

ENVIRONMENTAL QUALIFICATION OF SAFETY-RELATED

ELECTRICAL EQUIPMENT

IEB 79-01B

TECHNICAL EVALUATION REPORT

CALVERT CLIFFS 2

DOCKET NO. 50-318

DATED: November 12, 1980

Licensee: Baltimore Gas and Electric Company

Type Reactor: PWR, Combustion Engineering

Size: 845 MWe

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## 1. INTRODUCTION

### 1.1 General

The NRC Office of Inspection and Enforcement (I/E) issued Bulletin 79-01B, "Environmental Qualification of Class 1E Equipment" in January 1980. This bulletin required the licensee to perform a detailed evaluation of the environmental qualification on Class 1E electrical equipment required to function under postulated accident conditions and to submit a report on this action.

This document is a report on the evaluation of the licensee's response to this bulletin.

## 2. BACKGROUND AND DISCUSSION

### 2.1 General

The evaluation of the licensee's response was accomplished by performing an on-site inspection of selected class 1E equipment and by examining the licensee's report for completeness and technical accuracy. The licensee's report used in this evaluation is dated October 31, 1980, and therefore, does not include the response to the bulletin supplement which was issued on 9/30/80 in the form of Generic Questions and Answers

### 2.2 On-Site Verification Inspections

The on-site inspection, made on selected IE equipment, verified proper installation of equipment, overall interface integrity, and manufacturers nameplate data. The manufacturer and model number from the nameplate data was compared to information given in the Component Evaluation Work Sheets (CES) of the licensee's report.

If any discrepancies were noted between the installed equipment and the correspondence equipment addressed in the licensee's report, they are referenced in Section 4.8 of this report. The site inspection is documented by Report Number IE 50-318/80-18.

### 2.3 Evaluation of Licensee's Report

Each component as addressed on the Component Evaluation Work Sheets (CES) of the licensee's report was examined for completeness and accuracy to the criteria given in the bulletin. This examination assumed qualification documents (analysis, test reports, etc.) referenced by the licensee in their submittal are acceptable.

The results of this examination are documented in Appendix B.

### 3. General Information

#### 3.1 Identification of Class 1E Electrical Equipment

The licensee's list of systems was compared to the systems list issued by the Environmental Qualification Branch (EQB) and discussed in Section 4.1 of this report.

It is recognized that there are differences in nomenclature of systems because of plant vintage and engineering design, therefore, many of these systems may not exist or have different titles. These differences will be addressed in the Safety Evaluation Report (SET) that will be prepared for this site.

#### 3.2 Service Conditions

The service condition accident environment, HELB/LOCA inside containment and HELB outside containment are indicated or discussed in the licensee's report and are based on the FSAR accident analysis and Section 4.3 of this report.

#### 3.3 Qualification Documentation

Appendix A is a list of documents (test reports, analysis, letters, etc.) used by the licensee in determining the environmental qualification of plant equipment for Calvert Cliffs Nuclear Power Plant, Unit 2. These references have been tabulated by the licensee and are indicated on the applicable CES of their report.

### 4. Technical Evaluation

The basis for the technical evaluation is the information provided by the licensee, Baltimore Gas and Electric Company, for the Calvert Cliffs Unit 2 and the inspection of the as-installed equipment of the Compressed Air System which is located outside the containment. (IE Inspection Report 50-318/80-18.

Utilizing the information identified above<sup>2</sup>, the reviewer assessed its adequacy in relation to the DOR guidelines<sup>6</sup>, NUREG 0588, and the supplements<sup>4</sup> to IEB 79-01B which provides the Commission's requirements and staff positions.

The quality control measures utilized by the licensee included using experienced consultants to perform the tasks required by IEB 79-01B. Independent technical overview of each part of the effort was performed by the licensee's engineering staff. In addition, an extensive review of the final response and sign-off approvals by various levels of the licensee's engineering management was required.

#### 4.1 Identification of Safety-Related Equipment

The licensee reviewed their documentation to establish the systems required to achieve a safe shutdown or provide isolation for the events identified in IEB 79-01B. These systems were then evaluated against the DOR guidelines. The systems identified and included in the evaluation are:

1. Chemical and Volume Control
2. Compressed Air (isolation valves only)
3. Condensate and Feedwater
4. Containment Air Recirculation and Cooling
5. Cooling Water
6. Electrical
7. Main Steam
8. Nuclear Heating
9. Plant Heating (isolation valve only)
10. Radiation Monitoring
11. Reactor Coolant
12. Reactor Coolant and Waste Process Sample (isolation valves only)
13. Safety Injection and Containment Spray
14. Sampling (isolation valves only)
15. Ventilation
16. Waste Processing (isolation valves only)

The list of systems including those that were excluded was provided to the Equipment Qualification Branch (EQB). The EQB compared the list to a "Q" list developed by the staff<sup>2</sup> and to the lists provided by similar facilities to determine the completeness of the licensee's response.

Based on the information provided by the licensee and the reviewers comparison<sup>2</sup>, it has been determined that the systems identified are within the guidance provided in Section 3.0 and Appendix A of the DOR Guidelines and are acceptable with this exception.

##### 1. "Q" List

The acceptability of the licensee's list in paragraph 4.1 will be evaluated by the Equipment Qualification Branch (EQB) and addressed in the Safety Evaluation Report (SER) to be issued by February 1980.

#### 4.2 Master List

The licensee developed a master list based on their system evaluation as required by IEB 79-01B. The licensee's 90 day response includes a list of references which provided the basis for including or excluding specific components/equipment from having a detailed data work sheet as required by IEB 79-01B.

The reviewer has reviewed the supporting basis for the inclusion or exclusion of equipment provided in the references and have concluded that References dated March 6, 1980 and May 27, 1980 are acceptable except as noted in 4.1.

#### 4.3 Service Condition

##### 4.3.1 Inside Containment LOCA

The licensee provided temperature and pressure values for the Calvert Cliffs Nuclear Power Plant Unit 1 containment resulting from a LOCA. The licensee's 90 Day Response Report listed the maximum environments, but no profiles. These values are listed below:

Temperature:	276 <sup>o</sup> F
Pressure:	50 PSIG
Humidity:	100% R.H.
Chemical Spray:	1,700 PPM Boric Acid Solution
Radiation:	1 x 10 <sup>8</sup> Rads

The delay time from the event to the initiation of safety injection for the spectrum of breaks is indicated in their FSAR profiles figures 14.16-4 and 14.16-6. The licensee stated in their FSAR that the service conditions in the containment will return to the levels that existed prior to the event in less than 30 minutes.

##### 4.3.1.1 Radiation

The 1 x 10<sup>8</sup> Radiation requirement listed by the licensee meets the DOR guidelines, Section 4.1.2. The radiation levels calculated by the licensee are listed in the environmental charts of the licensee submittal<sup>3</sup>.

The reviewer has concluded that the radiation levels assigned by the licensee are within the staff's position in relationship to the second supplement<sup>4</sup> to IEB 79-01B.

##### 4.3.1.2 Submergence

The licensee<sup>3</sup> identified the components that are below the maximum expected flood level in containment, its location elevation, and their proposed action for each item. The components listed below the flood level (16' - 4") are listed in Appendix B of this report.

#### 4.3.1.3 Chemical Spray

The licensee stated that no chemical solutions are used in systems required for the accidents presently under consideration. The consideration of chemical sprays is included in Section 4.9 of this report.

#### 4.4 High Energy Line Breaks (HELB)

##### 4.4.1 HELB Inside Containment

The licensee has included the HELB and LOCA values as part of their data submittal<sup>5</sup> of October 31, 1980.

##### 4.4.2 HELB Outside Containment

The licensee is performing an analysis of the area outside containment and will present the results of their evaluation in the November 1, 1980 submittal.

The acceptability of the licensee's basis for specific equipment subjected to HELBs outside of containment cannot be evaluated at this time. It is expected that a complete review will be made after the November 1, 1980 data submittal has been completed by the licensee.

##### 4.4.3 Recirculated Fluids

The licensee indicated that both LOCA and HELB environments including areas where fluids are recirculated from inside containment to accomplish long-term cooling following a LOCA have been listed in their April 23, 1980 submittal<sup>1</sup>. An up-date was included in<sub>3</sub> the May 22, 1980 submittal<sup>10</sup> and October 31, 1980 submittal<sup>3</sup>.

#### 4.5 Margins

The DOR Guidelines indicate that special consideration was given to the time required to remain functional when establishing the criteria in Section 5.2 of the guidelines.

The normal operating temperature inside containment is approximately 120°F and the profiles indicate that the temperature returns to 120°F within 27.7 hours of the event. NUREG-0588, Section 3(4), requires that a type test be for a minimum of 1 hour in duration when the functional requirement is within the first seconds or minutes of an event and the DOR guidelines, Section 5.2, requires that the test duration be at least as long as the period from initiation until the service conditions return to the level that existed prior to the event.

Therefore, any type test that exceeds the functional operability time by 1 hour or longer meets the requirements defined in NUREG-0588 and the DOR guidelines for margin in relation to test duration for this facility.

The other consideration identified in the DOR guidelines in relation to the methods of qualification, other than identified specifically in this report will be addressed in the Safety Evaluation Report (SER) which will incorporate an audit of selected analysis and test reports identified in Appendix A.

#### 4.6 Aging

The licensee indicated that a study of the components subjected to harsh environments is still an outstanding item.<sup>3</sup> Details of the licensee's effort is included in their submittal.

The licensee has identified the components which are still listed as requiring data.

The DOR guidelines, Section 7, does not require a qualified life to be established for all safety-related electrical equipment, however, the following actions are required:

1. Detailed comparison of existing equipment to the materials identified<sup>4</sup> in Appendix C of the DOR guidelines. The first supplement<sup>4</sup> to IEB 79-01B requires the licensees to utilize the table and identify any additional materials as the result of their effort.
2. Establish an ongoing program to review surveillance and maintenance records to identify potential age related degradations.
3. Establish component maintenance and replacement schedules which include considerations of aging characteristics of the installed components.

The licensee has stated that the aging study is still in progress<sup>10</sup>.

We therefore, require that the licensee provide the details of a program which will include a continuing effort to obtain data on existing materials and address the actions identified above. In addition, we require the licensee provide a schedule for implementation of the program that identifies problem components.

#### 4.7 Documentation

The second supplement<sup>4</sup> to IEB 79-01B and the order<sup>5</sup>, No. CLI-80-21, requires the licensee have the documentation and data identified in the detailed worksheets which supports the qualification of the

safety related electrical equipment available for NRC audit. The second supplement identifies the type of information required and the locations where the records are to be maintained. The licensee has provided a response to the order and supplement which discusses their compliance and identifies any deviations, reference Appendix B of this report.

#### 4.8 Site Verification Inspection

An inspection of the installed components associated with the Compressed Air System was conducted on October 27-29, 1980, at the Calvert Cliffs 2 facility. The details of this inspection are documented in IE Inspection Report 50-318/80-18. The detailed identification of the components and the observations recorded will be addressed in the SER which will incorporate an audit of selected analysis and test reports identified in Appendix A.

#### 4.9 Equipment Data Review

The equipment listed in Appendix B is the status of the latest data submitted by the licensee in their response to IEB 79-01B. Appendix B identifies the licensee data in a format that allows the reviewer a quick look status of each listed component. The first four columns are self explanatory while the next three columns are defined as follows:

- Environment - The listing in this column identifies the environment that appears to have some question as to whether or not its in noncompliance with the requirements of the licensee.
- Category - As listed below a Category I through V has been assigned to the environment for a specific component or group of components as listed.
- Remarks - The remarks column was used to identify the environmental condition associated with the category number, or identify the system location when the licensee indicated that data was being looked for or an analysis was in progress. An example of this lack of data environment information in the licensee submittal is the requirement for aging.

The equipment has been listed and identified in one of the following categories:

- I Qualified for Plant Life
- II Qualified With Restrictions
- III Exempted From Qualification
- IV Qualification of Equipment Unresolved, and
- V Equipment Not Qualified

The number in the ( ) in the component block on the table indicates the number of identical components listed, but may have a different title within the report.

#### 4.10 Conclusion

This evaluation is based on the on-site inspection, the information supplied by the licensee in their IEB 79-01B submittal, their FSAR, and the assumption that the Qualification Documentation (Test Reports, Analysis, Letters, etc.) are acceptable.

The Region I reviewer using the guidance<sup>9</sup> and instructions<sup>8</sup>, for the evaluation of licensees data submittals and the site verification inspections that were performed to verify the IE Bulletin 79-01B, January 1980 data, submittal information, finds the licensee to be in accordance with the NRC direction<sup>4,5</sup> except as listed in Appendix B and C of this report.

The results of this evaluation does not necessarily imply that the equipment is unreliable, unsafe or represents a significant safety issue; it does imply that additional information is required and that the items in Appendix B and C will be evaluated by the Equipment Qualification Branch (EQB) and addressed in the Safety Evaluation Report (SER) to be written for this license by February, 1981.

#### 5. Licensee Event Reports (LERs)

No licensee event reports were submitted by the licensee, associated with their evaluation of IEB 79-01B, as of October 31, 1980.

#### 6. References

1. IEB 79-01B, Memo to V. Thomas (NRC) from A. Finkel (NRC) dated August 18, 1980.
2. EQ Branch Comparison of systems and parameters. (Systems List CE PWR)
3. Baltimore Gas and Electric Company, Revised and Updated Response to IEB 79-01B, dated October 31, 1980.
4. Supplement Information to IEB 79-01B, dated February 29, 1980, and September 30, 1980 and October 24, 1980.
5. Order requiring licensees implement requirements of Commission Memorandum and Order of May 23, 1980 (CLI-80-21).
6. Division of Operating Reactors (DOR), "Guidelines for Evaluating Environmental Qualification of Class IE Electrical Equipment in Operating Reactors", Enclosure 4 to IEB 79-01B.
7. NUREG-0588, "Interim Staff Position on Environmental Qualification of Safety Related Electrical Equipment", dated December 1979.

8. Inspection Requirements for Verifying Reactor Licensee Responses to IE Bulletin No. 79-01B, dated April 25, 1980.
9. IE Support and Review of Environmental Qualification of Electrical Equipment at Operating Reactors, dated October 10, 1980.
10. Baltimore Gas and Electric Company, Responses to IEB 79-01B dated March 3, 1980, March 5, 1980, April 17, 1980, May 22, 1980 and October 31, 1980.

APPENDIX

A

Test Reports and Analysis References

1. Masoneilan Simulation LOCA Test Report
2. Specification M-293
3. Correspondence with TATE Engineering 4-29-80, 5-19-80  
(Radiation = 200 E + 6)
4. FSAR Section 5 and 14.15 for LOCA
5. Radiation Zones Reference Drawings A-105 and 106
6. NO/FC Technical Specification 3/4.6.4
7. ASCO Test Report AQS-21678/TR
8. Reactor Shielding Design Manual; Table 10.1
9. Limitorque Test Report 600456 12-9-75
10. FSAR 10A.1-16 Main Steam Line Break
11. F and P Test Report 2204-51-8-006 12-68; Seismic 9-71
12. FIRL Test Report F-C2815 5-70; c of c 9-71, 10-71 and 11-71
13. American Air Filter Co. Test Report 4-7-73
14. Mechanical Calculation 8-2-5, Temperature = 120<sup>o</sup>F
15. FIRL Test Report F-C2525 10-69
16. FIRL Test Report F-C4350 7-76
17. Okonite Summary of FIRL Test Report 5-77
18. BIW Test Report No. 9299 11-72
19. FIRL Test Report F-C2935
20. BIW Test Report No. 73C212
21. FIRL Test Report F-C2750 3-70
22. FIRL Test Report F-C2442 4-69
23. FIRL Test Report F-C2781 3-70
24. Hatfield Report 2-70
25. ETD Report No. 16024
26. Amphenol Sams Test Report No. 123-1252 6-74
27. Reference E-406 Design and Construction Standard
28. FSAR 10A.3-4 Rev Tmax of 212<sup>o</sup>F with/SG Building Line Break
29. F&P Radiation Summary Report DP2224-1 #004 11-73
30. GULF Test Report E115-138 12-71 and c of c 10-4-71
31. Bechtel Letter 5-22-73; Velan c of c 5-2-73
32. Seismic Calculation 12-18-69
33. G.E. Performance Data 7-8-69

APPENDIX

B

Equipment Status References

The following notes are referenced in the remarks column of the equipment status listing.

- NOTES:
1. Fisher and Porter Transmitters - will be replaced due to the difficulty in obtaining the replacement parts required to maintain the qualification of this equipment. To be completed during the Unit 1 Cycle 6 and Unit 2 Cycle 5 refueling outages.
  2. Asco Solenoid Valves - valves for which adequate documentation does not exist will be replaced with fully qualified valves. To be completed during the 1980 refueling outage.
  3. Raychem Cable - require further information on humidity from vendor. To have resolved by January 1, 1981.
  4. Amphenol Connectors - Evaluating qualification test program. To be completed by June 1, 1982 concurrent with nuclear instruments.
  5. Bendix Connectors - Evaluating qualification test program. To be completed by June 1, 1982 concurrent with nuclear instruments.
  6. ITT Cannon Connectors - Evaluating qualification test program. To be completed by June 1, 1982 concurrent with nuclear instruments.
  7. Kings Connectors - Evaluating qualification test program. To be completed by June 1, 1982 concurrent with nuclear instruments.
  8. Republic/Teledyne Solenoid Valves - Require further information from vendor on temperature and radiation. To be resolved by January 1, 1981.
  9. Westinghouse Fission Chambers - C-E users group evaluating new component design.
  10. Westinghouse Radiation Monitor - Require further information from vendor. To have resolved by January 1, 1981.
  11. Rosemont RTD - Cannot obtain sufficient qualification data. To be replaced during the Unit 1 Cycle 6 and Unit 2 Cycle 5 refueling outages.
  12. Dragon Solenoid Valve - Cannot obtain sufficient qualification data. To be replaced next scheduled outage after January 1, 1981.

The licensee stated that records and test data concerning the environmental qualification of Class 1E electrical equipment are being maintained separate from the Plant History File.

Component	Ident.	Part/Serial	Containment		Environment	Category	Remarks
			IN	OUT			
Containment Sump Level	-	2LT4144 2LT4145	x x		All All	V	Unit 2: Same as Unit 1 13' - 1" (Below water level)
Pressurizer 21 Vapor Sample Pressurizer 21 Liquid Sample	-	2SV5465 2SV5466	x x		All All	V	Unit 2: Same as Unit 1 13' - 0" and 13' - 9" (Below water level)
Reactor Coolant Hot Leg RCP Bleed Containment	- -	2SV5467 2SV506	x x		All All	V V	Unit 2: Same as Unit 1 14' - 6" Unit 2: This valve closes in less than 7 second on STAS actuation. This valve fails closed and is not required to operate post LOCA. 14' - 0" (Below water level)
Wide & Power Range Channels	-	2N1001 2N1010	x				Unit 2: Same as Unit 1 (Below water level)
Cable Tray	-	ZD2CF08	x		Submergence Test	IV	Unit 2: Test Required. 11' - 0" (Below water level)



Component	Part #	Part # (Ref)	Cont: In Comp	Inventorment	Category	Remarks
Radiation Panel (3) QIB (15)	Max Temp House 30-count	1101	IN	ATT	IV	Note 10
		1645RH	X	Time Aging Radiation	IV IV IV	Note 11
Pressure Transmitter (14)	Chamber/Porter	530-1000	X	Time Aging	IV IV	Note 1
Motor 4KV 200 HP	4115- Chalmers	311R- 301V5	X	Time Aging Radiation	IV IV IV	No data available No data available Licensee to establish schedule for data submittal.
Motor 4KV 400 HP (2)	GE	50B11052	X	Time Aging	IV IV	No data available Licensee to establish schedule for data submittal
PCV 400V 6.6HP	Limitorque	SMB-3- 100	X	Time Aging	IV IV	No data available No data available

Component	Manuf.	Part/Serial	Containment		Environment	Category	Remarks
			IN	OUT			
MWP Following Models	Lindorpec	SBB-2-50-000 SBB-00-10 SBB-00-25 SBB-0-40 SBB-1-60 SBB-00-5			Time Aging Radiation	IV IV IV	Flow and Aging data for the listed MWP are outstanding None.
Solenoid Valve (7)	Dragon	10222		X	Time Aging	IV IV	Not Identified } Note 12 Analysis being performed
Solenoid Valve (7)	Dragon	10222	X		Time Temperature Radiation Aging	IV IV V IV	Not Identified } Note 12 Margin Problem - Requirement 276°F, tested at 275°F Rad Req. 1 x 10 <sup>18</sup> ; Qual test at 1 x 10 <sup>17</sup>
Flow ZHR	Fischer/Porter	1382495		X	Time Aging	IV IV	Not Identified

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Component	Manuf.	Part/Serial No.	Cont. Stat.		Fusion	Fatigue	Remarks
			HI	OUT			
Solenoid Valve (4)	ASCO	MPR315	X	X	Time	IV	Note 2
Motor 480V 1HP (2)	Reliance	P14G10	X	X	Time Aging	IV	Requirements Not Identified
Motor 120V 0.2HP (2)	Johnson	981AA-2	X	X	Time Aging	IV IV IV IV	
Heater 450W 750W (2)	Westinghouse	ERS	X		Time Aging	IV IV	Requirements Not Identified
120V 500W 2-GHP	Pratt	TN2000-3	X		Time Aging Temperature	IV IV IV	Requirements Not Identified
Motor 480V 3HP	GE	FJF	X		Time Temperature P.H. Aging	IV IV IV IV	Requirements Not Identified

Component	Mfr.	Part/ Serial NO.	Containment		Environment	Category	Remarks
			IN	OUT			
Cable	Anacosta	--	X			IV	Time and Aging requirements are to be established and identified by the licensee for the listed cables.  Note 1 applies to the Raychem Cable. Require schedule for Completion From Licensee
	Glennite	--	X			IV	
	Saychem	--	X			IV	
	Boston	--	X			IV	
	Continental	--	X			IV	
	Cerro	--	X			IV	
	Kerflite	--	X			IV	
	Levils	--	X			IV	
	Rockbestos	--	X			IV	
Terminal Block	Westinghouse	542247	X		Aging Radiation Time	IV IV IV	Time and Aging to be defined. Radiation requirement is $1 \times 10^4$ . Tested at $1.4 \times 10^6$ . Ref. Reactor Shield Design Table 10.1
Terminal Block	Durham-AN	B112	X		Time Aging	IV IV	To be identified by licensee. Require schedule for Completion From Licensee
Connector	Amphenol ITT Kings	279-75 19457 XII5905	X X X			IV IV IV	Note 1 - Time and Aging Environments Not Listed.

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Component	Mfg.	Part/Serial No.	Containment		Environment	Category	Remarks
			IN	OUT			
Junction Boxes	Hoffman	139/B	X		All	IV	Not Tested, For later In Age Tests only.
Solenoid Valve (10)	ASCO	6323 Series	X		Aging	IV	Requirement Not Identified.
Limiting 40W 1/3 HP	--	SM-008-5	X		Aging	IV	Requirement Not Identified.
Motorque 40W/3HP (2)		SHB-2-60	X		Aging Time	IV IV	Requirements Not Identified
Level Transmitter (6)	Fischer/Porter	1302435	X		Time Radiation Aging	IV V IV	Requirements Not Identified Qual Requirement $1 \times 10^9$ , tested at $0.82 \times 10^6$ Note 1 Study being performed

Component	Manuf.	Part/Serial	Contaminant	Inspection	Category	Remarks
Solar 4959 /SIP (4) Polar 4909 12-5IP (4)	Pollance Pollance	X32415 6A6AM X32377	Oil X X	Time Angle Time Angle	IV IV IV IV	Not Identified Study being performed Not Identified Study being performed
Solenoid Valve (2)	ASCO	R102240 B120676	X	Time Temperature Radiation Angle	IV V IV IV	Not Identified Qual Recurrence of 212ur, tested at 1:00P Note 2 Not Identified Study being performed

APPENDIX

C

Licensee Exceptions

The following licensee response addresses the safety related equipment located in harsh environments including that required for cold shutdown. "The non-safety related additional cold shutdown equipment located in harsh environments and the safety related equipment installed as a result of the TMI Action Plan will be submitted by February 1, 1981 as directed in IE Bulletin No. 79-01B Supplement No. 3".