

PARTIAL REVIEW

Equipment Evaluation Report By the  
Office of Nuclear Reactor Regulation

For Consumers Power Company  
Palisades Nuclear Power Station  
Docket No. 50-255

Environmental Qualification of Safety-Related  
Electrical Equipment

Dated: February 10, 1981

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(PARTIAL REVIEW)  
EQUIPMENT EVALUATION REPORT BY THE  
OFFICE OF NUCLEAR REACTOR REGULATION

FOR CONSUMERS POWER COMPANY  
PALISADES NUCLEAR POWER STATION  
DOCKET NO. 50-255  
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 January 21, 1980, NRC and FRC representatives visited the Palisades plant site, inspected safety-related systems and equipment, discussed plant operating procedures with plant personnel, and reviewed available qualification documentation. The inspection verified proper installation of equipment, overall interface integrity, and manufacturers nameplate data.

The following evaluation incorporates the CPC submittals 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. In addition to the concerns identified below, the staff's systems review has not included those equipment items discussed in Section 5.0 of this report. The licensee submitted an extensive list of safety-related electrical equipment. This list was evaluated and identical components within

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	278	51	100%
MSLB	380	53	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 278 F for LOCA does not satisfy the above requirement. A saturation temperature corresponding to the pressure profile (298 F peak temperature at 51 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.

a plant area exposed to the same environment were grouped; 77 item types of equipment were identified and assessed by the staff. In paragraph 4.1.1 of the TER FRC has pointed out that valve position indicating switches should be reviewed; if failure of a limit switch degrades the safety circuit or provides false information to the operator, qualification should be addressed. The licensee should provide resolution of this concern. The systems and instrumentation list is contained in Appendix D.

### 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 licensees 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 Palisades 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

FRC notes that for the EEQ review the accidents which were used to evaluate equipment were the LOCA inside containment. As stated in paragraph 3.2 of this report this plant is equipped with automatic containment spray system, however, the temperature for the MSLB inside containment exceeds the LOCA profile by 100 F and would be the limiting condition if reanalysis does not result in reduction of the temperature conditions following a MSLB inside containment. FRC further notes that the equipment evaluated on the basis of the LOCA profile would require reevaluation to MSLB conditions if either temperature or pressure from MSLB exceeds the LOCA conditions by a significant amount. The licensee should provide the necessary information to resolve this concern.

#### 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. ESF Room
2. Pipeway (Room 150)
3. Room 118
4. Room 121A
5. Room 123
6. Room 238
7. Room 338

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 6 feet above basement floor (elev. 596 feet). The licensee has not identified any equipment below this level.

### 3.6 Chemical Spray

The licensee's FSAR value for the chemical concentration is 1750-2000 PPM boron and hydrazine (50 to 100 PPM) plus manually added sodium hydroxide solution to control pH between 7.0 and 8.3. The exact volume percent used by the vendors for qualification testing should be verified by the licensee. Therefore, for the purpose of this review, the effects of chemical spray will be considered unresolved.

### 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 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 is  $2 \times 10^7$  RADS gamma and  $2 \times 10^8$  RADS beta for the integrated dose inside containment. These values envelope, with margin, the licensees specified values at the equipment location. A required value established outside containment of  $5 \times 10^6$  RADS has been used by the licensee to specify limiting radiation levels within the ESF room. 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 licensees 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, indicating 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 staffs review of the licensees 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.

APPENDIX D (CONTINUED)

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

Primary System Temperature

Pressurizer Pressure

Pressurizer Level

Safety Injection Tank Level\*\*

Containment Sump Level\*

Steam Generator Feedwater Flow

Steam Generator Level

Steam Generator Pressure

Steam Generator Steam Flow

Power Range Safety Channel

Power Range Neutron Channel

Pressurizer Spray Flow

Containment Radiation Monitor\*\*

Containment Pressure\*\*

ESF Room Temperature\*\*

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 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
- 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

TER ITEM NO.	EQUIPMENT DESCRIPTION	MANUFACTURER	MODEL/ TYPE	DEFICIENCIES
2	SOV Operator	ASCO	NP-831654E	QI
3	SOV Operator	ASCO	WPX-HAV-202-301-F	QI
4	SOV Operator	ASCO	HTX-8320A16V	QI
32	Cable	ROME	UNK	QM
33	Cable	ROME	UNK	QM
35	Motor	GE	5K405YK232	QM,A
(R)40A	SOV Operator	ASCO	LB8316C-44	QI
(R)40B	SOV Operator	ASCO	LB8316C-34	QI
(R)41	SOV Operator	ASCO	LB8316C-36	QI
(R)42	SOV Operator	ASCO	LB8316C-46	QI
(R)45	SOV Operator	ASCO	LB83612	QI
(R)46	SOV Operator	ASCO	HPX8320A26	QI

## APPENDIX B (CONTINUED)

TER ITEM NO.	EQUIPMENT DESCRIPTION	MANUFACTURER	MODEL/ TYPE	DEFICIENCIES
50	Motor	Westinghouse	68F13512	QI,A
51	Motor	GE	5KB188 47A100	QI
(R)53A	SOV Operator	ASCO	HT8320A22	QI
(R)61	Transmitter	Foxboro	613DM	A,QT,R,QM
67B	Transducer	Fischer Controls	E/P-546	QI,A,R
(R)76B	SOV Operator	ASCO	WPHT8300-B6I-RF	QI
76C	SOV Operator	ASCO	WPHT8300-B61-RF	QI
(R)76D	SOV Operator	ASCO	WPHT8300-B61-RF	QI
76E	SOV Operator	ASCO	WPHT8300-B61-RF	QI
(R)76F	SOV Operator	ASCO	WPHT8300-B61-RF	QI
79	Cable	ROME	UNK	QI
90C	Transmitter	Rosemount	1153A	A,QT
21	Connector	Amphenol	74868-U59-A-U	QM,P
22	Terminal Blocks	Westinghouse	805432	A,QM,QT,P
28	Cable	Anixter Wire	UNK	QI,QM,A
31	Cable	Universal Wire	UNK	QI,QM,A
34	Cable	Time Wire	UNK	QI
(R)52	Motor	GE	5K256YK161	QI
(R)58	Transmitter	Fischer Porter	50EP1072A	QI
(R)62A	Transmitter	Fischer Porter	13D2465BA	QI,S
62B	Transmitter	Fischer Porter	50EP1031B	QI
62C	Transmitter	Fischer Porter	UNK	QI
63	Transmitter	Fischer Porter	10B2466AAAB1	QI,S

APPENDIX B (CONTINUED)

TER ITEM NO.	EQUIPMENT DESCRIPTION	MANUFACTURER	MODEL/ TYPE	DEFICIENCIES
50	Motor	Westinghouse	68F13512	QI,A
51	Motor	GE	5KB188 47A100	QI
(R)53A	SOV Operator	ASCO	HT8320A22	QI
(R)61	Transmitter	Foxboro	613DM	A,QT,R,QM
67B	Transducer	Fischer Controls	E/P-546	QI,A,R
(R)76B	SOV Operator	ASCO	WPHT8300-B6I-RF	QI
76C	SOV Operator	ASCO	WPHT8300-B61-RF	QI
(R)76D	SOV Operator	ASCO	WPHT8300-B61-RF	QI
76E	SOV Operator	ASCO	WPHT8300-B61-RF	QI
(R)76F	SOV Operator	ASCO	WPHT8300-B61-RF	QI
79	Cable	ROME	UNK	QI
90C	Transmitter	Rosemount	1153A	A,QT
21	Connector	Amphenol	74868-U59-A-U	QM,P
22	Terminal Blocks	Westinghouse	805432	A,QM,QT,P
28	Cable	Anixter Wire	UNK	QI,QM,A
31	Cable	Universal Wire	UNK	QI,QM,A
34	Cable	Time Wire	UNK	QI
(R)52	Motor	GE	5K256YK161	QI
(R)58	Transmitter	Fischer Porter	50EP1072A	QI
(R)62A	Transmitter	Fischer Porter	13D2465BA	QI,S
62B	Transmitter	Fischer Porter	50EP1031B	QI
62C	Transmitter	Fischer Porter	UNK	QI
63	Transmitter	Fischer Porter	10B2466AAAB1	QI,S

APPENDIX B (CONTINUED)

TER ITEM NO.	EQUIPMENT DESCRIPTION	MANUFACTURER	MODEL/ TYPE	DEFICIENCIES
(R)65	Transmitter	Foxboro	613HM	QI
68	Positioner	Masoneilan	8012	QI
(R)69	Alternator	Square D	9038	QI,A,R
(R)70	Positioner	Honeywell	M-233	QI,A,QT,R
71	Thermostat	Johnson	T-7170	QI
74	Temperature	Rosemount	104-VCX	QI
75	Rad Monitor	Victoreen	847-1	QI,QM,A,T,P,M
(R)89	Transmitter	Foxboro	611GM	A,QT,CS,R
90A	Transmitter	Foxboro	611GH	QI,S
90B	Transmitter	Foxboro	UNK	QT,S,R

APPENDIX C

List of Equipment in Section 4.3  
Equipment Considered Acceptable or Conditionally Acceptable

TER ITEM NO.	EQUIPMENT DESCRIPTION	MANUFACTURER	MODEL/ TYPE	DEFICIENCIES
17A	Electrical Penetration	Viking	29-0004-0000	A
17B	Electrical Penetration	Viking	UNK	A
17C	Electrical Penetration	Viking	UNK	A
17D	Electrical Penetration	Viking	UNK	A
18	Electrical Penetration	Viking	UNK	A
19	Electrical Penetration	Viking	29-0001-0000	A
20	Electrical Penetration	Viking	29-0008-0000	A
25B	Cables	GE	UNK	A
26	Cables	Okonite	UNK	A
27	Cables	Okonite	UNK	A
29	Cables	Anaconda	UNK	A
30	Cables	Rockbestos	Firewall III	A
77	Cables	Rockbestos	UNK	A
78	Cables	Rockbestos	UNK	A
83	Cables	Okonite	UNK	A
84	Cables	Am. Insul. Wire	ES-06612-002-000	A
23A	Cables	GE	UNK	A
23B	Cables	GE	UNK	A
24	Cable	GE	UNK	A
25A	Cable	GE	UNK	A
36	Hydrogen Recombiner	Westinghouse	A	A
55	MOV	Limitorque	SMB-00-15	A
57	MOV	Limitorque	SMB-000	A

## APPENDIX C (CONTINUED)

TER ITEM NO.	EQUIPMENT DESCRIPTION	MANUFACTURER	MODEL/ TYPE	DEFICIENCIES
80	Cable	Moore	1890-9	A
82	Cable	GE	UNK	A
88	MOV	Limatorque	SMB-3-100	A
1	SOV Operator	ASCO	LM831614	
6A	Solenoid	Magnetrol	18A43	
6B	Solenoid	Magnetrol	18AR43A	
59	Transmitter	Fischer Porter	50EP1042A	
67A	Transducer	Fischer Controls	E/P-546	
73	Detector	Rosemount	104-VCX	

APPENDIX D

A. Safe Shutdown Systems

System	Term	Function
Reactor Protection/Trip Systems*	S	Trip reactor when predetermined set points are exceeded.
Shutdown Cooling Systems+	L	Long term heat removal capability
Primary Coolant System	I	Transfers reactor heat to the steam generators
Chemical and Volume Control Systems*	L	Provides reactor makeup water during cooldown/long-term chemical control.
Component Cooling Water System	L	An intermediate cooling loop between the RHR system and other primary heat loads and the service water systems.
Service Water System	L	Transfers heat from the component cooling heat exchangers to the river, lake, or other heat sink.
Primary Sampling System*	L	Self-explanatory
Containment Air Conditioning/Ventilation System*	I/L	Self-explanatory
Auxiliary Feedwater System*	I/L	Provides steam generator makeup water for decay heat removal and plant cool-down.

+ System required for cold shutdown only.

\* Systems used for both safe shutdown and accident mitigation purposes.

\*\* Instruments utilized for accident mitigation purposes only.

(S) Short Term \_\_\_\_\_ Less than 24 hours

(I) Interimmediate Term \_\_\_\_\_ Up to 30 days

(L) Long Term \_\_\_\_\_ 30 days plus

APPENDIX D (CONTINUED)

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

System	Term	Function
High Pressure Safety Injection System	I	Provides high pressure cooling water to the core post-accident
Low Pressure Safety Injection System	L	Provides cooling water to the core post-accident
Containment Spray	I	Post-accident containment pressure and fission product control
Iodine Removal System	I	Post-accident iodine removal.
Containment Isolation System	L	Isolates ccontainment penetrations in case of accidents.
Main Steam Line Isolation System	L	Shuts MSIVs on main steam line break.
Pressurizer Relief System	I	Vents RCS system pressure to the containment via a holding tank.
Hydrogen Control System	I	Post-accident hydrogen removal.
Engineered Safeguards Room Air Conditioning/Ventilation System	I/L	Self-explanatory