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Robert L. Mittl General Manager
Nuclear Assurance and Regulation

June 6, 1985

Director of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
7920 Norfolk Avenue
Bethesda, MD 20814

Attention: Mr. Walter Butler, Chief
Licensing Branch 2
Division of Licensing

Gentlemen:

EQUIPMENT QUALIFICATION
HOPE CREEK GENERATING STATION
DOCKET NO. 50-354

Pursuant to discussions with D. Wagner and H. Garg on June 5, 1985, enclose please find one (1) copy each of the Sample Equipment Environmental Qualification Review Checklists and the Environmental Design Criteria for the Hope Creek Generating Station; Report No. 10855-D7.5, Rev. 2.

Should you have any questions in this regard, please contact us.

Very truly yours,

R L Mittl

C D. H. Wagner
USNRC Licensing Project Manager

A. R. Blough
USNRC Senior Resident Inspector

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BC General Manager - Engineering
General Manager - Hope Creek Operations
Project Manager - Hope Creek (w/o attach)
Site Engineering Manager - Hope Creek
Chief Project Engineer - Hope Creek
Associate General Solicitor
B. G. Markowitz - Bechtel Power Corporation
Conner & Wetterhahn
R. Green (NJ State Bureau of Rad. Prot.)
Site Licensing Group
PSE&G Bethesda Office
J. J. Wroblewski
R. F. Drewnowski (w/o attach)
C. Lambert
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EQUIPMENT ENVIRONMENTAL QUALIFICATION

REVIEW CHECKLISTS

General

The environmental qualification review checklists have been developed as an aid for reviewing safety related equipment qualification plans and reports and for assurance that all applicable requirements have been considered, evaluated and achieved or deficiencies identified. Applicable checklist(s) shall be completed.

1. Qualification document reviewed is:

   Test Plan _____ Test Report _____
   Title _____ Date _____

2. Qualification Method/Test Plan

   ____ Type test. (Complete Checklist 1).

   ____ Operating experience. (Complete Checklist 2).

   ____ Analysis. (Complete Checklist 3).

   ____ Combination of above. (Complete applicable checklists).

   ____ Mild environment. (Complete Checklist 4)

   ____ Test plan (Complete Checklist 5)

3. Is the qualification document traceable to the equipment being qualified?

   _____ Yes _____ No

4. What portions of the qualification document need clarification or justification.

   4.1 If minor, do you consider the qualification document acceptable?

5. Qualification document has been reviewed to:
   NUREG 0588, Cat. I _____
   NUREG 0588, Cat. II _____
   DOR Guidelines _____

   Reviewed by _____ Date _____

   Checked by _____ Date _____

CHECKLIST 1

QUALIFICATION BY TYPE TESTING

QUALIFICATION REQUIREMENTS	EVAL Y	EVAL N	EVAL NA	SECTION PAGE NO	REMARKS
1.0 Test Sequence					
1.1 Is test sequence specified in Section 6.3.2 of IEEE 323-74 and/or in daughter standard used?					
1.2 If not, is the test sequence used justified as most severe?					
1.3 Is same test specimen used throughout the complete test sequence?					
2.0 Margin					
2.1 Do margins compare to the suggested margins per Section 6.3.1.5 of IEEE 323-1974 and/or in daughter standard? [Also refer to NUREG 0588 Section 3(4)]					
2.2 If not, is justification provided for deviations?					
3.0 Aging					
3.1 Thermal Aging					
3.1.1 Which methodology is used for thermal aging? ___ Arrhenius ___ n Degree Rule (Needs Justification) ___ Other					
3.1.2 Time and temperature used for aging _____ °C _____ Hours Note: Aging time of less than 100 hours is not acceptable.					
3.1.3 To what period of qualified life does the aging bring the equipment? _____ years.					

NA - Not Applicable; CTP - Comment to Project; CTV - Comment to Vendor;
Y - Yes; N - No; EVAL. - Evaluation

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CHECKLIST 1

QUALIFICATION BY TYPE TESTING

QUALIFICATION REQUIREMENTS	EVAL. Y	N	NA	SECTION PAGE NO	REMARKS
3.1.3 Are the acceleration rate and activation energy used, justified and documented?					
3.2 Mechanical and Electrical Aging					
3.2.1 Is mechanical wear simulated?					
3.2.2 Is electrical contact degradation simulated?					
3.2.3 Is the selection of number of operating cycles for accelerated rate justified and documented?					
Note: This aging is applicable to electro-mechanical equipment (e.g., switches, relays, etc.).					
3.3 Radiation Aging					
3.3.1 What is the total radiation (TID Rads) to which the equipment is irradiated?					
_____ Rads					
3.3.2 What is the dose rate and duration used?					
_____ Rads/Hour _____ Hours					
3.3.3 Does the test TID exceed the required values?					
3.3.4 What is the radiation source?					
____ Cobalt-60					
____ Cesium-137					
____ Other (needs justification)					
3.3.5 Is Beta radiation adequately addressed?					
3.3.6 Is neutron radiation adequately addressed?					

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CHECKLIST 1

QUALIFICATION BY TYPE TESTING

QUALIFICATION REQUIREMENTS	EVAL. Y	N	NA	SECTION PAGE NO	REMARKS
3.5 Synergism					
3.5.1 Are synergistic effects (when these effects are known to have a significant effect on equipment performance) considered and accounted for in preconditioning and testing of equipment?					
3.6 Maintenance and Replacement Schedule					
3.6.1 Has the equipment maintenance and replacement schedule (for components less than 40 years life) been established and provided?					
4.0 Vibration (Non-Seismic)					
4.1 Is the equipment aged for non-seismic vibration per IEEE 323-74 and/or daughter standard?					
5.0 Humidity					
5.1 Is the effect of humidity during normal operation and design basis event considered?					
6.0 Dust					
6.1 Is dust environment condition considered and addressed?					
7. Testing Under Normal and DBA Conditions					
7.1 DBA Simulation					
7.1.1 For equipment located inside containment or subject to HELB did the test temperature-pressure profile envelop the required profile?					
7.1.2 If not, are the deviations justified?					
7.2 Installation					
7.2.1 Is equipment tested in a manner that simulates its expected installation?					
7.2.2 If not, is analysis performed and justification provided to show that equipment's performance will not be affected by other installation configurations?					

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CHECKLIST 1

QUALIFICATION BY TYPE TESTING

QUALIFICATION REQUIREMENTS	EVAL. Y	N	NA	SECTION PAGE NO	REMARKS
7.3 Test Instruments Calibration					
7.3.1 Is test equipment calibrated against auditable calibration standards?					
7.3.2 Is documentation to verify such calibration available for audit?					
7.4 Monitoring					
7.4.1 Is the equipment electrically energized during test?					
7.4.2 Are simulated loads applied during test?					
7.4.3 Are input signals applied during test?					
7.4.4 Are power supply extremes applied during test?					
7.4.5 Is the temperature to which the equipment is qualified when exposed to the simulated accident environment determined by temperature readings sufficiently close to the equipment to characterize actual environment?					
7.4.6 If not, is heat transfer analysis performed to determine temperature at the equipment?					
7.4.7 Are performance characteristics or the functional operability of the equipment verified throughout its range of required operability? _____ Before testing _____ Periodically during testing _____ After testing					
7.4.8 Is the operability status of the equipment monitored during test?					

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CHECKLIST 1

QUALIFICATION BY TYPE TESTING

QUALIFICATION REQUIREMENTS	EVAL. Y	N	NA	SECTION PAGE NO	REMARKS
7.5 Spray					
7.5.1 Is the equipment qualified for: ___ Chemical spray (PWR) ___ Demineralized water spray (BWR) ___ None of the above					
7.5.2 Is the concentration of chemicals used at least as severe as that resulting from the most limiting mode of plant operation?					
7.5.3 Is most severe chemical spray environment which results from single failure in the spray system assumed?					
7.5.4 Is spray incorporated at or near the maximum pressure and temperature conditions that would occur when spray system actuates?					
7.6 Submergence					
7.6.1 Is the equipment subjected to submergence?					
7.6.2 If yes, is equipment required to function after submergence?					
7.6.3 If yes, is equipment located in qualified watertight enclosures?					
7.6.4 If yes, are watertight enclosures qualified by test or analysis to demonstrate the adequacy of such protection?					
7.6.5 If not located in watertight enclosures, is equipment demonstrated to be qualified by test for the seal integrity and functional operability for the duration required?					
7.7 Disassemble and Inspection					
7.7.1 After testing, is the equipment disassembled to the extent necessary for inspection and the findings recorded?					

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CHECKLIST 1

QUALIFICATION BY TYPE TESTING

QUALIFICATION REQUIREMENTS	EVAL. Y	N	NA	SECTION PAGE NO	REMARKS
8.0 Test Sample Failures					
8.1 Has acceptance criteria been established for testing?					
8.2 Has any equipment sample failed to perform Class 1E functions required by equipment qualification?					
8.3 Was any modification made to the equipment or test specimen after the start of type test?					
8.4 If yes, was modification justified?					
8.4 Was the failure adequately analyzed and attributable to random type failure mechanism?					
9.0 Documentation					
9.1 Does type test data documentation contain the following?					
___ A reference indicating applicability of equipment tested to equipment provided for Hope Creek					
___ The equipment performance requirements in accordance with the technical specifications					
___ Identification of specific feature(s) to be demonstrated by the test					
___ Test plan					
___ Report of the test results including:					
___ Objective					
___ Equipment tested					
___ Description of test facility (test setup) and instrumentation including calibration					
___ Test procedures					
___ Test data and accuracy (results)					
___ Summary, conclusions and recommendation					
___ Supporting data					
___ Approval signature and date					

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CHECKLIST 2

QUALIFICATION OF OPERATING EXPERIENCE

QUALIFICATION REQUIREMENTS	EVAL Y	EVAL N	EVAL NA	SECTION PAGE NO	REMARKS
1.0 What is the environment in the operating facilities?					
Fac #1 Fac #2 Fac #3					
1.1 Temperature					
1.2 Pressure					
1.3 Relative Humidity					
1.4 Radiation					
1.5 Submergence					
1.6 Vibration					
1.7 Power Supply Extremes					
1.8 Dust					
1.9 Physical Location					
1.10 Mounting Arrangements					
2.0 Are above environments determined by measurement (where applicable)?					
3.0 Are effects of noncontinuous measurements justified by analysis?					
4.0 How is the performance of electric equipment to be qualified determined?					
-- From measured data					
-- By analysis of failures					
-- Both					
5.0 Data shall include the following:					
5.1 Measurement or determination of all performance characteristics in the specification					
5.2 Recording and analysis of all failures					
5.3 Trends that occurred during the operating period.					
5.4 Log of all periodic maintenance (including adjustments and calibration) and inspection.					

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CHECKLIST 2

QUALIFICATION OF OPERATING EXPERIENCE

QUALIFICATION REQUIREMENTS	EVAL Y	EVAL N	EVAL NA	SECTION PAGE NO	REMARKS
5.5 Document to demonstrate the following as evidence for determination of qualification					
-- The equipment whose operational history becomes a basis for qualification is of equipment bearing the same designation.					
-- The recorded operating environment equals or exceeds the design environment in severity.					
-- The performance of in-service equipment equalled or exceeded the specified requirements.					
-- The period of time for which the above requirements are demonstrated to be met (with reasonable margin) is equal to the qualified life					
6.0 Was any modification made to the equipment at the beginning of the operating experience reporting period?					
7.0 Documentation					
Does operating experience data documentation contain the following?					
7.1 The equipment performance specification					
7.2 The interface or boundary conditions of the equipment.					
7.3 The specifications of equipment for which operating experience is available.					
7.4 Identification of specific features to be demonstrated by operating experience.					
7.5 Comparison of past application and specifications with the new equipment specifications for each feature identified above.					
7.6 Summary and source of operating experience applicable to equipment qualification.					
7.7 The basis on which the data have been determined to be suitable and the equipment qualified.					
7.8 Approval signature and date.					

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CHECKLIST 3

QUALIFICATION BY ANALYSIS

QUALIFICATION REQUIREMENTS	EVAL Y	EVAL N	EVAL NA	SECTION PAGE NO	REMARKS
1.0 Why equipment is (to be) qualified by analysis.					
-- Testing is impractical because of size of equipment					
-- Limitation due to the state-of-the-art					
-- Other					
2.0 Analysis method used is:					
-- Mathematical modeling					
-- Extrapolation					
-- Both of the above					
-- Other					
3.0 Analysis is based on:					
-- Established principles (standards, literature, etc.)					
-- Operating experience data					
-- Partial type test data					
-- Combination of the above (Check all that apply)					
4.0 Are all assumptions used in the analysis justified?					
5.0 Is the constructed mathematical model valid?					
6.0 Is the extrapolation performed justified?					
7.0 Are known material phase changes and reactions identified to ensure that no adverse changes occur within the extrapolation limits?					

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CHECKLIST 3

QUALIFICATION BY ANALYSIS

QUALIFICATION REQUIREMENTS	EVAL Y	EVAL N	EVAL NA	SECTION PAGE NO	REMARKS
8.0 Does the analysis performed demonstrate that the equipment performance will meet or exceed its specified values for the most severe environment or sequence of environments in the specification during its qualified life?					
9.0 Documentation					
9.1 Does the analysis data documentation contain the following (as applicable)?					
9.1.1 The equipment performance specifications					
9.1.2 The specific features, postulated failure modes or the failure effects analyzed					
9.1.3 The assumptions, empirically derived values, and mathematical models used together with appropriate justification for their use					
9.1.4 Description of analytical methods or computer programs used					
9.1.5 A summary of analytically established performance characteristics and their acceptability					
9.1.6 The basis for the extrapolation where test data or operating experience data have been extrapolated					
9.1.7 Approval signature and date					

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CHECKLIST 4

QUALIFICATION OF SAFETY-RELATED EQUIPMENT IN MILD ENVIRONMENT

QUALIFICATION REQUIREMENTS	EVAL Y	EVAL N	EVAL NA	SECTION PAGE NO	REMARKS
1.0 Does the project specification and/or purchase requisition specify the (current) normal and abnormal environmental conditions for the equipment location.?					
1.1 Is the equipment environment maintained by a Class 1E support system?					
2.0 Are materials in the equipment susceptible to degradation due to thermal and/or radiation aging in equipment's environment?					
2.1 If yes, what is the method for maintaining qualification:					
_____ maintenance/surveillance					
_____ replacement schedules					
_____ other					
2.2 Reference vendor manual/instruction, if any, to support 2.1.					
3.0 Qualification Method (any of the following):					
____ Certification of conformance to the design specification					
____ Type test per IEEE 323-1974 _____ -1971 _____					
____ Combination of test, evaluation & analysis					
____ Other, (explain) _____					
4.0 Are the qualification documents signed and dated?					

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CHECKLIST 5

REVIEW OF TEST PLAN

QUALIFICATION REQUIREMENTS	EVAL Y	EVAL N	EVAL NA	SECTION PAGE NO	REMARKS
1.0 Are the components to be tested to applicable standards?					
2.0 Does the procedure state times and temperatures to be used for thermal aging?					
3.0 Does the procedure state dose rate and total dose for radiation aging?					
4.0 What is to be the radiation source? _____					
5.0 Are all organic components to be aged?					
5.1 If not, what are the exceptions? _____					
5.2 What is the justification for exception? _____ _____					
6.0 Are solid state components to be aged?					
6.1 If not, what is the justification? _____ _____					
7.0 To what length of qualified life will the proposed aging bring the component? _____					
8.0 Is the proposed test sequence the same as the sequence specified in Section 6.3.2 of IEEE 323-74 and/or daughter standard?					
9.0 Does the proposed temperature-pressure profile envelop the required profile?					
10.0 How much margin is proposed for Pressure?_____ Temperature?_____ Radiation? _____					
11.0 Are thermocouples to be mounted on the surface of the equipment during DBA simulation test.					
11.1 If not, how is temperature to be measured? ____					
12.0 Are the proposed voltages and frequencies compatible to specified requirements?					

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CHECKLIST 5

REVIEW OF TEST PLAN

QUALIFICATION REQUIREMENTS	EVAL Y	EVAL N	EVAL NA	SECTION PAGE NO	REMARKS
12.1 What margin is proposed? Voltage _____ Frequency_____					
12.2 Do proposed margins adequately compare to the suggested margins of IEEE 323-1974?					
13.0 What operating cycling is proposed? _____					
14.0 Does the procedure address dust conditions?					
15.0 Are the documents signed and dated?					

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