

ENVIRONMENTAL QUALIFICATION OF SAFETY-RELATED

ELECTRICAL EQUIPMENT

IEB 79-018

TECHNICAL EVALUATION REPORT

MAINE YANKEE ATOMIC POWER COMPANY

DOCKET NO. 50-309

DATED:

Licensee: Maine Yankee Atomic Power Company

Reactor: PWR, Combustion Engineering

Rating: 2630 MW Thermal

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1. INTRODUCTION

1.1 General

The NRC Office of Inspection and Enforcement (I/E) issued Bulletin 79-018, "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, 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 1E 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 Environmental Qualification Worksheets 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 50-309/80-14.

2.3 Evaluation of Licensee's Report

Each component as addressed on the Environmental Qualification Worksheets 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 Equipment 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 (SER) 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 Maine Yankee Atomic Power Company. These references have been tabulated by the licensee and are indicated on the applicable Environmental Qualification Worksheets of their report.

4. Technical Evaluation

The basis for the technical evaluation is the information provided by Yankee Atomic Electric Company (YAEC) in their submittal³ YAEC-1229, dated October 31, 1980, for the Maine Yankee Atomic Power Company and the verification inspection of the as-installed equipment of the Main Steam System, High Pressure Safety Injection System and Containment Spray System. The installation verification consisted of an inspection of components located outside primary containment that could be exposed to a harsh environment and documented by IE Inspection Report 60-309/80-14.

Utilizing the information identified above, the reviewer assessed its adequacy in relation to the DOR guidelines⁵, NUREG 0588⁷, and supplements⁴ to IEB 79-018 which provides the Commission's requirements and staff positions.

4.1 Identification of Safety-Related Equipment

The licensee reviewed his documentation to establish the systems required to achieve a safe shutdown or provide isolation for the events identified in IEB 79-018. These systems were then evaluated against the DOR guidelines. The systems identified and included in the evaluation are:

1. Auxiliary Feedwater System
2. Chemical and Volume Control
3. Containment Air Activity Sampling System
4. Containment Air Recirculation System
5. Containment Leak Monitoring System
6. Containment Spray System
7. Emergency Power System
8. Feedwater System
9. Fire Protection System
10. Heating Ventilation and Air Conditioning System
11. High Pressure Safety Injection System
12. Low Pressure Safety Injection System
13. Main Steam System
14. Post-Accident Monitoring System
15. Primary Containment Cooling System
16. Primary Sampling System
17. Primary Vent and Drain System
18. Reactor Coolant System
19. Secondary Component Cooling System
20. Service Water System

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 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, the reviewer has determined that the systems identified are within the guidance provided in Section 3.0 and Appendix A of the DOR Guidelines². However, because the licensee has identified systems and components, it does not necessarily mean the licensee intends to qualify those systems and components.

The licensee has provided a Master List of safety-related electrical equipment normally available for accident mitigation and bringing the plant to cold shutdown status. The Master List is based on the systems identified above, which originates from Table I.1 of the submittal³ and identifies the electrical equipment which is required to function under postulated accident conditions. Equipment is identified as such by a reference to Appendix II of the submittal³, environmental qualification worksheet. Electrical equipment

identified as not being required to function under postulated accident conditions have a note reference instead of an environmental qualification worksheet. The notes are defined as follows:

- (1) Required to function under non-harsh environmental conditions.
- (2) Not required to function for any accident.
- (3) Not required to function for the accident producing the harsh environmental conditions.

Additionally, the licensee has identified other safety-related electrical equipment that will not have an environmental qualification worksheet because:

- (1) The equipment is not required for mitigation of design basis accidents; however, it is used to maintain Tech Specs prior to an accident.

The reviewer identified safety-related electrical equipment that the licensee identified in the submittal as not requiring environmental qualifications. The licensee's justification for not qualifying specific electrical equipment are:

- (1) Required to function under non-harsh environmental conditions.
- (2) Not required to function for any accident.
- (3) Not required to function under the harsh environmental conditions of that accident.
- (4) This is required per TMI Lessons Learned; however, it is under evaluation.
- (5) Not required for mitigation of design basis accidents; however, it is used to maintain Tech Specs prior to an accident.

Examples of safety-related equipment not requiring environmental qualification are

- (1) High Pressure Safety Injection System

Safety injection tank instruments located inside containment. Pressure transmitters (3), pressure switches (6), level transmitters (3) and level switches (6).

(2) Main Steam System

Steam generator pressure inputs to the Reactor Protection System. Pressure transmitters (12). ¹⁰These transmitters were identified in the May 1980, submittal ³to be environmentally qualified. The October 1980, submittal ³ indicates the transmitters are "Not required to function under the harsh environmental conditions of that accident" and will not be environmentally qualified.

Main Steam line dump valves to atmosphere (18).

(3) Reactor Coolant System

Reactor coolant flow inputs to Reactor Protection System. Pressure transmitters (12).

Thermal margin inputs to Reactor Protection System. Temperature elements.

Pressurizer spray control valves (2).

The following systems and components located inside containment have not been identified by the licensee in his submittal ³. The reviewer has evaluated the systems and components against the DOR guidelines and there appear to be omissions of data. They are:

- (1) The Compressed Air System.
- (2) Reactor Coolant System pressurizer power operated relief valves (PORV).
- (3) Containment Air Recirculation System dampers.

The above specific examples identified by the reviewer will be evaluated by the Equipment Qualification Branch (EQB) and addressed, if applicable, in the Safety Evaluation Report (SER) to be written for this facility. (Qualification of Equipment Unresolved, Category IV)

4.2 Master List

The licensee developed a master list based on their system evaluation as required by IEB 79-018. The licensee's submittal ³ provided the basis for including specific components/equipment detailed data work sheets as required by IEB 79-018.

The reviewer has reviewed the master list for the inclusion of equipment and has the following comment:

The licensee's submittal³ does not identify terminal lugs, cable splices, instrument and terminal box sealant material, terminal boxes, penetration connection boxes, rigid conduit, and flexible conduit.

The above components identified by the reviewer will be evaluated by the EQB and addressed, if applicable, in the SER to be written for this facility. (Qualification of Equipment Unresolved, Category IV)

4.3 Service Condition

4.3.1 Inside Containment LOCA

The licensee provided temperature and pressure profiles for the Maine Yankee containment resulting from a LOCA. The reactor containment temperature and pressure profiles, Figures III.1-1 and III.1-2 of their submittal³, are based upon a re-analysis of the LOCA and Main Steam Line Break (MSLB) performed by Combustion Engineering during the uprating of Maine Yankee to 2630 MW thermal. The temperature and pressure profiles for the new LOCA, in these figures, do not return to the operating conditions specified before the LOCA.

The LOCA temperature and pressure profiles prior to Maine Yankee's uprating are also shown in Figures III.1-1 and III.1-2. These profiles were obtained from Maine Yankee FSAR Figures 14.15-2 and 14.15-3. The maximum environments identified are:

Temperature:	278°F
Pressure:	54 PSIG
Humidity:	100%
Chemical Spray:	1720 PPM Boron as H_3BO_3 1 pH = 9.5
Radiation:	Maximum not stated

The delay time from the event to the initiation of safety injection for the spectrum of breaks is indicated in FSAR Section 14.15-2.

4.3.1.1 Temperature and Pressure Profiles

The temperature and pressure profiles for the new LOCA, Figures III.1-1 and III.1-2 of the submittal³, extend only 100 seconds into the accident.

The reviewer has concluded that the above information is incomplete.

4.3.1.2 Radiation

The licensee does not state a maximum radiation dose in the submittal³. The radiation dose values for the equipment have been identified in the equipment qualification worksheets. The licensee basis for determining the radiation doses to equipment required to function during and after a LOCA have been calculated in accordance with Supplement #2 of the IES 79-01B and the DOR Guidelines.

The reviewer will address equipment in Section 4.9 of this report that do not meet the radiation doses required by the guidelines.

4.3.1.3 Submergence

The licensee identified the flood level as 1.7 feet. The acceptability of the licensee's basis for specific equipment subjected to submergence is included in Section 4.9 of this report.

4.3.1.4 Chemical Spray

The licensee identified the requirement for the containment sprays to be at least 1720 ppm boric acid solution. This requirement is contained in the Maine Yankee Technical Specifications, Section 3.6. The consideration of sprays is included in Section 4.9 of this report.

Subsections 4.3.1.1, 4.3.1.2, 4.3.1.3 and 4.3.1.4 above contain unresolved items and are considered: (Category IV, Qualification of Equipment Unresolved).

4.4 High Energy Line Breaks (HELB)

4.4.1 HELB Inside Containment

The Maine Yankee facility has an automatic containment spray system. The DOR Guidelines³, Section 4.2.1, indicates that LOCA qualified equipment inside containment is acceptable for HELBs if the automatic spray system is not subject to disabling single component failures.

The reviewer performed a single failure evaluation of the containment spray system. It appears that the system is not subjected to a disabling single component failure in accordance to the requirements of the DOR Guidelines³, Section 4.2.1, and that the LOCA qualified equipment inside containment is acceptable for HELBs.

However, the MSLB temperature profile, Figure III.1-1 of the submittal³, indicates a peak temperature of approximately 340°F. Because this peak is of such short duration, 100 seconds, the licensee considered the effect on equipment qualification as minimal.

4.4.2

HELB Outside Containment

The licensee's May 1980, submittal¹⁰ indicated that "Supplemental Report on Effects of Postulated Break in a High Energy Piping System Outside the Containment," September 1973, provide the results of their review of high energy line breaks. The submittal¹⁰ indicated that the environmental radiations had no adverse effect on safe shutdown of the plant in all cases analyzed.

However, the licensee's October 1980, submittal³ Appendix III notes:

"Because of preliminary results from recent HELB and Heat-up studies, many areas previously believed to be non-harsh have now been determined to be harsh. The impact on equipment qualification has yet to be fully analyzed and resolved."

The specific equipment where this applies is included in Section 4.9 of this report as: (Category IV, Qualification of Equipment Unresolved.)

Appendix III of the submittal contains the environmental service conditions under which certain safety-related electrical equipment is required to function. The following sections of Appendix III address the various HELB environmental parameters for the:

- (1) Primary Auxiliary Building/Auxiliary Feedwater Pump Area
- (2) Steam and Feedwater Valve Area
- (3) Turbine Building

The main steam line atmospheric dump valves have been identified in the submittal³ as "Not required to function for any accident." These same valves are described in Section 7 of the September 1973 report, as being needed to maintain the reactor coolant system cooldown rate within the 50°F per hour design limit prescribed in the FSAR. These valves have been identified as (Category IV, Qualification of Equipment Unresolved) in Section 4.1 above.

4.4.3 Recirculated Fluids

Appendix III of the licensee's submittal³ contains the environmental service conditions under which certain safety-related electrical equipment is required to function. The following sections of Appendix III address the various recirculated fluids environmental parameters for the:

- (1) Primary Auxiliary Building/Auxiliary Feedwater Pump Area
- (2) Spray Pump Area

The acceptability of the parameters identified and the basis for specific equipment qualification are included in Section 4.9 of this report.

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.

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.

The considerations of margins is included in Section 4.9 of this report. Equipment with questions is classified: (Category IV, Qualification of Equipment Unresolved).

4.6 Aging

The licensee indicated that a study of the components subjected to harsh environments is still an outstanding item. Details of the licensee's effort is included in their final submittal³.

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 in Appendix C of the DOR guidelines. The first supplement⁴ 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.

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.

The considerations of aging is included in Section 4.9 of this report. Equipment with questions is classified: (Category IV, Qualification of Equipment Unresolved).

4.7 Documentation

The second supplement⁴ to IEB 79-01B and the order⁵, 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 supplement⁴ identifies the type of information required and the locations where the records are to be maintained.

The licensees response in the area of documentation appears to be acceptable. A central file containing all the available documentation for environmental qualification is located at the engineering offices of the Yankee Atomic Electric Company.

4.8 Site Verification Inspection

An inspection of the installed components associated with the Main Steam System, High Pressure Safety Injection System and Containment Spray System was conducted on September 8-11, 1980, at the Maine Yankee facility. The details of this inspection are included in IE Inspection Report 50-309/80-14.

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 was submitted by the licensee in their response to IEB 79-018. This list contains equipment with unresolved items. Appendix B identifies the licensee's data in a format that allows the reviewer to quickly scan the unresolved items. The component column describes the component and references the system from the equipment qualification worksheet from Appendix II of the submittal³. The next three columns are self explanatory, the following three columns are defined as:

Environment - This column identifies the environmental parameter that appears to be unresolved.

Category - This column addresses the equipment status as follows:

I Qualified for Plant Life

II Qualified with Restriction

III Exempted from Qualification

IV Qualification of Equipment Unresolved

V Equipment not Qualified

Remarks - This column describes the environmental parameter or other miscellaneous comments.

4.10 Conclusion

This evaluation is based on the on-site inspection, the information supplied by the licensee in their submittal³, their FSAR, and the assumption that the Qualification Documentation (Test Reports, Analysis, Letters, etc.) are acceptable.

The Region I reviewer using the guidance^{6,7} and instructions, for the evaluation of licensee's data submittals and the site verification inspections that were performed to verify the IE Bulletin 79-018, January 1980 data, submittal information, finds the licensee to be in accordance with the NRC direction⁹, except as listed in Appendix B and the body 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 unresolved items will be evaluated by the Equipment Qualification Branch (EQB) and addressed in the Safety Evaluation Report (SER) to be written for this facility.

5. Licensee Event Reports (LERs)

No licensee event reports were submitted by the licensee, associated with their evaluation of IEB 79-018, as of November 10, 1980.

6. References

1. IEB 79-018, 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. Yankee Atomic Electric Company, Revised and Updated Response to IEB 79-018, dated October 31, 1980.
4. Supplement Information to IEB 79-018, 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 79-018.
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. 79-018, dated April 25, 1980.
9. IE Support and Review of Environmental Qualification of Electrical Equipment at Operating Reactors, dated October 10, 1980.
10. Yankee Atomic Electric Company, Responses to IEB 79-018 dated May 1980, March 1980 and August 1980.

APPENDIX

A

Test Reports and Analysis Lists

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- 001 Letter, Combustion Engineering, Inc., to Maine Yankee Atomic Power Company, MYC-4169, dated January 25, 1978. (This letter contains revised containment pressure and temperature tables for Maine Yankee.)
- 002 Maine Yankee Atomic Power Station Technical Specification 3.7 (pages 3.7-1 and 3.7-2) and FSAR Section 6.2.
- 003 Maine Yankee Atomic Power Station FSAR Question/Answer 6.10.
- 004 Maine Yankee FSAR, Section 9.13.3.
- 005 Maine Yankee Atomic Power Station FSAR Question/Answer 6.11.
- 006 Maine Yankee Emergency Procedure 2-14, "Long-Term Core Cooling Realignment."
- 007 Engineering Analysis #MY-#, "Radiation Dose Calculation."
- 008 Acton Report No. 15564-#, Report of "Thermal Aging Analysis of (Specific Equipment Title) for Class 1E Service at Maine Yankee Nuclear Power Generating Station".
- 009 EDS Report 02-0570-1065, "Environmental Qualification of Class 1E Electrical Equipment", September 1980, Revision 0.
- 010 EDS Report 02-0570-1069, Revision 0, "Pressure and Temperature Conditions at Maine Yankee Due to High Energy Line Break (HELB) Outside Containment and Heat-Up Caused by Recirculation Fluids Due to Loss-of-Coolant Accident (LOCA) Inside Containment".
- 011 Test Report, "Qualification Test - Joy Axivane Fan and Reliance Motor for Recirculation Service for Nuclear Containment", dated October, 1969. (Pages 0-3, 4, 5).
- 012 Letter with Enclosures, Reliance Electric Company to Stone and Webster, dated April 8, 1971.
- 013 Letter with Enclosure, Reliance Electric Company to Stone and Webster, dated August 17, 1970.
- 014 MYS-2864, "Specification for Motors for Containment Recirculating Fans for Maine Yankee Atomic Power Station", dated September 30, 1970.
- 015 Test Report #F-C2857, "Test of Electrical Cables Under Simulated Post-Accident Reactor Containment Service."
- 016 Letter, Cerro Wire and Cable Company to Stone and Webster, dated March 8, 1971.
- 017 Letter, Cerro Wire and Cable Company to Maine Yankee Atomic Power Company, dated May 20, 1971.

- 018 MYS-3912, "Specification for 600V Insulated Power Cable for Containment Recirculating Fans", dated March 22, 1971.
- 019 Test Report #600198, "Test of Limitorque Valve Operator to Meet General Requirements of an Electric Valve Actuator in Nuclear Reactor Containment Environment."
- 020 Letter, Radiation International, Inc. to Franklin Institute Research Laboratory, dated May 23, 1979.
- 021 Letter with Enclosure, Limitorque Corporation to Yankee Atomic Electric Company, dated May 4, 1979.
- 022 Portions of Maine Yankee Drawings #11550-1.23-20A.
- 023 Test Report: #F-C3341, "Long-Term Testing of Electrical Cables Under Simultaneous Exposure to Gamma Radiation, Steam and Chemical Spray", dated January, 1973.
- 024 Test Report: #2204-51-8-006, "Maximum Credible Accident Test on Electronic Transmitters".
- 025 Qualification Tests of Differential Transmitters Under Nuclear Radiation.
- 026 Test Report: "Qualification of Firewall III Class 1E Electric Cables".
- 027 Test Report: #IPS-383, "Qualification Test Program of Electrical Instrumentation Cables for Virginia Electric and Power Company for Surry Power Station - Units 1 and 2", dated November 27, 1978.
- 028 Letter, Anaconda (Continental) to Yankee Atomic Electric Company, dated May 30, 1979.
- 029 Letter with Enclosure, Anaconda (Continental) to Stone and Webster, dated July 11, 1978.
- 030 Letter, Continental Wire and Cable Corporation to Stone and Webster, dated June 2, 1971.
- 031 MYS-3268, "Specification for 600V Instrumentation Cable".
- 032 Letter, General Electric to Vermont Yankee Nuclear Power Corporation, #G-HB-8-13, dated February 2, 1978.
- 033 Engineering Analysis #MY-401, "Qualification for Radiation Environment".
- 034 Test Report: #ER-184, "DBA Test - Stone and Webster Cable Assembly", by D. G. O'Brien, Inc., dated September, 1971.
- 035 Letter, Maine Yankee Atomic Power Station to USNRC, #WMY 77-113, dated December 3, 1977.

- 036 Letter with Enclosure, Collyer Engineering Corporation to Connecticut Yankee Atomic Power Company, dated January 13, 1967.
- 037 Test Report #3788, Rosemount, Inc., "Qualification Test Report for Rosemount Pressure Transmitters".
- 038 Engineering Analysis #521, "Evaluation of Environmental Qualifications".
- 039 Vendor Data for HPSI Pumps.
- 040 Vendor Data for LPSI Pumps.
- 041 Vendor Data for LPSI Pumps.
- 042 Vendor Data for CS Pumps.
- 043 Supplementary Report on Effects of a Postulated Break in a High Energy Piping System Outside the Containment - September, 1973 - Maine Yankee Atomic Power Station.
- 044 Fischer and Porter Specification for Model 1082496.
- 045 Combustion Engineering Specification 4467-488-903.
- 046 Final Report F-C3834, Franklin Institute done for Gems Sensors Division; DeLaval.
- 047 Test Report No. AQS21678/TR, "Qualification Tests of Solenoid Valves by Environmental Exposure to Elevated Temperature, Radiation, Wear Aging, Seismic Simulation, Vibration Endurance, Accident Radiation and Loss-of-Coolant Accident (LOCA) Simulation", dated March 1978.
- 048 Test Report #600376A, "Nuclear Power Station Qualification Type Test Report, Limitorque Valve Actuators for BWR Service", dated May 13, 1976.
- 049 Letter, Limitorque to Action Testing Corp., dated October 3, 1978.
- 050 C74045-1, IEEE PES Conference Paper, "Qualification of Power and Control Cable for Class 1E Applications", by T. H. Ling and W. F. Morrison of the Anaconda Wire and Cable Company.
- 051 "Radiation Effects on Electrical Insulations" by P. H. Ware.
- 052 Okonite Report No. NWRN-1, "Qualification of Okonite Ethylene-Propylene Rubber Insulation for Nuclear Plant Service".
- 053 MG1, NEMA Standards Publication for Motors and Generators.
- 054 Okonite Engineers, Note 74-1.

- 055 Specifications for Thermocouple Extension Cable for Maine Yankee Atomic Power Station, Wiscasset, Maine, Seller: Claude S. Gordon, Purchase Order No. MY-240.
- 056 CE Specification No. 4467-488-701, A Project Engineering Specification for a Pressurizer Heater Proportional Power Control Unit, Combustion Engineering, Inc., Utility Division, Windsor, Connecticut.

APPENDIX

8

Equipment Status Tables

NOTES

1. The qualified radiation data provided is for the actuator excluding the motor. The licensee is presently working with Limitorque Corp. to obtain radiation tolerance data for these motors. This information will be available for review on completion.
2. The solenoid operated valves currently installed are ASCO EHBX8320 and 8311A31F. Although the valves operate before the abnormal environment associated with the accident has an opportunity to develop, we have assigned a one hour operating time per Supplement #2 of IEB 79-018. Based on the above, it is planned to replace these valves with the ASCO NP-1 Series valve which is fully qualified for LOCA and HELB environments.
3. Because of preliminary results from recent HELB and Heat-Up studies, many areas previously believed to be non-harsh have now been determined to be harsh. The impact on equipment qualification has yet to be fully analyzed and resolved; and therefore, the conclusions reached herein are to be considered preliminary.
4. Qualification of this component for the required operating time has been determined to be adequate based on an evaluation of the qualification data used to qualify it for all applicable environmental parameters indicated on this worksheet (See Reference 038).
5. The transmitters have been qualified for 3.5×10^6 R. The licensee refers to reference #025, in Appendix A as the documentation to which these transmitters are qualified.
6. Aging qualification is under investigation and will be provided when completed.
7. Qualification is being done by the vendor under a generic utility program scheduled for completion by June 1981.
8. The vendor is currently testing these components to address all the environmental parameters. Complete test reports will be available for review on completion.
9. This equipment is included because of NUREG-0573.

Component	Manuf.	Part/ Serial No.	Containment		Environment	Category	Remarks
			IN	OUT			
Motor Operator C&VCS-1	Linitorque Corp.	SMB-00	X		Submergence Radiation	IV	The elevations of HCV-251, HCV-261 and HCV-271 are below the maximum postulated flood level. However, the function of this equipment is completed prior to submergence (if any). EOB to evaluate. Note No. 1
Solenoid Operated Valve CAAS-1 C&VCS-2 FP-1 LPSI-3	Asco	B311A31F and EHBX8320	X		Aging	V	Note No. 2. Requires a schedule from the licensee.
Solenoid Operated Valve C&VCS-3 HPSI-3	Asco	B311A31F and EHBX8320	X		Aging Submergence	V	Note No. 2. Requires a schedule from the licensee. This solenoid valve will be moved to above flood level when it is replaced. Requires a schedule from the licensee.
Flow Transmitter C&VCS-4	Fischer and Porter	1082195		X	Time Temperature Pressure Radiation Aging Rh	IV	Note No. 3
Motor CS-1	Allis- Chalmers	507-LP		X	Time Temperature Pressure Radiation Aging RH	IV	Note No. 3. A request has been placed with Allis-Chalmers through Acton Labs for information. EOB to evaluate.

Component	Manuf.	Part/ Serial No.	Contain- ment		Environ- ment	Category	Remarks
			IN	OUT			
Motor Operator CS-2	Limorque	SMB-00 SMB-000 SMB-00C		X	Radiation Time	IV	Note No. 1. Note No. 3. Note No. 4. ENB to evaluate.
Fan Motor CAR-1	Reliance Electric	324308-1X and 324308-2X	X		Time	IV	Note No. 4. ENB to evaluate.
Pressure Transmitter CS-3	Fischer and Porter	50EP1070		X	Time Temperature Pressure RH Radiation Acid	IV	Note No. 3
Motor Control Center EPS-1	Westing- house	Type W		X	Time Temperature Pressure RH Radiation Acid	IV	Note No. 3 The licensee is presently working with Westinghouse Corporation to obtain qualification data. This information will be available for review on completion.
Pressure Transmitters Level Transmitters FW-1	Fischer and Porter	50EP1000 Pressure 1302495 Level	X		Radiation	IV	Note No. 5. IOB to evaluate.

Component	Manuf.	Part/ Serial No.	Containment		Environment	Category	Remarks
			IN	OUT			
Solenoid Operated Valve HPSI-4	Asco	8311A31F and ENBX0320		X	Atmos	V	Note No. 2. Requires a schedule from the licensee.
Flow Transmitter HPSI-5	Fischer and Porter	Not Shown		X	Time Temperature Pressure RH Radiation Aging	IV	Note No. 3. Note No. 6.
Motor HPSI-6	GE	5K37J- G403		X	Time Temperature Pressure RH Radiation Aging	IV	Note No. 3. Note No. 6 The motors were designed and built using Reference 053. Present analysis shows that the harsh environment will only exist for a short time and that the motors will operate satisfactorily.
Pressure Switch HPSI-8	Fischer and Porter	1401PV- 03-NS		X	Time Temperature Pressure RH Radiation Aging	IV	Note No. 3. Note No. 6
Motor HPSI-7	Westing- house	7001 7002 7003		X	Time Temperature Pressure RH Radiation Aging	IV	Note No. 3. Note No. 6.

Component	Manuf.	Part/ Serial No.	Contain- ment		Environ- ment	Category	Remarks
			IN	OUT			
Motor Operator LPSI-4	Limitorque	SMB-1	X		Radiation Time	IV	Note No. 1. Qualification of this component for the required operating time has been determined to be adequate based on an evaluation of the qualification data used to qualify it for all applicable environmental parameters indicated on this worksheet (See Reference 038). EOB to evaluate.
Motor HPSI-1	Westing- house	5089-5		X	Time Temperature Pressure RH Radiation Aging	IV	Note No. 3.
Motor Operator HPSI-2	Limitorque	SMB-0 SMB-1		X	Radiation	IV	Note No. 1. Note No. 3.
Flow Transmitter LPSI-5	Fischer and Porter	10B2496		X	Time Temperature Pressure RH Radiation Aging	IV	Note No. 3. Note No. 6
Hydrogen Analyzer PAM-1	COMSIP, Inc.	K-III		X	Time Temperature Pressure RH Radiation Aging	IV	Note No. 3 Note No. 7.

Component	Manuf.	Part/ Serial No.	Contain- ment		Environ- ment	Category	Remarks
			IN	OUT			
Radiation Detector PAH-2	General Atomic	RD-23	X		Time Temperature Pressure RH Radiation Aging	IV	Note No. 8. Note No. 9.
Pressure Transmitter PAH-5	Fischer and Porter	50EP1041	X		Radiation	IV	Note No. 5. EOB to evaluate.
Level Transmitter PAH-6	GEMS	XH-36495	X		Time Spray Aging Submergence	IV	The equipment manufacturer is currently qualifying a replacement unit which will be purchased by Maine Yankee when complete. Equipment was not tested for submergence; however, the electronics will not be affected because they are at the top of the unit which is not subject to submergence. EOB to evaluate. Note No. 9.
Pressure Transmitter PAH-7	Fischer and Porter	50EP1070		X	Time Temperature Pressure RH Radiation Aging	IV	Note No. 3.
Pressure Transmitter PAH-8	Rosemount	1153 Series D		X	Time Temperature Pressure RH Radiation Aging	IV	Note No. 3. Note No. 7.

Component	Manuf.	Part/ Serial No.	Containment		Environment	Category	Remarks
			IN	OUT			
Acoustic Transmitter PAH-9	B&H	NA	X		Time Temperature Pressure RH Radiation Aging	IV	Note No. 9. Note No. 8.
Acoustic Accelerometer PAH-10	B&H	NA	X		Time Temperature Pressure RH Radiation Aging	IV	Note No. 9. Note No. 8.
Solenoid Operated Pilot Valve PV-1, PV-2, PCC-1	Asco	8311A31F and EHBX8320	X		Aging	V	Note No. 2. Requires a schedule from the licensee.
Pump PCC-2	Allis- Chalmers	507US		X	Time Temperature Pressure RH Aging	IV	Note No. 3. The licensee is presently working with Allis-Chalmers Corp. to obtain qualification data for these motors. This information will be available for review on completion.
Solenoid Operated Pilot Valve PS-1	Asco	8311A31F and EHBX8320	X		Aging Submergence	V	Note No. 2. Requires a schedule from the licensee. These valves will be moved to above flood level when they are replaced. Requires a schedule from the licensee.

Component	Manuf.	Part/ Serial No.	Contain- ment		Environ- ment	Category	Remarks
			IN	OUT			
Pressure Transmitter RC-1	Fischer and Porter	50EP1000	X		Radiation	IV	Note No. 5. EQB to evaluate.
Motor Operator RC-3	Limitorque	SMB-000 SMB-00	X		Radiation	IV	Note No. 1.
Pressurizer Heater Dist. Cabinet RC-5	Hesting- house	EHB3070		X	Time Temperature Pressure RH Aging	IV	Note No. 3. Note No. 8.
RTD RC-6	Rosemount	104 VC	X		Time Temperature Pressure RH Radiation Aging	IV	Note No. 9. The qualifications of various RTD's for a post-accident environ- ment are being investigated.
Motor Operator RC-4	Limitorque	SMB-00 SMB-000	X		Radiation Time	IV	Note No. 1. Note No. 4. EQB to evaluate.

Component	Manuf.	Part/ Serial No.	Contain- ment		Environ- ment	Category	Remarks
			IN	OUT			
Control Cabinets E-2PA, E-2PB, RC-7	Hesting- house	Not Shown		X	Time Temperature Pressure RH	IV	Note No. 3.
Pumps SCC-1	Allis- Chalmers	507US		X	Time Temperature Pressure RH Radiation Aging	IV	Note No. 3. The licensee is presently working with Allis-Chalmers Corp. to obtain qualification data for these motors. This information will be available for review on completion.
Terminal Block ELEC-7	Square D	1828-C19	X		Time Temperature Pressure RH Radiation	V	These units will be replaced during the next scheduled outage. Note No. 9.
Control Cable ELEC-8	Collyer	PE/PVC/ PVC	X		Time Temperature Pressure RH Radiation Aging	V	The presently installed cable is qualified by test for expected environment and operating time. Qualification for an operating time of one hour will necessitate replacing this cable with cable that is appropriately qualified. Requires a schedule from the licensee. Note No. 9.
Control Cable ELEC-10	Collyer	PE/PVC/ PVC		X	Aging	IV	Note No. 3.

Component	Manuf.	Part/ Serial No.	Contain- ment		Environ- ment	Category	Remarks
			IN	OUT			
Limit Switch ELEC-13	NAHCO	EA740- 80,000	X		Time Temperature Pressure RH Radiation Aging	V	The licensee is planning to replace these components. Requires a schedule from the licensee. Note No. 9.
Terminal Block ELEC-14	Square D	1288-219		X	Time Temperature Pressure RH Radiation Aging	IV	Note No. 3. Operation of equipment utilizing this component occurs before the abnormal environment associated with an accident has had an opportunity to fully develop and affect component integrity. EOB to evaluate.
Pressurizer Heater Power Cable ELEC-15	GE	Silicone Rubber Insul. Twisted Glass Brqld	X		Time Temperature Pressure RH Radiation Aging	IV	Note No. 3. The licensee is presently with General Electric to obtain qualification documentation. This information will be available for review on completion.
Limit Switch ELEC-16	NAHCO	D2400X	X		Time Temperature Pressure RH Radiation Aging	IV	The licensee is planning to replace these components at the next scheduled outage. Note No. 9.
Limit Switch ELEC-17 ELEC-18	Micro Switch Co.	DTE6-2RN2		X	Time Temperature Pressure RH Radiation Aging	IV	The licensee is planning to replace these components. Requires a schedule from the licensee. Note No. 9.