UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

ENVIRONMENTAL QUALIFICATION OF ELECTRIC EQUIPMENT IMPORTANT TO SAFETY

BOSTON EDISON COMPANY

PILGRIM NUCLEAR POWER STATION

DOCKET NO. 50-293

INTRODUCTION

Equipment which is used to perform a necessary safety function must be demonstrated to be capable of maintaining functional operability under all service conditions postulated to occur during its installed life for the time it is required to operate. This requirement, which is embodied in General Design Criteria 1 and 4 of Appendix A and Sections III, XI, and XVII of Appendix B to 10 CFR Part 50, is applicable to equipment located inside as well as outside containment. More detailed requirements and guidance relating to the methods and procedures for demonstrating this capability for electrical equipment have been set forth in 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants," NUREG-0588, "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment" (which supplements IEEE Standard 323 and various NRC Regulatory Guides and industry standards), and "Guidelines for Evaluating Environmental Qualification of Class 1E Electrical Equipment in Operating Reactors" (DOR Guidelines).

BACKGROUND

On February 8, 1979, the NRC Office of Inspection and Enforcement (IE) issued to all licensees of operating plants (except those included in the systematic evaluation program (SEP) IE Bulletin (IEB) 79-01, "Environmental Qualification of Class 1E Equipment." This Bulletin, together with IE Circular 78-08 (issued on May 31, 1978), required the licensees to perform reviews to assess the adequacy of their environmental qualification programs.

On January 14, 1980, NRC issued IEB 79-01B which included the DOR Guidelines and NUREG-0588 as attachments 4 and 5, respectively. Subsequently, on May 23, 1980, Commission Memorandum and Order CLI-80-21 was issued and stated that the DOR Guidelines and portions of NUREG-0588 form the requirements that licensees must meet regarding environmental qualification of safety-related electrical equipment in order to satisfy those aspects of 10 CFR Part 50, Appendix A, General Design Criteria (GDC) 4. Supplements to IEB 79-01B were issued for further clarification and definition of the staff's needs. These supplements were issued on February 29, September 30, and October 24, 1980.

In addition, the staff issued orders dated August 29, 1980 (amended in September 1980) and October 24, 1980 to all licensees. The August order required that the licensees provide a report, by November 1, 1980, documenting the qualification of safety-related electrical equipment. The October order required the establishment of a central file location for the maintenance of all equipment qualification records. The central file was mandated to be established by December 1, 1980. The staff subsequently issued a Safety Evaluation (SE) on the environmental qualification of safety-related electrical equipment to the licensee on September 11, 1981. This SE requested the licensee to "either provide documentation of the missing qualification information which demonstrates that safety-related equipment meets the DOR Guidelines or NUREG-0588 requirements or commit to a corrective action (requalification, replacement, (etc.))." The licensee was required to respond to NRC within 90 days of receipt of the SE. In response to the staff SE issued in 1981, the licensee submitted additional information regarding the qualification of safety-related electrical equipment. This information was evaluated for the staff by the Franklin Research Center (FRC) in order to: 1) identify all cases where the licensee's response did not resolve the significant qualification issues, 2) evaluate the licensee's qualification documentation in accordance with established criteria to determine which equipment had adequate documentation and which did not, and 3) evaluate the licensee's qualification documentation for safety-related electrical equipment located in harsh environments required for TMI Lessons Learned Implementation. A Technical Evaluation Report (TER) was issued by FRC on January 19, 1983. A Safety Evaluation was subsequently issued to the Boston Edison Company on April 13, 1983, with the FRC TER as an attachment.

A final rule on environmental qualification of electric equipment important to safety for nuclear power plants became effective on February 22, 1983. This rule, Section 50.49 of 10 CFR Part 50, specifies the requirements of electrical equipment important to safety located in a harsh environment. In accordance with this rule, equipment for Pilgrim may be qualified to the criteria specified in either the DOR Guidelines or NUREG-0588, except for replacement equipment. Replacement equipment installed subsequent to February 22, 1983 must be qualified in accordance with provisions of 10 CFR 50.49, using the guidance of Regulatory Guide 1.89, unless there are sound reasons to the contrary.

A meeting was held with each licensee of plants for which a TER had been prepared for the staff by FRC in order to discuss all remaining open issues regarding environmental qualification, including acceptability of the environmental conditions for equipment qualification purposes, if this issue had not yet been resolved. On May 22, 1984, a meeting was held to discuss Boston Edison's proposed method to resolve the environmental qualification deficiencies identified in the April 13, 1983 SE and January 19, 1983 FRC TER. Discussions also included Boston Edison's general methodology for compliance with 10 CFR 50.49, and justification for continued operation for those equipment items for which environmental qualification is not yet completed. The minutes of the meeting and proposed method of resolution

for each of the environmental qualification deficiencies are documented in the July 9, August 3, and September 24, 1984, January 21 and January 29, 1985 submittals from the licensee.

EVALUATION

The evaluation of the acceptability of the licensee's electrical equipment environmental qualification program is based on the results of an audit review performed by the staff of: (1) the licensee's proposed resolutions of the environmental qualification deficiencies identified in the April 13, 1983 SE and January 19, 1983 FRC TER; (2) compliance with the requirements of 10 CFR 50.49; and (3) justifications for continued operation (JCO) for those equipment items for which the environmental qualification is not yet completed.

Proposed Resolutions of Identified Deficiencies

The proposed resolutions for the equipment environmental qualification deficiencies, identified in the April 13, 1983 SE, and the FRC TER enclosed with it, are described in the licensee's submittals identified above. During the May 22, 1984 meeting with the licensee, the staff discussed the proposed resolution of each deficiency for each equipment item identified in the FRC TER and found the licensee's approach for resolving the identified environmental qualification deficiencies acceptable. The majority of deficiencies identified were documentation, similarity, aging, qualified life and replacement schedule. All open items identified in the SE dated April 13, 1983 were also discussed and the resolution of these items has been found acceptable by the staff.

The approach described by the licensee for addressing and resolving the identified deficiencies includes replacing equipment, performing additional analyses, utilizing additional qualification documentation beyond that reviewed by FRC, obtaining additional qualification documentation and determining that some equipment is outside the scope of 10 CFR 50.49, and therefore not required to be environmentally qualified, e.g., located in a mild environment. The proposed resolutions were discussed in detail on an item by item basis with the licensee during the May 22, 1984 meeting. Replacing or exempting equipment, for an acceptable reason, are clearly acceptable methods for resolving environmental qualification deficiencies. The more lengthy discussions with the licensee concerned the use of additional analyses or documentation. Although we did not review the additional analyses or documentation, we discussed how analysis was being used to resolve deficiencies identified in the FRC TER and the content of the additional documentation in order to determine the acceptability of these methods. (As noted above, the minutes of the meeting and subsequent licensee correspondence documenting the proposed methods of resolution were reviewed by the staff.) The licensee's equipment environmental qualification files will be audited during follow-up inspections to be performed by Region I, with assistance from IE headquarters and NRR staff as necessary. Since a significant amount of documentation has already been

reviewed by the staff and Franklin Research Center, the primary objective of the file audit will be to verify that the files contain the appropriate analyses and other necessary documentation to support the licensee's conclusion that the equipment is qualified. The inspections will verify that the licensee's program for surveillance and maintenance of environmentally qualified equipment is adequate to assure that this equipment is maintained in the as-analyzed or tested condition. The method used for tracking periodic replacement parts, and implementation of the licensee's commitments and actions, e.g., regarding replacement of equipment, will also be verified.

Based on the discussions with the licensee and our review of its submittals, we find the licensee's approach for resolving the identified environmental qualification deficiencies acceptable.

Compliance with 10 CFR 50.49

In its July 9, and August 3, 1984 submittals, the licensee has described the approach used to identify equipment within the scope of paragraph (b)(1) of 10 CFR 50.49, equipment relied upon to remain functional during and following design basis events. The licensee states it has, as part of the effort in identifying the Master List of equipment, reviewed all postulated design basis accidents documented in the Final Safety Analysis Report (FSAR) including a Loss-of-Coolant Accident (LOCA) inside containment and High Energy Line Breaks (HELBs) outside containment, including flooding outside containment. Therefore, all design basis events which could potentially result in a harsh environment were addressed in identifying safety-related electrical equipment to be environmentally qualified within the scope of paragraph (b)(1) of 10 CFR 50.49.

The licensee's approach for identifying equipment within the scope of paragraph (b)(1) is in accordance with the requirements of that paragraph, and therefore acceptable.

In its January 21, 1985 submittal the licensee has described the methodology used to identify electrical equipment within the scope of paragraph (b)(2) of 10 CFR 50.49, nonsafety-related electrical equipment whose failure under postulated environmental conditions could prevent satisfactory accomplishment of safety functions, as summarized below:

1. A list was generated of safety-related electric equipment as defined in paragraph (b)(1) of 10 CFR 50.49 required to remain functional during and following design basis Loss-of-Coolant Accidents or High Energy Line Break Accidents. The LOCA/HELB accidents are the only design-basis accidents which result in significantly adverse environments to electrical equipment which is required for safe shutdown or accident mitigation. The list was based on reviews of the Final Safety Analysis Report, Technical Specifications, Emergency Operating Procedures, Piping and Instrumentation Diagrams (P&IDs), and electrical distribution diagrams.

2. The elementary wiring diagrams of the safety-related electrical equipment identified in Step 1 were reviewed to identify any auxiliary devices electrically connected directly into the control of power circuitry of the safety-related equipment (e.g., automatic trips) whose failure due to postulated environmental conditions could prevent required operation of the safety-related equipment.

3. The operation of the safety-related systems and equipment were reviewed to identify any directly mechanically connected auxiliary systems with electrical components which are necessary for the required operation of the safety-related equipment (e.g., cooling water or lubricating systems). This involved the review of P&IDs, component technical manuals, and/or systems descriptions in the FSAR.

4. Nonsafety-related electrical circuits indirectly associated with the electrical equipment identified in Step 1 by common power supply or physical proximity were considered by a review of the electrical design including the use of applicable industry standards (e.g., IEEE, NEMA, ANSI, UL, and NEC) and the use of properly coordinated protective relays, circuit breakers, and fuses for electrical fault protection.

We find the methodology used by the licensee is acceptable since it provides reasonable assurance that equipment within the scope of paragraph (b)(2) of 10 CFR 50.49 has been identified.

With regard to paragraph (b)(3) of 10 CFR 50.49, the licensee refers to its November 1, 1984 letter for identification of Category 1 and 2 equipment which requires environmental qualification to meet the intent of Regulatory Guide (RG) 1.97. The staff has not yet completed its review for conformance to Regulatory Guide 1.97. However, in the attachments to its November 1, 1984 letter the licensee specifies exceptions to the guidance, justifications, proposed modifications and the schedule for the upgrade. The staff will determine the acceptability of these justifications as part of its review for conformance with Regulatory Guide 1.97. This further staff review for Regulatory Guide 1.97 conformance may result in the licensee being required to include additional equipment in its environmental qualification program. After staff review and acceptance of the R.G. 1.97 submittal, Boston Edison states that it will add the applicable equipment to the Environmental Qualification Master Equipment List and will implement its schedule of R.G. 1.97 activities including environmental qualification.

We find the licensee's approach to identifying equipment within the scope of paragraph (b)(3) of 10 CFR 50.49 acceptable since it is in accordance with the requirements of that paragraph.

Justification for Continued Operation

The licensee has provided, in its August 3, and September 24, 1984, January 21 and January 29, 1985 submittals, a justification for continued

operation (JCO) addressing each item of equipment for which the environmental qualification is not yet completed. Enclosure 1 is the JCO equipment list for the Pilgrim facility.

We have reviewed the JCOs provided by the licensee and find them acceptable since they are based on essentially the same criteria that were used by the staff and its contractor to review JCOs previously submitted by licensees. These criteria, listed below, are also essentially the same as those contained in 10 CFR 50.49(i).

a. The safety function can be accomplished by some other designated equipment that is qualified, and failure of the principal equipment as a result of the harsh environment will not degrade other safety functions or mislead the operator.

b. Partial test data exists that, while not demonstrating full qualification, does provide a basis for concluding the equipment will perform its function. If it cannot be concluded from the available data that the equipment will not fail after completion of its safety function, then that failure must not result in significant degradation of any safety function or provide misleading information to the operator.

c. Limited use is made of administrative controls over equipment that has not been demonstrated to be fully qualified. For any equipment assumed to fail as a result of the accident environment, that failure must not result in significant degradation of any safety function or provide misleading information to the operator.

CONCLUSIONS

Based on the above evaluation, we conclude the following with regard to the qualification of electric equipment important to safety within the scope of 10 CFR 50.49.

- Boston Edison's electrical equipment environmental qualification program complies with the requirements of 10 CFR 50.49.
- The proposed resolutions for each of the environmental qualification deficiencies identified in the April 13, 1983 SE and FRC TER are acceptable.
- Continued operation until completion of the licensee's environmental qualification program will not present undue risk to the public health and safety.

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Dated: March 26, 1985

Enclosure 1

Justification for Continued Operation Equipment List

Pilgrim Tag No.	NRC TER No.	Description
MO220-2	1	Limitorque DC Motor Operator
MO4002	2	Limitorque AC Motor Operator
MO1001-63	3	Limitorque AC Motor Operator
MO2301-4	4A	Limitorque AC Motor Operator
MO1201-16	4B	Limitorque AC Motor Operator
MO220-1	4C	Limitorque AC Motor Operator
MO1001-50, MO1201-2	5	Limitorque AC Motor Operators
MO202-5A, MO202-5B	6	Limitorque AC Motor Operators
MO/N-109, MO/N-113	7,8	Honeywell Damper Actuators
MO1001-60	9	Limitorque DC Motor Operator
MO1001-23A/23B, MO1001-26A/26B	11,20	Limitorque AC Motor Operators
MO1400-25A, MO1400-25B	12,10b	Limitorque AC Motor Operators
MO1400-24A, MO1400-24B	13,10a	Limitorque AC Motor Operators
MO1201-5, MO1201-80	14,15	Limitorque DC/AC Motor Operators
MO2301-5	16	Limitorque DC Motor Operator
MO1001-29B	17B	Limitorque AC Motor Operator
MO2301-8	18	Limitorque DC Motor Operator
MO1301-17	19	Limitorque DC Motor Operator
MO1001-47	21	Limitorque DC Motor Operator
MO1001-28A, MO1001-28B	22a,17a	Limitorque AC Motor Operators
MO1001-29A	22b	Limitorque AC Motor Operator
MO1001-21,32	24,23	Limitorque DC/AC Motor Operators

Pilgrim Tag No.	NRC TER No.	Description
MO1301-25,26	26,25	Limitorque DC Motor Operators
MO2301-10	27	Limitorque DC Motor Operator
MO2301-3	28a	Limitorque DC Motor Operator
MO2301-9	28B	Limitorque DC Motor Operator
MO2301-14	29	Limitorque DC Motor Operator
MO2301-35,36	31,30	Limitorque DC Motor Operators
MO401A/B, MO406A/B	33,38	Limitorque DC Motor Operators
MO1400-4A, MO1400-4B	39,36	Limitorque AC Motor Operators
MO1001-36A,36B, 37A,37B	40a,32, 40j, 37f	Limitorque AC Motor Operators
MO1400-3A,3B	40B,37g	Limitorque AC Motor Operators
MO1001-7A,7B, 7C,7D	40C,37a, 40d,37b	Limitorque AC Motor Operators
MO1001-43(A-D)	40f,37c, 40e,37d	Limitorque AC Motor Operators
MO1001-16A,16B	40g,37e	Limitorque AC Motor Operators
MO1001-18A,18B	40h,35	Limitorque AC Motor Operators
MO1001-34A,34B	40i,34	Limitorque AC Motor Operators
MO1301-60	41	Limitorque DC Motor Operator
SV2300-9	42	Skinner Solenoid Valve
CV9068A,B	43	Atkomatic Solenoid Valves
AO201-IA/D	85	AVCO Solenoid Valve/Terminal Blocks
AO203-2A/D, J623,J624, J625,J626	86	AVCO Solenoid Valve/Terminal Blocks
MCC D7,D8,D9	88	Cutler Hammer DC Motor Control Centers
MCC B14,B15, B17,B18,B20	89a,90, 89b	Nelson Electric AC Motor Control Centers

Pilgrim Tag No.	NRC TER No.	Description
VAC201A,B VEX210A,B	91,93	Motor Termination Splices
VAC204A,B C,D	92	Louis Allis Unit Cooler Motors
HR-1A,2A,3A,4A 1B,2B,3B,4B	97	Honeywell Humidity Control Relays
None	100	Ring Tongue Terminals
C152,153,154,155, 156,157,158,159	107,108	General Electric Panel Indicating Lights
Cable PE/PVC	110,111,112,118, 119,120,121,122, 123,124,252	General Electric Cables
PS1001-90A/D	189,203	Static-O-Ring Pressure Switches
PS-512A/D	190,202	Static-O-Ring Pressure Switches
PS1001-89A/D	191,189	Static-O-Ring Pressure Switches
PS1-1001-83A/D	192,193 198,204	Static-o-Ring Pressure Switches
PS1360-9(A-D)	194	Barksdale Pressure Switches
PS2368A,B	195	Barksdale Pressure Switches
PS2360-1	196	Barksdale Pressure Switch
PS-2389(A-D)	207	Barksdale Pressure Switches
LIS-263-72A-D	213,212	Yarway Level Indicating Switches
LIS-263-57A,B	214,210	Yarway Level Indicating Switches
-263-58A,B	211	
LITS-263-73A,B, LS-2351A,B	227,226 232	Yarway Level Indicating Switches Robert Shaw Level Switches
GE Cable	250	General Electric Cable
HS-1A,2A,3A,4A, 1B,2B,3B,4B	256	Honeywell Humidity Sensors
TSW-1A,1B	258	Fenwal Temperature Switches

Pilgrim Tag No.	NRC TER No.	Description
C68,C69	259,260, 261,262	Allen Bradley/Sola/ Contactor/Transformer/Wire
None	264,266	Electroswitch Panel Control Switches
CS42-1724,1725, 1824,1825	269	General Electric Control Panel Switches
312D,712B, S157279	N/A	Anaconda/General Electric Cable
HPCI Turbine EG-R	152	Woodward Turbine Governor Control
HPCI Turbine Cable Assemblies	153	Turbine Governor Control Cables
HPCI Turbine Magnetic Pickup	154	Woodward Turbine Speed Sensor
None	155	Woodward Ramp Generator and Signal Converter
None	156	Woodward Turbine Speed Controller
None	157	Woodward Turbine Governor Control
EG-M Control Box	158	Woodward Turbine Governor Control
DPIS-261,2A-2	172	Barton Differential Pressure Switches
DPIS-5040A, B	173	Barton Differential Pressure Switches
DPIS-1001-79B	176	Barton Differential Pressure Switch
DPIS-1001-79A	180	Barton Differential Pressure Switch
PS1451A/B, PS1464A/B	181,208	Static-O-Ring Pressure Switches
PS1001-93A-D, PS1001-104A-D	182,209	Static-O-Ring Pressure Switches
None	185	Square D Oil Pressure Switch

Pilgrim Tag No.	NRC TER No.	Description
412A,106, 212B,SCI6	N/A	Okonite/Kerite/Rockbestos Cables
C129A,B	N/A	Instrument Rack w/ Terminal Blocks and Wire
C150,C151	N/A	Electric Switch/General Electric Switches
C2205A,C2207A,B C2260,C2201	N/A	Instrument Rack w/ Terminal Blocks and Wire
C2207A	N/A	Instrument Rack w/ Terminal Blocks
C2257A,B		
C2303,T2303	N/A	HPCI Control Panels
C61A,C61B	N/A	General Electric Control Panel Indicating Lights
C61A,C61B	N/A	Johnson/Agastat Control Panel Relays
CS42-1821,1822	N/A	General Electric Control Panel Switches
CX2,CX4,540,CX8	N/A	Polyethylene Insulated Cables
J32,J451,J538	N/A	Buchanan Junction Box w/ Terminal Blocks
J,539		
J216,J217	N/A	Junction Box w/ Terminal Blocks
J444,J463		
J462,J466		
J561,J874,		
J866,J863		
J599,J600		
J601,J602		
J606,J603		
J604,J720		
J859	N/A	Kerite Junction Box w/Splice
MO1001-19	N/A	Limitorque Motor Operator
MO1301-49,	N/A	Limitorque Motor Operator

Pilgrim Tag No.	NRC TER No.	Description
M03800,M03805, M03801,M03806, M02301-6,M04009A, M04009B,M04085A, M04065,M04083,M04084	N/A	Limitorque Motor Operators
N912,N923, N921	N/A	General Electric Local Control Switches
P202(A-F)	N/A	General Electric RBCCW Pump and Motor Termination Splices
P229	N/A	Baldor Lube Oil Pump Motor
PS2390A,B	N/A	Static-O-Ring Pressure Switches
PS4008,PS4058,	N/A	Barton Pressure Switches
None	N/A	Ring Tongue Terminations
S1,S37,GXG,Z3, Z3A,548,C02,C03, S19,S27	N/A	PE/PVC Cables
SVL82,83	N/A	ASCO Solenoid Valves
SVL61	N/A	ASCO Solenoid Valve
DPT1001-604A, B	223	Rosemount Level Transmitters
PS261-23A	183	Barksdale Pressure Switche
PS263-49B, 50B	199	Barksdale Pressure Switches
PS263-53B	200	Barksdale Pressure Switch
PS263-51C, D	201	Barksdale Pressure Switches