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NUCLEAR REGULATORY COMMISSION  
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SAFETY EVALUATION BY THE  
OFFICE OF NUCLEAR REACTOR REGULATION  
OMAHA PUBLIC POWER DISTRICT  
FORT CALHOUN STATION UNIT 1  
DOCKET NO. 50-285

ENVIRONMENTAL QUALIFICATION OF ELECTRIC EQUIPMENT IMPORTANT TO SAFETY

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 Electric 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 50, Appendix A, General Design Criterion (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 Report (SER) on environmental qualification of safety-related electrical equipment to the licensee on May 29, 1981. This SER 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 SER. In response to the staff SER 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 November 10, 1982. A Safety Evaluation Report was subsequently issued to the Omaha Public Power District on January 11, 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 50, specifies the requirements of electrical equipment important to safety located in a harsh environment. In accordance with this rule, equipment for Fort Calhoun Unit 1 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 the 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 March 23, 1984, a meeting was held to discuss Omaha Public Power District's proposed method to resolve the environmental qualification deficiencies identified in the January 11, 1983 SER and November 10, 1982 FRC TER. Discussions also included Omaha Public Power District'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 May 31, 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 of: (1) the licensee's proposed resolutions of the environmental qualification deficiencies identified in the January 11, 1983 SER and November 10, 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 11, 1983 SER, and the FRC TER enclosed with it, are described in the licensee's May 31, 1984 submittal. During the March 23, 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 SER dated January 11, 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. We discussed the proposed resolutions in detail on an item by item basis with the licensee during the March 23, 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. The licensee's equipment environmental qualification files will be audited by the staff during follow-up inspections to be performed by Region IV, 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 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 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 May 31, 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 a master list of all equipment required to remain functional during or after a design basis accident (DBA) and which is exposed to a harsh environment as a result of the design basis accident was prepared. FSAR Appendix M identified the Loss of Coolant Accident (LOCA) and Main Steam Line Break (MSLB) as the only DBA resulting in a harsh environment which require qualification investigation. The actual master list was prepared based on equipment requirements and equipment location derived from the FSAR, Technical Specifications, Emergency Procedures, P&IDs (flow diagrams) and electrical diagrams.

The licensee states that all design basis accidents which result in a harsh environment (including flooding) which could expose safety related electrical equipment required to function to mitigate the accident to the harsh environment was considered in its review.

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 equipment whose failure under postulated environmental conditions could prevent satisfactory accomplishment of safety functions, is summarized below:

1. The equipment master list was generated to include all equipment which must remain functional during or after a design basis accident and which is exposed to a harsh environment as a result of the design basis accident. The plant specific Loss of Coolant Accident (LOCA) and High Energy Line Break (HELB) analysis, FSAR Appendix M, identified the LOCA and Main Steam Line Break (MSLB) as the only DBA resulting in a harsh environment which requires equipment qualification. The actual master list was prepared based on DBA equipment requirements, and equipment location based on the FSAR, Technical Specification, Emergency Procedures, P&IDs (flow diagrams and electrical diagrams).
2. The list also includes auxiliary devices in the electrical circuit also exposed to the harsh environment, which could prevent the operation of the safety-related (required to function) component. Also included are the auxiliary system (ventilation, cooling water, etc.) which are required for the operation of the safety-related system or components.
3. A review of the effects of the failure of non-safety related equipment was made. With regards to electrical isolation and faults, the Fort Calhoun Station instrument and control power and three phase AC (4160V and 480V) systems are designed with isolation devices such as fuses to clear any faults which may occur. A fault on a non-safety related device should, therefore, not affect the operation of a safety-related device.

We find the methodology being 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 states that post accident monitoring equipment has been adequately considered. Those items required in the Station Emergency Procedures have been identified and qualified for the required function and environment. This includes those items required by NUREG-0737. --

Any changes or upgrades to accident monitoring equipment will be implemented on a negotiated schedule.

Final implementation of post accident monitoring equipment and its scope was directed by NUREG-0737, Supplement 1, which required the review and implementation of Regulatory Guide 1.97 (Rev. 2). This is an ongoing program with a schedule negotiated by the Fort Calhoun Station Project Manager.

The staff has not yet completed its review for conformance to, and acceptability of, 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.

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 31, 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 the JCO provided by the licensee in its May 31, 1984 submittal and find it acceptable since it is based on essentially the same criteria that were used by the staff and its contractor to review JCO's 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 can not 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 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.

- ° Omaha Public Power District'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 11, 1983 SER 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.

Justification For Continued Operation Equipment List

<u>Fort Calhoun Tag No.</u>	<u>NRC TER No.</u>	<u>Description</u>
C9-17, C9-1, C9-10, C9-7, B2-6, C9- 8, C9-9, C9-12, C9-13, A11-7, A11-8, A4-8, C9-11, C9-18, B2-9, A4-9, D5-7, D10-5, D5-8, D10-6, C9-13, C9-16, D5-6, B5-1, B5-2, E2-9, E2-10, E9-7,  E9-8, E9-10, E1-3, E2-8, E2-7, B1-3, B2-10, A11-4, A4-3, A4-4, D5-3, D5-4, D10-3, D10-4, D5-7, D10-5, A11-2, A4-2, D5-4, D10-4, C9-5, E2-7, B2-6, E9-7, C9-14, E2-5, B2-1, B2-5, B1-1, E1-1, E2-4, E6-1, E9-4, C6-1, C6-2, C8-2, E9-5	99	Conax Electrical Penetrations