

Safety Evaluation Report By the
Office of Nuclear Reactor Regulation
Equipment Qualification Branch

For Commonwealth Edison Co.
Zion Nuclear Power Station Unit No. 1,
Docket No. 50-295

Environmental Qualification of Safety-Related
Electrical Equipment

8106080406

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SAFETY EVALUATION REPORT BY THE
OFFICE OF NUCLEAR REACTOR REGULATION
EQUIPMENT QUALIFICATION BRANCH
FOR COMMONWEALTH EDISON CO.
ZION NUCLEAR POWER STATION, UNIT NO. 1
DOCKET NO. 50-295
ENVIRONMENTAL QUALIFICATION OF SAFETY-RELATED
ELECTRICAL EQUIPMENT

1.0 INTRODUCTION

General Design Criteria 1 and 4 specify that safety-related electrical equipment in nuclear facilities must be capable of performing their safety-related function under all normal, abnormal and accident conditions. The NRC staff has required that all licensees of operating reactors evaluate the qualification of their safety-related electrical equipment which is located in a harsh environment.

2.0 BACKGROUND

In 1977, the NRC staff instituted the systematic evaluation program (SEP) to determine the extent to which the licensing basis for the older operating nuclear plants complies with current licensing criteria. Topic III-12 of this program relates to the environmental qualification of safety-related equipment. In December 1977, the NRC issued a generic letter to all SEP plant licensees requesting that they review the adequacy of existing equipment qualification documentation. NRC review of licensee responses led to the preparation of NUREG-0458, an interim NRC assessment of the environmental qualification of electrical equipment.

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 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 program. On November 13, 1979 the DOR (Division of Operating Reactors) "Guidelines for Evaluating Environmental Qualification of class IE Electrical Equipment in Operating Reactors" were prepared to form the basis for reviewing equipment in all operating plants.

In October 1979, the NRC contracted with Franklin Research Center (FRC) for assistance in the detailed review of the SEP equipment environmental qualification and prepare the technical evaluation reports (TERs).

In February 1980, the NRC decided to include Indian Point Units 2 and 3 and Zion Units 1 and 2 in the SEP program for the purpose of equipment environmental qualification review.

Also in February 1980, the NRC staff met with personnel from FRC and representatives of the SEP group in an open session at NRC headquarters to review the program in relation to the DOR guidelines.

On May 23, 1980, the Commissioners issued Memorandum and Order CLI-80-21, which states that the DOR guidelines and NUREG-0588 set the requirements that licensees and applicants must meet regarding the environmental qualification of safety-related electrical equipment to satisfy 10 CFR 50, Appendix A, General Design Criteria (GDC)-4. This order required the staff to complete

safety evaluation reports (SERs) for all operating plants by February 1, 1981. In addition this Order requires that all licensees must have qualified safety-related electrical 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 a letter dated March 5, 1980, the Zion licensee, Commonwealth Edison Company (CECO) was formally asked to address the environmental qualification of safety-related equipment for the Zion Station. In response to this request, CECO submitted information which was transmitted by a letter dated May 2, 1980.

On June 6, 1980, CECO presented a revised submittal, updated with the latest available information pertaining to equipment qualification. CECO submitted additional information on September 24, October 1, October 20, and October 31, 1980.

2.1 PURPOSE

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

2.2 SCOPE

The scope of this report includes that equipment which must function to mitigate the consequences of Loss-of-Coolant Accident (LOCA) or a High-Energy-Line Break (HELB) inside or outside containment, and whose environment would be adversely affected by that accident.

3.0 STAFF EVALUATION

The staff's evaluation of the licensee's responses was accompanied by performing an on-site inspection of selected Class IE equipment and by examining the licensee's report for completeness and acceptability. The criteria described in the DOR Guidelines and NUREG-0588, in part, were used as a basis for the staff's evaluation of the adequacy of the Licensee qualification program.

During the week of June 2, 1980, NRC and FRC representatives visited the Zion plant site, inspected safety-related systems and equipment, identified and tabulated safety-related components through discussions with plant personnel, and conducted a general review of CECO's submittal of May 2, 1980. The inspection spot checked proper installation of accessible equipment, and manufacturers nameplate data. The manufacturer and model number

from the nameplate data were compared to information given in the Licensee's submittal.

The following safety evaluation incorporates the CECO submittal and the Franklin Research Center technical evaluation report (TER).

3.1 COMPLETENESS OF SAFETY-RELATED EQUIPMENT

In accordance with the DOR guidelines, the licensee was directed to establish a list of systems and display instrumentation needed to mitigate the consequences of a LOCA or HELB, inside or outside containment, and reach safe shutdown. The lists of safety related systems and display instrumentation were developed from a review of plant safety analyses and emergency procedures. The display instrumentation selected includes parameters to monitor overall plant performance as well as to monitor performance of the systems on the list. The systems list was established on the basis of the functions that must be performed for mitigation of the consequences of a LOCA or HELB without regard to location of equipment relative to a potentially hostile environment. The staff has determined and verified that the systems considered by the licensee are those 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 concludes that the systems identified by the licensee are acceptable. The systems and instrumentation list is contained in Appendix D.

The licensee submitted an extensive list of safety-related electrical equipment. This list was evaluated and identical components within

a plant area exposed to the same environment were grouped; 96 item types of equipment were identified and assessed by the staff. Items with exceptions are discussed in section 5.0 of this report.

3.2 SERVICE CONDITIONS

The Commission Memorandum and Order (CLI-80-21), dated May 23, 1980 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 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 for Zion 1 relative to the temperature, pressure, and the containment spray caustics, has been performed in accordance with the above stated requirements. For this review the staff reviewed the qualification documentation to ensure that the qualification specifications envelope the conditions established by the licensee. 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 environmental conditions are enveloped by the large break LOCA environmental conditions. The staff assumed and requires that the licensee verify, that the containment spray system is not subjected to a disabling single component failure and therefore satisfies the DOR Guideline requirements of Section 4.2.1.

Equipment submergence has also been addressed where the possibility exists that flooding of equipment may result from high energy line breaks (HELB).

3.3 TEMPERATURE, PRESSURE, AND HUMIDITY CONDITIONS INSIDE CONTAINMENT

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

| | Max. Temp. ($^{\circ}$ F) | Max. Press. (psig) | Humidity |
|------|----------------------------|--------------------|----------|
| LOCA | 271 | 47 | 100% |
| MSLB | | (Not provided) | |

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 271° F does not satisfy the above requirement. A saturation temperature corresponding to the pressure profile (295° F peak temperature at 47 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.

3.4 TEMPERATURE, PRESSURE AND HUMIDITY CONDITIONS OUTSIDE CONTAINMENT

The licensee has provided the temperature pressure, humidity and applicable environmental values associated with a HELB outside containment in the following plant areas:

1. Upper Safety Valve Room
2. Lower Safety Valve Room
3. Main Steam & Feedwater Pipe Tunnel
4. Tendon Tunnel
5. Aux. building (elev. 579 feet)
6. Aux. building (elev. 592 feet)
7. Seal water heat exchanger rooms.
8. Pipe tunnels and penetration areas
9. Centrifugal charging pump rooms
10. RHR heat exchanger rooms
11. Boric acid evaporator and RAD waste rooms

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. The staff assumed for this review, unless, otherwise noted, that the methodology employed by the licensee is in accordance with the appropriate criteria as established by the Commission Memorandum and Order (CLI-80-21), dated May 23, 1980. The licensee's value for maximum submergence is 3.5 feet (elev. 581.5 feet).

The licensee has identified 4 equipment item models below this level. The staff concurs with the licensee's position as presented in the TER,

(1) operation is not required post LOCA and is therefore exempt from qualification, one item, and (2) failure due to submergence does not result in degradation of the capability to attain safe shutdown, one item. Based on the TER the staff has determined that qualification is required for two items; interim justification for continued operation has been provided by the licensee.

The licensee should provide an assessment of the failure modes associated with the submergence of equipment. Assurance should also be provided that the subsequent failure of this equipment will not adversely affect any other safety functions or mislead an operator. Additionally, the licensee should discuss operating time across the spectrum of events in relation to the time of submergence. If the results of the licensee's assessment are acceptable, then the equipment may be exempt from the submergence parameter of qualification.

3.6 Chemical Spray

The licensee's FSAR value for the chemical concentration is 2500-3000 PPM boric acid solution corresponding to approximately 1.2 volume percent used by the vendors for qualification testing.

3.7 Aging

The DOR Guidelines, section 7, does not require a qualified life to be established for all safety related electrical equipment, however the following actions are required:

1. Detailed comparison of existing equipment to the materials identified in Appendix C of the DOR guidelines. The first supplement to IEB-79-01B requires the licensees to utilize the table and identify any additional materials as a 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.

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

The staff will review the licensee's response, when submitted, and report its evaluation in a supplemental report.

3.8 RADIATION (INSIDE AND OUTSIDE CONTAINMENT)

The licensee has provided values for radiation levels postulated to exist following a LOCA event. The application and methodology employed to determine these values have been presented to the licensee as part of the NRC staff criteria contained in the DOR Guidelines, NUREG-0588 and the guidance provided in IEB-79-01B, Supplement 2. The value required by the

licensee inside containment is an integrated dose of 1×10^8 RADS. This value envelopes the DOR Guideline requirements and is therefore acceptable. A required value outside containment of 2×10^7 RADS has been used by the licensee to specify limiting radiation levels within the centrifugal charging pump rooms of the auxiliary building. 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.

4.0 QUALIFICATION OF EQUIPMENT

The following subsections are the staff's assessment, based on the licensee's submittal, and the Franklin TER 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 conditioned only on the satisfactory resolution of the staff's concern identified in Section 3.7.

The NRC staff in its assessment of the licensee's submittal and the TER did not review the methodology employed to determine the values established by the licensee. However, in reviewing the TER a determination was made by the staff as to the stated conditions presented by the licensee. Additionally, the detailed review of supporting documentation referenced by the licensee (e.g., test reports) has been completed by FRC.

The environmental qualification data bank to be established by the staff will provide the means to cross reference each supporting document to the referencing licensee.

Where supporting documents were 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. An appendix for each subsection is attached which provides a list of equipment which requires additional information and/or corrective action. 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 evaluations.

4.1 EQUIPMENT REQUIRING IMMEDIATE CORRECTIVE ACTION

Appendix A identifies equipment (if any) in this category. The licensee was requested to perform a review of the facility's safety-related electrical equipment. The licensee's review of this equipment has not identified any equipment requiring immediate corrective action and therefore no licensee event reports were submitted. In addition the staff, in this review, has not identified any safety-related electrical equipment which is known not to be able to perform its intended safety function during the time period in which it is required to operate.

4.2 EQUIPMENT REQUIRING ADDITIONAL INFORMATION AND/OR CORRECTIVE ACTION

Appendix B identifies equipment in this category including the tabulation of their deficiencies. The deficiencies are noted by a letter relating to the legend, identified below, including that insufficient information has been provided for the qualification parameter or condition.

R - Radiation

T - Temperature

QT - Qualification Time

RT - Required Time

P - Pressure

H - Humidity

CS - Chemical Spray

MA - 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 4.0, these deficiencies do not necessarily mean that the equipment is unqualified. However, they are cause for concern and require further case-by-case evaluations. 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 provide essential safety functions in the harsh environment and failure of it in the harsh environment will not impact safety related functions or mislead an operator.
- (2a) Equipment performs its function prior to 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 criteria.
- (4) Equipment not subjected to a harsh environment as a result of the postulated accident.

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

It should be noted that where testing is presently 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 their proposed corrective action, on a timely basis, to assure that qualification can be established by June 30, 1982.

4.3 EQUIPMENT CONSIDERED ACCEPTABLE OR CONDITIONALLY ACCEPTABLE

Based on the staff's review of the licensee's submittal and the TER 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's 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 a material evaluation on their equipment was conducted to assure that no known materials susceptible to degradation due to aging have been used in their equipment.
- (2) establish an ongoing program to review the surveillance and maintenance records of their plant 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 submitted, and report on the resolution in a supplemental report.

5.0 DEFERRED REQUIREMENTS

IE Bulletin 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. To permit a uniform program schedule the SEP plant reviews have been amended. The staff required that this information be provided by February 1, 1981. The staff will provide a supplemental safety evaluation addressing these concerns.

6.0 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. 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 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 assure 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 on NUREG-0588 or commit to a corrective action (re-qualification, 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), the licensee to 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 we 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 (CLI-80-21) and with the licensing orders issued by NRR on October 24, 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, and
- (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

LIST OF EQUIPMENT IN SECTION 4.1, EQUIPMENT REQUIRING IMMEDIATE
CORRECTIVE ACTION

| TER ITEM NO. | EQUIPMENT DESCRIPTION | MANUFACTURER | MODEL / TYPE |
|-----------------|--------------------------|--------------|-----------------|
|-----------------|--------------------------|--------------|-----------------|

NO EQUIPMENT IN THIS CATEGORY

APPENDIX B

List of Equipment in Section 4.2, Equipment Requiring
Additional Information And/Or Corrective Action

LEGEND:

Designation for Deficiency

- | | |
|---|---|
| R - Radiation | M - Margin |
| T - Temperature | I - HELB Evaluation Outside Containment Not Completed |
| QT - Qualification Time | QM - Qualification Method |
| RT - Required Time | RPN - Equipment Relocation or Replacement, Adequate Schedule Not Provided |
| P - Pressure | EXN - Exempted Equipment Justification Inadequate |
| H - Humidity | SEN - Separate Effects Qualification Justification Inadequate |
| CS - Chemical Spray | QI - Qualification Information Being Developed |
| A - Material Aging Evaluation, Replacement Schedule, Ongoing Equipment Surveillance | RPS - Equipment Relocation or Replacement Schedule provided |
| S - Submergence | |

| TER ITEM NO. | EQUIPMENT DESCRIPTION | MANUFACTURER | MODEL/ TYPE | DEFICIENCIES |
|-----------------|--------------------------|--------------|----------------|--------------|
| 20 | Junction box | UNK | EB-215 | QM,QI,S,CS |
| 21 | Junction box | UNK | EB-214 | QM,QI,S,CS |
| 22 | Junction box | UNK | EM-47150 | QM,QI,S,CS |
| 23 | Junction box | UNK | UNK | QM,QI,S,CS |
| 38 | Junction box | UNK | EM-47150 | QM,QI,S,CS |
| | Terminal block | Marathon | 6000 | QM,QI,S,CS |
| 50 | Junction box | UNK | EM-47150 | QI,S,CS,A |
| | Terminal block | Marathon | 6000 | QI,S,CS,A |
| 51 | Junction box | UNK | EB-214 | QI,S,CS,A |
| | Terminal block | Marathon | 6000 | QI,S,CS,A |
| 55 | Junction box | UNK | EM-47150 | QI,S,CS,A |

APPENDIX B (CONTINUED)

| TER ITEM NO. | EQUIPMENT DESCRIPTION | MANUFACTURER | MODEL/ TYPE | DEFICIENCIES |
|-----------------|--------------------------|--------------|---|---------------------------|
| 71 | Junction box | UNK | EB-215 | QI,S,CS,A |
| | Terminal block | Marathon | 6000 | |
| 72 | Junction box | UNK | EM-47150 | QI,S,CS,A |
| | Terminal block | Marathon | 6000 | |
| 73 | Junction box | UNK | EB-215 | QI,S,CS,A |
| | Terminal block | Marathon | 6000 | |
| 74 | Junction box | UNK | EB-214 | QI,S,CS,A |
| | Terminal block | Marathon | 6000 | |
| 48 | Junction box | UNK | EM-47150 | QI,S,CS,A |
| | Terminal block | Marathon | 6000 | |
| 7 | SOV operator | ASCO | 8300 | QI,A,T,P,CS, R,M,QM,QT |
| 53 | SOV operator | ASCO | HPX-8320A25 LB-83146 LB-831654 HPX-8320A26 | QI,A,T,R |
| 66 | SOV operator | ASCO | 8316E34 | QI,A,T,R |
| 37 | Remote shutdown panel | UNK | UNK | QI,A |
| 34 | Electrical indicators | Westinghouse | VX-252 | QI,A,T,P,R,M,QM QT |
| 6 | Motor | Westinghouse | 585.5CSP | QI,A,QM |
| 42 | Motor | UNK | 36MP/184 | A,R |
| 56 | Motor | Westinghouse | HSDP | QI,A |

Appendix B, Continued

| TER ITEM NO. | EQUIPMENT DESCRIPTION | MANUFACTURER | MODEL/ TYPE | DEFICIENCIES |
|-----------------|----------------------------------|-----------------|------------------------|------------------------|
| 16 | Electrical penetrations | D.G. O'Brien | Type 4.1 | A,CS,R |
| 17 | Electrical penetrations | D.G. O'Brien | Type 3.1 | A,CS,R |
| 18 | Electrical penetrations | D.G. O'Brien | Types 2.1, 2.2, 2.3 | A,CS,R |
| 19 | Electrical penetrations | D.G. O'Brien | Type 5.1 | A,CS,R |
| 39A | MOV | Limitorque | SMB-3-100 | QI,A,T,P,R,M,QT |
| 1A | MOV | Limitorque | SMB-3 | QI,A,T |
| 52C | MOV | Limitorque | SMB-1 | QI,QM,A,T,P,R,M, QT |
| 52D | MOV | Limitorque | SMB-0 | QI,QM,A,T,P,QT,R, M |
| 52E | MOV | Limitorque | SMB-00 | QI,QM,A,T,P,QT,R, M |
| 52F | MOV | Limitorque | SMB-000 | QI,QM,A,T,P,QT,R, M |
| 60 | MOV | Limitorque | SMB-0 | QI,QM,A,T,P,QT,R, M |
| 43A | Temperature switch | United Electric | C-300 | QI,QM,A,R |
| 12 | Resistance temperature detectors | SOSTMAN | UNK | QI,A,S,CS,R |
| 69 | Electrical indicator | Weschler | UNK | QI,QM,A,T,P,QT,R, M |
| 75 | Electrical penetration | D.G. O'Brien | Type 1.1 | QI,A,QM,CS,R |
| 76 | Electrical penetration | D.G. O'Brien | Type 5.2 | QI,A,QM,CS,R |
| 44 | Hydrogen recombiner blower | GE | 5K182 CK742 | QI,A,R |

APPENDIX B, Continued

| TER ITEM NO. | EQUIPMENT DESCRIPTION | MANUFACTURER | MODEL TYPE | DEFICIENCIES |
|-----------------|--------------------------|------------------|------------------------|------------------------|
| 5 | Limit Swtich | NAMCO | EA180 | A,QM,CS |
| 11 | Level Transmitter | BARTON | 386 | QI,QM,A,QT,CS |
| 8A | Transmitter | Fischer & Porter | 10B2496 PBBABBB-NS | QI,QM,A,QT,CS, M,S |
| 10A | Transmitter | Fischer & Porter | 10B2491V CBB-NS | QI,QM,A,QT,CS, M |
| 10B | Transmitter | Fischer & Porter | 13D2495K BBABBB-NS | QI,QM,A,QT,CS, M,S |
| 10D | Transmitter | Fischer & Porter | 50-EP1041 BCXA-NS | QI,QM,A,QT,CS, M |
| 31 | Motor | Westinghouse | HSDP SBDP | QI,A,T |
| 58 | Motor | UNK | Type B | QI,A,QM,T,P,QT, R,M |
| 61 | Motor | Westinghouse | TBFC | QI,A |
| 70 | Pressure Switch | Barksdale | 9672-3 | QI,QM,A,T,P,QT, R,M |
| 33 | Transmitter | Fischer & Porter | 10B2495 | QI,QM,A,QT,M |
| 64B | MOV | Limatorque | SMB-00-15 | QI,QM,A,T,P,QT, R,M |
| 65 | SOV Operator | ASCO | HPX-8320 A25, A26 | QI,A,T,P,QT |
| 67 | SOV Operator | Ross | 233693 | QI,A,T,P,QT,R |
| 9 | Level Switch | Magnetrol | A-153-FEP/ VPX-Y-3X | P,QT,S,CS |
| 3 | SOV Operator | ASCO | LB831654 | QI,A |
| 82 | SOV Operator | ASCO | THT-8316 -C34 | QI,A,T,P,QT,CS, R |
| 67 | Pressure Transmitter | Fischer & Porter | 50EP104 LBCXA | RPS |

APPENDIX C

LIST OF EQUIPMENT IN SECTION 4.3, EQUIPMENT CONSIDERED ACCEPTABLE
OR CONDITIONALLY ACCEPTABLE

LEGEND: A - Material Aging Evaluation

| TER ITEM NO. | EQUIPMENT DESCRIPTION | MANUFACTURER | MODEL/ TYPE | DEFICIENCIES |
|-----------------|--------------------------|--------------------------------------|----------------|--------------|
| 24 | Cable | Boston Insulated Wire & Cable Co. | CSPE/LSPE | A |
| 78 | Cable | Boston Insulated Wire & Cable Co. | CSPG/LSPE | A |
| 25 | Cable | Kerite Corp. | Various | A |
| 28 | Cable | Kerite Corp. | Various | A |
| 26 | Splices | Raychem Corp. | WCSF (N) | A |
| 27 | Splices | Kerite Corp. | UNK | A |
| 77 | Cable | Anaconda | Various | A |
| 79 | Cable | Okonite | Various | A |
| 80 | Cable | Rockbestos | Various | A |
| 81 | Cable | Samuel Moore | Various | A |
| 32A | MOV | Limitorque | SMB-2 | A |
| 52A | MOV | Limitorque | SMB-0 | A |
| 52F | MOV | Limitorque | SMB-000 | A |
| 52G | MOV | Limitorque | SMB-00-15 | A |
| 64A | MOV | Limitorque | SMB-2 | A |
| 1D | MOV | Limitorque | SMB-1 | A |
| 32C | MOV | Limitorque | SMB-00 | A |
| 32D | MOV | Limitorque | SMB-000 | A |
| 32E | MOV | Limitorque | SMB-000 | A |
| 39B | MOV | Limitorque | SMB-000 | A |
| 57 | MOV | Limitorque | SMB-00 | A |

APPENDIX C, Continued

| TER ITEM NO. | EQUIPMENT DESCRIPTION | MANUFACTURER | MODEL/ TYPE | DEFICIENCIES |
|-----------------|--|------------------------|------------------------------|--------------|
| 2 | Limit Switch | NAMCO | DX-2400 | |
| 13 | Humidity sensor | Taylor | 10H5 | |
| 14 | Resistance temperature detectors | UNK | 3 Wire | |
| 36A | Distribution panel | Fischbach- Hatfield | B/M-C458 | |
| 35 | Pressure switch | United Electric | J110-164 | |
| 45 | Radiation Detector | Nuclear Measurement | GM-912, SC-2-15, SC-2B | |
| 54A | Control panel | Westinghouse | UNK TBDP | |
| 59 | Thermostat | Penn | A-28-AA37 | |
| 8B | Flow transmitter | Fischer-Porter | 50EP1031 BCXA-NS | |
| 10C | Transmitter | Fischer-Porter | 10B2496 BBABBB-NS | |
| 46 | Pressure transmitter | Fischer-Porter | 50EP10971 | |
| 63 | Flow transmitter | Fischer-Porter | 10B296 PBBABBB | |
| 32B | MOV | Limitorque | H-3BC | |
| 1B | MOV | Limitorque | SMB-3-80 | |
| 1C | MOV | Limitorque | SMB-1 | |
| 1F | MOV | Limitorque | SMB-4 | |
| 1G | MOV | Limitorque | SMB-00 | |
| 4 | SOV Operator | ASCO | THT-8316 54-C34 | |
| IE | MOV | Limitorque | SMB-2 | |

APPENDIX D

Plant Safety-Related Systems and Display Instrumentation

A. Safe Shutdown Systems

| System | Term | Function |
|---|------|---|
| RP - Reactor Protection/Trip (1) | S | Trips reactor when predetermined set points are exceeded |
| MS - Main Steam (MSIVs, Safeties, Atmospheric Reliefs) (1) | I | Releases energy for plant cooldown |
| CV - Crib House Ventilation | L | Cools service water pump motors |
| FW - Steam Generator Feedwater/ Auxiliary Feedwater (1) | I/L | Provides makeup water to steam generator for cooldown |
| VC - Chemical and Volume Control (charging portions) (1) | L | Provides reactor makeup water and long-term chemical control |
| RH - Residual Heat Removal (required for cold shutdown) | L | Provides long-term heat removal |
| RC - Reactor Coolant | L | Transfers heat from core to steam generator |
| CC - Component Cooling | L | Removes heat from core to steam generator |
| SW - Service Water | L | Takes heat from component coolant heat exchanger to heat sink |
| DG - Diesel Generator (1) | S/I | Provides emergency onsite power |
| DC - 125 V DC Power Supply (1) | L | Provides back-up power |
| DO - Diesel Oil (1) | S/I | Provides lubrication for emergency diesels |
| AP - Auxiliary Power Distribution | L | As indicated |
| AR - Area Radiation Monitoring (1) | I/L | Detects radiation diesels |

LEGEND: (S) Short Term Less than 24 hours
(I) Intermediate Term Up to 30 days
(L) Long Term 30 days plus

NOTE: (1) Used for accident mitigation and safe shutdown
(2) The 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 FRC and/or the licensee.

Appendix D, continued

B. Accident Mitigating Systems (LOCA, MSLB, FWLB)

| System | Term | Function |
|---|------|--|
| CI - Containment Isolation Valve | L | Isolates containment penetration |
| RV - Reactor Containment Fan Coolers, Hydrogen Purge and Hydrogen Recombiners | I | Removes post LOCA containment heat and controls hydrogen |
| SI - Safety Injection and Accumulators | S/A | Provides post accident cooling water to core |
| Pressurizer Pressure Relief | I | Power operated relief valves relieve RCS pressure |
| PR - Post-Accident Sampling and Monitor- ing/Containment Radiation Monitor | L | As indicated |
| CS - Containment Spray | I | Provides post-accident containment provides and iodine control |
| IW - Isolation Valve Seal Water | I | Seals penetration with high-pressure water |
| PP - Penetration Pressurization | I | Seals electrical penetration with high-pressure air or nitrogen |
| IP - Vital Instrument Power Supply (1) | L | As indicated |
| AV - Pump Room Ventilation Coolers (RHR/SI/SC/CCP) | I/L | As indicated |
| PV - Control Room Ventilation | L | As indicated |
| OV - Auxiliary Electrical Equipment Room Ventilation | L | As indicated |
| TV - Turbine Building Ventilation | L | As indicated |

Appendix D, continued

C. Safe Shutdown/Accident Mitigating Instruments (LOCA, MSLB, FWLB)

| Instruments | Term |
|---|------|
| Pressurizer level | I |
| Pressurizer pressure | L |
| RCS Temperature | L |
| Containment pressure (2) | I |
| Steam line pressure | L |
| Steam line flow | S |
| Containment spray flow (2) | I |
| Safety injection flow (2) | I |
| Penetration pressurization (2) | I |
| Isolation valve seal water pressure (2) | I |
| Sump level (2) | L |
| Steam generator level | L |
| Auxiliary feed system flow | L |
| Secondary storage tank level | L |
| Chemical and volume control flow | I |
| RWST Level | I |
| BIT (Boron Injection Tank) (2) | S |
| Residual Heat Removal Flow | L |
| Component Cooling Water Flow | L |
| Service Water System | L |

Legend:

S - Short term less than 24 hr.
 I - Intermediate term up to 30 days
 L - long term more than 30 days

NOTE: (2) Required for accident mitigation only