



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

QUAD CITIES UNITS 1 AND 2

DOCKET NOS. 50-254/265

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 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 73-08 (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 equipment in order to satisfy those aspects of 10 CFR 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.

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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 environmental qualification of safety-related electrical equipment to the licensee on May 21, 1981. This SE directed 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. Technical Evaluation Reports (TERs) were issued by FRC on July 23, 1982. Safety Evaluations were subsequently issued to Commonwealth Edison on January 18, 1983, with the FRC TERs as an attachment.

A final rule on environmental qualification of electrical equipment important to safety for nuclear power plants became effective on February 22, 1984. This rule, Section 50.49 of 10 CFR 50, specifies the requirements to be met for demonstrating the environmental qualification of electrical equipment important to safety located in a harsh environment. In accordance with this rule, equipment for Quad Cities Units 1 and 2 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 January 26, 1984, a meeting was held to discuss Commonwealth Edison's proposed method of resolution of the environmental qualification deficiencies identified in the January 18, 1983 SE and July 23, 1982 FRC TER. Discussions also included Commonwealth 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 a March 30, 1984 submittal 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 to: (1) the licensee's proposed resolutions of the environmental qualification deficiencies identified in the January 18, 1983 SE and July 23, 1982 FRC TER; (2) compliance with the requirements of 10 CFR 50.49; and (3) justification 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 January 18, 1983 SEs and the FRC TERs enclosed with it, are described in the licensee's March 30, 1984 submittal. During the January 26, 1984 meeting with the licensee, the staff discussed the proposed resolution of each deficiency for each equipment item identified in the FRC TERs 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 SEs dated January 18, 1983 were also discussed and the resolution of these items has been found acceptable by the staff. The evaluation of the P/T profiles is under review separately. Should the results of this review identify conditions that are significantly different from the environmental envelopes used for equipment qualification, an assessment of the impact of the changes in the profiles would be required.

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, installing radiation shielding, and exempting some equipment from qualification, e.g., located in the mild environment. We discussed the proposed resolutions in detail on an item by item basis with the licensee during the January 26, 1984 meeting. Replacing, shielding or exempting equipment, for an acceptable reason, are clearly acceptable methods for resolving environmental qualification deficiencies. The more lengthy of our 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. The licensee's equipment environmental qualification files will be audited by the staff during follow-up inspections to be performed by Region III, 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 they 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 environmental 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 equipment, will also be verified.

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

Compliance with 10 CFR 50.49

In its March 30, 1984 submittal, 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 that flooding outside the drywell and environmental effects resulting from all design basis events such as loss of coolant accidents and main steam line breaks inside containment and high energy line breaks outside containment were reviewed in the identification of safety-related electrical equipment which was to be environmentally qualified. The flooding and environmental effects resulting from High-Energy Line Breaks (HELBs) outside containment were also considered in the identification of this equipment. Therefore, all design basis events including accidents at Quad Cities Units 1 and 2 were considered in the identification of electrical equipment within the scope of paragraph (b)(1) of 10 CFR 50.49 (i.e., "safety-related electric equipment...").

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.

The method used by the licensee for identification of electrical equipment within the scope of paragraph (b)(2) of 10 CFR 50.49, nonsafety-related electric whose failure under postulated environmental conditions could prevent satisfactory accomplishment of safety functions, is 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 or following design basis events such as loss of coolant accidents and main steam line breaks inside containment and high energy line breaks outside containment. A system analysis was performed to identify the set of electrical equipment which the system requires in order to perform its design basis safety function. The list was based on reviews of Technical Specifications, Emergency Operating Procedures, Piping and Instrumentation Drawings, Schematics and electrical one line diagrams and control logic diagrams;

2. A system failure analysis was performed on each safety-related system to identify the set of equipment requiring environmental qualification. The system failure analysis included a review of the safety system operation, systems interaction and operation of equipment with each safety system. This failure analysis identified all auxiliary systems and equipment which are necessary for the required operation of the safety-related system or equipment. This effort included review of the plant safety analyses, technical specification, emergency operating procedures, piping and instrumentation diagrams, schematics, wiring diagrams, electrical one line diagrams and control logic diagrams. The entire instrument loop associated with each identified instrument was reviewed to identify any other components whose function could adversely affect operation of the equipment required to remain functional. A small number of equipment items were identified as potentially affecting the performance of the equipment required to remain functional. These items were added to the equipment qualification master list and were subsequently qualified under the equipment qualification program, therefore eliminating the potential for affecting or degrading system performance.
3. Based on the above considerations, the licensee has not specifically classified any electrical equipment as nonsafety-related whose failure under postulated environmental conditions could prevent accomplishment of required safety functions by the safety-related equipment. Therefore, the current master list of electrical equipment and the review methodology is judged by the licensee to adequately address electrical equipment within the scope of 10 CFR 50.49 (b)(2).

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

With regard to paragraph (b)(3) of 10 CFR 50.49, the licensee position is stated in the March 30, 1984 letter for identification of post-accident monitoring equipment which requires environmental qualification to meet the intent of Regulatory Guide 1.97. The staff has not yet completed its review for conformance to Regulatory Guide 1.97. Equipment that currently falls within the category classified as certain post-accident monitoring equipment was selected based on the following:

- ° Sensors for display instrumentation channels which are exposed to a harsh environment following a design basis accident. These are identified in the plant Emergency Operating Procedures and are used by the operator to diagnose system failure to perform safety functions.
- ° Instrumentation previously identified based on plant walkdowns conducted under the Systematic Evaluation Program (SEP Topic III-12).

As this activity is completed, equipment considered by the licensee to be classified as Regulatory Guide 1.97 revision 2 category 1 or category 2 items will be fully qualified in accordance with 10 CFR 50.49 criteria before operation in the plant.

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 May 21, 1984 submittal, justification for continued operation addressing each item of equipment for which the environmental qualification is not yet completed (see enclosure for the JCO equipment list).

We have reviewed each JCO provided by the licensee in its May 21, 1984 submittal 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 that does not demonstrate full qualification, but provides 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 misleading information to the operator.
- c. Limited use 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.

- ° Commonwealth 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 January 18, 1985 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.

This completes the Quad Cities Units 1 and 2 electrical equipment environmental qualification program review. Upon completion of the program, the licensee is required to 1) submit a letter stating that all equipment within the scope of 10 CFR 50.49 has been identified and is environmentally qualified, and 2) maintain all environmental qualification documentation up to date and in an auditable form as required by paragraph (j) of 10 CFR 50.49.

Enclosure:
As stated

Principal Contributor: P. Shemanski

Dated: January 11, 1985

ENCLOSURE

Justification for Continued Operation Equipment List

Quad Cities Unit 1 <u>Tag No.</u>	NRC TER <u>No.</u>	<u>Description</u>
TE-1-1291-60A thru H	53	Temperature Elements
FS-1 1464A,B	11	Barton Flow Switches
MO-1-1402-24A,B MO-1-1402-25A,B	7	Limatorque Motorized Valve Actuators
MO-1-1402-38A,B	8	Limatorque Motorized Valve Actuators
DPIS-1-2352,-2353	None	Differential Pressure Indicating Switches
MO-1-2301-4	13	Limatorque Motorized Valve Actuators
PS-1-2389A thru D	None	Pressure Switches
TS-1-2370 A thru D TS-1-2371 A thru D TS-1-2372 A thru D TS-1-2373 A thru D	15	United Electric Controls Temperature Switches
1-203-3B thru E	18	Dresser Industries Solenoid Vaives
DPIS-1-1001-81A,B	32	Differential Pressure Indicating Switches
DPIS-1-1001-78A,B	35	Barton Differential Pressure Switches

<u>Tag No.</u>	<u>No.</u>	<u>Description</u>
Quad Cities	NRC	
	TER	
MO-1-1001-23A,B	26	Limatorque Motorized Valve Operators
MO-1-1001-26A,B	6	Limatorque Motorized Valve Operators
MO-1-1001-29A,B	24	Limatorque Motorized Valve Operators
MO-1-1001-5A,B	23	Limatorque Motorized Valve Operators
MO-1-1001-63	28	Limatorque Motorized Valve Operators
PS-1-1622A,B	21	Static-O-Ring Pressure Switches
SO-1-1601-50A,B	47	Versa Solenoid Valves
FSL-1/2-7541-33A,B	63	Mercoïd Flow Switches
FSL-1/2-7541-8A,B		
MO-1/2-7504A,B	None	Motor-Operated Dampers
MO-1/2-7507A,B		
MO-1/2-7505A,B		
1/2-7506A,B	60	New York Blower Electric Motors
22212-29A,B	65	Harlo Instrument and Control Panels
1-5746A,B	37	General Electric Motors
1-5748A,B	38	General Electric Motors
MO-1-3706	41	Limatorque Motorized Valve Actuator
MO-1-220-1	19	Limatorque Motorized Valve Actuator

Quad Cities <u>Tag No.</u>	NRC TER <u>No.</u>	<u>Description</u>
SO-1-203-1A thru D SO-1-203-2A thru D	16	Gould Solenoid Valves
LIS-1-263-58A,B LIS-1-263-73A,B	42	Yarway Level Indicating Switches
MO-1-202-5A,B	46	Limiterque Motorized Valve Actuators
POS-1-220-44 POS-1-220-45	58	Weigland Electric Heaters
MO-1-1301-16	None	Motor-operated Gate Valve
Cable	53	General Electric Cable XLPE
79-01B-1 thru 8 DW-203-3A 1RB-166 thru -169 1RB-63 thru-66 None	57	Allen-Bradley Terminal Blocks

ENCLOSURE

Justification for Continued Operation Equipment List

<u>Tag No.</u>	<u>No.</u>	<u>Description</u>
Quad Cities Unit 2	NRC	
	TER	
TE-1-1291-60A thru H	1	Temperature Elements
FS-1-1464A,B	11	Barton Flow Switches
MO-1-1402-24A,B	7	Limiterque Motorized Valve Acturators
MO-1-1402-25A,B		
MO-1-1402-38A,B	8	Limiterque Motorized Valve Acturators
DPIS-1-2352, -2353	None	Differential Pressure Indicating Switches
MO-1-2301-4	13	Limiterque Motorized Valve Acturators
PS-1-2389A thru D	None	Limiterque Motorized Valve Acturators
TS-1-2370A thru D	15	United Electric Controls Temperature
TS-1-2371A thru D		Switches
TS-1-2372A thru D		
TS-1-2373A thru D		
1-203-3B thru E	18	Dresser Industries Solenoid Valves
DPIS-1-1001-81A,B	32	Differential Pressure Indicating Switches
DPIS-1-1001-78A,B	35	Barton Differential Pressure Switches

Quad Cities <u>Tag No.</u>	NRC TER <u>No.</u>	<u>Description</u>
MO-1-1001-23A,B	26	Limatorque Motorized Valve Operators
MO-1-1001-26A,B	6	Limatorque Motorized Valve Operators
MO-1-1001-29A,B	24	Limatorque Motorized Valve Operators
MO-1-1001-5A,B	23	Limatorque Motorized Valve Operators
MO-1-1001-63	28	Limatorque Motorized Valve Operators
PS-1-1622A,B	21	Static-O-Ring Pressure Switches
SO-1-1601-50A,B	47	Versa Solenoid Valves
1-5746A,B	37	General Electric Motors
1-5748A,B	38	General Electric Motors
MO-1-3706	41	Limatorque Mptorized Valve Actuator
MO-1-220-1	19	Limatorque Motorized Valve Actuator
SO-1-203-1A thru D SO-1-203-2A thru D	16	Gould Solenoid Valves
LIS-1-263-58A,B LIS-1-263-73A,B	42	Yarway Level Indicating Switches
MO-1-202-5A,B	45	Limatorque Motorized Valve Actuators

Quad Cities <u>Tag No.</u>	NRC TER <u>No.</u>	<u>Description</u>
POS-2-220-44, -45	None	Position Switches
SO-2-220-45	None	Solenoid Valve
MO-2-1301-16	None	Motor-Operated Gate Valve
Cable	None	XLPE Insulation With Polyvinyl Chloride Jacket