

SAFETY EVALUATION REPORT  
OFFICE OF NUCLEAR REACTOR REGULATION  
EQUIPMENT QUALIFICATION BRANCH  
SURRY POWER STATION UNIT 2  
DOCKET NO. 50-281

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 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.

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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 21, 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 December 22, 1982. A Safety Evaluation Report was subsequently issued to the Virginia Power and Electric Company (Vepco) for Surry Power Station Unit 2 on January 26, 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 for electrical equipment important to safety located in a harsh environment. In accordance with this rule, equipment for Surry Unit 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 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 19, 1984, a meeting was held to discuss Vepco's proposed method to resolve the environmental qualification deficiencies identified in the January 26, 1983 SER and December 22, 1982 FRC TER. Discussions also include Vepco'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 January 11, 1985 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 26, 1983 SER and December 22, 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 26, 1983 SER, and the FRC TER enclosed with it, are described in the licensee's January 11, 1985 submittal. During the March 19, 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 26, 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 19, 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 II, 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 January 11, 1985 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 the environmental effects (including flooding) from all postulated design basis accidents (both inside and outside containment) analyzed in Surry Unit 2 Final Safety Analysis Report (FSAR) were considered in the identification of safety-related electrical equipment to be environmentally qualified. These accidents include Loss of Coolant Accidents and Main Steam Line Breaks inside containment, and various High Energy Line Breaks (HELB's) outside containment. Those systems required to perform the following functions were first identified:

Veeco prepared its initial list of safety-related electrical equipment in response to IEB 79-01B by determining which safety-related plant electrical equipment is required to function to obtain hot safe shutdown. This list was based on reviews of the Final Safety Analysis Report (FSAR), Technical Specifications, Emergency Operating Procedures and flow and electrical diagrams for safety systems. Mechanical and auxiliary systems necessary to support the operation of equipment on the Environmental Qualification Master

List (EQML) (e.g. cooling water or lubricating systems) were also considered. The electrical equipment identified is incorporated into the EQML, which was reviewed and accepted by the NRC on May 20, 1981. Subsequent to that time, electrical items which were installed due to TMI requirements and are located in a harsh environment have been added, and items to be qualified under Regulatory Guide 1.97 have been identified on the EQML. With the issuance of the EQ Rule (10 CFR 50.49), those EQML items identified as located in a mild environment were deleted. Subsequent reviews and/or local refinements of the Environmental Zone Descriptions have identified a few additional mild environment items, which have also been deleted.

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. A list of safety-related electrical equipment (as defined in paragraph (b)(1) of 10 CFR 50.49) required to remain functional during or following design-basis Loss of Coolant Accident (LOCA) or High Energy Line Break (HELB) Accidents was generated. 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 (FSAR), Technical Specifications, Emergency Operating Procedures, and flow and electrical diagrams for safety systems.
2. The elementary wiring diagrams of the safety-related electrical equipment identified in Step 1 have been reviewed to identify any auxiliary devices electrically connected directly into the control or power circuitry of the safety-related equipment (e.g., automatic trips) whose failure due to postulated environmental conditions could prevent the required operation of the safety-related equipment.

3. The operation of the safety-related systems and equipment was 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 electrical and flow diagrams, 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 in physical proximity were considered by a review of the original Surry Power Station 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 circuit fault protection.

The failure due to environmental effects on the systems and equipment identified by the process delineated in Steps 2, 3 or 4 above was reviewed for potential impact on the EQML equipment. No additional electrical equipment was identified by this review. However, the review did identify that a short circuit on certain non-safety branch circuits fed from the 120 VAC Vital Bus System could potentially degrade the voltage on the Vital Bus. Even though the likelihood of such an occurrence is low, Veeco is proceeding to install in-line fuses to protect the Vital Bus from faults on the non-safety branch circuits.

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.

#### Post-Accident Monitoring Equipment - 10 CFR 10.49(b)(3)

The Post-Accident monitoring instrumentation is presently derived from Regulatory Guide 1.97 Revision 3 by comparing, on a point-by-point basis, the list of generic points in Regulatory Guide 1.97 Revision 3 with existing plant parameters. The resultant list, including the equipment to be added, was transmitted to the NRC on January 31, 1984 (Serial No. 053). The staff has not yet completed its review for conformance to Regulatory Guide 1.97.

Upon completion of that review and agreement by Vepco and the NRC on the appropriate list, the Category 1 and 2 variables will be added to the EQML. Certain of these items have been identified and will be upgraded under the Regulatory Guide 1.97 implementation schedule.

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 January 11, 1985 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 January 11, 1985 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 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.

- ° Vepco's, Surry Unit 2 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 26, 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>Surry Tag No.</u>	<u>NRC TER No.</u>	<u>Description</u>
PT-RS-256A -256B	1	Fischer Pressure Transmitters
PT-LM-201A -201B	116	Rosemount Pressure Transmitters
FT-2945, -2946	13	Rosemount Flow Transmitters
FT-2961, -2962, -2963	12	Barton Flow Transmitters
LT-2477, -2487 -2497	16	Rosemount Level Transmitters
TE-2410, -2420, -2430 -2412B, -2412D -2422B, -2422D -2432B, -2432D -2413, -2423, -2433	24	Rosemount Resistance Temperature Detectors
TE-2411B, -2411C, -2411D -2412C, -2422C, -2432C -2421B, -2421C, -2421D -2431B, -2431C, -2431D	24A	Rosemount Resistance Temperature Detectors
2-CC-P-2A/2B	60, 61	General Electric Motors
SOV-SS-200A1	82	ASCO Solenoid Operated Valve