

Partial Review____
EQUIPMENT EVALUATION REPORT BY THE
OFFICE OF NUCLEAR REACTOR REGULATION
EQUIPMENT QUALIFICATION BRANCH

FOR DUQUESNE LIGHT COMPANY
BEAVER VALLEY POWER STATION UNIT NO. 1

DOCKET NO. 50-334

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3 STAFF EQUIPMENT EVALUATION

The staff evaluation of the licensee's response included an onsite inspection of selected Class 1E 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 (May 8-9, 1980) of selected safety-related electrical equipment. Flow transmitters, limit switches, motor-operated valves, solenoid-operated valves, junction boxes, and pressure transmitters were inspected. The inspection addressed 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 the information given in the Component Evaluation Work Sheets (CES) of the licensee's report. Four deficiencies were noted during the inspection:

- (1) A solenoid associated with a throttle valve was found to be internally disassembled in that the solenoid retaining clip had fallen from the core guide. This deficiency has since been corrected.
- (2) A throttle valve was identified as having an unqualified position-indicating limit switch. Six additional limit switches of the same model were subsequently identified as not having qualification documentation. The licensee has ordered qualified replacement switches and has committed to installing these at the first outage in which plant conditions are such that equipment can be removed from service to make the replacement. The staff requires, however, that a specific commitment be made for the replacement of the switches. The licensee has provided a justification for interim operation.
- (3) Main steam flow transmitters appeared to have unqualified installations which could permit transmitter internals to be exposed to steam or humidity during both normal and accident conditions. The licensee subsequently determined that these flow transmitters are not required for any protection function and are not covered by IEB 79-01B.
- (4) A motor-operated valve which the licensee had identified as required to operate during post-accident conditions was found to be below containment

flood level. The IE inspector observed that the valve had an unsealed motor conduit. The licensee has since committed to modifications in the control circuit of the valve. These modifications will prevent any possibility of a spurious opening of the valve. A justification for interim operation has been provided.

Additional details of the site inspection can be found in IE Report 50-334/80-12. 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.

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.

Based upon information in the licensee's submittal, the equipment location references, and in some cases subsequent conversations with the licensee, the staff has verified and determined that the systems included in the licensee's submittal 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 therefore concludes that the systems identified by the licensee (listed in Appendix C) are acceptable.

The licensee identified 247 individual items of equipment relating to 55 equipment types.

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 for Beaver Valley Unit No. 1 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.

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 Containment

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	269.3	38	100
MSLB	--	41.1	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 of 269°F does not satisfy the above requirement. Furthermore, the licensee's specified pressure is low as compared with plants of similar design. The licensee is requested to verify that the LOCA pressure profile in the FSAR was calculated based on the code requirements defined in NUREG-0588. If, by using these codes, the peak containment pressure is still 38 psig, a saturation temperature corresponding to the pressure profile (284°F peak temperature at 38 psig) should be used. If, however, the calculated peak pressure is higher than 38 psig, the saturation

temperature corresponding to the new pressure profile should be used. In addition, the licensee should provide the calculated value for temperature in an MSLB accident.

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 environment associated with an HELB outside containment. The following areas outside containment have been addressed:

- (1) auxiliary building
- (2) cable vault area
- (3) main steam valve house

The staff has reviewed the parameters used by the licensee for determination of harsh environments outside containment, and the method appears to be based on HELB analyses in the FSAR. However, the licensee has indicated that plant modifications will be implemented to reduce the severity of the harsh environment in several areas outside containment. No schedule for completion was provided. The licensee must furnish a commitment for these modifications for staff review.

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 698 ft 9 in. Equipment below this level has been identified by the licensee, along with the proposed corrective action. The licensee identified four equipment types which could be subjected to submergence during an accident. The control circuit for motor-operated gate valves will be modified by June 30, 1982 to prevent any possibility of a spurious opening. Limit switches and power cables were also listed as being subject to submergence. The licensee should provide an assessment of the failure modes associated with the submergence of these components. The licensee should also provide assurance that the subsequent failure of these components will not adversely affect any other safety functions or mislead an operator.

It is not clear from the information submitted that submergence of safety-related electric 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 15,000 ppm boric acid solution. In most cases, equipment was qualification tested at this concentration. In several instances, however, lower concentrations were utilized, as noted in Appendix F. The licensee must provide justification for the lower values or test the components at the nominal boric acid concentration.

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 example, 5 years, 15 years, or 40 years). In its assessment of these submittals, the staff did not review the adequacy of the methodology or 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.

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 ranging from 1.0×10^7 to 2.2×10^8 rads. In one location (outside the crane wall in containment), the radiation service condition provided by the licensee

is lower (1.0×10^7) than that provided in the DOR guidelines (4×10^7) 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.

The required values of radiation doses outside containment supplied by the licensee range from 1.6×10^5 to 6.7×10^6 rads. These values appear to consider the radiation levels influenced by the source-term methodology associated with post-LOCA recirculation fluid lines and are, 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

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 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 will provide a supplemental safety evaluation addressing these concerns.

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

Equipment Description	Manufacturer	Component No.	Deficiency
Power Cable	Kerite	5000V Insulation	QT,A
High Temperature Cable	Cerro	1000V SR Insulation	QT,T,CS,A
Power Cable	Okonite	600V Okonite Insulation	QT,CS,A,S
Power Cable	Okonite	1000V Okonite Insulation	QT,CS,A,S
Instrument Cable	Continental	SR Instrument Cable	QT,CS,R,A,QI
Electrical Penetration	Viking	Types I, II, III, IV, V, VIII, & IX	QT,M,A
Terminal Block	Buchanan	0511, 0211	QT,M,A

Equipment Description	Manufacturer	Component No.	Deficiency
Terminal Block	Penn Union	Series 1000	QT,A
Solenoid Valve	ASCO	NP8320, 8316	QM,QI,A
Limit Switch	NAMCO	EA180	QM,CS,A,S
Limit Switch	NAMCO	EA700	QT,T,P,H,CS,R,A, RPS,RPN
Limit Switch	NAMCO	EA740	QM,CS,A,RPS
Flow Transmitter	Fischer-Porter	10B2496	M,CS,R,A,RPS
Flow Transmitter	Barton	386a, c	CS,M,A,S,RPS
Level Transmitter	GEMS	XM-59342	QT,M,P,A,QI
Level Transmitter	Mason-Neilan	12522	QT,T,P,R,H,CS, A,M,RPS
Pressure Transmitter	Fischer-Porter	50EP1031	QT,T,P,R,H,CS,RPS
RTD	Sostman	118348-1	QT,R,A,RPS
Temperature Resistance Bulb	Trinity	n/a	QT,T,P,H,CS,R,A, RPS
Motor Operator	Limitorque	SMB0140	QT,A
Motor Operator	Limitorque	SMB:MOV-CH-310	S,A
Motor Operator	Limitorque	SMB:MOV-CH-378	RT,A
Motor Operator	Limitorque	SMB:MOV-RC-535 536, 537	RT,A
Motor Operator	Limitorque	SMB:SI-842	A,QT,RPS
Pump Motor	General Electric	SK6319XJ20A	QT,M,A,CS
Motor Operator	Limitorque	SMB:CC-112 Series	QT,T,P,H,CS,R,A
Pump Motor	Westinghouse	70F67868	QT,T,P,H,A
Motor Operator	Limitorque	SMB:RH-605	QT,T,P,H,R,A
Motor Operator	Limitorque	SMB:RH-700, 701	QT,P

Equipment Description	Manufacturer	Component No.	Deficiency
Motor Operator	Limitorque	RH-720A&B	QT
Motor Operator	Limitorque	RH-758	QT,T,P,H,R,CS,A
Terminal Block	Marathon	1500 Series	QT,A,QI
Cable Splice	Okonite	T95, T35	QT,A
Cable Splice	Kerite	Biseal 3 Tape	QT,T,R,A,RPS
SIS Wire	General Electric	Vulkene #57275	QT,T,A,RPS
SIS Wire	General Electric	Vulkene #57279	QT,A
Control Switch	Westinghouse	OT2	QT,T,R,H,A
Motor Control Center	Allis-Chalmers	n/a	QT,T,A
Solenoid Valve	ASCO	HPX8320A26	QT,T,H,R,A,RPN
Limit Switch	NAMCO	D2400X	QT,T,P,H,R,A,RPS
Limit Switch	NAMCO	EA740	QM,T,A,RPS
Pressure Transmitter	Fischer-Porter	50EP1071BCXB	QT,T,P,H,R,A,RPS
Pressure Transmitter	Fischer-Porter	50EP1041	QT,T,P,H,R,A,RPS
Motor Operator	Limitorque	SMB:SI-863A,B; SI-864A,B;SI- 885A,B,C,D; SI- 890A,B,C	T,A
Motor Operator	Limitorque	SMB:860A,B; 862A,B	QT,A QT,A
Pump Motor	Westinghouse	S070F67723	QT,T,A
Motor Operator	Limitorque	SMB Series: FW- 151, 156; MS-105; RS-155,156; RW-103, 104, 105, 106, 114	EXN

APPENDIX C

Equipment Considered Acceptable or
Conditionally Acceptable

(Category 4.3)

Equipment Description	Manufacturer	Component No.	Deficiency
SIS Wire	Rockbestos	Firewall SIS	A
Pressure Transmitter	Barton	Lot 2	A
Pressure Transmitter	Barton	Lot 2	A
Motor Operator	Limitorque	SMB:SI-865, A, B, C	A
Motor Operator	Limitorque	SMB:CH-115 Series; CH-275 Series; CH-289; 370; 373; 381; 836; 867A, B, C, D; 869 A, B	A

APPENDIX D
Safety-Related Systems¹

Function	System
Emergency reactor shutdown	Reactor coolant Reactor protection Safeguards actuation Charging and volume control
Containment isolation	Containment isolation ² Main steam Feedwater Safety injection Charging and volume control Residual heat removal Containment depressurization Primary sampling Leakage monitoring Containment vacuum
Reactor core cooling	Charging and volume control Safety injection
Containment heat removal	Containment depressurization
Core residual heat removal	Residual heat removal Reactor coolant Feedwater Main steam Steam dump Component cooling water Service water
Prevention of significant release of radioactive material to environment	Containment depressurization Hydrogen recombiner Radiation monitoring Primary sample
Supporting systems	Emergency power Safety equipment area ventilation Control room habitability Drains aerated system Drains hydro system HTG, vent, air conditioner reactor Reactor plant river water system

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 is necessary to verify the system(s) function with the IE regional reviewer and/or licensee.

²Consists of other isolation valves not listed below.