Temperature is 430°F

B. Solutions:

1) In accordance with 79-01B
"Guidelines for Evaluating
Environmental Qualification",
page 7, paragraph 4.2.1
"Equipment qualified for a LOCA
environment is qualified for a
MSLB environment . "

EQUIPMENT DESCRIPTION & MARK NO.

P.O. NA-10/1010

Nuclear Steam Supply System

Westinghouse Electric Corp.

RCS Temp
TE- 1412 B, D
TE- 1422 B, D
TE- 1432 B, D
TE- 2412 B, D
TE- 2422 B, D
TE- 2432 B, D

Rosemount 176KF

Inside Containment

DESCRIPTION OF ENVIRONMENT

Main Steam Line Break (MSLB)

430°F	0 to 2 min
280°F	2 to 60 min
150°F	>60 min
45 psig	0 to 30 min
Reduce from 45 to 0 psig	30 to 60 min
0 psig	>60 min

3×10^7 rads

ENVIRONMENT TO WHICH EQUIP. IS QUALIFIED

MSLB

>320°F @ 66 psig

Radiation: 1×10^8 rads

OPERABILITY REQUIREMENTS

30 sec Post MSLB

OPERABILITY DEMONSTRATED

30 sec Post MSLB

ACCURACY REQUIREMENTS

±0.2%

ACCURACY DEMONSTRATED

± 0.2%

MANNER OF QUALIFICATION

Test - Sequential

QUALIFICATION DOCUMENT

MSLB

WCAP-9157

QUALIFICATION DEFICIENCIES AND RECOMMENDED SOLUTIONS

MSLB

A. Deficiencies:

Qualified to [illegible]°F, peak temperature is 430°F

B. Solutions:

In accordance with 79-01B "Guidelines for Evaluating Environmental Qualification", page 7, paragraph 4.2.1, "Equipment qualified for a LOCA environment is qualified for a MSLB environment...."