

SAFETY EVALUATION REPORT BY THE
OFFICE OF NUCLEAR REACTOR REGULATION
EQUIPMENT QUALIFICATION BRANCH
FOR OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN
DOCKET NO. 50-285

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ENVIRONMENTAL QUALIFICATION OF SAFETY-RELATED ELECTRICAL EQUIPMENT

1 INTRODUCTION

General Design Criteria 1 and 4 specify that safety-related electrical equipment in nuclear facilities must be capable of performing its safety-related function under environmental conditions associated with all normal, abnormal, and accident plant operation. In order to ensure compliance with the criteria, the NRC staff required all licensees of operating reactors to submit a reevaluation of the qualification of safety-related electrical equipment which may be exposed to a harsh environment.

2 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 IE 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.

Subsequently, Commission Memorandum and Order CLI-80-21 (issued on May 23, 1980) states that the DOR guidelines and portions of NUREG-0588 (which were issued on January 14, 1980, as enclosures 4 and 5 to IEB-79-01B) 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. This order also requires the staff to complete safety evaluation reports (SERs) for all operating plants by February 1, 1981. In addition, this order requires that the licensees have qualified safety-related equipment installed in their plants by June 30, 1982.

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 order also required that all safety-related electrical equipment be qualified by June 30, 1982. In response, the licensee submitted information through letters dated April 17, June 20, July 17, October 31, and November 19 and 25, 1981.

2.1 Purpose

The purpose of this SER is to identify equipment whose qualification program does not provide sufficient assurance that the equipment is capable of performing the design function in hostile environments. The staff position relating to any identified deficiencies is provided in this report.

2.2 Scope

The scope of this report is limited to an evaluation of the equipment which must function in order to mitigate the consequences of a loss-of-coolant accident (LOCA) or a high-energy-line-break (HELB) accident, inside or outside containment, while subjected to the hostile environments associated with these accidents.

3 STAFF EVALUATION

The staff evaluation of the licensee's response included an onsite inspection of selected Class IE equipment and an examination of the licensee's report for completeness and acceptability. The criteria described in the DOR guidelines and in NUREG-0588, in part, were used as a basis for the staff evaluation of the adequacy of the licensee's qualification program.

The NRC Office of Inspection and Enforcement performed (1) a preliminary evaluation of the licensee's response, documented in a technical evaluation report (TER) and (2) an onsite verification inspection (March 13-14, 1980) of selected safety-related electrical equipment. The low-pressure safety injection system was inspected. The inspection verified proper installation of equipment, overall interface integrity, and manufacturers' nameplate data. The manufacturer's name and model number from the nameplate data were compared to information given in the Component Evaluation Work Sheets (CES) of the licensee's report. The site inspection is documented in a report dated March 26, 1980. No deficiencies were noted. For this review, the documents referenced above have been factored into the overall staff evaluation.

3.1 Completeness of Safety-Related Equipment

In accordance with IEB 79-01B, the licensee was directed to (1) establish a list of systems and equipment that are required to mitigate a LOCA and an HELB and (2) identify components needed to perform the function of safety-related display information, post-accident sampling and monitoring, and radiation monitoring.

The staff developed a generic master list based upon a review of plant safety analyses and emergency procedures. The instrumentation selected includes parameters to monitor overall plant performance as well as to monitor the performance of the systems on the list. The systems list was established on the basis of the functions that must be performed for accident mitigation (without regard to location of equipment relative to hostile environments).

The list of safety-related systems provided by the licensee was reviewed against the staff-developed master list.

Based on the licensee's submittal, the staff has concluded that the information on safety-related systems included in the submittal is insufficient to verify that those systems are all the systems required to achieve or support: (1) emergency reactor shutdown, (2) containment isolation, (3) reactor core cooling, (4) containment heat removal, (5) core residual heat removal, and (6) prevention of significant release of radioactive material to the environment. The staff acknowledges the licensee's effort to include only those safety-related systems located in a potentially harsh environment. However, this review requires the listing of all safety-related systems, both inside and outside potentially harsh environments. As noted in Appendix D, additional information on core residual heat removal and supporting systems is required to verify the completeness of safety-related systems. Exceptions to the requirements are discussed in Section 5 of this report.

Display instrumentation which provides information for the reactor operators to aid them in the safe handling of the plant was not specifically identified by the licensee. A complete list of all display instrumentation mentioned in the LOCA and HELB emergency procedures must be provided. Equipment qualification information in the form of summary sheets should be provided for all components of the display instrumentation exposed to harsh environments. Instrumentation which is not considered to be safety related but which is mentioned in the emergency procedure should appear on the list. For these instruments, (1) justification should be provided for not considering the instrument safety related and (2) assurance should be provided that its subsequent failure will not mislead the operator or adversely affect the mitigation of the consequences of the accident. The environmental qualification of post-accident sampling and monitoring and radiation monitoring equipment is closely related to the review of the TMI Lessons-Learned modifications and will be performed in conjunction with that review.

The licensee identified 129 items of equipment which were assessed by the staff.

3.2 Service Conditions

Commission Memorandum and Order CLI-80-21 requires that the DOR guidelines and the "For Comment" NUREG-0588 are to be used as the criteria for establishing the adequacy of the safety-related electrical equipment environmental qualification program. These documents provide the option of establishing a bounding pressure and temperature condition based on plant-specific analysis identified in the licensee's Final Safety Analysis Report (FSAR) or based on generic profiles using the methods identified in these documents.

On this basis, the staff has assumed, unless otherwise noted, that the analysis for developing the environmental envelopes, relative to the temperature, pressure, and the containment spray caustics, has been performed in accordance with the requirements stated above. The staff has reviewed the qualification documentation to ensure that the qualification specifications envelope the conditions established by the licensee. During this review, the staff assumed that for plants designed and equipped with an automatic containment spray system which satisfies the single-failure criterion, the main-steam-line-break (MSLB) environmental conditions are enveloped by the large-break-LOCA environmental conditions. The staff evaluated the design of the containment spray and found that the system

is not subjected to a disabling single-component failure and therefore satisfies the requirements of Section 4.2.1 of the DOR guidelines.

Equipment submergence has also been addressed where the possibility exists that flooding of equipment may result from HELBs.

3.3 Temperature, Pressure, and Humidity Conditions Inside Containmentment

The licensee has provided the results of accident analyses as follows:

| | <u>Max Temp (°F)</u> | <u>Max Press (psig)</u> | <u>Humidity (%)</u> |
|------|----------------------|-------------------------|---------------------|
| LOCA | 285 | 57 | 100 |
| MSLB | 401 | (Not Provided) | 100 |

The staff has concluded that the minimum temperature profile for equipment qualification purposes should include a margin to account for higher-than-average temperatures in the upper regions of the containment that can exist due to stratification, especially following a postulated MSLB. Use of the steam saturation temperature corresponding to the total building pressure (partial pressure of steam plus partial pressure of air) versus time will provide an acceptable margin for either a postulated LOCA or MSLB, whichever is controlling, as to potential adverse environmental effects on equipment.

The licensee's specified temperature (service condition) of 285°F does not satisfy the above requirement. A saturation temperature corresponding to the peak profile (305°F peak temperature at 57 psig) should be used instead. The licensee should update his equipment summary tables to reflect this change. If there is any equipment that does not meet the staff position, the licensee must provide either justification that the equipment will perform its intended function under the specified conditions or propose corrective action.

The staff notes that for the EEQ review the accidents which were used to evaluate equipment were LOCAs inside containment. As stated in Section 3.2 of this report, this plant is equipped with an automatic containment spray system. However, the temperature for the MSLB inside containment exceeds the LOCA profile by 115°F for a short time (about two minutes). The licensee should provide the analysis to verify that the effects of this short-term peak temperature do not affect the environmental qualification of the safety-related equipment which was qualified using the LOCA profile.

3.4 Temperature, Pressure, and Humidity Conditions Outside Containmentment

The licensee has provided the temperature, pressure, humidity and applicable environment associated with an P₂LB outside containment. The following areas outside containment have been addressed:

- (1) ECCS pump rooms (HPSI, LPSI, and containment spray) Rooms 21 and 22
- (2) Main steam and main feedwater piping areas (Room 81)
- (3) Ventilation areas containing safety-related equipment

The staff has verified that the parameters identified by the licensee for the MSLB are acceptable.

3.5 Submergence

The maximum submergence levels have been established and assessed by the licensee. Unless otherwise noted, the staff assumed for this review that the methodology employed by the licensee is in accordance with the appropriate criteria as established by Commission Memorandum and Order CLI-80-21.

The licensee's value for maximum submergence is at the 1000.9 ft level. Equipment below this level has been identified by the licensee, along with the proposed corrective action. The licensee identified eight safety-related electrical components as having the potential for becoming submerged after a postulated event.

The licensee stated that the equipment required to function under submerged conditions has been qualified by test or analysis or by design modifications using qualified sealer material. Therefore, conditioned only on the satisfactory resolution and review of the supporting documentation discussed in Section 4 of this report, the staff concludes that the licensee's response satisfies the Commission requirements and is acceptable.

It is not clear from the information submitted that submergence of safety-related electrical equipment outside of containment was addressed. The licensee should address this area more specifically in the 90-day response and upgrade the CES as appropriate.

3.6 Chemical Spray

The licensee's FSAR value for the chemical concentration is 1700 ppm boric acid solution. The licensee identified that some of the equipment was tested using different spray solutions ranging between 1000 ppm and 3000 ppm boric acid. Based on a review of the information submitted by the licensee, the staff concludes that the justification provided in using less severe solutions is incomplete in part. The staff requires that the licensee amend his response and justify the qualification adequacy of all the equipment that was subjected to less severe caustic sprays expected at the plant site. The staff will review the licensee's response when it is submitted and discuss the resolution in a supplemental report.

3.7 Aging

Section 7 of the DOR guidelines does not require a qualified life to be established for all safety-related electrical equipment. However, the following actions are required:

- (1) Make a detailed comparison of existing equipment and the materials identified in Appendix C of the DOR guidelines. The first supplement to IEB-79-01B requires licensees to utilize the table in Appendix C 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.

The licensee identified a number of equipment items for which a specified qualified life was established (for examples, 5 years, 15 years, or 40 years). In its assessment of these submittals, the staff did not review the adequacy of the methodology nor the basis used to arrive at these values; the staff has assumed that the established values are based on state-of-the-art technology and are acceptable.

For this review, however, the staff requires that the licensee submit supplemental information to verify and identify the degree of conformance to the above requirements. The response should include all the equipment identified as required to maintain functional operability in harsh environments.

The licensee indicated that this phase of the response is outstanding and that the review is in progress. The staff will review the licensee's response when it is submitted and discuss its evaluation in a supplemental report.

3.8 Radiation (Inside and Outside Containment)

The licensee has provided values for the radiation levels postulated to exist following a LOCA. The application and methodology employed to determine these values were presented to the licensee as part of the NRC staff criteria contained in the DOR guidelines, in NUREG-0588, and in the guidance provided in IEB-79-01B, Supplement 2. Therefore, for this review, the staff has assumed that, unless otherwise noted, the values provided have been determined in accordance with the prescribed criteria. The staff review determined that the values to which equipment was qualified enveloped the requirements identified by the licensee.

The value required by the licensee inside containment is an integrated dose of 3×10^6 rads. This value does not envelope the DOR guideline requirements (4×10^7 rads) and therefore is not acceptable. The radiation service condition provided by the licensee is lower than provided in the guidelines for gamma and beta radiation. The licensee is requested to either provide justification for using the lower service condition or use the guidelines for both gamma and beta radiation. If the former option is chosen, then the analysis--including the basis, assumptions, and a sample calculation--should be provided.

A required value outside containment of 4×10^6 rads has been used by the licensee to specify limiting radiation levels within the low- and high-pressure safety injection ECCS system pump rooms of the auxiliary building (Room 13). This value appears to consider the radiation levels influenced by the source term methodology associated with post-LOCA recirculation fluid lines and is therefore acceptable.

4 QUALIFICATION OF EQUIPMENT

The following subsections present the staff's assessment, based on the licensee's submittal, of the qualification status of safety-related electrical equipment.

The staff has separated the safety-related equipment into three categories: (1) equipment requiring immediate corrective action, (2) equipment requiring additional qualification information and/or corrective action, and (3) equipment considered acceptable if the staff's concern identified in Section 3.7 is satisfactorily resolved.

In its assessment of the licensee's submittal, the NRC staff did not review the methodology employed to determine the values established by the licensee. However, in reviewing the data sheets, the staff made a determination as to the stated conditions presented by the licensee. Additionally, the staff has not completed its review of supporting documentation referenced by the licensee (for example, test reports). It is expected that when the review of test reports is complete, the environmental qualification data bank established by the staff will provide the means to cross reference each supporting document to the referencing licensee.

If supporting documents are found to be unacceptable, the licensee will be required to take additional corrective actions to either establish qualification or replace the item(s) of concern. This effort will begin in early 1981.

An appendix for each subsection of this report provides a list of equipment for which additional information and/or corrective action is required. Where appropriate, a reference is provided in the appendices to identify deficiencies. It should be noted, as in the Commission Memorandum and Order, that the deficiencies identified do not necessarily mean that equipment is unqualified. However, they are cause for concern and may require further case-by-case evaluation.

4.1 Equipment Requiring Immediate Corrective Action

Appendix A identifies equipment (if any) in this category. The licensee was asked to review the facility's safety-related electrical equipment. The licensee's review of this equipment has not identified any equipment requiring immediate corrective action. Three licensing event reports (LERs) have been submitted by the licensee (LER 79-007, LER 80-006, and LER 80-007, dated March 19, April 28 and May 8, 1980). In all cases, the licensee has either committed to replace the equipment during the first refueling outage or has modified the design with satisfactorily qualified sealant material (see Appendix A for additional information). The staff has reviewed the modifications and the corrective action taken and finds the proposed changes acceptable. In addition, in this review, the staff has not identified any safety-related electrical equipment which is not able to perform its intended safety function during the time in which it must operate.

4.2 Equipment Requiring Additional Information and/or Corrective Action

Appendix B identifies equipment in this category, including a tabulation of deficiencies. The deficiencies are noted by a letter relating to the legend (identified below), indicating that the information provided is not sufficient for the qualification parameter or condition.

Legend

R - radiation
T - temperature

QT - qualification time
RT - required time
P - pressure
H - humidity
CS - chemical spray
A - material-aging evaluation; replacement schedule; ongoing equipment surveillance
S - submergence
M - margin
I - HELB evaluation outside containment not completed
QM - qualification method
RPN - equipment relocation or replacement; adequate schedule not provided
EXN - exempted equipment justification inadequate
SEN - separate-effects qualification justification inadequate
QI - qualification information being developed
RPS - equipment relocation or replacement schedule provided

As noted in Section 4, these deficiencies do not necessarily mean that the equipment is unqualified. However, the deficiencies are cause for concern and require further case-by-case evaluation. The staff has determined that an acceptable basis to exempt equipment from qualification, in whole or part, can be established provided the following can be established and verified by the licensee:

- (1) Equipment does not perform essential safety functions in the harsh environment, and equipment failure in the harsh environment will not impact safety-related functions or mislead an operator.
- (2a) Equipment performs its function before its exposure to the harsh environment, and the adequacy for the time margin provided is adequately justified, and
- (2b) Subsequent failure of the equipment as a result of the harsh environment does not degrade other safety functions or mislead the operator.
- (3) The safety-related function can be accomplished by some other designated equipment that has been adequately qualified and satisfies the single-failure criterion.
- (4) Equipment will not be subjected to a harsh environment as a result of the postulated accident.

The licensee is, therefore, required to supplement the information presented by providing resolutions to the deficiencies identified; these resolutions should include a description of the corrective action, schedules for its completion (as applicable), and so forth. The staff will review the licensee's response, when it is submitted, and discuss the resolution in a supplemental report.

It should be noted that in cases where testing is being conducted, a condition may arise which results in a determination by the licensee that the equipment does not satisfy the qualification test requirements. For that equipment, the licensee will be required to provide the proposed corrective action, on a timely basis, to ensure that qualification can be established by June 30, 1982.

4.3 Equipment Considered Acceptable or Conditionally Acceptable

Based on the staff review of the licensee's submittal, the staff identified the equipment in Appendix C as (1) acceptable on the basis that the qualification program adequately enveloped the specific environmental plant parameters, or (2) conditionally acceptable subject to the satisfactory resolution of the staff concern identified in Section 3.7.

For the equipment identified as conditionally acceptable, the staff determined that the licensee did not clearly

- (1) state that an equipment material evaluation was conducted to ensure that no known materials susceptible to degradation because of aging have been used,
- (2) establish an ongoing program to review the plant surveillance and maintenance records in order to identify equipment degradation which may be age related, and/or
- (3) propose a maintenance program and replacement schedule for equipment identified in item 1 or equipment that is qualified for less than the life of the plant.

The licensee is, therefore, required to supplement the information presented for equipment in this category before full acceptance of this equipment can be established. The staff will review the licensee's response when it is submitted and discuss the resolution in a supplemental report.

5 DEFERRED REQUIREMENTS

IEB 79-01B, Supplement 3 has relaxed the time constraints for the submission of the information associated with cold shutdown equipment and TMI lessons-learned modifications. The staff has required that this information be provided by February 1, 1981. The staff will provide a supplemental safety evaluation addressing these concerns.

6 CONCLUSIONS

The staff has determined that the licensee's listing of safety-related systems and associated electrical equipment whose ability to function in a harsh environment following an accident is required to mitigate a LOCA or HELB is complete and acceptable, except as noted in Section 3 of this report. The staff has also determined that the environmental service conditions to be met by the electrical equipment in the harsh accident environment are appropriate, except as noted in Section 3 of this report. Outstanding information identified in Section 3 should be provided within 90 days of receipt of this SER.

The staff has reviewed the qualification of safety-related electrical equipment to the extent defined by this SER and has found no outstanding items which would require immediate corrective action to ensure the safety of plant operation. However, the staff has determined that many items of safety-related electrical equipment identified by the licensee for this review do not have adequate

documentation to ensure that they are capable of withstanding the harsh environmental service conditions. This review was based on a comparison of the qualification values with the specified environmental values required by the design, which were provided in the licensee's summary sheets.

Subsection 4.2 identified deficiencies that must be resolved to establish the qualification of the equipment; the staff requires that the information lacking in this category be provided within 90 days of receipt of this SER. Within this period, the licensee should either provide documentation of the missing qualification information which demonstrates that such equipment meets the DOR guidelines or NUREG-0588 or commit to a corrective action (requalification, replacement, relocation, and so forth) consistent with the requirements to establish qualification by June 30, 1982. If the latter option is chosen, the licensee must provide justification for operation until such corrective action is complete.

Subsection 4.3 identified acceptance and conditional acceptance based on noted deficiencies. Where additional information is required, the licensee should respond within 90 days of receipt of this SER by providing assurance that these concerns will be satisfactorily resolved by June 30, 1982.

The staff issued to the licensee Sections 3 and 4 of this report and requested, under the provisions of 10 CFR 50.54(f), that the licensee review the deficiencies enumerated and the ramifications thereof to determine whether safe operation of the facility would be impacted in consideration of the deficiencies. The licensee has completed a preliminary review of the identified deficiencies and has determined that, after due consideration of the deficiencies and their ramification, continued safe operation would not be adversely affected.

Based on these considerations, the staff concludes that conformance with the above requirements and satisfactory completion of the corrective actions by June 30, 1982 will ensure compliance with the Commission Memorandum and Order of May 23, 1980. The staff further concludes that there is reasonable assurance of continued safe operation of this facility pending completion of these corrective actions. This conclusion is based on the following:

- (1) that there are no outstanding items which would require immediate corrective action to assure safety of plant operation
- (2) some of the items found deficient have been or are being replaced or relocated, thus improving the facility's capability to function following a LOCA or HELB
- (3) the harsh environmental conditions for which this equipment must be qualified result from low-probability events; events which might reasonably be anticipated during this very limited period would lead to less demanding service conditions for this equipment.

APPENDIX A

Equipment Requiring
Immediate Corrective Action
(Category 4.1)

LEGEND:

Designation for Deficiency

- R - Radiation
- T - Temperature
- QT - Qualification time
- RT - Required time
- P - Pressure
- H - Humidity
- CS - Chemical spray
- A - Material aging evaluation, replacement schedule, ongoing equipment surveillance
- S - Submergence
- M - Margin
- I - HELB evaluation outside containment not completed
- QM - Qualification method
- RPN - Equipment relocation or replacement, adequate schedule not provided
- EXN - Exempted equipment justification inadequate
- SEN - Separate effects qualification justification inadequate
- QI - Qualification information being developed
- RPS - Equipment relocation or replacement schedule provided

| Item | Equipment | Manufacturer | Model | Deficiency |
|-------------------|------------------|--------------|--------------|----------------|
| C-33 ¹ | Limit Switch | Honeywell | DT-2RN2-RH | RPN,T,P,R,QM |
| C-32 ¹ | Limit Switch | Honeywell | OPAR30 | RPN,T,P,R,QM |
| C-30 ² | Pressure Switch | Barksdale | DZT-M15055 | RPN,T,P,R,QM |
| C-37 ³ | Vent Fan Splices | Dow-Corning | RTV-3,45 | |
| C-26 ¹ | Limit Switch | NAMCO | EA-180-11302 | RPN,QT,QI,QM-S |

¹The licensee committed to replace this equipment. Failure of this equipment may give the operator incorrect information for valve status, but will not cause inadvertant valve operation or prohibit the function of other safety-related circuits.

²The licensee committed to replace this equipment with LOCA-qualified equipment or relocate it outside containment. The switch is used to isolate containment instrument air header. In the event of equipment failure, the backup instrumentation outside containment will detect low system pressure and manual isolation can be achieved (LER-007).

³Splices were replaced with material qualified to withstand the LOCA environment. Corrective action was completed May 9, 1980 (LER 80-006,007).

APPENDIX B

Equipment Requiring Additional Information
and/or Corrective Action
(Category 4.2)

LEGEND:

Designation for Deficiency

- R - Radiation
- T - Temperature
- QT - Qualification time
- RT - Required time
- P - Pressure
- H - Humidity
- CS - Chemical spray
- A - Material aging evaluation, replacement schedule, ongoing equipment surveillance
- S - Submergence
- M - Margin
- I - HELB evaluation outside containment not completed
- QM - Qualification method
- RPN - Equipment relocation or replacement, adequate schedule not provided
- EXN - Exempted equipment justification inadequate
- SEN - Separate effects qualification justification inadequate
- QI - Qualification information being developed
- RPS - Equipment relocation or replacement schedule provided

| Item | Equipment | Manufacturer | Model | Deficiency |
|------|-------------------|------------------------|-------------|-------------|
| C-27 | Solenoid Valve | Valcor | | RPN,QM-S |
| C-28 | Solenoid Valve | ASCO | NP8320A185E | RPN,QM-S |
| R1-1 | Solenoid Valve | ASCO | HTX831429 | T,P,EXN,R-M |
| R1-2 | Limit Switch | Fisher Governor Co. | 304 | T,P,EXN,R-M |
| R5-1 | Motor Operator | Limatorque | SMB-003 | T,P,R,EXN |
| S-1 | Limit Switch | Fisher Control | 304 | T-M,EXN |
| S-2 | Solenoid Operator | ASCO | WPHT-831429 | QM |

APPENDIX B (Continued)

| Item | Equipment | Manufacturer | Model | Deficiency |
|------|--------------------|------------------------|--------------|----------------|
| I-26 | Solenoid Valve | ASCO | WPHT-831429 | QM,R-M |
| I-15 | Limit Switch | Fisher Governor Co. | 304 | R-M |
| I-27 | Solenoid Valve | ASCO | WPHT-831429 | R-M |
| I-7 | Limit Switch | Fisher Governor Co. | 304 | R-M |
| R1-3 | Solenoid Valve | ASCO | HTX831429 | R-M,T,P,QM-EXN |
| R1-4 | Unit Switch | Fisher Governor Co. | 304 | R-M,T,P,QM-EXN |
| R2-1 | Solenoid Valve | ASCO | HTX831429 | R-M,T,P,QM-EXN |
| R2-2 | Limit Switch | Fisher Governor Co. | 304 | R-M,T,P,QM-EXN |
| R4-1 | Motor | Allis Chalmers Co. | 030 | R-M,T,P,QM-EXN |
| R4-2 | Solenoid Valve | ASCO | HTX831429 | T,P,QM-EXN |
| R4-3 | Limit Switch | Microswitch | BZE6 | T,P,QM-EXN,R-M |
| R4-4 | Limit Switch | Fisher Governor Co. | 304 | R-M,T,P,QM-EXN |
| S-8 | Level Transmitter | GE/MAC | 555 | T,P |
| S-4 | Motor/HVAC | Trane | SCMZ-304 | QM-T,P |
| S-5 | Fan Motor | ILG Industries | | QM,T,P |
| R3-2 | Limit Switch | Fisher Governor Co. | 304 | QM-FXN,P,T |
| C-16 | Temperature Sensor | Alison Control Inc. | ASL-120(132) | QM |
| C-17 | Temperature Sensor | Alison Control Inc. | ASL-72(192) | QM |

APPENDIX B (Continued)

| Item | Equipment | Manufacturer | Model | Deficiency |
|------|--------------------|---------------------|------------|----------------|
| C-18 | Temperature Sensor | Alison Control Inc. | ASL-60-SS | QM |
| R2-3 | Solenoid Valve | ASCO | HTX831429 | T,P,QM-EXN |
| R2-4 | Limit Switch | Fisher Governor Co. | 304 | T,P,QM-EXN |
| R4-5 | Solenoid Valve | ASCO | LB8316C44 | R-M,P,T,QM-EXN |
| R4-6 | Limit Switch | Honeywell | OPAR30 | P,T,QM-EXN |
| R3-1 | Solenoid Valve | ASCO | WPHT831429 | P,T,QM-EXN |
| I-8 | Limit Switch | NAMCO | D1200G | R-M |
| I-9 | Limit Switch | NAMCO | D1200G | R-M |
| R2-5 | Solenoid Valve | ASCO | HTX(HT) | P,T,QM-EXN |
| R2-6 | Limit Switch | Fisher Governor Co. | 304 | P,T,QM-EXN |
| R2-9 | Limit Switch | Fisher Governor Co. | 546 | P,T,QM-EXN |
| R4-7 | Solenoid Valve | ASCO | HTX-831429 | P,T,QM-EXN |
| R4-8 | Limit Switch | Fisher Governor Co. | 304 | P,T,QM-EXN |
| C-6 | Cable Splices | | | T-M |
| *C-0 | Flow Transmitter | Foxboro | E13DH | R,S-SEN |
| I-30 | Solenoid Valve | ASCO | HTX831429 | R-M |
| I-13 | Limit Switch | NAMCO | D2400X | R-M |
| I-2 | Solenoid Valve | ASCO | HTX831429 | R-M |
| I-14 | Limit Switch | Microswitch | OP-AR7112 | R-M |
| I-19 | Solenoid Valve | ASCO | HT8321A5 | R-QM |

*See Attachment I: Foxboro Letter (3/12/81), "Potential Deficiency Affecting Foxboro Transmitters," for corrective action.

APPENDIX B (Continued)

| Item | Equipment | Manufacturer | Model | Deficiency |
|-------|-----------------|------------------------|-----------|----------------|
| I-11 | Limit Switch | NAMCO | D1200G | R |
| I-20 | Solenoid Valve | ASCO | LB8316C44 | R,QM |
| I-25 | Solenoid Valve | ASCO | HT8321A5 | R,QM |
| I-6 | Limit Switch | Microswitch | 51ML1 | R-M |
| I-18 | Solenoid Valve | ASCO | LB8316C44 | R,QM |
| I-5 | Limit Switch | Microswitch | 51ML1 | R-M |
| R1-11 | Motor Operator | Limatorque | SMB-000 | T,P,QM-EXN |
| R1-14 | Solenoid Valve | ASCO | HTX831429 | T,P,QM-EXN |
| R1-15 | Limit Switch | NAMCO | D2400X | T,P,QM-EXN,R-M |
| R7-1 | Solenoid Valve | ASCO | HTX | T,P,QM-EXN,R-M |
| R7-2 | Limit Switch | NAMCO | D1200G | T,P,QM-EXN,R-M |
| R4-9 | Solenoid Valve | ASCO | HTX | T,P,QM-EXN |
| R4-10 | Limit Switch | Fisher Governor Co. | 304 | T,P,QM-EXN |
| I-24 | Solenoid Valve | ASCO | LB8316C44 | R-QM |
| I-12 | Limit Switch | NAMCO | D1200G | R |
| I-21 | Solenoid Valve | ASCO | LB8316C44 | R-QM |
| I-10 | Limit Switch | NAMCO | D1200G | R |
| R1-5 | Solenoid Valve | ASCO | HTX831429 | T,P,QM-EXN |
| R1-6 | Limit Switch | Fisher Governor Co. | 304 | T,P,QM-EXN |
| R1-12 | Motor Operator | Limatorque | SMB-2 | T,P,QM-EXN |
| R1-13 | Position Switch | Fisher Governor Co. | 546 | T,P,QM-EXN,R-M |
| R2-7 | Solenoid Valve | ASCO | HTX831429 | T,P,QM-EXN |

APPENDIX B (Continued)

| Item | Equipment | Manufacturer | Model | Deficiency |
|-------|----------------------|---------------------|------------|----------------|
| R2-8 | Limit Switch | Fisher Governor Co. | 304 | T,P,QM-EXN |
| R4-11 | Solenoid Valve | ASCO | HTX | T,P,QM-EXN |
| R4-12 | Limit Switch | Fisher Governor Co. | 304 | T,P,QM-EXN |
| I-29 | Solenoid Valve | ASCO | WPHT831429 | R-M |
| I-17 | Limit Switch | Fisher Governor Co. | 304 | R-M |
| I-28 | Solenoid Valve | ASCO | WPHT831429 | R-M |
| I-16 | Limit Switch | Fisher Governor Co. | 304 | R-M |
| R4-13 | Solenoid Valve | ASCO | HTX831429 | T,P,QM-EXN |
| R4-14 | Limit Switch | Microswitch | BEZ6-2RQ2 | T,P,QM-EXN,R-M |
| *C-21 | Pressure Transmitter | Foxboro | E11GM | SEN, R |
| C-23 | Heaters | E. I. Wiegard Co. | Cartridge | R,P,QM |
| *C-22 | Pressure Transmitter | Foxboro | E11GM | SEN(R), R |
| *C-20 | Pressure Transmitter | Foxboro | E11GM | SEN(R), R |
| *C-35 | Level Transmitter | Foxboro | E13DM,DH | SER-R, R |
| R3-3 | Solenoid Valve | ASCO | LB8320A26 | P,T,QM-EXN,R-M |
| R3-4 | Limit Switch | NAMCO | D2400X | P,T,QM-EXN,R-M |
| R1-7 | Solenoid Valve | ASCO | HT831429 | P,T,QM-EXN |
| R1-8 | Limit Switch | Fisher Governor Co. | 304 | P,T,QM-EXN,R-M |
| R1-9 | Solenoid Valve | ASCO | HT831429 | P,T,QM-EXN |

*See Attachment I: Foxboro Letter (3/12/81), "Potential Deficiency Affecting Foxboro Transmitters," for corrective action.

APPENDIX B (Continued)

| Item | Equipment | Manufacturer | Model | Deficiency |
|-------|----------------|------------------------|------------|----------------|
| R1-10 | Limit Switch | Fisher Governor Co. | 304 | P,T,QM-EXN,R-M |
| C-28A | Solenoid Valve | ASCO | NP8320A185 | RPN |
| C-29 | Solenoid Valve | ASCO | | |

APPENDIX C

Equipment Considered Acceptable
or Conditionally Acceptable
(Category 4.3)

LEGEND:

Designation for Deficiency

- R - Radiation
- T - Temperature
- QT - Qualification time
- RT - Required time
- P - Pressure
- H - Humidity
- CS - Chemical spray
- A - Material aging evaluation, replacement schedule, ongoing equipment surveillance
- S - Submergence
- M - Margin
- I - HELB evaluation outside containment not completed
- QM - Qualification method
- RPM - Equipment relocation or replacement, adequate schedule not provided
- EXN - Exempted equipment justification inadequate
- SEN - Separate effects qualification justification inadequate
- QI - Qualification information being developed
- RPS - Equipment relocation or replacement schedule provided

| Item | Equipment | Manufacturer | Model | Deficiency |
|------|-------------------------|--------------|-------------|------------|
| C-19 | Fan Motor | Reliance | 60-30-1200 | A |
| C-32 | Fan Motor | Reliance | 4830-20-MM | A |
| I-4 | Motor | GE | 5K815526A35 | |
| I-23 | Solenoid Valve | ASCO | LB8316C44 | |
| I-22 | Solenoid Valve | ASCO | LB8316C44 | |
| C-3 | Electrical Penetrations | Conax | | |

APPENDIX C (Continued)

| Item | Equipment | Manufacturer | Model | Deficiency |
|------|----------------------|-----------------------|---------------------|------------|
| C-4 | Adhesive Sealant | Dow-Corning | RTV-3144 | A |
| C-36 | Cable Splices | Amp & Amer. Pamcor | AMP-CAT-321280 | |
| C-34 | Cable Splices | Feeder Cables | | |
| C-37 | Vent Fan Splices | Dow-Corning | RTV-3145 | |
| C-7 | Terminal Blocks | States | M-25014(16) (18) | |
| C-8 | Terminal Boxes | Hoffman | | |
| C-9 | Cable | Cerro-Wire & Cable | | A |
| C-10 | Cable | Cerro-Wire & Cable | | A |
| C-11 | Cable | Cerro-Wire & Cable | | A |
| C-12 | Cable | Cerro-Wire & Cable | | A |
| C-13 | Cable | Anaconda Wire | Triplexed | A |
| I-3 | Motor | GE | 5K815524A51 | |
| C-14 | Motor Operator | Limitorque | SMB-0 | A |
| C-15 | Motor Operator | Limitorque | SMB-0 | A |
| I-1 | Motor | GE | 5K818837A38 | |
| C-1 | Motor Operated Valve | Limitorque | SMB-0 | A |
| C-2 | Motor Operated Valve | Limitorque | SMB-3 | A |
| S-12 | Solenoid Valve | Valcor | | A |
| S-13 | Limit Switch | Fisher Controls | 304 | |
| S-11 | Solenoid Valve | ASCO | LB8316C36 | |

APPENDIX C (Continued)

| Item | Equipment | Manufacturer | Model | Deficiency |
|------|----------------------|------------------------|------------|------------|
| S-20 | Motor Operator | Limatorque | SMB-000 | A |
| S-14 | Solenoid Valve | ASCO | WPHT831429 | |
| S-15 | Limit Switch | Fisher Governor Co. | 304 | |
| S-16 | Motor Operated Valve | Limatorque | SMB | A |
| S-9 | Motor Operated Valve | Limatorque | SMB | |
| S-6 | Solenoid Valve | ASCO | HTX | |
| S-7 | Solenoid Valve | ASCO | HT8320A8 | |
| S-16 | Motor Operated Valve | Limtorque | SMB | A |
| S-10 | Limit Switch | Fisher Governor Co. | 304 | |

APPENDIX D

Safety-Related Systems List¹

| FUNCTION | SYSTEM |
|---|---|
| Emergency Reactor Shutdown | Reactor Coolant Reactor Protection Safeguards Actuation Chemical and Volume Control |
| Containment Isolation | Chemical and Volume Control Main Steam Feedwater and Blowdown Containment Spray Demineralized Water System Containment Hydrogen Purge Instrument Air High Pressure Safety Injection Low Pressure Safety Injection Nitrogen Supply Plant Air Sampling Raw Water Waste Disposal Auxiliary Feedwater |
| Reactor Core Cooling | High Pressure Injection Low Pressure Injection Safety Injection Tanks |
| Containment Heat Removal | Containment Spray Containment HVAC |
| Core Residual Heat Removal ² | Low Pressure Injection (Part of Shutdown Cooling) Power Operated Relief Valves Main Feedwater Auxiliary Feedwater Main Steam Component Cooling Water Raw Water |

¹The NRC staff recognized that there are differences in nomenclature of systems because of plant vintage and engineering design: consequently, some systems performing identical or similar functions may have different names. In those instances it was necessary to verify the system(s) function with the responsible IE regional reviewer and/or the 1st ~~stage~~.

²Additional systems information needed for this function.

APPENDIX D (Continued)

| FUNCTION | SYSTEM |
|--|---|
| Prevention of Significant Release of Radioactive Material to Environment | Containment Hydrogen Purge Sampling Radiation Monitoring Post Accident Sampling and Monitoring Containment Spray (Iodine Removal) |
| Supporting Systems ² | Control Room Ventilation |

The Foxboro Company

12 March 1981

Subject: Potential Deficiency Affecting Foxboro Transmitters,
Model Numbers N-E11, N-E13 or E11, E13 with suffix
Codes /MCA, /MCA/RRW, or /MCA/RR

Gentlemen:

Our records indicate that you have received one or more of the Foxboro model numbered transmitters listed above. This letter is to notify you that two deficiencies have been discovered in some of these transmitters which may exist in the units shipped to you. The transmitters in question operate at a signal level of 10-50mA. Similar model numbered units operating at 4-20mA are not affected.

The first issue involves the possible use of incorrect insulating sleeving on transistor and zener diode lead wires in the amplifier. The second issue involves the use of a specific vendor's capacitor which is not hermetically sealed (although claimed to be so). As a result, the capacitor electrolyte can leak under adverse service conditions, specifically heat and time. The failure mode is a decrease in resistance across the capacitor resulting in electrical leakage. The transmitter operation can be affected by limiting the output to something less than full value which, in time, can degrade to no output at all.

Insulating Sleeving - Radiation resistant sleeving consisting of a silicone coated glass fiber braid has been substituted by a teflon sleeving in some transmitters. Tests have shown that teflon will become brittle and deteriorate with a substantial integrated radiation dose. Foxboro testing has demonstrated that the teflon sleeving used in these devices will withstand an integrated dose of 10 megarads with no noticeable deterioration. Tests to 200 megarads produce the brittle conditions which can result in the teflon flaking from the wires. Based on these tests, operating plants not expected to exceed an integrated dose of 10 megarads have no potential problem and no action is required.

Where the integrated dose rate could exceed 10 megarads, then units in service should be inspected to determine if the proper insulating material has been used. This can be accomplished by opening the transmitter in accordance with Foxboro Master Instruction MI 20-145. The amplifier cover must be removed exposing the amplifier assembly. At one end of the assembly, a transistor and a zener diode are mounted in the base casting which serves as a heat sink. The insulating material in question is a sleeving slipped over the lead wires from these two components. The proper material is white and heavy looking. Positive

FOXBORO

Page 2
12 March 1981

Subject:

identification can be made by inspecting one end of the material to establish that the outer material covers an inner braid. Teflon, if used, will be a single layer material and could be either clear or white.

If improper insulation is present, then the corrective action is to replace the amplifier (Foxboro P/N N0148PW). Replacement amplifiers can be purchased from your local Foxboro Sales or Service Representatives. If you prefer to have Foxboro Service Personnel inspect the equipment and, if necessary, replace the amplifier, this can be arranged at standard service rates.

Capacitor - The capacitor degradation problem was discovered over time through tracking failure situations. Internal corrective action has been taken to remove the vendor involved from the qualified vendor list and to purge all stock of capacitors from this vendor. Degradation of this capacitor is a function of time and service conditions with heat being a primary contributor. This phenomenon was observed in recent tests of transmitters using these capacitors. The capacitor in question is manufactured by Cornell-Duebilier and can be specifically identified by a type number in the form TX-65-XXXX as well as a monogram in a box followed by a date code, e.g.

| | |
|-----|------|
| CDE | 0874 |
|-----|------|

. It is assigned Foxboro part number N0141MF.

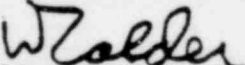
To determine if this capacitor is present requires a visual inspection of the amplifier which can be accomplished as described above for the insulating sleeving inspection. The recommended corrective action should the above described capacitor be present is to replace the amplifier (Foxboro P/N N0148PW) although it is possible to replace the capacitor with a Foxboro provided substitute. Use of Foxboro Service personnel to perform the inspection and replacement, if necessary, can be arranged at standard service rates as described above.

Due to lack of knowledge of specific application, redundancy, and the like, Foxboro cannot determine if the NRC reporting requirements of 10CFR Part 21 are applicable. This determination is the responsibility of the user and any such reporting would be made by them after completing their evaluation of the situation.

If you have any questions regarding the above, please contact the undersigned directly.

Very truly yours,

THE FOXBORO COMPANY


William Calder, Manager
Corporate Quality Assurance

joy
120381

Enclosure MI 20-145

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