

PARTIAL REVIEW

Equipment Evaluation Report By the
Office of Nuclear Reactor Regulation

For Consumers Power Company
Big Rock Point Nuclear Power Station
Docket No. 50-155

Environmental Qualification of Safety-Related
Electrical Equipment

Dated: February 13, 1981

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PARTIAL REVIEW

SAFETY EVALUATION REPORT BY THE OFFICE OF NUCLEAR REACTOR REGULATION

FOR CONSUMERS POWER COMPANY
BIG ROCK POINT NUCLEAR POWER STATION
DOCKET NO. 50-155
ENVIRONMENTAL QUALIFICATION OF SAFETY-RELATED
ELECTRICAL EQUIPMENT

3.0 STAFF EVALUATION

The staff's evaluation of the licensee's responses was accomplished 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's qualification program.

During the week of September 8, 1980, NRC and FRC representatives visited the Big Rock Point 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 CPC's 1978 submittals. The inspection verified proper installation of equipment, overall interface integrity, and manufacturers nameplate data. The manufacturer and model number from the nameplate data was compared to information given in the Licensee's submittal.

The following evaluation incorporates the CPC 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. FRC has identified certain items that the licensee has deleted from the equipment list as not requiring qualification. (Ref. Appendix K of the TER.) FRC has evaluated the licensee's position and in certain cases does not agree. The licensee should provide additional information to resolve the concern or provide adequate qualification.

The system 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; 59 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 Big Rock Point relative to the temperature, pressure, and the containment spray caustics, have 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. 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 environmental conditions

are enveloped by the large break LOCA environmental conditions. The staff assumed and requires that the licensee verifies, 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. (F)	Max. Press. (psig)	Humidity
LOCA	235	27	100%
MSLB	Not Provided	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 235 F does not satisfy the above requirement. A saturation temperature corresponding to the pressure profile (270 F peak temperature at 27 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. Pipe Tunnel
2. Electrical Penetration Room
3. Sphere Ventilating Room
4. Core Spray Room

The licensee has used 210 F and 2.2 psig conditions in the pipe tunnel due to the HELB outside containment. The staff considers saturation temperature at the peak pressure resulting from a HELB as the minimum level for acceptance. The licensee should update his summary tables to reflect this change. If there is any equipment that does not meet the staff position, the licensee must provide justification that the equipment will perform its intended function under saturated conditions, or propose corrective action.

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 has provided a value of 590 feet elevation as the submergence level, and has evaluated each equipment item to this value. Several equipment items have been identified in the TER as being deficient in the submergence parameter of qualification.

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 containment spray system consists of two spray trains; one train is automatically started after a 15 minute time delay and the other locked out of operation. The licensee concluded that some form of containment spray is required immediately following an accident and that the existing design is not acceptable.^{1/} The licensee has stated that the spray consists of water from the fire protection system and that no chemicals are required. The licensee must provide additional information to address the spray parameter of qualification for affected equipment items.

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/} Amendment No. 37 to the Facility Operating License dated January 13, 1981, authorized modifications to the containment spray system that incorporate (1) a prompt automatic containment spray system, (2) a remote manual backup spray system, and (3) the addition of spray nozzles in the steam drum cavity.

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 licensees 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. Therefore, for this review,

the staff has assumed that the values provided, unless otherwise noted, have been determined in accordance with the prescribed criteria. The staff's review assessed that the values to which equipment was qualified, enveloped the requirements identified by the licensee. The values established by the licensee are 7.3×10^5 RADS gamma and 1.3×10^7 RADS beta for the integrated dose inside containment. The radiation service condition provided by the licensee is lower than provided in the DOR Guidelines for gamma and beta radiation. The Licensee is requested to either provide justification for using the lower service condition or use the service condition provided in the DOR 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 4×10^4 RADS has been used by the licensee to specify limiting radiation levels within the core spray room. This value does not appear to consider the radiation levels influenced by the source term methodology associated with post-LOCA recirculation fluid lines. The licensee must correct this along with the associated equipment summary sheets.

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

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

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 4.0, 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 licensees:

- (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 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 evaluation addressing these concerns.

APPENDIX B

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

NOTE: (R) Licensee has committed
to replace equipment

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
2	Electrical Penetration	Conax	10 thru 12	QI,QM,A
8	Level Switch	Yarway	4420C	QI,A,S,R
10	Transmitter	Westinghouse	59DP4C997050	QI,QT
11A	MOV	Limitorque	SMA-00	QI,A,QT,R
11B	MOV	Limitorque	SMA-00	QI,A,R
11C	MOV	Limitorque	SMA-2-60	QI,A,R
12A	MOV	Rotork	14A-SYNCRASET	QI,QM,A,R
12B	MOV	Rotork	14A-SYNCRASET	QI,QM,A,R

APPENDIX B (CONTINUED)

TER ITEM NO.	EQUIPMENT DESCRIPTION	MANUFACTURER	MODEL/ TYPE	DEFICIENCIES
17	Motor	GE	SK436XJ1A11	QI,A
19A	Pressure Switch	Static-0-Ring	12L-AA5-FSS	QI,A,R
19B	Pressure Switch	Static-0-Ring	4NN-E411-YXSTT	QI,A,R
(R)24A	SOV Operator	ASCO	HTX-800C61RF	QI,A
(R)24B	SOV Operator	ASCO	830060RF	QI,A
25	SOV Operator	ASCO	831620	QI,A
(R)26	SOV Operator	ASCO	830060R	QI
29	SOV Operator	ASCO	830060R	QI,A
30	SOV Operator	ASCO	HTX831677	QI,A
31	Solenoid	Target Rock	73V001	QI,QM,A
(R)34	SOV Operator	ASCO	831622	QI,A
35	SOV Operator	ASCO	831622	QI
37	Splice	3M	UNK	QI,A,R
42	Cable	Anaconda	32277	QI,A,S
43	Cable	Cerro	UNK	QI,A,S
44	Cable	Kerite	FR	QI,A,S
45	Cable	Raychem	SLPE-FLAMTROL	QI,A,S
3	Electrical Penetration	Amphenol-Borg	Type 8	QI
4	Electrical Penetration	UNK	Type 9	QI
5	Transmitter	ITT Barton	386	QI,A,QT,S
7	Level Switch	Yarway	4320PE	QI,A,R

APPENDIX B (CONTINUED)

TER ITEM NO.	EQUIPMENT DESCRIPTION	MANUFACTURER	MODEL/ TYPE	DEFICIENCIES
(R)9	Transmitter	ITT Barton	386	QI,A,QT
20	Pressure Switch	Static-0-Ring	9TA-S4-11SSX12	QI,A,QM,T,M
21	Transmitter	Rosemount	1151GP	QI
38A	Terminal Blocks	GE	CR-151	QI,A,QM,CS,R
38B	Terminal Blocks	States	NT	QI,A,QM,CS,R
39A	Terminal Blocks	Westinghouse	542247	QI,A,QM,CS,R
39B	Terminal Blocks	Westinghouse	805432	QI,A,QM,CS,R
40	Terminal Blocks	GE	EB-25	QI,A,QM,CS,R
48	Cable	UNK	UNK	QI
49	Cable	UNK	UNK	QI
50	Cable	UNK	UNK	QI
52	Cable	GE	UNK	QI,QM
53	Cable	Okonite	UNK	QI,QM
55	Cable Splice	AMP/Certiseal	324549 324990	QI
56	Junction Box	Rumsey Electric	TB-240	QI
57	Transmitters	Foxboro	E11GM-HSAE-1	QI,QM,A,R
58	Terminal Blocks	Crouse-Hinds	F1C7222	QI
60	Splice	UNK	UNK	QI

APPENDIX C

List of Equipment in Section 4.3

Equipment Considered Acceptable or Conditionally Acceptable

TER ITEM NO.	EQUIPMENT DESCRIPTION	MANUFACTURER	MODEL/ TYPE	DEFICIENCIES
1	Electrical Penetration	GE	Types 1 thru 7	A
13	MOV	Limitorque	SMA-00	A
14	MOV	Limitorque	SMA-1	A
15	MOV	Rotork	14A	A
22	Transmitter	Rosemount	1152GP9A92PB	A
36	Junction Box	UNK	UNK	
41	Terminal Connection	AMP/Special Products	PIDG	A
46	Cable	Raychem	FLAMTROL	A
47	Cable	Rockbestos	FIREWALL III	A
59	MOV	Limitorque	SMA-000-5	

APPENDIX D

A. Safe Shutdown Systems

System	Term	Function
Reactor Protection System*	S	Trips reactor when predetermined setpoints are exceeded
Emergency Power AC-DC*	L	Self-explanatory
Emergency Condenser*	I	Emergency heat sink on loss of main condenser

* Required for both safe shutdown and accident mitigation.

** Required for accident mitigation only.

(S) Short Term _____ Less than 24 hours.

(I) Intermediate Term _____ Up to 30 days.

(L) Long Term _____ 30 days plus.

APPENDIX D (CONTINUED)

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

System	Term	Function
Containment Isolation	L	Isolates containment penetration in case of accidents
Core Spray (and backup systems)	I	Post accident reactor makeup water source
Enclosure Spray (and backup systems)	I	Post accident containment pressure/fission product control
Safeguards Activation	S	Initiates safety injection upon exceeding certain monitored parameter setpoints
Radiation Monitoring and Sampling	L	Self-explanatory
Reactor Depressurization	S	Relieves reactor steam to the suppression pool to lower reactor vessel pressure for LPCI/core spray operation
Main Steam Line Isolation	L	Shuts MSIVs to isolate MSLB
Post-Incident System long Term Cooling	L	Long term post accident core cooling
Fire Water System	L	Cooling water for post incident system long term cooling
Radwaste System	L	Isolation of containment penetration in case of accident

APPENDIX D (CONTINUED)

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

System	Term
Reactor Vessel Level	L
Reactor Pressure	L
Core Spray Flow**	I
Emergency Condenser Level	I
Containment Enclosure Spray Flow**	I
Fire System Strainer Differential Pressure**	L
Steam Drum Pressure	I
Steam Drum Level	I/L
Fire System Pressure**	L