

Please Send Copy of XA to PDR  
**TECHNICAL EVALUATION REPORT**

**REVIEW OF LICENSEES' RESOLUTION OF OUTSTANDING ISSUES  
FROM NRC EQUIPMENT ENVIRONMENTAL QUALIFICATION  
SAFETY EVALUATION REPORTS (F-11 and B-60)**

CAROLINA POWER AND LIGHT COMPANY  
H. B. ROBINSON UNIT 2

NRC DOCKET NO. 50-261

FRC PROJECT C5257

NRC TAC NO. 42466

FRC ASSIGNMENT 13

NRC CONTRACT NO. NRC-03-79-118

FRC TASK 511

*Prepared by*

Franklin Research Center  
20th and Race Streets  
Philadelphia, PA 19103

FRC Group Leader: C. J. Crane

*Prepared for*

Nuclear Regulatory Commission  
Washington, D.C. 20555

Lead NRC Engineer: N. B. Le  
P. Shemanski

July 8, 1982

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, or any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for any third party's use, or the results of such use, of any information, apparatus, product or process disclosed in this report, or represents that its use by such third party would not infringe privately owned rights.

Please Send Copy of XA to PDR

8207130575  
XA



**Franklin Research Center**

A Division of The Franklin Institute

The Benjamin Franklin Parkway, Phila. Pa. 19103 (215) 448-1000

## TECHNICAL EVALUATION REPORT

### REVIEW OF LICENSEES' RESOLUTION OF OUTSTANDING ISSUES FROM NRC EQUIPMENT ENVIRONMENTAL QUALIFICATION SAFETY EVALUATION REPORTS (F-11 and B-60)

CAROLINA POWER AND LIGHT COMPANY  
H. B. ROBINSON UNIT 2

NRC DOCKET NO. 50-261

FRC PROJECT C5257

NRC TAC NO. 42466

FRC ASSIGNMENT 13

NRC CONTRACT NO. NRC-03-79-118

FRC TASK 511

*Prepared by*

Franklin Research Center  
20th and Race Streets  
Philadelphia, PA 19103

FRC Group Leader: C. J. Crane

*Prepared for*

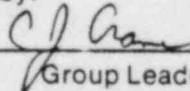
Nuclear Regulatory Commission  
Washington, D.C. 20555

Lead NRC Engineer: N. B. Le  
P. Shemanski

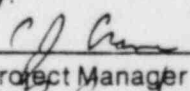
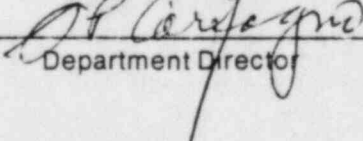
July 8, 1982

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, or any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for any third party's use, or the results of such use, of any information, apparatus, product or process disclosed in this report, or represents that its use by such third party would not infringe privately owned rights.

Reviewed by:

  
\_\_\_\_\_  
Group Leader

Approved by:

  
\_\_\_\_\_  
Project Manager  
  
\_\_\_\_\_  
Department Director



Franklin Research Center

A Division of The Franklin Institute

The Benjamin Franklin Parkway, Phila. Pa. 19103 (215) 448-1000

## CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
1	INTRODUCTION . . . . .	1-1
	1.1 Purpose of the Evaluation . . . . .	1-1
	1.2 Scope of the Evaluation . . . . .	1-1
	1.3 Generic Issue Background. . . . .	1-2
	1.4 Specific Issue Background . . . . .	1-10
2	NRC CRITERIA FOR ENVIRONMENTAL QUALIFICATION . . . . .	2-1
	2.1 Criteria Provided by the NRC. . . . .	2-1
	2.2 Staff Positions and Supplemental Criteria . . . . .	2-1
	2.2.1 Requirements and Applicable Criteria . . . . .	2-1
	2.2.2 Application of Requirements and Criteria to TMI Lessons Learned Implementation Equipment . . . . .	2-3
	2.2.3 Equipment Not in the Scope of the Qualification Review . . . . .	2-4
	2.2.4 Clarification of Qualification Requirements . . . . .	2-5
	2.2.5 Additional Clarification of Qualification Requirements . . . . .	2-8
3	METHODOLOGY USED FOR THE EVALUATION . . . . .	3-1
	3.1 Introduction. . . . .	3-1
	3.2 Methodology . . . . .	3-2
	3.3 NRC Qualification Categories and Definitions. . . . .	3-8
	3.4 Implementation Guide for Fulfilling NRC Criteria. . . . .	3-12
4	TECHNICAL EVALUATION . . . . .	4-1
	4.1 Introduction. . . . .	4-1
	4.2 Summary of the Evaluation . . . . .	4-2
	4.3 Methodology Used by the Licensee. . . . .	4-10
	4.3.1 Completeness of Safety-Related Equipment List. . . . .	4-10
	4.3.2 Environmental Service Conditions . . . . .	4-11
	4.3.3 Submergence . . . . .	4-16
	4.3.4 Chemical Spray . . . . .	4-18
	4.3.5 Aging . . . . .	4-18
	4.4 Equipment Environmental Qualification Evaluation. . . . .	4-20

CONTENTS (Cont.)

<u>Section</u>	<u>Title</u>	<u>Page</u>
5	CONCLUSIONS . . . . .	5-1
6	REFERENCES . . . . .	6-1
APPENDIX A - ENVIRONMENTAL SERVICE CONDITIONS		
APPENDIX B - LISTING OF SAFETY-RELATED ELECTRICAL EQUIPMENT		
APPENDIX C - PLANT SAFETY-RELATED SYSTEMS AND DISPLAY INSTRUMENTATION		
APPENDIX D - REVIEW OF LICENSEE'S RESPONSE TO NRC EEQ SER CONCERNING JUSTIFICATION FOR INTERIM OPERATION		
APPENDIX E - REQUEST FOR ADDITIONAL INFORMATION		
APPENDIX F - EQUIPMENT WHICH IS EXEMPT OR NOT IN SCOPE OF THE REVIEW		

FOREWORD

This Technical Evaluation Report was prepared by Franklin Research Center under a contract with the U.S. Nuclear Regulatory Commission (Office of Nuclear Reactor Regulation, Division of Operating Reactors) for technical assistance in support of NRC operating reactor licensing actions. The technical evaluation was conducted in accordance with criteria established by the NRC.

Principal contributors to the technical preparation of this report were C. J. Crane, J. A. Murphy, K. E. Weise, D. J. Schmitz, and K. J. Ieason of the Franklin Research Center.

T. J. DelGaizo from WESTEC Services, Inc., R. Garrison from ORFI Systems, Inc., and M. A. Fedele from Evaluation Associates, Inc., also contributed to the technical preparation of this report through subcontracts with Franklin Research Center.

IDENTIFICATION OF PROPRIETARY INFORMATION

Some of the information in this technical evaluation report was obtained from manufacturers' proprietary test reports. All proprietary test reports are identified as such in Section 6, References, of this report. Checksheets in Section 4 containing proprietary information have been replaced with a checksheet page stating that the proprietary information has been removed.

## 1. INTRODUCTION

### 1.1 PURPOSE OF THE EVALUATION

The purpose of this report is to:

- o evaluate licensees' resolutions of outstanding issues related to safety-related electrical equipment environmental qualification (EEQ) discussed in the Nuclear Regulatory Commission (NRC) Safety Evaluation Reports (SERs) in accordance with NRC criteria. The objective is to identify all cases where a licensee's response has not resolved the significant qualification issues.
- o evaluate licensees' qualification documentation of safety-related electrical equipment located in harsh environments in accordance with criteria established by the NRC and to identify (1) equipment for which qualification documentation is adequate, i.e., substantiates that the equipment is capable of performing its specified design basis safety function when it is exposed to a harsh environment and (2) equipment for which qualification documentation is deficient, i.e., does not give reasonable assurance that the equipment is capable of performing its specified safety function.
- o evaluate licensees' qualification documentation of safety-related electrical equipment located in harsh environments required for TMI Lessons Learned Implementation. The objective is to evaluate qualification documentation of equipment within the scope of IE Bulletin 79-01B, Supplement 3 (item 2) [9],\* in accordance with criteria established by the NRC in a manner identical to the evaluation of all other safety-related electrical equipment.

### 1.2 SCOPE OF THE EVALUATION

The scope of this report is limited to the evaluation of environmental qualification of electrical equipment that must function to mitigate the consequences of a loss-of-coolant accident (LOCA) or high energy line break (HELB) and whose environment is adversely affected by that event.

---

\*For References, see Section 6. Note that reference numbers are not presented in sequential order.

With respect to TMI Action Plan Implementation, the scope of this report is limited to those sections of NUREG-0737 [13] applicable to equipment having an installation implementation date of January 1, 1981. Where applicable, a review is to be performed on installed equipment with implementation dates after January 1, 1981 if adequately identified by the Licensee.

The NRC has determined that the evaluation of environmental qualification of equipment items (1) located in plant areas whose environment is not adversely affected by the design basis event (DBE) (e.g., equipment located in "mild" environments) or (2) required to achieve and maintain cold shutdown, is not to be included within the scope of this report. However, where the Licensee has identified these equipment items in the EEQ submittals to the NRC, these items have been listed in NRC evaluation Category III.b in this report (see Section 3 of this report for definition of NRC evaluation categories).

Qualification aspects not included within the scope of this evaluation are:

- o seismic and dynamic qualification
- o equipment protection against natural phenomena
- o equipment operational service conditions (e.g., vibration, voltage, and frequency deviations)
- o equipment located where it is subjected to the outdoor environment
- o equipment protection against fire hazards
- o equipment protection against missiles
- o equipment located in plant areas whose environment is not adversely affected by the design basis event
- o equipment required to achieve and maintain cold shutdown.

### 1.3 GENERIC ISSUE BACKGROUND

Safety-related electrical equipment must be capable of performing design safety functions under all normal, abnormal, and accident conditions. The purpose of equipment qualification is to provide tangible evidence that equipment will operate on demand and to verify design performance, thereby establishing assurance that the potential for common-mode failure is minimized.



Of particular concern is the assurance that equipment will remain operable during and following exposure to the harsh environmental conditions (i.e., temperature, pressure, humidity [steam], chemical sprays, radiation, and submergence) imposed as a result of a design basis accident. These harsh environments are generally defined by the limiting conditions resulting from the complete spectrum of postulated break sizes, break locations, and single failures consequent to a LOCA, main steam line break (MSLB) inside the reactor containment, or a HELB outside the reactor containment (such as a main steam or feedwater line break). In addition, depending on specific plant design features, other postulated HELB locations may be associated with:

- o the chemical and volume control system (CVCS) letdown line
- o the steam supply piping to
  - the auxiliary feedwater (AFW) pump turbine
  - the reactor core isolation cooling (RCIC) pump turbine
  - the high pressure core injection (HPCI) pump turbine
  - the isolation condenser
- o steam generator blowdown.

The NRC criteria for reviewing the safety of nuclear power generating stations include the requirement that the qualification of safety-related electrical equipment be substantiated by auditable documentation of the program that establishes the ability of the equipment to function as specified in the station design. This report is restricted to a technical evaluation of the equipment's ability to function in harsh environments resulting from DBEs.

Qualification criteria applied during the licensing of the older nuclear power plants have been modified over the years, and specific industry standards concerning qualification have been revised as the design of reactor systems has changed and as regulatory and operating experience has accumulated. Examples of such standards are IEEE Standards 279-71, 323-74, 383-74, 317-76, 334-80, 381-77, 382-80, 535-79, 627-80, 649-80, and 650-79. NRC NUREG documents 0413 and 0588 have been developed to address this topic. In particular, NUREG-0588 (published for comment in December 1979 and reissued as Revision 1 in July 1981) formally presented the NRC staff positions regarding selected areas of environmental qualification of safety-related electrical equipment in the resolution of General Technical Activity A-24,

"Qualification of Class IE Safety Related Equipment." The positions documented therein are applicable to plants that are or will be in the construction permit or operating license review process.

Although qualification standards and regulatory requirements have undergone considerable development, all of the currently operating nuclear power plants are required to comply with 10CFR50, Appendix A, General Design Criteria for Nuclear Power Plants, Section I, Criterion 4. This criterion states in part that "structures, systems and components important to safety shall be designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing and postulated accidents, including loss-of-coolant accidents."

Qualification requirements are also embodied in (1) 10CFR50 Appendix A, General Design Criteria 1, 2, and 23 and (2) 10CFR50 Appendix B, Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants, Criteria III, "Design Control," and XI, "Test Control." These requirements are applicable to safety-related equipment located outside as well as inside containment.

The NRC staff has evaluated the licensees' equipment qualification programs by reviewing the qualification documentation of selected safety-related equipment as part of the operating license review for each plant. The NRC staff has also used a variety of methods to assure that these general requirements are met for electrical safety-related equipment. In the oldest plants, qualification was based on the fact that electrical components were of high industrial quality. After 1971, qualification was judged on the basis of IEEE Std 323-71; however, no regulatory guide was issued adopting this standard. For plants whose SERs were issued after July 1, 1974, the Commission issued Regulatory Guide 1.89, which in most respects adopted the most recent standard, IEEE Std 323-74.

In November 1977, the Union of Concerned Scientists petitioned the NRC Commissioners to upgrade current standards for the environmental qualification of safety-related electrical equipment in operating plants. Subsequently, the NRC staff instituted the Systematic Evaluation Program (SEP) to determine the degree to which the older operating nuclear power plants deviated from current

licensing criteria. The subject of electrical equipment environmental qualification (SEP Topic III-12) was selected for accelerated evaluation as part of this program. Seismic qualification of equipment was to be addressed as a separate SEP topic. In December 1977, the NRC issued a generic letter to all SEP plant licensees requesting that they initiate reviews to determine the adequacy of existing equipment qualification documentation.

Preliminary NRC review of licensee responses led to the preparation of NUREG-0458, an interim NRC assessment of the environmental qualification of electrical equipment. This document concluded that "no significant safety deficiencies requiring immediate remedial actions were identified." However, it was recommended that additional effort should be devoted to examining the installation and environmental qualification documentation of specific electrical equipment in all operating reactors.

On May 31, 1978, the NRC Office of Inspection and Enforcement issued IE Circular 78-08, "Environmental Qualification of Safety-Related Electrical Equipment at Nuclear Power Plants," which required all licensees of operating plants (except those included in the SEP) to examine their installed safety-related electrical equipment and ensure appropriate qualification documentation for equipment function under postulated accident conditions. Subsequently, on February 8, 1979, the NRC Office of Inspection and Enforcement issued IE Bulletin 79-01, which was intended to raise the threshold of IE Circular 78-08 to the level of Bulletin, i.e., action requiring a licensee response. This Bulletin required a complete re-review of the environmental qualification of safety-related electrical equipment as described in IE Circular 78-08.

The review of the licensees' responses indicated certain deficiencies within the scope of equipment addressed, definition of harsh environments, and adequacy of support documentation. It became apparent that generic criteria were needed for evaluating the electrical equipment environmental qualification for both SEP and non-SEP operating plants. Therefore, during the second half of 1979, the Division of Operating Reactors (DOR) of the NRC issued internally a document entitled "Guidelines for Evaluating Environmental Qualification of Class IE Electrical Equipment in Operating Reactors" [5]. (The document is hereafter

referred to as the "DOR Guidelines.") The document was prepared as a screening standard for reviewing all operating plants, including SEP plants. It was originally intended that the licensees evaluate their qualification documentation in accordance with the DOR Guidelines. However, initial NRC review of this documentation, which was compiled to support licensee submittals, revealed the need for obtaining independent evaluations and for accelerating the qualification review program.

In October 1979, the NRC awarded Franklin Research Center a contract to provide assistance in the "Review and Evaluation of Licensing Actions for Operating Reactors," which included an assignment for review of equipment environmental qualification documentation under SEP Topic III-12. The assignment was to review equipment environmental qualification documentation and to present the results in the form of a Technical Evaluation Report for the 11 oldest plants (included in the SEP review). The plants included within the assignment were the Palisades, Oyster Creek, Ginna, Haddam Neck, Yankee Rowe, LaCrosse, and Big Rock Point plants and Zion Station Units 1 and 2, Indian Point Units 2 and 3, Millstone Unit 1, Dresden Unit 2, and San Onofre Unit 1. (This assignment was completed in April 1981.)

On January 14, 1980, the NRC Office of Inspection and Enforcement issued the DOR Guidelines and IE Bulletin 79-01B, which expanded the scope of IE Bulletin 79-01 and requested additional information on environmental qualification of safety-related electrical equipment at operating facilities, excluding the 11 facilities undergoing the SEP review. This Bulletin cited the DOR Guidelines as the criteria to be used in evaluating the adequacy of the safety-related electrical equipment qualification. The scope of the review was expanded to include HELBs (inside and outside containment) in addition to equipment aging and submergence. The NRC advised the licensees that the criteria contained in the DOR Guidelines would be used in its review of licensee submittals; NUREG-0588 would be used as a guide in cases where the DOR Guidelines do not provide sufficient detail.

In early February 1980, the NRC decided that Indian Point Units 2 and 3 and Zion Station Units 1 and 2 should be included within SEP Topic III-12 for the purpose of equipment environmental qualification review.

On February 21, 1980, the NRC and representatives of the SEP Plant Owners Group held an open meeting at NRC headquarters to discuss an accelerated review program in accordance with the DOR Guidelines. Representatives of the Indian Point Units and Zion Station also attended this meeting. The NRC formally issued to all licensees represented at the meeting the DOR Guidelines document which included a second document, "Guidelines for Identification of That Safety Equipment of SEP Operating Reactors for Which Environmental Qualification Is To Be Addressed" [5], together with the request that the licensees review their plant systems and provide additional equipment environmental qualification information to the NRC on an accelerated schedule.

For non-SEP plants, the NRC Office of Inspection and Enforcement formed a task force including a principal reviewer in each region and a task leader from headquarters. The regional members were assigned responsibility for the technical review of the licensees' responses to IE Bulletin 79-01B, and the task leader was assigned responsibility for the overall coordination of the review effort with NRC staff to assure overall consistency. The regional reviewers held meetings with the licensees in their respective regions, which resulted in staff positions being issued in a supplement to IE Bulletin 79-01B dated February 29, 1980.

In April 1980, the NRC organizational structure was modified and the Equipment Qualification Branch was formed within the new Division of Engineering. Responsibility for reviewing the status of equipment qualification for all plants was assigned to this branch.

On May 23, 1980, the NRC issued Memorandum and Order CLI-80-21 [10], specifying that licensees and applicants must meet the requirements set forth in the DOR Guidelines and NUREG-0588 regarding environmental qualification of safety-related electrical equipment in order to satisfy 10CFR50, Appendix A, General Design Criteria, Section I, Criterion 4. This Order also established that the SERs on this subject, to be prepared by the NRC staff, must be issued on February 1, 1981 and that all subsequent actions to be taken by licensees to achieve full compliance with the DOR Guidelines or NUREG-0588 must be completed no later than June 30, 1982. The Memorandum and Order established the DOR Guidelines and NUREG-0588 as acceptable interpretations of the General

Design Criteria for an interim period. Rulemaking was proposed for the purpose of establishing a permanent interpretation of the General Design Criteria.

The staff held regional meetings with the licensees and interested parties during the week of July 13, 1980. The staff issued a second supplement to IE Bulletin 79-01B, a response to significant questions raised during the public meetings, and two Orders. The Order dated May 30, 1980 required the licensees to comply with the previously issued Commission Memorandum and Order of May 27, 1980 (CLI-80-21). The above orders required the licensees to complete the tasks identified in IE Bulletin 79-01B no later than November 1, 1980 to allow the staff to comply with the February 1, 1981 date imposed by the Commission Order. The responses to the questions were issued on February 29, 1980; and the second and third supplements to IE Bulletin 79-01B, highlighting the staff positions affecting the licensees' responses, were issued on September 29 and October 24, 1980, respectively.

In October 1980, EG&G Idaho, Inc., awarded Franklin Research Center a contract to provide assistance in the equipment environmental qualification review for 13 of the plants whose licensees responded to IE Bulletin 79-01B. The assignment was to evaluate the licensees' equipment environmental qualification submittals and to present the results in the form of a Technical Evaluation Report for each plant. The objective of this Technical Evaluation Report was to review the licensees' submittals to determine if safety-related electrical equipment was reviewed for environmental qualification in accordance with the DOR Guidelines and NUREG-0588 as required by IE Bulletin 79-01B. The NRC was to perform an audit of the qualification documentation references as part of its Safety Evaluation Program. If discrepancies were found, the audit was to be extended. The plants included within this assignment were Nine Mile Point Unit 1, Millstone Unit 2, Salem Unit 1, Browns Ferry Units 1, 2, and 3, Brunswick Units 1 and 2, Hatch Units 1 and 2, Dresden Unit 3, and Quad Cities Units 1 and 2. (This assignment was completed in June 1981.)

In mid-1981, the NRC issued SERs on environmental qualification of safety-related electrical equipment to licensees of all operating plants.

Where additional qualification information was required, the licensees were directed to respond to the NRC within 90 days of receipt of the SER.

In May 1981, under the licensing action assistance contract, NRC authorized Franklin Research Center to proceed with the review and evaluation of the environmental qualification of safety-related electrical equipment located in harsh environments, required for TMI Lessons Learned Implementation on 71 operating plants.

In July 1981, the NRC conducted extensive meetings with the nuclear industry to address concerns and questions regarding qualification of safety-related equipment. In addition, the NRC provided licensees with detailed information with respect to the format and expected content of the licensees' 90-day responses to the NRC SERs. Draft outlines of the following proposed programs were also presented to the industry: environmental qualification of equipment located in "mild" environments, seismic and dynamic qualification, and environmental qualification of mechanical equipment.

On September 23, 1981, the NRC Commissioners considered a petition (SECY-81-486) to extend the deadline for actions to be taken by licensees to achieve environmental qualification of all safety-related equipment. On September 30, 1981, the NRC Commissioners extended this deadline to the second refueling outage after March 31, 1982.

In October 1981, the NRC authorized Franklin Research Center to include within the scope of the existing EEQ assignment (TMI Lessons Learned Implementation Equipment) the evaluation of licensees' resolutions of outstanding issues related to equipment environmental qualification discussed in the NRC SERs in accordance with NRC criteria. The assignment was to review the qualification documentation and to present the results in the form of a Technical Evaluation Report for 71 operating plants. (This report was developed within the scope of this assignment.)

On January 7, 1982, the NRC Commissioners approved the issuance of the proposed rule, "Environmental Qualification of Electric Equipment for Nuclear Power Plants," for public comment. The proposed rule was published in the Federal Register (Volume 47, No. 13) dated January 20, 1982.

In February 1982, Proposed Revision 1 to Regulatory Guide 1.89, "Environmental Qualification of Electric Equipment for Nuclear Power Plants," was issued for public comment. This regulatory guide was issued to (1) reflect current NRC positions on equipment qualification and (2) provide guidelines for meeting the NRC Commissioners proposed rule on equipment qualification.

The final rule, "Environmental Qualification of Electric Equipment for Nuclear Power Plants," was subsequently issued on April 16, 1982 by the NRC (to be published in the Federal Register) to clarify and strengthen the criteria for environmental qualification of electrical equipment. The final rule is to be incorporated into 10CFR50 as Section 50.49, "Environmental Qualification of Electric Equipment for Nuclear Power Plants." The significant features of the rule are:

- o Requalification of electrical equipment in accordance with the rule will not be required for equipment qualified or being qualified in accordance with the DOR Guidelines and IE Bulletin 79-01B or NUREG-0588, provided the qualification program commenced within 90 days after the effective date of the rule.
- o The requirement to qualify equipment needed to complete one path of achieving and maintaining a cold shutdown condition has been deleted.
- o A new section has been added, covering the qualification of equipment located in mild environments.
- o The Commission deadline for actions to be taken by licensees to achieve environmental qualification of all safety-related equipment is extended to the second refueling outage after March 31, 1982.

On April 20, 1982, the NRC staff issued Generic Letter No. 82-09 [11] to all licensees, presenting the NRC's position and clarification of certain aspects of the environmental qualification requirements.

#### 1.4 SPECIFIC ISSUE BACKGROUND

On May 31, 1978, the NRC Office of Inspection and Enforcement issued IE Circular 78-08, "Environmental Qualification of Safety-Related Electrical Equipment at Nuclear Power Plants," which required all licensees of operating plants to examine their installed safety-related electrical equipment and



ensure appropriate qualification documentation for equipment function under postulated accident conditions. Subsequently, on February 8, 1979, the NRC Office of Inspection and Enforcement issued IE Bulletin 79-01, which was intended to raise the threshold of IE Circular 78-08 to the level of Bulletin, i.e., action requiring a licensee response.

On January 14, 1980, the NRC Office of Inspection and Enforcement issued the DOR Guidelines and IE Bulletin 79-01B, which expanded the scope of IE Bulletin 79-01 and requested additional information on environmental qualification of safety-related electrical equipment at operating facilities.

On March 15, 1980, CP&L provided the NRC with a submittal in response to IE Bulletin 79-01B for the H. B. Robinson Steam Electric Plant Unit 2 [22].

On July 7, 1980, CP&L submitted to the NRC further information [1, 2] in response to IE Bulletin 79-01B.

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 (August 25-29, 1980) of selected safety-related electrical equipment. The reactor coolant, safety injection, auxiliary cooling, and heating, ventilation, and air conditioning systems and electrical penetration assembly were inspected. All the equipment inspected is located inside containment. The inspection verified 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 information given in the component evaluation work sheets of the Licensee's report. The site inspection is documented in report IE 50-261/80-20. No deficiencies were noted.

On November 21, 1980 [3, 4], CP&L submitted to the NRC Revision 1 and Revision 2 to the previous response to IE Bulletin 79-01B.

On January 30, 1981 [14, 15], CP&L submitted to the NRC Revision 3 to the previous response to IE Bulletin 79-01B.

The NRC issued a Safety Evaluation Report (SER) to the Licensee on May 21, 1981 [16].

On July 21, 1981, with NRC approval, FRC requested from CP&L additional technical information regarding the 79-01B Revision 3 submittal [33]. On July 31, 1981, CP&L provided FRC with (1) Analysis of High Energy Line Break Outside Containment, (2) 45-day response to I&E Bulletin 79-01B, (3) General Plant Procedure No. 6, and (4) Reference 52 of CP&L's response to Supplement 3 to I&E Bulletin 79-01B [17].

On August 31, 1981, CP&L transmitted to the NRC the response to the SER [20].

Requests for qualification documentation were transmitted to the NRC on November 24, 1981 [30], February 1, 1982 [31], and April 7, 1982 [32].

By letter dated March 1, 1982, CP&L stated that the most efficient and productive way to deal with the FRC request for qualification documents was to have an audit/meeting with the NRC and FRC at Raleigh [24].

## 2. NRC CRITERIA FOR ENVIRONMENTAL QUALIFICATION

### 2.1 CRITERIA PROVIDED BY THE NRC

The screening guidelines used to evaluate the electrical equipment environmental qualification program were:

- o DOR Guidelines, "Guidelines for Evaluating Environmental Qualification of Class 1E Electrical Equipment in Operating Reactors," November 1979 [5]
- o NUREG-0588, Revision 1, "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment," July 1981 [12].

Other appropriate references used in the review of the licensees' electrical equipment environmental qualification submittals are:

- o IE Bulletin 79-01B, "Environmental Qualification of Class 1E Equipment," January 14, 1980; Supplement No. 1, February 29, 1980; Supplement No. 2, September 29, 1980; and Supplement No. 3, October 24, 1980 [6, 7, 8, 9]
- o NUREG-0737, "Clarification of TMI Action Plan Requirements," November 1980 [13]. This document is applicable for the selection of equipment for the evaluation of the environmental qualification of safety-related electrical equipment located in harsh environments required for TMI Lessons Learned Implementation. The scope of the review is limited to equipment associated with specific sections of NUREG-0737 which have an installation implementation date of January 1, 1981. Where applicable, a review is to be performed on installed equipment with implementation dates after January 1, 1981 if adequately identified by the licensee.

### 2.2 STAFF POSITIONS AND SUPPLEMENTAL CRITERIA

The NRC identified the following staff positions and supplemental criteria to be used in conjunction with the referenced screening guidelines.

#### 2.2.1 Requirements and Applicable Criteria

Items 3 and 17 of Supplement 2 to IE Bulletin 79-01B [8] describe the application of the DOR Guidelines and NUREG-0588 to operating reactors (ORs),

near term operating license applicants (NTOLs), and construction permit applicants (CPs). The qualification requirements and applicable criteria are stated as follows:

[Question 3]

"Define the requirements and applicable criteria for ORs, NTOLs, and OLs. Specifically address the NTOLs whose CP SER is prior to July 1974 and after July 1974. Can a CP whose SER is prior to 1974 use the DOR guidelines?"

[NRC Answer to Question 3]

"Table 1 describes the application of each document. All operating reactors as of May 23, 1980, will be evaluated against the DOR guidelines. In cases where the DOR guidelines do not provide sufficient detail, but NUREG-0588 Category II does, NUREG-0588 will be used.

TABLE 1  
REQUIREMENTS

<u>ORs</u>	<u>OLs</u>		<u>CPs</u>
	<u>CP SER</u> <u>Before 7/1/74</u>	<u>CP SER</u> <u>After 7/1/74</u>	
DOR GUIDELINES	NUREG-0588 (CAT. II)	NUREG-0588 (CAT. I)	NUREG-0588 (CAT. I) or NEW RULE WHEN IN EFFECT

REPLACEMENT COMPONENTS  
USE NUREG-0588 (CAT. I)

All plants licensed after May 23, 1980, shall conform to NUREG-0588. In accordance with Regulatory Guide 1.89, all such operating licenses for facilities whose construction permit SER is dated July 1, 1974 or later, are to be reviewed against IEEE Std. 323-1974. Thus, for these licensees, the operating license applicant is to qualify equipment to the Category I column in NUREG-0588. For operating licenses issued after May 23, 1980, whose construction permit SER is dated before July 1, 1974, the operating license applicant is to qualify equipment to at least Category II column of NUREG-0588; unless the licensee made commitment in the construction permit record to use the 1974 standard, or unless the operating licensee application record indicates that the 1974 standard is to be used, in such cases Column I of NUREG-0588 is to be used.

While there are differences between the Category II column of NUREG-0588 and the DOR guidelines, the differences are in details and in the

optional part of the documents. The minimum requirements set forth by these documents are general and compatible. Thus, the minimum standards set by either of the two documents are equally applicable to ORs and NTOLs."

[Question 17]

"Define the requirements for 'replacement parts.' Are they the same for 'spare' parts? Clearly discuss the alternatives for existing inventories of parts/components. If equipment is ordered to meet IEEE Std. 323-1974 standard but lead time exceeds June 1982, can we use IEEE Std. 323-1971 qualified components in the interim?"

[NRC Answer to Question 17]

"The requirements for 'replacement' and 'spare' parts are the same for the purposes of complying with the Commission order and memorandum. After May 1980, all parts used to replace presently installed parts shall be qualified to Category I of NUREG-0588 'unless there are sound reasons to the contrary.' Nonavailability and/or the fact that the part to be used as a replacement is a spare part purchased prior to May 23, 1980, and is in stock are among the factors to be considered in weighing whether there are 'sound reasons to the contrary.' All replacement parts shall as a minimum conform to the requirements described in the answer to question 3. Justification for deviation from Category I of NUREG-0588 shall be documented by the licensee and records shall be available for audit, upon request by the NRC."

#### 2.2.2 Application of Requirements and Criteria to TMI Lessons Learned Implementation Equipment

The NRC requested an evaluation of the environmental qualification of safety-related electrical equipment located in harsh environments required for TMI Lessons Learned Implementation in accordance with criteria established by the NRC in a manner identical to the evaluation of all other safety-related electrical equipment. Additionally, Item 21 of Supplement 2 to IE Bulletin 79-01B [8] states:

"TMI Lessons Learned instrumentation will be considered in the February 1, 1981 SER. This equipment is subject to the same requirements as other safety-related electrical equipment. The guidance and requirements of NUREG-0588 referenced daughter standards, and Reg Guides will be used by the staff in assessing the adequacy of the qualification information."

Item 2 of Supplement 3 to IE Bulletin 79-01B [9] states:

"IEB 79-01B required a 90 day response which was due in mid-April 1980. Supplement 1 (Feb. 1980) informed licensees that equipment which was

'planned' to be installed as a result of lessons learned need not be addressed in that response. Some of this equipment has since been installed. Supplement #2 (Q.5, Q.21) identified that the staff position was that equipment which is installed should be treated in a manner similar to all other safety-related electrical equipment and be addressed in the November 1, 1980 submittal. This position represents no change in staff position regarding the scope of the review. However, since the staff position on this issue was unclear the following will apply:

- a. Qualification information for installed TMI Action Plan equipment must be submitted by February 1, 1981.
- b. Qualification information for future TMI Action Plan equipment (ref. NUREG-0737, when issued), which requires NRC pre-implementation review, must be submitted with the pre-implementation review data.
- c. Qualification information for TMI Action Plan equipment currently under NRC review should be submitted as soon as possible.
- d. Qualification information for TMI Action Plan equipment not yet installed which does not require pre-implementation review should be submitted to NRC for review by the implementation date."

### 2.2.3 Equipment Not in the Scope of the Qualification Review

Supplement 2 of IE Bulletin 79-01B [8] permits deferment of the review of environmental qualification for all safety-related equipment items located in plant areas where the equipment is not exposed to the direct effects of a high energy line break (HELB) or to nuclear radiation emanating from circulation of fluids containing radioactive substances. Supplement 3 of IE Bulletin 79-01B [9] permits deferment of the review of environmental qualification for all equipment required to achieve and maintain the plant in a cold shutdown condition. Supplements 2 and 3 of 79-01B originally permitted deferment until after February 1, 1981 of the qualification review of equipment located in a mild environment or required to achieve and maintain the plant in a cold shutdown condition. Since the issuance of Supplements 2 and 3, the NRC has determined that the review of environmental qualification for this equipment is not within the scope of the present review program.

## 2.2.4 Clarification of Qualification Requirements

### 2.2.4.1 Service Conditions Inside Containment for a Loss-of-Coolant Accident (DOR Guidelines Section 4.1)

For pressurized water reactors (PWRs), the DOR Guidelines state that the containment temperature and pressure conditions as a function of time should be based on the most recent NRC-approved service conditions specified in the Final Safety Analysis Report (FSAR) or other licensee documentation. In the specific case of pressure-suppression type containments, the following minimum high temperature conditions may be used: (1) boiling water reactor (BWR) drywells -- 340°F for 6 hours and (2) PWR ice condenser lower compartments -- 340°F for 3 hours. As stated in Supplement 2 to IE Bulletin 79-01B [8], "these values are a screening device, per the Guidelines, and can be used in lieu of a plant-specific profile, provided that expected pressure and humidity conditions as a function of time are accounted for."

Service conditions should bound those expected for coolant and steam line breaks inside containment with due consideration given to analytical uncertainties. The steam line break condition should include superheated conditions, the peak temperature, and subsequent temperature/pressure profiles as functions of time. If containment spray is to be used, the impact of the spray on required equipment should be assessed.

The adequacy of a plant-specific profile depends on the assumptions and design considerations at the time the profiles were developed. The DOR Guidelines and NUREG-0588 provide guidance and considerations required to determine if the calculated plant-specific temperature/pressure profiles encompass the loss-of-coolant accident (LOCA) and HELB accidents inside containment.

### 2.2.4.2 Submergence

(DOR Guidelines Section 4.1, Subitem 3; and Section 4.3.2, Subitem 3)

Equipment submergence (inside or outside containment) should be addressed where the possibility exists that submergence of equipment may result from HELBs or other postulated occurrences. Supplement 2 to IE Bulletin 79-01B [8] provides the following additional criterion: If the equipment satisfies the

guidance and other requirements of the DOR Guidelines or NUREG-0588 for the LOCA and HELB accidents, and the licensee demonstrates that its failure will not adversely affect any safety-related function or mislead the operator after submergence, the equipment can be considered exempt from the submergence portion of the qualification requirements.

#### 2.2.4.3 Simulated Service Conditions and Test Duration (DOR Guidelines Section 5.2.1)

The Guidelines require that the test chamber environment envelop the required service conditions for a time equal to the period from the initiation of the accident until the service conditions return to normal. Supplement 2 to IE Bulletin 79-01B [8] provides the following additional criterion:

"Equipment designed to perform its safety-related function within a short time into an event must be qualified for a period of at least 1 hour in excess of the time assumed in the accident analysis. The staff has indicated that time is the most significant factor in terms of the margins required to provide an acceptable confidence level that a safety-related function will be completed. The 1-hour qualification requirement is based on the acceptance of a type test for a single unit and the spectrum of accidents (small and large breaks) bounded by the single test."

#### 2.2.4.4 Test Sequence (DOR Guidelines Section 5.2.3)

Supplement 2 to IE Bulletin 79-01B [8] provides the following additional criteria:

"Sequential testing requirements are specified in NUREG-0588 and the DOR Guidelines. Licensees must follow the test requirements of the applicable document.

1. If the test has been completed without aging in sequence, justification for such a deviation must be submitted.
2. If testing of a given component has been scheduled but not initiated, the test sequence/program should be modified to include aging.
3. Test programs in progress should be evaluated regarding the ability to comply by incorporating aging in the proper sequence. These programs would then fall in the first or second category."



## 2.2.4.5 Radiation

(DOR Guidelines Sections 4.1.2, 4.2.2, and 4.3.2, Subitem 2)

Supplement 2 to IE Bulletin 79-01B [8] provides the following additional criteria:

"Both the DOR Guidelines and NUREG-0588 are similar in that they provide the methods for determining the radiation source term when considering LOCA events inside containment (100% noble gases/50% iodine/1% particulates). These methods consider the radiation source term resulting from an event which completely depressurizes the primary system and releases the source term inventory to the containment.

NUREG-0578 provides the radiation source term to be used for determining the qualification doses for equipment in close proximity to recirculating fluid systems inside and outside of containment as a result of LOCA. This method considers a LOCA event in which the primary system may not depressurize and the source term inventory remains in the coolant.

NUREG-0588 also provides the radiation source term to be used for qualifying equipment following non-LOCA events both inside and outside containment (10% noble gases/10% iodine/0% particulates).

When developing radiation source terms for equipment qualification, the licensee must ensure consideration is given to those events which provide the most bounding conditions. The following table summarizes these considerations:

	<u>LOCA</u>	<u>Non-LOCA HELB</u>
Outside Containment	NUREG-0578 (100/50/1 in RCS) [*]	NUREG-0588 (10/10/0 in RCS)
Inside Containment	<u>Larger of</u>	
	NUREG-0588 (100/50/1 in containment)	NUREG-0588 (10/10/0 in RCS)
	or	
	NUREG-0578 (100/50/1 in RCS)	

\*The numbers in parentheses represent % noble gases/% iodine/% particulates. RCS means reactor coolant system.

Gamma equivalents may be used when consideration of the contributions of beta exposure has been included in accordance with the guidance given in the DOR Guidelines and NUREG-0588. Cobalt 60 is one acceptable gamma radiation source for environmental qualification of safety-related equipment. Cesium 137 may also be used."

### 2.2.5 Additional Clarification of Qualification Requirements

The NRC has worked with a number of licensees, at their requests, to provide further clarification on environmental qualification requirements. On January 20, 1982, the NRC issued Generic Letter No. 82-09 [11] presenting staff positions on certain aspects of the qualification requirements. Generic Letter No. 82-09 states:

#### "1. Operator Display Instrumentation

- Q. Given the interrelated activities associated with display instrumentation (e.g., NUREG-0700, NUREG-0799, proposed Regulatory Guide 1.97 and Equipment Qualification efforts), what display instrumentation referenced in emergency operating procedures must be identified in licensee submittal to the NRC?
- A. All display instrumentation referenced in the emergency procedures need not be identified. The NRC requires that licensees need only identify and have available qualification documentation on those operator display instruments which are safety-related (see Question 2). If licensees have previously supplied a listing of all display instrumentation referenced in emergency procedures, licensees may identify (such as by the use of an \*) which of those instruments are safety-related. The staff will defer review of the basis for this safety-related classification until other NRC activities<sup>1</sup> have been implemented. When these other activities are implemented, additional instruments presently not requiring qualification may require upgrading to a safety-related status and/or may require qualification. Licensees will be required at that time to qualify this instrumentation in accordance with the following criteria:
- o For new or upgraded instrumentation with a required operation date prior to the equipment qualification deadline, qualification must be accomplished by the equipment qualification deadline.

<sup>1</sup>Such activities include preparation of new emergency procedures (NUREG-0799), control room design reviews (NUREG-0700), and upgrading of accident monitoring instrumentation (Reg. Guide 1.97 and NUREG-0737).

- o For new or upgraded instrumentation with a required operation date after the equipment qualification deadline, qualification must be accomplished prior to equipment operation and plant acceptance.

## 2. Safety-Related Equipment

- Q. For Equipment Qualification purposes, what constitutes all safety-related electrical equipment?
- A. The Commission, in CLI-80-21, required the environmental qualification of only safety-related electrical equipment. Identification of the safety-related equipment installed at specific plants can be obtained from FSARs, Technical Specifications and other docketed correspondence setting forth NRC requirements or licensee commitments. Identification of safety-related equipment installed in harsh environments at specific plants must be supplied by the licensee. The necessity for upgrading nonsafety-related system to safety-related status will be the subject of other NRC reviews.

## 3. Replacement Parts

- Q. Please clarify the NRC requirements on replacement parts.
- A. In CLI-80-21, the Commission stated that unless there were sound reasons to the contrary, replacement equipment should be qualified to the standards set forth in Category I of NUREG-0588. The Commission's position was designed to promote the policy of upgrading the environmental qualification and reliability of installed safety-related electrical equipment. To meet this overall goal, licensees must institute internal policy practices consistent with the Commission's statement.

Situations may arise in which upgrading to NUREG-0588, Category I of replacement equipment qualified to NUREG-0588, Category II or the DOR Guidelines will not be compatible with overall station safety and performance goals. Licensees must review such situations on a case-by-case basis and determine that 'sound reasons to the contrary' do, in fact, exist which warrant the use of replacement equipment (not necessarily in-kind) qualified to the DOR Guidelines or NUREG-0588, Category II. For equipment located in a harsh environment, licensees' procedures must provide for documentation and substantiation of such determinations.

Conditions which reflect sound reasons why qualification standards for replacement of equipment in a harsh environment need not be upgraded to NUREG-0588, Category I include the following:

1. The licensee has replacement equipment in stock that meets the DOR Guidelines or NUREG-0588, Category II, and procurement actions regarding such replacement equipment had commenced prior to May 23, 1980.
2. Replacement equipment qualified to the NUREG-0588, Category I standards does not exist.
3. Replacement equipment qualified to the NUREG-0588, Category I standards is not available to meet installation and operation schedules. Equipment qualified to the DOR Guidelines or NUREG-0588, Category II may be used for an interim period until Category I equipment is obtained and an outage of sufficient duration is available for replacement. Justification for use of the non-Category I qualified replacement equipment beyond this interim period must be submitted to the NRC for approval prior to the end of the interim period and in sufficient time for reasonable NRC review.
4. Replacement equipment qualified to NUREG-0588, Category I standards would require significant plant modifications to accommodate its use.
5. Operating performance and reliability data for the Category I equipment indicates poor overall equipment performance. For example, mean time to failure is significantly shorter for the Category I replacement equipment.
6. The use of replacement equipment qualified to NUREG-0588, Category I standards has a significant probability of creating human factor problems that will negatively affect plant safety and performance, e.g., (1) knowledge, skills and ability of existing plant staff require significant upgrading to operate or maintain the specific Category I replacement equipment; (2) the use of equipment qualified to Category I standards creates a one-of-a-kind application; or (3) maintenance, surveillance or calibration activities are unnecessarily complex.

5. Submergence Outside Containment

- Q. For equipment qualification purposes, what are the staff requirements concerning submergence of equipment outside containment?

- A. The Staff requires that the licensee submit documentation on the qualification of safety-related equipment that could be submerged due to a high energy line break outside containment.

6. Radiation

- Q. Is the staff screening value of  $4 \times 10^7$  rads applicable to all operating reactors?
- A. No. This screening value is applicable only to PWRs with dry type containments. However, for PWRs with dry type containments, the licensee may choose to use plant specific analysis instead of the screening value. For plants with other containment types, the licensee must use plant specific analysis.

Acceptable to the Staff for equipment qualification purposes are radiation values developed as part of the plant licensing process provided that they are based on the TID14844 source terms and are conservatively performed. In order to assure that the methodologies are appropriate, the Staff requests two component specific sample calculations (one for inside and one for outside containment), and a brief written description of each of the methodologies used, their application and associated conservatisms. Such sample calculations and a statement by the licensee that the values of radiation exposure of components so derived are appropriate for environmental qualification of equipment will satisfy the Staff's concern on the 'Radiation Specification Value' used during the qualification reviews.

7. Containment Service Conditions

- Q. Must the Staff value (identified in the SERs) of  $T_{SAT}$  for PWRs and  $T_{SAT} + 20^{\circ}F$  for BWRs be used as the maximum in-containment temperature for the purpose of equipment qualification?
- A. No. The Staff will accept the use of these values. However, an acceptable alternative to the NRC staff's temperature criterion used for the service conditions must base that service condition on the FSAR analysis or other NRC approved analysis, provided that the specific analysis, or a summary of that analysis, together with reference to the previous NRC acceptance of the analysis is submitted by the licensee. In addition, some of the information in the associated safety evaluation may require clarification.

8. One Hour Minimum Operating Time

- Q. The Staff has previously indicated that certain exceptions to the one hour minimum operating time rule are permitted. Can further clarification be provided?

- A. With regard to plants subject to the qualification requirements of the DOR Guidelines or Category II of NUREG-0588, for those pieces of equipment tested prior to May 23, 1980, the test data and analysis may be used to qualify the equipment to the required operating time plus an appropriate margin. The one hour margin requirement need not be applied. However, subsequent failures should be shown not to be detrimental to plant safety.

The one hour time margin rule is not applicable to equipment whose safety function is performed prior to significant changes in the environment at the equipment location.

9. Aging

- Q. Must a qualified life be developed for all safety-related electrical equipment located in harsh environments?
- A. Section 7 of the DOR Guidelines and Section 4.2, Category II of NUREG-0588, do not require a qualified life to be established for all safety-related electrical equipment located in harsh environments. A qualified life, in accordance with the provisions in IEEE 323-1974, is required for equipment, including replacement parts, qualified to Category I of NUREG-0588 that is located in a harsh environment.

An acceptable method for addressing in-service degradation is through a preventive maintenance/surveillance program with equipment and component refurbishment and/or replacement based on known susceptibility to aging degradation, the results of inspections, or manufacturers recommendations. These elements of the program lead to an understanding on a device specific basis of the nature and extent of the increased stress levels encountered during Design Basis Accidents and resultant degradation (if any) which may occur. Arrhenius or other appropriate accelerated aging methodologies may be used to establish replacement and refurbishment schedules if the component's design and materials application are sufficiently simple and the necessary data are available to allow a meaningful application.

In plants subject to the qualification requirements of either the DOR Guidelines or NUREG-0588 Category II, for equipment that has been identified as being susceptible to significant degradation due to thermal and radiation aging, the schedule for inspection of and/or replacement of the susceptible components in that equipment must be incorporated into the preventive maintenance and surveillance programs, and that information should be incorporated into the system component evaluation worksheets (SCEWS). For other equipment, the aging column in the SCEWS should be marked 'No Known Susceptibility'."

### 3. METHODOLOGY USED FOR THE EVALUATION

#### 3.1 INTRODUCTION

As discussed in Section 1.3 of this report, the NRC issued Safety Evaluation Reports (SERs) on environmental qualification of safety-related equipment to licensees of all operating plants in mid-1981.

The SERs identified various equipment qualification deficiencies as indicated below:

#### 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	
(R) - Licensee has committed to replace equipment	

The SERs directed licensees to "either provide documentation of the missing qualification information which demonstrates that safety-related equipment meets the DOR Guidelines or NUREG-0588 requirements or commit to a corrective action (re-qualification, replacement [etc.]) to establish qualification by June 30, 1982." Licensees were required to respond to the NRC within 90 days of receipt of the SER.

As stated in Section 1.1, the purpose of this report is (1) to evaluate licensees' resolutions of outstanding issues related to safety-related electrical equipment environmental qualification (EEQ) discussed in the NRC's SERs in accordance with NRC criteria, and (2) to evaluate licensees' qualification documentation of safety-related electrical equipment, including

TMI Lessons Learned Implementation equipment, located in harsh environments in accordance with criteria established by the NRC (see Section 2 of this report). The methodology used to evaluate (1) the Licensee's response to the NRC SER and (2) the equipment environmental qualification is presented herein.

### 3.2 METHODOLOGY

The Licensee, Carolina Power and Light Company, provided a response to the SER and additional qualification information in its submittals [17, 20] to the NRC for the Robinson Unit 2 Nuclear Power Plant.

The following bases provided by the NRC were used to determine the relative completeness of the Licensee's submittals:

- o Determine whether the Licensee provided specific responses to the SER concerns.
- o Determine whether the Licensee proposed corrective actions and a schedule for completion of the actions.
- o Determine whether the Licensee addressed the NRC's concern for margin with respect to the containment environmental conditions.
- o Determine whether the Licensee revised the environmental parameters.
- o Determine whether the Licensee's System Component Evaluation Work Sheets (SCEWS) were updated to correct deficiencies and add supplemental information.
- o Determine whether the Licensee provided justifications for interim operation for all unqualified equipment.
- o Determine whether the Licensee addressed aging and incorporated the results into the equipment maintenance program.

The extensive list of safety-related electrical equipment\* in various locations of the plant identified by the Licensee was analyzed, and all identical equipment located within plant areas that are exposed to the same environmental service conditions was grouped together and designated an

---

\*In this report, the term "safety-related electrical equipment" refers to the equipment defined by the two NRC Guidelines referenced in Section 2.1.



"equipment item." In this report, the term "equipment item" refers to a specific type of electrical equipment, designated by manufacturer and model, which is representative of all identical equipment in a plant area exposed to the same environmental service conditions (e.g., Flow Transmitter, Fischer & Porter, Model 10B2496, located within containment). This analysis resulted in a reduced listing of equipment (equipment items) that formed the basis for the review.

Appendix A contains the environmental service conditions for each location. Appendix B contains the tabulation of the equipment items, locations, function, plant identification numbers, required operating time, and applicable qualification documentation references. Appendix C lists the plant systems identified by the Licensee and the NRC as being essential to safety.

Each item in the list of safety-related electrical equipment items was reviewed in relation to:

- o the Licensee's response to the SER concerns
- o technical information received from the Licensee as a result of requests for additional information (Appendix E)
- o technical data derived from the Licensee's submittal
- o NRC DOR Guidelines or NUREG-0588 Revision 1 criteria
- o the Licensee's definition of harsh service environments (Appendix A)
- o documentation cited by the Licensee as evidence of qualification
- o applicable and available qualification documentation associated with the overall equipment environmental qualification program
- o the Licensee's analysis and/or justification of qualification
- o Licensee-proposed corrective action for qualification deficiencies
- o the Licensee's equipment/part replacement schedules
- o the Licensee's technical arguments concerning the adequacy of equipment, based on system operational considerations
- o the Licensee's rationale concerning exemption of equipment from qualification.

Topics not within the scope of the evaluation are:

- o completeness of the Licensee's listing of safety-related equipment
- o acceptability of Licensee-provided environmental service conditions.

The NRC requested an evaluation of the environmental qualification of safety-related electrical equipment located in harsh environments required for TMI Lessons Learned Implementation. The objective is to evaluate qualification documentation of equipment within the scope of IE Bulletin 79-01B, Supplement 3 (item 2), in accordance with criteria established by the NRC (see Section 2 of this report) in a manner identical to the evaluation of all other safety-related electrical equipment. The scope of this review is limited to TMI Action Plan equipment associated with those sections of NUREG-0737 which have an equipment installation implementation date of January 1, 1982 (sections are identified below). Where applicable, a review was to be performed on installed equipment with implementation dates after January 1, 1981 if adequately identified by the licensee.

- II.B.3 (ALL/1-1-81) Post-Accident Sampling Capability of Reactor Coolant and Containment
- II.D.3 (ALL/1-1-81) Direct Indication of Relief and Safety Valve Position
- II.E.1.2 (PWR/1-1-81) Auxiliary Feedwater System Automatic Initiation and Flow Indication
- II.E.3.1 (PWR/1-1-81) Emergency Power Supply for Pressurizer Heaters (Safety-Grade Interfaces)
- II.E.4.1 (ALL/7-1/81) Dedicated Hydrogen Penetrations
- II.E.4.2 (ALL/1-1-81) Containment Isolation Dependability
- II.F.2 (PWR/1-1-81) Instrumentation for Detection of Inadequate Core Cooling
- II.G.1 (PWR/1-1-81) Emergency Power for Pressurizer Equipment (Safety-Grade Interfaces)
- II.K.2.10 (PWR/B&W/7-1-81) Safety-Grade Anticipatory Reactor Trip
- II.K.3.9 (PWR/W/1-1-81) PID Controller Modification (If Hardware Change Involved)

- II.K.3.12 (PWR/W/1-1-81) Anticipatory Reactor Trip upon Turbine Trip
- II.K.3.13 (PWR/GE/7-1-81) Separation of HPCI and RCIC Initiation Signals
- II.K.3.15 (BWR/GE/7-1-81) Prevention of Spurious Isolation of HPCI and RCIC Systems
- II.K.3.19 (BWR/GE/7-1-81) Interlock on Recirculation Pump Loop
- II.K.3.21 (BWR/GE/7-1-18) Restart of Core Spray and LPCI Systems (If Hardware Changed Out)
- II.K.3.27 (BWR/GE/7-1-81) Provide Common Reference Level for Vessel Level Instrumentation (If Hardware Changed Out)

Licensees whose plants were included within the NRC Systematic Evaluation Program received a Technical Evaluation Report (TER) in addition to the SER. The TER was based on a review of equipment environmental qualification documentation associated with the Licensee's EEQ submittals. The qualification deficiencies identified in the SER were derived from the TER. Plants included within this program were the Palisades, Oyster Creek, Ginna, Haddam Neck, Yankee Rowe, LaCrosse, and Big Rock Point plants and Zion Station Units 1 and 2, Indian Point Units 2 and 3, Millstone Unit 1, Dresden Unit 2, and San Onofre Unit 1. For these plants, the evaluation presented herein is based on (1) the result of the initial TER, (2) the Licensee's response to the NRC SER and the TER, and (3) the Licensee's updated EEQ submittal(s).

TERs were also developed for the following plants: Nine Mile Point Unit 1, Millstone Unit 2, Salem Unit 1, Browns Ferry Units 1, 2, and 3, Brunswick Units 1 and 2, Hatch Units 1 and 2, Dresden Unit 3, and Quad Cities Units 1 and 2. The objective of those TERs was to review the Licensee's submittals to determine if safety-related electrical equipment was reviewed for environmental qualification by the Licensee in accordance with the DOR Guidelines and NUREG-0588 as required by IE Bulletin 79-01B. For these 13 plants and all other plants, excluding the 14 plants associated with the Systematic Evaluation Program, the evaluation presented herein is based solely on (1) the Licensee's response to the NRC SER and (2) the Licensee's revised EEQ submittal(s).

This technical evaluation was conducted to identify (1) whether the Licensee provided an adequate response to the SER concerns (and TER concerns,


where applicable), (2) major deficiencies within the equipment qualification program, and (3) whether the Licensee proposed adequate corrective actions to resolve qualification deficiencies and provided a schedule for completion of the corrective actions. The TER was written primarily to address deviations from the NRC criteria and requirements. Technical data or test results that satisfy the qualification criteria are not discussed herein.

The evaluation presented in Section 4 of this report includes completed equipment environmental qualification review checksheets (partially handwritten) which compile both the technical information necessary to conduct the review and the results of the evaluation. Parameters listed on these checksheets were derived from the appropriate NRC screening criteria. The evaluation of each equipment item includes several checksheet pages. Only those checksheet pages necessary to complete the evaluation for each equipment item are included in this report. A complete listing of the checksheet pages is shown on the bottom of Checksheet 1a, reproduced here as Figure 3-1.

The checksheets contain the following information:

- o Equipment item information (see Figure 3-1), for example:
  - Solenoid Valve Located in Turbine Building (Area #7)
  - Automatic Switch Co. (ASCO) Model LB8300B61U
  - Actuates Feedwater Control Valves (V-4269, V-4270)
  - Licensee Reference 839
  - Required Operating Time: Short term (SI signal)
  - TER Checksheet No. 1
  - Reference 59, Section 4.5.2.6
  - Licensee Submittal: Page 9 [62]; Table 3, Page 1 [1]; SCEW 1
- o Qualification deficiencies identified in the SER (see Figure 3-1)
- o Licensee's response to the SER
- o Licensee's statements and rationale for qualification
- o Licensee's corrective action and replacement schedule
- o Evaluation of qualification including identification of all deficiencies
- o Evaluation of system considerations presented by the Licensee as a rationale for excluding equipment from qualification.

The results of the evaluation are summarized on Checksheet 2 (Equipment Environmental Qualification Summary Form) for each equipment item. Checksheet

 <p>Franklin Research Center A Division of The Franklin Institute 20th and Race Streets, Phila., Pa. 19103 (215) 448-1000</p>	<p>NRC Contract No. NRC-03-79-118 FRC Project No. C5257 FRC Assignment No. 13 FRC Task No. _____</p>	<p>Page 1a</p>
<p>EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. ____</p>		

Equipment Item No. 1  
Solenoid Valves Located in Turbine Building (Area #7)  
Automatic Switch Co. (ASCO) Model LB8300B61U  
Actuates Feedwater Control Valves (V-4269, V-4270)  
Licensee Reference 1617  
Required Operating Time: Short term (SI signal)  
TER Checksheet No. 1  
Reference 59, Section 4.5.2.6  
Licensee Submittal: Page 9 [62]; Table 3, Page 1 [1]; FRC SCEW 1

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
(See Section 3 of this TER for Legend)

R, T, QI, RE, P, H, CS, A, S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,  
Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, 3b, 3c, 3d
System Consideration Review	4a, 4b, 4c, 4d, 4e, 4f
Equipment Environmental Qualification Review	5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h, 5i, 5j
Installed TMI Lessons Learned Implementation Equipment Summary	6a, 6b
Maintenance and Replacement Schedule Summary	7a, 7b, 7c

Figure 3-1. Sample Checksheet Page 1a  
"Equipment Item"

2 specifically identifies any qualification deficiencies determined by the evaluation and identifies the NRC qualification category to which the equipment item was assigned. A sample Checksheet 2 is presented in Figure 3-2.

All information was reviewed for conformance to the NRC criteria referenced in Section 2 of this report. As requested by the NRC, all applicable and available qualification documentation associated with the overall Equipment Environmental Qualification (EEQ) program was used by the reviewers, whether referenced by the Licensee or not.

Upon completion of the review for each equipment item, an overall evaluation of the component and a specific conclusion with respect to its qualification was developed. Based on the evaluation, each equipment item was assigned to one of the generic qualification categories provided by the NRC. The NRC category descriptions are presented in Section 3.3 of this report.


### 3.3 NRC QUALIFICATION CATEGORIES AND DEFINITIONS

- o NRC Category I.a  
EQUIPMENT THAT SATISFIES ALL APPLICABLE REQUIREMENTS OF THE DOR GUIDELINES OR NUREG-0588, OR HAS ACCEPTABLE DEVIATIONS FROM THE DOR/NUREG CRITERIA

This category includes equipment items which are fully acceptable on the basis that all applicable criteria defined in the DOR Guidelines or NUREG-0588 are (1) satisfied and the equipment has been found to be qualified or (2) sufficient information has been presented to determine that deviations from the criteria are acceptable or insignificant.

- o NRC Category I.b  
EQUIPMENT FOR WHICH DEVIATIONS FROM THE DOR GUIDELINES OR NUREG-0588 ARE JUDGED CONDITIONALLY ACCEPTABLE PROVIDED THAT SPECIFIC MODIFICATIONS ARE MADE

This category includes equipment items that do not satisfy one or more of the applicable criteria defined in the DOR Guidelines or NUREG-0588; however, the Licensee has stated that specific modifications will be made on or before a designated date. This equipment is considered by NRC to be conditionally acceptable provided that the specific modifications are made by the Licensee. When the modifications are completed as proposed, the Licensee states that the equipment will satisfy all applicable NRC requirements. Examples of specific modifications are (1) replacement of unqualified equipment with qualified equipment, (2) equipment hardware

 Franklin Research Center A Division of The Franklin Institute 20th and Race Streets, Phila., Pa. 19103 (215) 448-1000	NRC Contract No. NRC-03-79-118 FRC Project No. C5257 FRC Assignment No. 13 FRC Task No. _____	Page 2
EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. ____		

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

<u>NRC REQUIREMENTS</u>	DESIGNATION: <u>X = DEFICIENCY</u>
Documented Evidence of Qualification Adequate	_____
Adequate Similarity Between Equipment and Test Specimen Established	_____
Aging Degradation Evaluated Adequately	_____
Qualified Life or Replacement Schedule Established (If Required)	_____
Program Established to Identify Aging Degradation	_____
Criteria Regarding Aging Simulation Satisfied (If Required)	_____
Criteria Regarding Temperature/Pressure Exposure:	_____
o Peak Temperature Adequate	_____
o Peak Pressure Adequate	_____
o Duration Adequate	_____
o Required Profile Enveloped Adequately	_____
o Steam Exposure (If Required) Adequate	_____
Criteria Regarding Spray Satisfied	_____
Criteria Regarding Submergence Satisfied	_____
Criteria Regarding Radiation Satisfied	_____
Criteria Regarding Test Sequence Satisfied	_____
Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied	_____
Criteria Regarding Functional Testing Satisfied	_____
Criteria Regarding Instrument Accuracy Satisfied	_____
Test Duration Margin (1 hour + Function Time) Satisfied	_____
Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I)	_____
<hr/>	
<u>NRC QUALIFICATION CATEGORY</u>	DESIGNATION: <u>X = CATEGORY</u>
I.a Equipment Qualified	_____
I.b Equipment Qualification Pending Modification	_____
II.a Equipment Qualification Not Established	_____
II.b Equipment Not Qualified	_____
II.c Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified	_____
III.a Equipment Exempt From Qualification	_____
III.b Equipment Not in the Scope of the Qualification Review	_____
IV Documentation Not Made Available	_____

Figure 3-2. Sample Checksheet Page 2

"Equipment Environmental Qualification Summary Form"

modification, (3) equipment relocation above submergence level, (4) relocation or shielding of equipment from radiation source, (5) verification of qualification by additional testing, (6) equipment relocation to a mild environment, and (7) qualification testing of equipment in progress.

o NRC Category II.a

EQUIPMENT FOR WHICH QUALIFICATION DOCUMENTATION IS INSUFFICIENT TO ESTABLISH THAT THE EQUIPMENT IS OR IS NOT QUALIFIED IN ACCORDANCE WITH THE DOR GUIDELINES OR NUREG-C588

The qualification of equipment items in this category, in accordance with the requirements of the DOR Guidelines or NUREG-0588, is significantly deficient or inconclusive based upon review of (1) the documentation provided by the Licensee or (2) applicable and available qualification documentation associated with the overall equipment environmental qualification program. The qualification documentation indicates significant deficiencies, which can be categorized as follows: (1) appropriate documentation reflecting qualification has not been cited and made available for review by the Licensee and there is no knowledge of applicable documentation; (2) the Licensee is awaiting qualification from the equipment vendor; or (3) the qualification documentation indicates significant deficiencies; however, where testing was conducted, no reported failures or severe anomalies were observed which would unquestionably affect the ability of the equipment to perform its design basis safety function(s).

o NRC Category II.b

EQUIPMENT THAT IS UNQUALIFIED

This category includes equipment items whose qualification documentation has been judged to be seriously deficient based upon review of (1) the documentation provided by the Licensee, or (2) applicable and available qualification documentation associated with the overall equipment environmental qualification program. The qualification documentation indicates serious deficiencies reported during testing; for example, severe anomalies or failure of the test specimen, which could affect the ability of the equipment to perform its safety function. NRC has requested immediate written notification when an equipment item is placed in this category during the course of the review.

o NRC Category II.c

EQUIPMENT THAT SATISFIES ALL APPLICABLE REQUIREMENTS OF THE DOR GUIDELINES OR NUREG-0588 WITH THE EXCEPTION OF QUALIFIED LIFE

This category includes equipment items that are acceptable on the basis that all applicable criteria defined in the DOR Guidelines or NUREG-0588 are satisfied with the exception of the qualified life criterion. The Licensee (1) has not evaluated qualified life or replacement schedule, (2) has not adequately evaluated qualified life or replacement schedule, or (3) has not adequately interpreted qualified life in terms of calendar time. [Note: The component replacement schedule discussed in Section 7.0 of the



DOR Guidelines is, in effect, a qualified life. It is not essential to use the term "qualified life," but the replacement schedule must be justified.]

o NRC Category III.a  
EQUIPMENT THAT IS EXEMPT FROM QUALIFICATION

This category includes equipment items that are exempt from qualification on the basis that (1) the equipment does not provide a safety function (i.e., should not have been included in the equipment list submitted by the Licensee), or (2) the specific safety-related function of the equipment can be accomplished by some other designated equipment that is fully qualified and satisfies the single failure criterion. In addition, any failure of the exempt equipment must not mislead the operator or degrade the ability of qualified equipment to perform its required safety-related function.

o NRC Category III.b  
EQUIPMENT NOT IN THE SCOPE OF THE QUALIFICATION REVIEW

This category includes equipment items addressed by the Licensee in the equipment environmental qualification submittals which are (1) required to achieve and maintain the plant in a cold shutdown condition or (2) located in a mild environment. Supplement 2 of IE Bulletin 79-01B permits deferment of the review of environmental qualification for all safety-related equipment items located in plant areas where the equipment is not exposed to the direct effects of a high energy line break (HELB) or to nuclear radiation emanating from circulation of fluids containing radioactive substances. Supplement 3 of IE Bulletin 79-01B permits deferment of the review of environmental qualification for all equipment required to achieve and maintain the plant in a cold shutdown condition. Supplements 2 and 3 of IE Bulletin 79-01B originally permitted deferment until after February 1, 1981 of the qualification review of equipment located in a mild environment or required to achieve and maintain the plant in a cold shutdown condition. Since the issuance of Supplements 2 and 3, the NRC has determined that the review of environmental qualification for this equipment is not within the scope of this report.

o NRC Category IV  
EQUIPMENT FOR WHICH QUALIFICATION DOCUMENTATION HAS NOT BEEN MADE AVAILABLE FOR REVIEW

This category includes equipment items for which qualification documentation in accordance with the requirements of the DOR Guidelines or NUREG-0588 has been cited by the Licensee as evidence of qualification; however, this documentation has not been made available for review. Therefore, a conclusion cannot be reached with respect to qualification of this equipment.

### 3.4 IMPLEMENTATION GUIDE FOR FULFILLING NRC CRITERIA

The NRC has requested that a detailed implementation guide for fulfilling NRC criteria be prepared as part of this assignment. The implementation guide will present a fully detailed discussion of the principal qualification criteria presented in the DOR Guidelines and NUREG-0588. The primary emphasis will be to clarify technical points, eliminate possible misconceptions, and clearly provide definitive guidance to enable licensees to understand and resolve, in an expeditious manner, qualification deficiencies identified as a result of this TER. The implementation guide (TER-C5257-532) has been prepared and issued to the NRC. The implementation guide is either appended to this TER or will be forwarded to the Licensee by the NRC under a separate letter. The Licensee is encouraged to review that document.

#### 4. TECHNICAL EVALUATION

##### 4.1 INTRODUCTION

The technical evaluation presented in this section represents the equipment environmental qualification (EEQ) assessment for each equipment item listed in Appendix B in accordance with the methodology presented in Section 3 of this report. The evaluations were conducted to identify any major deficiencies within the Licensee's equipment qualification program and to determine whether the Licensee (1) provided an adequate response to the SER concerns, (2) proposed adequate corrective actions to resolve qualification deficiencies, and (3) provided a schedule for completion of the corrective actions.

The evaluations are based on the available qualification documentation provided by the Licensee, complemented in several cases by other relevant technical information. The major qualification deficiencies that have been identified and the results of the evaluation are shown in the Equipment Environmental Qualification Summary Forms (Tables 4-1, 4-2, 4-3, and 4-4) presented in Section 4.2.

Observations concerning the Licensee's qualification methodology presented in response to the NRC SER are presented in Section 4.3.

Technical evaluations of the environmental qualification of the equipment items are presented in Section 4.4.

#### 4.2 SUMMARY OF THE EVALUATION

The following tabulations represent a summary of the results of the equipment environmental qualification evaluation conducted in accordance with the methodology presented in Section 3.

Table 4-1 summarizes the number of equipment items assigned to each NRC qualification category as a result of the evaluation.

Table 4-2 summarizes the number of equipment items found to have a specific qualification deficiency.

Table 4-3 summarizes the number of equipment items for which the Licensee has proposed a specific corrective action to resolve a qualification deficiency.

Table 4-4 consists of Equipment Environmental Qualification Summary Forms for the equipment items, identifying (1) compliance with the qualification requirements defined in Section 2, (2) the resultant NRC qualification category, and (3) the Licensee-proposed corrective action.

TABLE 4-1  
 NUMBER OF EQUIPMENT ITEMS IN EACH QUALIFICATION CATEGORY

NRC CATEGORY	CATEGORY DESCRIPTION	NUMBER OF EQUIPMENT ITEMS
I.A	EQUIPMENT QUALIFIED----- [ EQUIPMENT ITEM NO(S).: 2, 3, 4, 26, 27, 28 ]	6
I.B	EQUIPMENT QUALIFICATION PENDING MODIFICATION----- [ EQUIPMENT ITEM NO(S).: 19, 20, 21, 31, 32 ]	5
II.A	EQUIPMENT QUALIFICATION NOT ESTABLISHED----- [ EQUIPMENT ITEM NO(S).: 1, 5, 6, 7, 8, 9, 10, 11, 18, 22, 23, 25 ]	12
II.B	EQUIPMENT NOT QUALIFIED----- [ EQUIPMENT ITEM NO(S).: 12, 13, 14, 15, 16, 17 ]	6
II.C	EQUIPMENT SATISFIES ALL REQUIREMENTS EXCEPT QUALIFIED LIFE OR REPLACEMENT SCHEDULE JUSTIFIED----- [ EQUIPMENT ITEM NO(S).: 29, 30 ]	2
III.A	EQUIPMENT EXEMPT FROM QUALIFICATION-----	0
III.B	EQUIPMENT NOT IN THE SCOPE OF THE REVIEW-----	0
IV	DOCUMENTATION NOT MADE AVAILABLE----- [ EQUIPMENT ITEM NO(S).: 24 ]	1
TOTAL		32

TABLE 4-2  
 QUALIFICATION DEFICIENCY SUMMARY

NRC REQUIREMENT	NUMBER OF DEFICIENT EQUIPMENT ITEMS
1. DOCUMENTED EVIDENCE OF QUALIFICATION ADEQUATE----- [ EQUIPMENT ITEM NO(S).: 1, 5, 6, 7, 8, 16, 17, 18, 19, 22, 23 ]	11
2. ADEQUATE SIMILARITY BETWEEN EQUIPMENT AND TEST SPECIMEN ESTABLISHED----- [ EQUIPMENT ITEM NO(S).: 7, 8, 9, 10, 11, 16, 22, 23, 31, 32 ]	10
3. AGING DEGRADATION EVALUATED ADEQUATELY----- [ EQUIPMENT ITEM NO(S).: 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 22, 23, 25, 29, 30 ]	19
4. QUALIFIED LIFE OR REPLACEMENT SCHEDULE ESTABLISHED (IF REQUIRED)----- [ EQUIPMENT ITEM NO(S).: 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 22, 23, 25, 29, 30 ]	19
5. PROGRAM ESTABLISHED TO IDENTIFY AGING DEGRADATION----- [ EQUIPMENT ITEM NO(S).: 5, 6, 7, 8, 16, 17, 22, 23 ]	8
6. CRITERIA REGARDING AGING SIMULATION (IF REQUIRED)----- [ EQUIPMENT ITEM NO(S).: 5, 6, 16, 17 ]	4
7. CRITERIA REGARDING TEMPERATURE/PRESSURE EXPOSURE:	
A. - PEAK TEMPERATURE ADEQUATE-----	0
B. - PEAK PRESSURE ADEQUATE-----	0
C. - DURATION ADEQUATE----- [ EQUIPMENT ITEM NO(S).: 16, 17, 25 ]	3
D. - REQUIRED PROFILE ENVELOPED ADEQUATELY----- [ EQUIPMENT ITEM NO(S).: 16, 17, 18, 25 ]	4

Table 4-2 (Cont.)

QUALIFICATION DEFICIENCY SUMMARY

NRC REQUIREMENT	NUMBER OF DEFICIENT EQUIPMENT ITEMS
E. - STEAM EXPOSURE (IF REQUIRED) ADEQUATE-----	0
8. CRITERIA REGARDING SPRAY SATISFIED----- [ EQUIPMENT ITEM NO(S).: 16, 17, 18, 25 ]	4
9. CRITERIA REGARDING SUBMERGENCE SATISFIED----- [ EQUIPMENT ITEM NO(S).: 13, 16, 17 ]	3
10. CRITERIA REGARDING RADIATION SATISFIED----- [ EQUIPMENT ITEM NO(S).: 5, 6 ]	2
11. CRITERIA REGARDING TEST SEQUENCE SATISFIED----- [ EQUIPMENT ITEM NO(S).: 5, 6, 12, 13, 14, 15, 16, 17 ]	8
12. CRITERIA REGARDING TEST FAILURES OR SEVERE ANOMALIES (IF ANY) SATISFIED----- [ EQUIPMENT ITEM NO(S).: 12, 13, 14, 15 ]	4
13. CRITERIA REGARDING FUNCTIONAL TESTING SATISFIED----- [ EQUIPMENT ITEM NO(S).: 16, 17, 18 ]	3
14. CRITERIA REGARDING INSTRUMENT ACCURACY SATISFIED----- [ EQUIPMENT ITEM NO(S).: 9, 10, 11, 16, 17, 18 ]	6
15. TEST DURATION MARGIN (1 HOUR + FUNCTION TIME) SATISFIED--- [ EQUIPMENT ITEM NO(S).: 6 ]	1
16. CRITERIA REGARDING MARGINS SATISFIED (NUREG-0588, CAT. 1)- [ EQUIPMENT ITEM NO(S).: 12, 13, 14, 15, 16, 17 ]	6

TABLE 4-3  
 LICENSEE CORRECTIVE ACTION SUMMARY

CORRECTIVE ACTION DESCRIPTION	NUMBER OF EQUIPMENT ITEMS
1. EQUIPMENT REPLACEMENT WITH QUALIFIED EQUIPMENT-----	0
2. EQUIPMENT MODIFICATION-----	0
3. EQUIPMENT RELOCATION ABOVE SUBMERGENCE LEVEL-----	0
4. RELOCATE OR SHIELD EQUIPMENT FROM RADIATION SOURCE-----	0
5. VERIFY QUALIFICATION BY ADDITIONAL TESTING/ANALYSIS-----	0
6. EQUIPMENT RELOCATION TO A MILD ENVIRONMENT-----	0
7. QUALIFICATION TESTING OF EQUIPMENT IN PROGRESS----- [ EQUIPMENT ITEM NO(S).: 20, 21, 31, 32 ]	4
8. OTHER (FOR DETAILED DESCRIPTION SEE SPECIFIC EQUIPMENT ITEMS)-- [ EQUIPMENT ITEM NO(S).: 12, 13, 14, 15, 19 ]	5
SCHEDULE FOR COMPLETION OF CORRECTIVE ACTION(S) HAS BEEN PROVIDED (SEE SPECIFIC EQUIPMENT ITEM FOR COMPLETION DATE)-----	0



Table 4-4

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

		FRC EQUIPMENT ITEM NUMBERS														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
NRC REQUIREMENTS (DESIGNATION: X = DEFICIENCY)																
1.	DOCUMENTED EVIDENCE OF QUALIFICATION ADEQUATE	X				X	X	X	X							
2.	ADEQUATE SIMILARITY BETWEEN EQUIPMENT AND TEST SPECIMEN ESTABLISHED							X	X	X	X	X	X	X	X	X
3.	AGING DEGRADATION EVALUATED ADEQUATELY					X	X	X	X	X	X	X	X	X	X	X
4.	QUALIFIED LIFE OR REPLACEMENT SCHEDULE ESTABLISHED (IF REQUIRED)					X	X	X	X	X	X	X	X	X	X	X
5.	PROGRAM ESTABLISHED TO IDENTIFY AGING DEGRADATION					X	X	X	X							
6.	CRITERIA REGARDING AGING SIMULATION SATISFIED (IF REQUIRED)					X	X		X							
7.	CRITERIA REGARDING TEMPERATURE/PRESSURE EXPOSURE															
	A. - PEAK TEMPERATURE ADEQUATE															
	B. - PEAK PRESSURE ADEQUATE															
	C. - DURATION ADEQUATE															
	D. - REQUIRED PROFILE ENVELOPED ADEQUATELY															
	E. - STEAM EXPOSURE (IF REQUIRED) ADEQUATE															
8.	CRITERIA REGARDING SPRAY SATISFIED															
9.	CRITERIA REGARDING SUBMERGENCE SATISFIED												X			
10.	CRITERIA REGARDING RADIATION SATISFIED					X	X									
11.	CRITERIA REGARDING TEST SEQUENCE SATISFIED					X	X					X	X	X	X	X
12.	CRITERIA REGARDING TEST FAILURES OR SEVERE ANOMALIES (IF ANY) SATISFIED												X	X	X	X
13.	CRITERIA REGARDING FUNCTIONAL TESTING SATISFIED															
14.	CRITERIA REGARDING INSTRUMENT ACCURACY SATISFIED									X	X	X				
15.	TEST DURATION MARGIN (1 HOUR + FUNCTION TIME) SATISFIED							X								
16.	CRITERIA REGARDING MARGINS SATISFIED (NUREG-0500, CAT. 1)												X	X	X	X
NRC QUALIFICATION CATEGORY (DESIGNATION: X = CATEGORY)																
I.A.	EQUIPMENT QUALIFIED	X	X	X												
I.B.	EQUIPMENT QUALIFICATION PENDING MODIFICATION															
II.A.	EQUIPMENT QUALIFICATION NOT ESTABLISHED	X				X	X	X	X	X	X	X				
II.B.	EQUIPMENT NOT QUALIFIED												X	X	X	X
II.C.	EQUIPMENT SATISFIES ALL REQUIREMENTS EXCEPT QUALIFIED LIFE OR REPLACEMENT SCHEDULE JUSTIFIED															
III.A.	EQUIPMENT EXEMPT FROM QUALIFICATION															
III.B.	EQUIPMENT NOT IN THE SCOPE OF THE REVIEW															
IV.	DOCUMENTATION NOT MADE AVAILABLE															
CORRECTIVE ACTION SPECIFIED (DESIGNATION: X = ACTION SPECIFIED)																
1.	EQUIPMENT REPLACEMENT WITH QUALIFIED EQUIPMENT															
2.	EQUIPMENT MODIFICATION															
3.	EQUIPMENT RELOCATION ABOVE THE SUBMERGENCE LEVEL															
4.	RELOCATE OR SHIELD EQUIPMENT FROM RADIATION SOURCE															
5.	VERIFY QUALIFICATION BY ADDITIONAL TESTING/ANALYSIS															
6.	EQUIPMENT RELOCATION TO A MILD ENVIRONMENT															
7.	QUALIFICATION TESTING OF EQUIPMENT IN PROGRESS															
8.	OTHER (---SEE SPECIFIC EQUIPMENT ITEM IF CHECKED---												X	X	X	X
SCHEDULE FOR COMPLETION OF CORRECTIVE ACTION(S) HAS BEEN PROVIDED																

Table 4-4 (Cont.)

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

		FRC EQUIPMENT ITEM NUMBERS															
		1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	
NRC REQUIREMENTS (DESIGNATION: X = DEFICIENCY)																	
1.	DOCUMENTED EVIDENCE OF QUALIFICATION ADEQUATE-----	X	X	X	X				X	X							
2.	ADEQUATE SIMILARITY BETWEEN EQUIPMENT AND TEST SPECIMEN ESTABLISHED-----	X	X						X	X							
3.	AGING DEGRADATION EVALUATED ADEQUATELY-----	X	X	X					X	X							
4.	QUALIFIED LIFE OR REPLACEMENT SCHEDULE ESTABLISHED (IF REQUIRED)-----	X	X	X					X	X					X	X	
5.	PROGRAM ESTABLISHED TO IDENTIFY AGING DEGRADATION-----	X	X						X	X							
6.	CRITERIA REGARDING AGING SIMULATION SATISFIED (IF REQUIRED)-----	X	X														
7.	CRITERIA REGARDING TEMPERATURE/PRESSURE EXPOSURE:																
	A. - PEAK TEMPERATURE ADEQUATE-----																
	B. - PEAK PRESSURE ADEQUATE-----																
	C. - DURATION ADEQUATE-----	X	X									X					
	D. - REQUIRED PROFILE ENVELOPED ADEQUATELY-----	X	X	X								X					
	E. - STEAM EXPOSURE (IF REQUIRED) ADEQUATE-----																
8.	CRITERIA REGARDING SPRAY SATISFIED-----	X	X	X													
9.	CRITERIA REGARDING SUBMERGENCE SATISFIED-----	X	X														
10.	CRITERIA REGARDING RADIATION SATISFIED-----	X	X														
11.	CRITERIA REGARDING TEST SEQUENCE SATISFIED-----	X	X														
12.	CRITERIA REGARDING TEST FAILURES OR SEVERE ANOMALIES (IF ANY) SATISFIED-----																
13.	CRITERIA REGARDING FUNCTIONAL TESTING SATISFIED-----	X	X	X													
14.	CRITERIA REGARDING INSTRUMENT ACCURACY SATISFIED-----	X	X	X													
15.	TEST DURATION MARGIN (1 HOUR + FUNCTION TIME) SATISFIED-----																
16.	CRITERIA REGARDING MARGINS SATISFIED (NUREG-0588, CAT. 1)-----	X	X														
NRC QUALIFICATION CATEGORY (DESIGNATION: X = CATEGORY)																	
I.A.	EQUIPMENT QUALIFIED-----											X	X	X			
I.B.	EQUIPMENT QUALIFICATION PENDING MODIFICATION-----				X	X	X										
II.A.	EQUIPMENT QUALIFICATION NOT ESTABLISHED-----			X					X	X		X					
II.B.	EQUIPMENT NOT QUALIFIED-----	X	X														
II.C.	EQUIPMENT SATISFIES ALL REQUIREMENTS EXCEPT QUALIFIED LIFE OR REPLACEMENT SCHEDULE JUSTIFIED-----																
III.A.	EQUIPMENT EXEMPT FROM QUALIFICATION-----														X	X	
III.B.	EQUIPMENT NOT IN THE SCOPE OF THE REVIEW-----																
IV.	DOCUMENTATION NOT MADE AVAILABLE-----									X							
CORRECTIVE ACTION SPECIFIED (DESIGNATION: X = ACTION SPECIFIED)																	
1.	EQUIPMENT REPLACEMENT WITH QUALIFIED EQUIPMENT-----																
2.	EQUIPMENT MODIFICATION-----																
3.	EQUIPMENT RELOCATION ABOVE THE SUBMERGENCE LEVEL-----																
4.	RELOCATE OR SHIELD EQUIPMENT FROM RADIATION SOURCE-----																
5.	VERIFY QUALIFICATION BY ADDITIONAL TESTING/ANALYSIS-----																
6.	EQUIPMENT RELOCATION TO A MILD ENVIRONMENT-----																
7.	QUALIFICATION TESTING OF EQUIPMENT IN PROGRESS-----						X	X									
8.	OTHER (SEE SPECIFIC EQUIPMENT ITEM IF CHECKED)-----				X												
	SCHEDULE FOR COMPLETION OF CORRECTIVE ACTION(S) HAS BEEN PROVIDED-----																

Table 4-4 (Cont.)

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

		FRC EQUIPMENT ITEM NUMBERS	
		1031	1032
NRC REQUIREMENTS (DESIGNATION: X = DEFICIENCY)			
1.	DOCUMENTED EVIDENCE OF QUALIFICATION ADEQUATE		
2.	ADEQUATE SIMILARITY BETWEEN EQUIPMENT AND TEST SPECIMEN ESTABLISHED	X	X
3.	AGING DEGRADATION EVALUATED ADEQUATELY		
4.	QUALIFIED LIFE OR REPLACEMENT SCHEDULE ESTABLISHED (IF REQUIRED)		
5.	PROGRAM ESTABLISHED TO IDENTIFY AGING DEGRADATION		
6.	CRITERIA REGARDING AGING SIMULATION SATISFIED (IF REQUIRED)		
7.	CRITERIA REGARDING TEMPERATURE/PRESSURE EXPOSURE:		
	A. - PEAK TEMPERATURE ADEQUATE		
	B. - PEAK PRESSURE ADEQUATE		
	C. - DURATION ADEQUATE		
	D. - REQUIRED PROFILE ENVELOPED ADEQUATELY		
	E. - STEAM EXPOSURE (IF REQUIRED) ADEQUATE		
8.	CRITERIA REGARDING SPRAY SATISFIED		
9.	CRITERIA REGARDING SUBMERGENCE SATISFIED		
10.	CRITERIA REGARDING RADIATION SATISFIED		
11.	CRITERIA REGARDING TEST SEQUENCE SATISFIED		
12.	CRITERIA REGARDING TEST FAILURES OR SEVERE ANOMALIES (IF ANY) SATISFIED		
13.	CRITERIA REGARDING FUNCTIONAL TESTING SATISFIED		
14.	CRITERIA REGARDING INSTRUMENT ACCURACY SATISFIED		
15.	TEST DURATION MARGIN (1 HOUR + FUNCTION TIME) SATISFIED		
16.	CRITERIA REGARDING MARGINS SATISFIED (NUREG-0500, CAT. 1)		
NRC QUALIFICATION CATEGORY (DESIGNATION: X = CATEGORY)			
I.A.	EQUIPMENT QUALIFIED		
I.B.	EQUIPMENT QUALIFICATION PENDING MODIFICATION	X	X
II.A.	EQUIPMENT QUALIFICATION NOT ESTABLISHED		
II.B.	EQUIPMENT NOT QUALIFIED		
II.C.	EQUIPMENT SATISFIES ALL REQUIREMENTS EXCEPT QUALIFIED LIFE OR REPLACEMENT SCHEDULE JUSTIFIED		
III.A.	EQUIPMENT EXEMPT FROM QUALIFICATION		
III.B.	EQUIPMENT NOT IN THE SCOPE OF THE REVIEW		
IV.	DOCUMENTATION NOT MADE AVAILABLE		
CORRECTIVE ACTION SPECIFIED (DESIGNATION: X = ACTION SPECIFIED)			
1.	EQUIPMENT REPLACEMENT WITH QUALIFIED EQUIPMENT		
2.	EQUIPMENT MODIFICATION		
3.	EQUIPMENT RELOCATION ABOVE THE SUBMERGENCE LEVEL		
4.	RELOCATE OR SHIELD EQUIPMENT FROM RADIATION SOURCE		
5.	VERIFY QUALIFICATION BY ADDITIONAL TESTING/ANALYSIS		
6.	EQUIPMENT RELOCATION TO A MILD ENVIRONMENT		
7.	QUALIFICATION TESTING OF EQUIPMENT IN PROGRESS	X	X
8.	OTHER (---SEE SPECIFIC EQUIPMENT ITEM IF CHECKED---)		
SCHEDULE FOR COMPLETION OF CORRECTIVE ACTION(S) HAS BEEN PROVIDED			

#### 4.3 METHODOLOGY USED BY THE LICENSEE

This section includes observations concerning the Licensee's qualification methodology presented in the response [20] to the NRC SER.

##### 4.3.1 Completeness of Safety-Related Equipment List

Section 3.1 of the NRC SER [16] identified the following concern:

"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."

In response to this concern, the Licensee stated [20]:

"The reference to display instrumentation requirements within the SER appears to limit the current need to instrumentation within the harsh environment and/or as mentioned in the LOCA and HELB emergency procedures. Instrumentation within harsh environment would be limited to those transmitters, switches, and RTD's already reported on SCEWS.

At present, CP&L is to develop new Emergency Instructions incorporating TMI emergency guidelines as part of a TMI action item requirement. These new instructions are scheduled for 1983 implementation. When reviewed and accepted for plant operational use, they will be reviewed for components and display instrumentation within plant harsh environment. If new instrumentation is required to meet these emergency procedures or if additional instrumentation is referenced by these procedures, a list will be compiled and SCEW's provided to the NRC."

It is concluded that the Licensee has satisfactorily responded to the SER concern.

#### 4.3.2 Environmental Service Conditions

##### 4.3.2.1 Containment Spray System

Section 3.2 of the NRC SER [16] identified the following concern:

"Commission Memorandum and Order CLI-80-21 required 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 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 envelop 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. The staff assumed, and requires the licensee to verify, that the containment spray system is not subjected to a disabling single-component failure and therefore satisfies the requirements of Section 4.2.1 of the DOR guidelines."

In response to this concern, the Licensee stated [20]:

"The SER requires the licensee to verify that the containment spray system is not subjected to a disabling single-component failure and therefore satisfies the requirements of Section 4.2.1 of the DOR Guidelines. H. B. Robinson FSAR Section 6.4.3, Design Evaluation, describes the capabilities of the containment spray system and addresses the single failure analysis for this system within Table 6.4-4 entitled, Single Failure Analysis - Containment Spray System, (see Appendix A).

As this system is not subject to a single component failure affecting its performance, the MSLB accident environment is not the limiting parameter for qualification per the DOR Guidelines Section 4.2.1. To further support this conclusion, a study performed for NRC IE Bulletin 80-04, Analysis of a PWR Main Steam Line Break with Continued Feedwater Addition, indicates a maximum containment pressure of 34.4 psig and a temperature of 257°F for the feedwater augmented MSLB."

It is concluded that the Licensee has provided a satisfactory response to the NRC concern.

## 4.3.2.2 Temperature, Pressure, and Humidity Conditions Inside Containment

Section 3.3 of the NRC SER [16] identified the following concern:

"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	265	42	100
MSLB	not provided	not provided	100

The staff has concluded that the minimum temperature profile used in the specifications 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 265°F does not satisfy the above requirement. Furthermore, the licensee's specified pressure is low as compared to plants of similar design. The licensee is requested to verify that the 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 42 psig, then a saturation temperature corresponding to the pressure profile (289°F peak temperature at 42 psig) should be used. If, however, the calculated peak pressure is higher than 42 psig, the saturation temperature corresponding to the new pressure profile should be used. 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."

In response to NRC concern, the Licensee stated [20]:

"The SER questions the pressure value as stated in our submittals and found within the H. B. Robinson FSAR. Apparently, a comparison with other plant's specified pressure values is used as the basis for this questioning. As reported in our prior responses to IE Bulletin 79-01B, the H. B. Robinson containment volume is  $2.1 \times 10^6$  ft<sup>3</sup>. This effectively accounts for both a lower pressure value and radiation level when defining LOCA parameters. Therefore, it is not practical to use comparisons in determining H. B. Robinson adequacy. Our FSAR has been reviewed by the U.S. Atomic Energy Commission and after several exchanges requiring amendments to this document, a Safety Evaluation Report was issued on May 18, 1970 accepting the LOCA evaluation as presented for operation. Further review of LOCA conditions was performed by the AEC

when the plant requested permission to increase power. A Safety Evaluation Report was issued on May 20, 1974 accepting the LOCA conditions and approving power increase. Per the DOR Guidelines Section 4.1.1, Service Conditions Inside Containment for a Loss of Coolant Accident (LOCA), Temperature and Pressure Steam Conditions, the FSAR analysis for containment temperature and pressure conditions is used for establishing the qualification of electrical equipment located within containment.

The service condition analysis was performed by Westinghouse Electric Company and the method utilized was reported to the AEC and subsequently enclosed as a Status Report by the Directorate of Licensing, dated October 15, 1974 within the Safety Evaluation Report by the Directorate of Licensing, U.S. Atomic Energy Commission for CP&L H.B. Robinson Unit #2, dated December 27, 1974. (See Appendix B, Westinghouse ECCS Evaluation Model).

Of further note, the H. B. Robinson calculated maximum pressure associated with a double-ended break is 38 psig (peaking at 12 seconds after LOCA and reducing to 32 psig after 3000 seconds). The stated 42 psig within our IE Bulletin 79-01B responses refers to the containment design pressure; therefore, a margin of approximately 11% above the conservative value of the blowdown peaks is available. H. B. Robinson Unit 2 FSAR, Section 14.3.4, Containment Integrity Evaluation, contains data and parameters associated with containment pressure. See Figure 14.3.4-2, Containment Pressure Transients for a Range of Break Sizes, Figure 14.3.4-4, Structural Heat Transfer Coefficient and Figure 14.2.4-6, Containment Capability Study, All Available Energy, for graphic presentation of H. B. Robinson LOCA profiles.

Per the above, we do not believe it is justified to recalculate the LOCA pressure and temperature profiles. The conservatism involved with the values and the tested values for equipment as recorded on the System Component Evaluation Work Sheets indicate there are no conflicting or questionable pressure and/or temperature values involved.

Addressing stratification within Containment, the upper regions where stratification may affect temperature do not contain any instrumentation or equipment related to IE Bulletin 79-01B. Only the containment fans are located on the crane deck level (elevation 275') and their test temperature exceeds LOCA temperature by 16% (11% if the saturation temperature associated with LOCA is considered)."

It appears that the Licensee has not resolved the NRC concern. Since the Licensee is responsible for identifying the environments, the parameters identified by the Licensee have been used in the evaluations contained in this Technical Evaluation Report. These parameters are reproduced in Appendix A.

#### 4.3.2.3 Temperature, Pressure, and Humidity Conditions Outside Containment

Section 3.4 of the NRC SER [16] identified the following concern:

"The licensee has provided the temperature, pressure, and humidity associated with an HELB outside containment, as well as applicable radiation levels associated with equipment in the proximity of recirculating fluid lines. The following area outside containment has been addressed:

##### (1) Auxiliary building

The licensee has used ambient temperature conditions in some areas 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 either provide justification that the equipment will perform its intended function under saturated conditions or propose corrective action."

In response to the NRC concern, the Licensee stated [20]:

"As stated in the SER, ambient temperature conditions have been used in some areas outside containment. As H. B. Robinson 2 has master listed equipment located on the turbine deck which is an open air area, it is impractical an to utilize an arbitrary value such as ambient saturation temperature for qualification purposes. Therefore, the System Component Work Sheets listing turbine Deck Area location will not be summarily revised.

Considering the Auxiliary Building, the following quote from the Report entitled: H. B. Robinson No. 2 Postulated Pipe Failure Analysis Outside of Containment, Section 10.0 Description of Compartment Environmental Effects Analysis, indicates only one enclosed volume subject to pressure and temperature buildup following rupture. This is the pipe penetration gallery. An analysis indicates a calculated pressure buildup of 0.2 psi and a maximum temperature increase of 2.4°F. This consequence is the result of the limiting postulated steam generator blowdown line rupture. These limiting environmental conditions will have no effect on the structural adequacy of the auxiliary building or on plant operation. It would be arbitrary to assume the ambient saturation temperature for equipment qualification purposes. Review of the System Component Work Sheets designated within the Reactor Auxiliary Building show qualification temperatures well in excess of the area requirement. Therefore, the System Component Work Sheets for the Reactor Auxiliary Building will not be changed to reflect a screening number when actual conditions have been calculated."

It is concluded that the Licensee has provided a satisfactory response to the NRC concern.



## 4.3.2.4 Radiation (Inside Containment)

Section 3.8 of the NRC SER [16] identified the following concern:

"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 ranges between  $9.5 \times 10^5$  to  $1.5 \times 10^8$  rads for the integrated dose. These values do not envelop the DOR guideline ( $4 \times 10^7$  rads) requirements and therefore are not acceptable. The radiation service condition provided by the licensee is lower than provided in the guidelines for gamma and beta radiation. The licensee is required to either provide justification for using the lower service condition or use the 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  $1.1 \times 10^6$  rads has been used by the licensee to specify limiting radiation levels within the RHR pump area of the auxiliary building. This value appears to consider the radiation levels influenced by the source term methodology associated with post-LOCA recirculation fluid lines and is therefore acceptable."

In response to the NRC concern, the Licensee stated [20]:

"The SER second paragraph for Section 3.8 states that the values submitted within CP&L's H. B. Robinson 90-day response do not envelop the DOR Guidelines ( $4 \times 10^7$  rads) requirements and therefore are not acceptable.

Radiation values listed on the submitted System Component Evaluation Work Sheets within the specification column reflect a series of calculations based upon containment volume, internal shielding, and instrumentation/equipment location. These calculations follow the procedures referenced as acceptable in the DOR Guidelines and provided within Appendix B. Sample calculations and representative nomogram use were presented as Appendix A within CP&L 90-day submittals; Rev. 0, Rev. 1, Rev. 2, and Rev. 3.

Of note is the reduced level radiation number due to oversized containment volume ( $2.1 \times 10^6$  ft<sup>3</sup>) and shield wall thickness (36 inches) when using the nomograms. Each instrument or equipment as represented on the work sheets was dimensioned by level within

containment or Reactor Auxiliary Building and located by compartment or shield wall to determine the maximum radiation level experienced under LOCA conditions. This figure was added to the normal operating radiation dose (40 year life) and a margin assigned. Section 1.3.2 of the H. B. Robinson 90-day Rev. 3 report provides additional insight into the assigned radiation levels. Individual dosages used on the work sheets are summarized and listed in Table 1.3.3 of the above mentioned report. For review purposes, response submitted figures and tables are included in this section to aid in evaluation of our radiation assignments.

When operating time for equipment/instrumentation was less than one (1) hour, a minimum of one (1) hour was picked for establishing dosage reduction based on the nomogram entitled, 30 Day Dose Connection Factor vs. Time Required to Remain Functional (HRS). This should establish sufficient margin and encompass existing test data.

For items located close to sump water flooding levels an additional radiation dosage was assigned based on actual operating time. As stated in Table 1.3.3 Notes (8) & (9), data used can be found in NUREG-0588, Appendix D, Table D-8, Containment Sump Gamma Dose Rates and Integrated Dose Versus Time.

Beta radiation was considered using Appendix D, Table D-6, Beta Dose Rates and Integrated Doses at the Containment Center Versus Time in Air. Based on the time of operation, equipment location, shield wall absorption, compartment wall absorption, insulation thickness, instrumentation housing absorption, motor case shielding, et al., beta contribution is less than 10% of the total gamma dose experienced by the listed equipment. This is a conservative assumption based on the DOR Guidelines requirement of the beta dose to be less than or equal to 10% of the total gamma dose to which an item of equipment has been qualified.

The above is the basis, assumptions, and basic analysis of the option chosen to justify the choice of lower service conditions than the generalized screening radiation service value stated in the SER and presented at the NRC 79-01B meeting held in Bethesda, Maryland on July 7-10, 1981. Sample calculations as included in our 90-day, Revision 3 response to IE Bulletin 79-01B are repeated as Appendix C of this report."

It is concluded that the Licensee has provided a satisfactory response to the NRC concern.

#### 4.3.3 Submergence

Section 3.5 of the NRC SER [16] identified the following concern:

"The licensee's value for maximum submergence is 231.2 ft elevation inside containment. Equipment below this level has been identified by the licensee. The licensee identified three safety-related level

transmitters mounted on the shield wall as having the potential for becoming submerged after a postulated event. The licensee stated that these transmitters are not the only source of data for operator assessment and decision needed for HELB and LOCA situations; therefore, their assumed failure upon submergence does not necessitate relocation or replacement. In this regard, licensee should provide an assessment of the failure modes associated with the submergence of these transmitters. 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. 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 these transmitters may be exempt from the submergence parameter of qualification.

It is not clear from the information submitted that submergence of safety-related electrical 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."

In response to the NRC concern, the Licensee stated [20]:

"The safety-related level transmitters (LT 459, LT 460, and LT 461) referred to in this paragraph provide pressurizer water level indication and are mounted in an instrument rack on the shield wall at elevation 230 ft within containment. These transmitters have been replaced with Rosemount Model 1153A transmitters during the August, 1980 outage at H. B. Robinson Unit 2. Instruction was given to remount as high as possible and practical in the instrument rack. A new measurement is required for re-evaluation of submergence level for these instruments. Additional study indicates their need time within the LOCA to be the first 30 minutes.

A study will be performed to evaluate the effect of new mounting, the rate of flood to determine useful time, and the effects of new emergency procedures on these instrumentation reading requirements. At this time, the statement that their assumed failure under submergence will not affect accident mitigation is still a valid one. This study will be completed by the date established by the NRC for completion of qualification of safety-related electrical equipment.

Submergence of new equipment outside of containment will also be studied. New modification of Auxiliary Building areas due to fire protection requirements need to be evaluated to establish drain paths and/or water accumulations. Existing reports indicate no detrimental water buildups due to HELB or small pipe breaks, but they do not account for building modification performed in recent months. A report on submergence of safety-related electrical equipment within harsh environment areas in the Auxiliary Building will be completed and submitted by the date established by the NRC for completion of qualification of safety-related electrical equipment."

It is concluded that the Licensee has not resolved the NRC concern but is currently in the process of evaluating the concern.

#### 4.3.4 Chemical Spray

Section 3.6 of the NRC SER [16] identified the following concern:

"The licensee has specified that boric acid solution constitutes the plant's chemical spray; however, the exact volume percent, concentration, and pH values were not provided. Therefore, for the purpose of this review, the effects of chemical spray will be considered unresolved. The staff will review the licensee's response when it is submitted and discuss the resolution in a supplemental report."

In response to the NRC concern, the Licensee stated [20]:

"The chemical spray consists of sodium hydroxide, boric acid, and refueling water. Mixing of the refueling water from the refueling water storage tank, the boric acid from the boric acid tank, the borated water contained within the accumulators, and primary coolant will bring the concentration of sodium hydroxide in the containment to approximately 0.6 weight percent solution caustic and 1.7 weight percent boric acid. This maintains a pH of at least 9.3. Spray additive eductors are designed to provide enough sodium hydroxide in the mixture so as not to exceed pH 10 during the injection phase."

It is concluded that the Licensee has provided a satisfactory response to the NRC concern.

#### 4.3.5 Aging

Section 3.7 of the NRC SER [16] identified the following concern:

"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 the Licensee 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) Establishment 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 examples, 5 years, 15 years, or 40 years). In its assessment of these submittals, the staff did not review the adequacy of the methodology nor 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.

The licensee indicated that this phase of the response is outstanding and that the review is in progress. The staff will review the licensee's response when it is submitted and discuss its evaluation in a supplemental report."

In response to the NRC concern, the Licensee stated [20]:

"Electrical equipment identified within harsh environments were reviewed against existing test data to determine if a 40 year life was established. When so established, this was recorded on the Component Evaluation Work Sheet. Also noted was the period within the test program when aging was addressed if this information was available from the test reports.

Section 4.0, Conclusions, of our 90-day response, Revision 3, dated February 1, 1981 reviewed the actions to be taken when less than 40 year life is realized for components and/or equipments. These actions are again summarized within Section III of this report.

To assure that aging is adequately covered under equipment qualification, it is our intent to establish a qualified life for all components in a harsh environment and to identify the component part or parts that limit qualified life. This will be the plant data base into which new safety equipment required by future modifications and replacement parts required by operation will be entered when evaluated and approved. This data base will form the baseline for a component inspection and replacement program. Comparisons of predicted age vs. actual age will modify the limiting life of either components or equipments. Factored into this program will be supportive elements such as elastomers, lubricants, mountings, and supplier conditions which are necessary to assure both operational life and qualification level.

This program will be compiled, evaluated, reviewed, approved, and operational by the date established by the NRC for completion of qualification of safety-related electrical equipment."

It is concluded that the Licensee has proposed a program which, if properly implemented, will resolve the NRC concern.

#### 4.4 EQUIPMENT ENVIRONMENTAL QUALIFICATION EVALUATION

The evaluation presented in this section of the report includes, for each equipment item, completed equipment environmental qualification review checksheets (partially handwritten) which present both the technical information necessary to conduct the review and the results of the evaluation.

===== !  
! EQUIPMENT ENVIRONMENTAL QUALIFICATION !  
! EQUIPMENT ITEM CHECKSHEET INDEX !  
! H.B. ROBINSON 2 !  
=====

FRC ITEM NO.	COMPONENT	MANUFACTURER	MODEL NUMBER	LOCATION
1	SOLENOID VALVE	ASCO	LB8320A185	REACTOR AUXILIARY BLDG.
2	SOLENOID VALVE	ASCO	NP831665E	CONTAINMENT, ELEV. 283'-0"
3	SOLENOID VALVE	ASCO	NP8316E35E	CONTAINMENT, ELEV. 283'-0"
4	SOLENOID VALVE	ASCO	2063812U	CONTAINMENT, ELEV. 283'-0"
5	MOTORIZED VALVE ACTUATOR	LIMITORQUE	SMB00	CONTAINMENT ELEV. 241'-0"
6	MOTORIZED VALVE ACTUATOR	LIMITORQUE	SMB3	CONTAINMENT, ELEV. 245'
7	MOTORIZED VALVE ACTUATOR	LIMITORQUE	SMB00	REACTOR AUXILIARY BLDG.
8	MOTORIZED VALVE ACTUATOR	LIMITORQUE	SMB1	REACTOR AUXILIARY BLDG.
9	FLOW TRANSMITTER	FISCHER AND PORTER	10B2496PFBABBB	REACTOR AUXILIARY BLDG.
10	PRESSURE TRANSMITTER	FISCHER AND PORTER	50EP1041PCXA	REACTOR AUXILIARY BLDG.
11	PRESSURE TRANSMITTER	FISCHER AND PORTER	50EP1041	REACTOR AUXILIARY BLDG.
12	PRESSURE TRANSMITTER	ROSEMOUNT	1153A	CONTAINMENT
13	LEVEL TRANSMITTER	ROSEMOUNT	1153A	CONTAINMENT
14	FLOW TRANSMITTER	ROSEMOUNT	1153A	CONTAINMENT
15	PRESSURE TRANSMITTER	ROSEMOUNT	1153GA9	CONTAINMENT
16	LEVEL TRANSMITTER	GEMS	XM52495	CONTAINMENT
17	LEVEL TRANSMITTER	GEMS	XM36495	CONTAINMENT
18	TEMPERATURE ELEMENT	ROSEMOUNT	176KF	CONTAINMENT, ELEV. 243'-0"
19	LEVEL SWITCH	MADISON	5602	CONTAINMENT, ELEV. 228'-0"
20	ACCELEROMETER	ENDEVCO	2273AM20	CONTAINMENT
21	AMPLIFIER	UNHOLTZ-DICKIE	22CA2TR	CONTAINMENT
22	ELECTRIC MOTOR	WESTINGHOUSE	506HPZ	REACTOR AUXILIARY BLDG.
23	ELECTRIC MOTOR	WESTINGHOUSE	685.5S	CONTAINMENT, ELEV. 275'-0"
24	ELECTRICAL PENETRATION	CROUSE-HINDS	1.2.2(745),1.2.2(747),1.2.4(74	CONTAINMENT ELEV. 234'-246'
25	ELECTRICAL CABLE	CONTINENTAL WIRE	CC2115	CONTAINMENT
26	ELECTRICAL CABLE	KERITE	HT/FR	CONTAINMENT
27	ELECTRICAL CABLE	ROCKBESTOS	VARIOUS	CONTAINMENT
28	ELECTRICAL CABLE	ROCKBESTOS	VARIOUS	REACTOR AUXILIARY BLDG.
29	ELECTRICAL CABLE	SAMUEL MOORE	THERMOCOUPLE EXTENSION	CONTAINMENT
30	ELECTRICAL CABLE SPLICE	RAYCHEM	VARIOUS	CONTAINMENT, ELEV. 234'-246'
31	ELECTRICAL CONNECTOR	AMP	535481, WIRE SIZE 16	CONTAINMENT, ELEV. 234'-0" - 246'-0
32	ELECTRICAL TAPE	3M/ELECTRO PRODUCTS	SCOTCH 70 (SILICON RUBBER)	CONTAINMENT



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 1

EQUIPMENT ITEM NO. 1 (TMI ACTION PLAN ITEM II.E.4.2)  
 SOLENOID VALVE LOCATED IN THE REACTOR AUXILIARY BLDG.  
 ASCO MODEL LB8320A185  
 REQUIRED OPERATING TIME: NOT STATED  
 TER CHECKSHEET NO. 1  
 LICENSEE REFERENCE(S): 2850  
 FUNCTION (PLANT ID): FUNCTION AND PLANT ID NOT STATED  
 LICENSEE SUBMITTAL: SCEW(S): 8 OF 15 [15]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

R, T, Q1, RT, P, H, CS, A, S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,

Not stated, Not applicable  
New item

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, <del>3b, 3c, 3d</del>
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	<del>5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h, 5i, 5j</del>
Installed TMI Lessons Learned Implementation Equipment Summary	6a, 6b
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 1

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/has not) provided a response to the SER concerns.
- The Licensee (has/~~has not~~) specifically stated that the equipment is qualified and/or will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/has not) proposed a corrective action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
- Corrective action specified by the Licensee:
  - Equipment replacement with qualified equipment
  - Equipment modification
  - Equipment relocation above submergence level
  - Relocate or shield equipment from radiation source
  - Verify qualification by additional (testing/analysis)
  - Equipment relocation to a mild environment
  - Qualification testing of equipment in progress
  - Other ( \_\_\_\_\_ )
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |  |                                |
|--|--------------------------------|
| I.a Qualified  | II.c Qualified Life Deficiency |
| I.b Modification   | III.a Exempt                   |
| <span style="border: 1px solid black; padding: 2px;">II.a Qualification Not Established</span> | III.b Not in Scope             |
| II.b Not Qualified   | IV Documentation Not Available |



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 1

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
 X = DEFICIENCY

Documented Evidence of Qualification Adequate	<u>X</u>
Adequate Similarity Between Equipment and Test Specimen Established	<u>    </u>
Aging Degradation Evaluated Adequately	<u>    </u>
Qualified Life or Replacement Schedule Established (If Required)	<u>    </u>
Program Established to Identify Aging Degradation	<u>    </u>
Criteria Regarding Aging Simulation Satisfied (If Required)	<u>    </u>
Criteria Regarding Temperature/Pressure Exposure:	
o Peak Temperature Adequate	<u>    </u>
o Peak Pressure Adequate	<u>    </u>
o Duration Adequate	<u>    </u>
o Required Profile Enveloped Adequately	<u>    </u>
o Steam Exposure (If Required) Adequate	<u>    </u>
Criteria Regarding Spray Satisfied	<u>    </u>
Criteria Regarding Submergence Satisfied	<u>    </u>
Criteria Regarding Radiation Satisfied	<u>    </u>
Criteria Regarding Test Sequence Satisfied	<u>    </u>
Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied	<u>    </u>
Criteria Regarding Functional Testing Satisfied	<u>    </u>
Criteria Regarding Instrument Accuracy Satisfied	<u>    </u>
Test Duration Margin (1 hour + Function Time) Satisfied	<u>    </u>
Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I)	<u>    </u>

NRC QUALIFICATION CATEGORY

DESIGNATION:  
 X = CATEGORY

I.a	Equipment Qualified	<u>    </u>
I.b	Equipment Qualification Pending Modification	<u>    </u>
II.a	Equipment Qualification Not Established	<u>X</u>
II.b	Equipment Not Qualified	<u>    </u>
II.c	Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified	<u>    </u>
III.a	Equipment Exempt From Qualification	<u>    </u>
III.b	Equipment Not in the Scope of the Qualification Review	<u>    </u>
IV	Documentation Not Made Available	<u>    </u>

TMI Action Plan Item No. II.E.4.2

*See pages 5i & 5j*



Franklin Research Center  
A Division of The Franklin Institute  
20th and Race Streets, Phila., Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
FRC Project No. C5257  
FRC Assignment No. 13  
FRC Task No. 511

Page  
30

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 1

NOTES:

- (1) To be utilized during TMI-2 accident scenario per procedure
- (2) Radiation level determined from Reactor Building Radiation Shielding Design Review
- (3) Equipment not purchased to meet qualification requirements

[14]



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 1

NOTES:

### 3 WAY SOLENOID VALVES

for Air, Inert Gas, Water and Light Hydraulic Oil  
1/4" and 1/2" N.P.T.

BULLETIN  
8320

#### General Description

This compact design eliminates the orifice connection in the solenoid — all connections are in the valve body providing in-line piping.

This modern design concept with orifice and pipe connections in the body also permits coil replacement without opening pipe connections — now necessary on other 3 way valves.

#### Applications

For automatic control of air, inert gas, water, light hydraulic oil, freon and all other gases and liquids . . . non-corrosive to brass and stainless steel. Valves are commonly used to apply pressure to and vent pressure from cylinders and diaphragms or for selection and diversion of pressure.

Special valves available for: • dry air-gas • continuous cycling • exceptionally long life • heavy-duty operation • clickless and quiet (no A-C hum) operation.

Refer to Long Life Construction on page 68.

Some typical applications are:

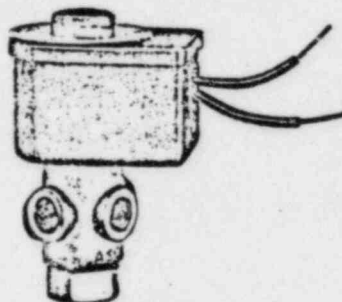
- automation
- vending
- air and hydraulic cylinders
- pilot operators
- gas sampling
- copying and reproduction equipment
- lubricating devices
- air conditioning
- instrumentation
- air dryers
- laundry equipment
- compressors

#### Specifications

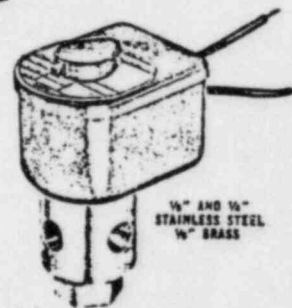
Operation: Three types available:

(a) Normally Closed — applies pressure when solenoid is energized; exhausts pressure when solenoid is de-energized.

(b) Normally Open — applies pressure when solenoid is de-energized; exhausts pressure when solenoid is energized.



1/4" BRASS



1/2" AND 1/4" STAINLESS STEEL  
1/4" BRASS

(c) Universal — for normally closed or normally open operation. Selection or diversion of pressure can be applied at 1, 2 or 3.

Pipe Sizes: 1/4" and 1/2" N.P.T.

Valve Parts in Contact with Media:

Body — Brass or 303 s.s., as listed.

Seals and Discs — Buna "N" or Urethane, as listed.

Core Tube — 305 s.s.

Core and Plugnut — 430F s.s.

Core Spring — 302 s.s.

Shading Coil — Copper (brass body); Silver (stainless steel body).

Disc Holder — Acetal.

Core Guide (10.5 and 16.7 watt only) — Acetal.

Solenoid Enclosures: Two types available:

(a) General Purpose (NEMA 1).

(b) Explosion-Proof and Watertight (NEMA 7C, 7D and 4).

Electrical: Standard Voltages:

24, 120, 240, 480 volts, A-C, 60 Hz (or 50 Hz in 110 volt multiples).

6, 12, 24, 120, 240 volts, D-C.

Other voltages available when required.

Coil: Continuous Duty Molded Class A or F Coils, as listed.

Temperature: Fluid: To 200°F. Maximum, as listed.

Ambient: Nominal Range, 32°F. to 77°F. (104°F. occasionally — see page 6 in Engineering Information Section.)

Installation: Mountable in any position without affecting operation.

Mounting: See dimension drawings.

Approvals: UL listed and CSA certified. Refer to page 6 for details.

Optional Features:

- Junction Box Solenoid Enclosure
- Strain-Relief Connector
- Manual Operator
- 1/2" Threaded Conduit Hub or Adapter
- Molded Class A or F Coils with Spade Terminals or Leads
- Dual Voltage Molded Class A or F Coils
- Class H High-Temperature Coil
- Open Frame Solenoid for Cabinet Installation



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 1

NOTES:

As can be seen from the preceding pages, the solenoid valves are suitable for a normal maximum ambient temperature of 77°F.

The materials of construction vary according to the type of internals specified for the application. The referenced report does not take into account all of the possible materials. The submittal does not contain any information regarding the valve internals or other materials of construction.

One of the more significant items that affect the valve life and suitability for temperatures beyond the 77°F identified on the preceding pages is the insulation system used for the solenoid coil. If the materials used were identified, it would be possible for the licensee to perform an analysis which would provide a determination of the suitability of the installed valve for the conditions described on the SCEW sheet. However, the licensee has not provided documentation to establish the environmental qualification of the equipment installed in the plant.

CONCLUSION

The licensee has not provided evidence of qualification of the installed solenoid valves.

In addition no radiation capability is provided by the manufacturer for these valves. The licensee has not provided a radiation analysis for the actual materials used in the valves.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. L

INSTALLED TMI LESSONS LEARNED IMPLEMENTATION EQUIPMENT SUMMARY

NRC requested an evaluation of the environmental qualification of safety-related electrical equipment located in harsh environments required for TMI Lessons Learned Implementation. The objective is to evaluate qualification documentation of equipment within the scope of IE Bulletin 79-01B, Supplement 3 (item 2), in accordance with criteria established by the NRC (see Section 2 of this report) in a manner identical to the evaluation of all other safety-related electrical equipment. The scope of this review is limited to TMI Action Plan equipment associated with specific sections of NUREG-0737 which have an installation implementation date of January 1, 1981 (sections are identified below). Where applicable, a review is to be performed on installed equipment with implementation dates after January 1, 1981 if adequately identified by the licensee.

This plant is a PWR , EWR .

The NSSS Vendor is Westinghouse (W) , Babcox & Wilcox (B&W) ,  
 Combustion Engineering (CE) , General Electric (GE) .

With respect to this equipment item, it is noted (applicable section checked):

- The Licensee does not provide adequate information with respect to identification of TMI Action Plan equipment installed as of 1/1/81.
- The Licensee has not provided the correlation of this equipment item with the specific sections of NUREG-0737. [The correlation is needed to ensure that all items are included in the review, e.g., if a transmitter is identified as a TMI Action Plan item, are the cable and the terminal blocks associated with the device also identified?]
- The Licensee has not provided the approximate installation date for the TMI Action Plan equipment items so that the appropriate qualification criteria (NUREG-0588 or DOR Guidelines) can be used in the EEQ evaluation.
- The Licensee has provided a standard Owners' Group position with respect to a NUREG-0737 technical area.
- The Licensee has requested extensions of implementation dates.
- The Licensee has stated that this equipment item is associated with the following section of NUREG-0737. (This list of applicable NUREG-0737 sections has been identified by NRC as sections within the scope of this review):
  - II.B.3 (ALL/1-1-81) Post-Accident Sampling Capability of Reactor Coolant and Containment
  - II.D.3 (ALL/1-1-81) Direct Indication of Relief and Safety Valve Position



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 1

- II.E.1.2 (PWR/1-1-81) Auxiliary Feedwater System Automatic Initiation and Flow Indication
- II.E.3.1 (PWR/1-1-81) Emergency Power Supply for Pressurizer Heaters (Safety-Grade Interfaces)
- II.E.4.1 (ALL/7-1-81) Dedicated Hydrogen Penetrations
- II.E.4.2 (ALL/1-1-81) Containment Isolation Dependability
- II.F.2 (PWR/1-1-81) Instrumentation for Detection of Inadequate Core Cooling
- II.G.1 (PWR/1-1-81) Emergency Power for Pressurizer Equipment (Safety-Grade Interfaces)
- II.K.2.10 (PWR/B&W/7-1-81) Safety-Grade Anticipatory Reactor Trip
- II.K.3.9 (PWR/W/1-1-81) PID Controller Modification (If Hardware Change Involved)
- II.K.3.12 (PWR/W/1-1-81) Anticipatory Reactor Trip upon Turbine Trip
- II.K.3.13 (BWR/GE/7-1-81) Separation of HPCI and RCIC Initiation Signals
- II.K.3.15 (BWR/GE/7-1-81) Prevention of Spurious Isolation of HPCI and RCIC Systems
- II.K.3.19 (BWR/GE/7-1-81) Interlock on Recirculation Pump Loop
- II.K.3.21 (BWR/GE/7-1-81) Restart of Core Spray and LPCI Systems (If Hardware Changed Out)
- II.K.3.27 (BWR/GE/7-1-81) Provide Common Reference Level for Vessel Level Instrumentation (If Hardware Changed Out)



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 2

EQUIPMENT ITEM NO. 2  
 SOLENOID VALVE LOCATED IN THE CONTAINMENT, ELEV. 283'0"  
 ASCO MODEL NP831665E  
 REQUIRED OPERATING TIME: 5 MINUTES  
 TER CHECKSHEET NO. 2  
 LICENSEE REFERENCE(S): 40, 649  
 FUNCTION (PLANT ID): NOT STATED (V12-7, -9, -11, -13; CVC-200A, B, C)  
 LICENSEE SUBMITTAL: SCEW(S): 20 OF 25 [20]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

(R), T, QT, RT, P, H, (CS), (A), S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,  
 Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, 3b, 3c, <del>3d</del>
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	5a, 5b, 5c, 5d, 5e, 5f, <del>5g, 5h, 5i, 5j</del>
Installed TMI Lessons Learned Implementation Equipment Summary	<del>6a, 6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 2

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/~~has not~~) provided a response to the SER concerns.
- The Licensee (has/~~has not~~) specifically stated that the equipment is qualified and/~~or~~ will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/has not) proposed a corrective action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
- Corrective action specified by the Licensee:
  - Equipment replacement with qualified equipment
  - Equipment modification
  - Equipment relocation above submergence level
  - Relocate or shield equipment from radiation source
  - Verify qualification by additional (testing/analysis)
  - Equipment relocation to a mild environment
  - Qualification testing of equipment in progress
  - Other ( \_\_\_\_\_ )
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |   |                                |
|---|--------------------------------|
| <input checked="" type="checkbox"/> I.a Qualified | II.c Qualified Life Deficiency |
| I.b Modification                                  | III.a Exempt                   |
| II.a Qualification Not Established                | III.b Not in Scope             |
| II.b Not Qualified                                | IV Documentation Not Available |



**EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 2**

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
X = DEFICIENCY

- Documented Evidence of Qualification Adequate \_\_\_\_\_
- Adequate Similarity Between Equipment and Test Specimen Established \_\_\_\_\_
- Aging Degradation Evaluated Adequately \_\_\_\_\_
- Qualified Life or Replacement Schedule Established (If Required) \_\_\_\_\_
- Program Established to Identify Aging Degradation \_\_\_\_\_
- Criteria Regarding Aging Simulation Satisfied (If Required) \_\_\_\_\_
- Criteria Regarding Temperature/Pressure Exposure:
  - o Peak Temperature Adequate \_\_\_\_\_
  - o Peak Pressure Adequate \_\_\_\_\_
  - o Duration Adequate \_\_\_\_\_
  - o Required Profile Enveloped Adequately \_\_\_\_\_
  - o Steam Exposure (If Required) Adequate \_\_\_\_\_
- Criteria Regarding Spray Satisfied \_\_\_\_\_
- Criteria Regarding Submergence Satisfied \_\_\_\_\_
- Criteria Regarding Radiation Satisfied \_\_\_\_\_
- Criteria Regarding Test Sequence Satisfied \_\_\_\_\_
- Criteria Regarding Test Failures or Severe Anomalies  
 (If Any) Satisfied \_\_\_\_\_
- Criteria Regarding Functional Testing Satisfied \_\_\_\_\_
- Criteria Regarding Instrument Accuracy Satisfied \_\_\_\_\_
- Test Duration Margin (1 hour + Function Time) Satisfied \_\_\_\_\_
- Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I) \_\_\_\_\_

NRC QUALIFICATION CATEGORY

DESIGNATION:  
X = CATEGORY

- I.a Equipment Qualified \_\_\_\_\_ X
- I.b Equipment Qualification Pending Modification \_\_\_\_\_
- II.a Equipment Qualification Not Established \_\_\_\_\_
- II.b Equipment Not Qualified \_\_\_\_\_
- II.c Equipment Satisfies All Requirements Except Qualified Life  
 or Replacement Schedule Justified \_\_\_\_\_
- III.a Equipment Exempt From Qualification \_\_\_\_\_
- III.b Equipment Not in the Scope of the Qualification Review \_\_\_\_\_
- IV Documentation Not Made Available \_\_\_\_\_

*see page 5 f*



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 2

LICENSEE RESPONSE TO NRC SER

4.2 Equipment Requiring Additional Information and/or Corrective Action  
(Appendix B)

The bulk of master list equipment was placed in this category and our review of deficiencies is based upon the following:

- Deletion of deficient listed equipment due to replacement programs carried out and reported in our 90-day, Revision 3 response dated February 1, 1981.
- Re-evaluation of CP&L's updated submittals by NRC Region II, Atlanta, GA, and reported in Environmental Qualification of Safety-Related Electrical Equipment IEB 79-013. Technical Evaluation Report - Docket No. 50-261; Plant: H. B. Robinson 2, dated November 6, 1980 and Revised November 11, 1980.

Equipment reported as qualified within NRC TER Revision 1, dated November 11, 1980:

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model No.</u>	<u>Location</u>
1. pump motor	Westinghouse	506UPZ	outside containment
2. motor operator	Limitorque	SMB-00	containment
3. motor operator	Limitorque	SMB-00	outside containment
4. motor operator	Limitorque	SMB-1	outside containment
5. flow transmitter	Fisher & Porter	10B2496 PBBABBB	outside containment
6. pressure transmitter	Fisher & Porter	50EP1041 BCXA	outside containment
7. fan motor	Westinghouse	685.5-S	containment
8. cable	Continental Wire & Cable	CC2115	containment
9. cable	Kerite	RT FR	containment
10. solenoid valve <sup>1</sup>	ASCO	NP831665E	containment

Notes:

<sup>1</sup>As reported in qualification test programs, components and/or materials will require replacement on a designated schedule to maintain qualification.

A. Solenoid Valve      ASCO      NP831665E      1      R,CS,A

<sup>A</sup>Items reported as qualified within NRC Region II revised TER, dated 11/7/80.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 2

3.2.6 Solenoid Valves

As reported in CP&L responses to NRC IE Bulletins 79-01 and 79-01B (45-day report), the listed solenoid valves in containment are to be replaced by qualified equipment. The in-place ASCO solenoid valves have not exhibited poor performance or required excessive maintenance. When manufactured and supplied, ASCO Company was not required to maintain the QC/QA procedures and programs necessary to allow traceability and certification needed for qualification.

The replacement valves are also ASCO Company equipment Model Nos. NP831665E, NP8316E35E and 206-381-2U used singly or in combination to achieve their valving function. These solenoid valve types were included in a qualification testing program to meet IEEE Standards 323, 344, and 382. Results of this testing are published in AUTOMATIC SWITCH COMPANY, Test Report No. AQS21678/TR, Revision A, entitled Qualification Tests of Solenoid Valves by Environmental Exposure to Elevated Temperature, Radiation, Wear Aging, Seismic Simulation, Vibration Endurance, Accident Radiation and LOCA Simulation.

The test parameters subjected the valves to a maximum temperature of 346°F, a maximum pressure of 125 PSIA, a relative humidity of 100%, a borated spray during the LOCA simulation and a total radiation of  $2.0 \times 10^6$  RADS. The test results are divided into two (2) parts--first the evaluation of the elastomers and coil materials and second the valve mechanisms and housing. The elastomers and coil materials, as reported, are qualified for a 4.4 year life (includes a 10% margin figure). The valve proper is qualified for a 40-year life.

This will require the coils and elastomers to be replaced on a scheduled basis to maintain the serviceability of the entire valve as well as its qualification. The proposed schedule is replacement of stated components on a four- (4) year cycle. Replacement will be performed during the closest outage or refueling to that time period.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 2

LICENSEE RESPONSE TO NRC SER (Continued)

Solenoid Valves

Replacement of in-containment solenoid valves identified within this report has been performed during the 1980 refueling outage (August - October, 1980). The ASCO valves specified as replacements are considered qualified by similar type testing performed by the manufacturer and reported within available qualification reports (Paragraph 3.1, Reference 47).

Additional action required - Noted in the manufacturer's report is a certified life of 4.4 years for the coil and elastomers within these solenoid valves. These elements will be replaced on a four- (4) year cycle to maintain complete operational capability.

Ri

[15]



Franklin Research Center  
A Division of The Franklin Institute  
20th and Race Streets, Phila., Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
FRC Project No. C5257  
FRC Assignment No. 13  
FRC Task No. 511

Page  
5

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 2

Checksheets 5a thru 5f have been removed due to the  
proprietary nature of information contained therein.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 3

EQUIPMENT ITEM NO. 3  
 SOLENOID VALVE LOCATED IN THE CONTAINMENT, ELEV. 283'0"  
 ASCO MODEL NP8316E35E  
 REQUIRED OPERATING TIME: 5 MINUTES  
 TER CHECKSHEET NO. 3  
 LICENSEE REFERENCE(S): 40, 649  
 FUNCTION (PLANT ID): NOT STATED (V12-7, -9, -11, -13; CVC-200A, B, C)  
 LICENSEE SUBMITTAL: SCEW(S): 20 OF 25 [20]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

(R), T, QT, RT, P, H, (CS), (A), S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,  
 Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, 3b, 3c, <del>3d</del>
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	<del>5a, 5b, 5c, 5d, 5e, 5f,</del> <del>5g, 5h, 5i, 5j</del>
Installed TMI Lessons Learned Implementation Equipment Summary	<del>6a, 6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 3

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

The Licensee (has/~~has not~~) provided a response to the SER concerns.

The Licensee (has/~~has not~~) specifically stated that the equipment is qualified and/or will function when exposed to the applicable DBE environmental service conditions.

The Licensee has presented information which shows there are no outstanding qualification deficiencies.

The Licensee (has/has not) proposed a corrective action for this equipment item whose qualification has not been fully established.

Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.

Corrective action specified by the Licensee:

Equipment replacement with qualified equipment

Equipment modification

Equipment relocation above submergence level

Relocate or shield equipment from radiation source

Verify qualification by additional (testing/analysis)

Equipment relocation to a mild environment

Qualification testing of equipment in progress

Other ( \_\_\_\_\_ )

The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.

The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)

The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

I.a Qualified

I.b Modification

II.a Qualification Not Established

II.b Not Qualified

II.c Qualified Life Deficiency

III.a Exempt

III.b Not in Scope

IV Documentation Not Available





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 3

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
X = DEFICIENCY

- Documented Evidence of Qualification Adequate \_\_\_\_\_
- Adequate Similarity Between Equipment and Test Specimen Established \_\_\_\_\_
- Aging Degradation Evaluated Adequately \_\_\_\_\_
- Qualified Life or Replacement Schedule Established (If Required) \_\_\_\_\_
- Program Established to Identify Aging Degradation \_\_\_\_\_
- Criteria Regarding Aging Simulation Satisfied (If Required) \_\_\_\_\_
- Criteria Regarding Temperature/Pressure Exposure:
  - o Peak Temperature Adequate \_\_\_\_\_
  - o Peak Pressure Adequate \_\_\_\_\_
  - o Duration Adequate \_\_\_\_\_
  - o Required Profile Enveloped Adequately \_\_\_\_\_
  - o Steam Exposure (If Required) Adequate \_\_\_\_\_
- Criteria Regarding Spray Satisfied \_\_\_\_\_
- Criteria Regarding Submergence Satisfied \_\_\_\_\_
- Criteria Regarding Radiation Satisfied \_\_\_\_\_
- Criteria Regarding Test Sequence Satisfied \_\_\_\_\_
- Criteria Regarding Test Failures or Severe Anomalies  
 (If Any) Satisfied \_\_\_\_\_
- Criteria Regarding Functional Testing Satisfied \_\_\_\_\_
- Criteria Regarding Instrument Accuracy Satisfied \_\_\_\_\_
- Test Duration Margin (1 hour + Function Time) Satisfied \_\_\_\_\_
- Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I) \_\_\_\_\_

NRC QUALIFICATION CATEGORY

DESIGNATION:  
X = CATEGORY

- I.a Equipment Qualified X \_\_\_\_\_
- I.b Equipment Qualification Pending Modification \_\_\_\_\_
- II.a Equipment Qualification Not Established \_\_\_\_\_
- II.b Equipment Not Qualified \_\_\_\_\_
- II.c Equipment Satisfies All Requirements Except Qualified Life  
 or Replacement Schedule Justified \_\_\_\_\_
- III.a Equipment Exempt From Qualification \_\_\_\_\_
- III.b Equipment Not in the Scope of the Qualification Review \_\_\_\_\_
- IV Documentation Not Made Available \_\_\_\_\_

SEE EQUIPMENT ITEM 2 FOR DETAILED EVALUATION, SHEETS 5a THROUGH 5f.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 3

LICENSEE RESPONSE TO NRC SER

4.2 Equipment Requiring Additional Information and/or Corrective Action  
(Appendix B)

The bulk of master list equipment was placed in this category and our review of deficiencies is based upon the following:

- Deletion of deficient listed equipment due to replacement programs carried out and reported in our 90-day, Revision 3 response dated February 1, 1981.
- Re-evaluation of CP&L's updated submittals by NRC Region II, Atlanta, GA, and reported in Environmental Qualification of Safety-Related Electrical Equipment IEB 79-01B. Technical Evaluation Report - Docket No. 50-261; Plant: H. B. Robinson 2, dated November 6, 1980 and Revised November 11, 1980.

Telecons with NRC, Bethesda, MD reviewing personnel July 29, 1981, et al.

Equipment reported as qualified within NRC TER Revision 1, dated November 11, 1980:

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model No.</u>	<u>Location</u>
10. solenoid valve <sup>1</sup>	ASCO	NP831665E	containment
11. solenoid valve <sup>1</sup>	ASCO	NP8316E35E	containment
12. solenoid valve <sup>1</sup>	ASCO	206-381-2U	containment

Notes:

<sup>1</sup>As reported in qualification test programs, components and/or materials will require replacement on a designated schedule to maintain qualification.

A. Solenoid Valve      ASCO                      NP8316E35E              1              R,CS,A

<sup>A</sup>Items reported as qualified within NRC Region II revised TER, dated 11/7/80.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 3

3.2.6 Solenoid Valves

As reported in CP&L responses to NRC IE Bulletins 79-01 and 79-01B (45-day report), the listed solenoid valves in containment are to be replaced by qualified equipment. The in-place ASCO solenoid valves have not exhibited poor performance or required excessive maintenance. When manufactured and supplied, ASCO Company was not required to maintain the QC/QA procedures and programs necessary to allow traceability and certification needed for qualification.

The replacement valves are also ASCO Company equipment \_\_\_\_\_ Model Nos. NP831665E, NP8316E35E and 206-381-2U used singly or in combination to achieve their valving function. These solenoid valve types were included in a qualification testing program to meet IEEE Standards 323, 344, and 382. Results of this testing are published in AUTOMATIC SWITCH COMPANY, Test Report No. AQS21678/TR, Revision A, entitled Qualification Tests of Solenoid Valves by Environmental Exposure to Elevated Temperature, Radiation, Wear Aging, Seismic Simulation, Vibration Endurance, Accident Radiation and LOCA Simulation.

The test parameters subjected the valves to a maximum temperature of 346°F, a maximum pressure of 125 PSIA, a relative humidity of 100%, a borated spray during the LOCA simulation and a total radiation of  $2.0 \times 10^8$  RADS. The test results are divided into two (2) parts--first the evaluation of the elastomers and coil materials and second the valve mechanisms and housing. The elastomers and coil materials, as reported, are qualified for a 4.4 year life (includes a 10% margin figure). The valve proper is qualified for a 40-year life.

This will require the coils and elastomers to be replaced on a scheduled basis to maintain the serviceability of the entire valve as well as its qualification. The proposed schedule is replacement of stated components on a four- (4) year cycle. Replacement will be performed during the closest outage or refueling to that time period.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 3

4.6 Solenoid Valves

Replacement of in-containment solenoid valves identified within this report has been performed during the 1980 refueling outage (August - October, 1980). The ASCO valves specified as replacements are considered qualified by similar type testing performed by the manufacturer and reported within available qualification reports (Paragraph 3.1, Reference 47).

Additional action required - Noted in the manufacturer's report is a certified life of 4.4 years for the coil and elastomers within these solenoid valves. These elements will be replaced on a four- (4) year cycle to maintain complete operational capability.

R



Franklin Research Center  
A Division of The Franklin Institute  
20th and Race Streets, Phila. Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
FRC Project No. C5257  
FRC Assignment No. 13  
FRC Task No. 511

Page  
5

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 3

Checksheets 5f have been removed due to the  
proprietary nature of information contained therein.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 4

EQUIPMENT ITEM NO. 4  
 SOLENOID VALVE LOCATED IN THE CONTAINMENT, ELEV. 283'0"  
 ASCO MODEL 2063812U  
 REQUIRED OPERATING TIME: 5 MINUTES  
 TER CHECKSHEET NO. 4  
 LICENSEE REFERENCE(S): 40, 649  
 FUNCTION (PLANT ID): NOT STATED (V12-7, -9, -11, -13; CVC-200A, B, C)  
 LICENSEE SUBMITTAL: SCEW(S): 20 OF 25 [20]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

(R), T, QT, RT, P, H, (CS), (A), S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,  
 Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, 3b, 3c, <del>3d</del>
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	<del>5a, 5b, 5c, 5d, 5e, 5f,</del> <del>5g, 5h, 5i, 5j</del>
Installed TMI Lessons Learned Implementation Equipment Summary	<del>6a, 6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 4

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/~~has not~~) provided a response to the SER concerns.
- The Licensee (has/~~has not~~) specifically stated that the equipment is qualified and/or will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/has not) proposed a corrective action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
- Corrective action specified by the Licensee:
  - Equipment replacement with qualified equipment
  - Equipment modification
  - Equipment relocation above submergence level
  - Relocate or shield equipment from radiation source
  - Verify qualification by additional (testing/analysis)
  - Equipment relocation to a mild environment
  - Qualification testing of equipment in progress
  - Other ( \_\_\_\_\_ )
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW

- CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |   |                                |
|---|--------------------------------|
| <input checked="" type="checkbox"/> I.a Qualified | II.c Qualified Life Deficiency |
| I.b Modification                                  | III.a Exempt                   |
| II.a Qualification Not Established                | III.b Not in Scope             |
| II.b Not Qualified                                | IV Documentation Not Available |



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 4

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
X = DEFICIENCY

- Documented Evidence of Qualification Adequate \_\_\_\_\_
- Adequate Similarity Between Equipment and Test Specimen Established \_\_\_\_\_
- Aging Degradation Evaluated Adequately \_\_\_\_\_
- Qualified Life or Replacement Schedule Established (If Required) \_\_\_\_\_
- Program Established to Identify Aging Degradation \_\_\_\_\_
- Criteria Regarding Aging Simulation Satisfied (If Required) \_\_\_\_\_
- Criteria Regarding Temperature/Pressure Exposure: \_\_\_\_\_
  - o Peak Temperature Adequate \_\_\_\_\_
  - o Peak Pressure Adequate \_\_\_\_\_
  - o Duration Adequate \_\_\_\_\_
  - o Required Profile Enveloped Adequately \_\_\_\_\_
  - o Steam Exposure (If Required) Adequate \_\_\_\_\_
- Criteria Regarding Spray Satisfied \_\_\_\_\_
- Criteria Regarding Submergence Satisfied \_\_\_\_\_
- Criteria Regarding Radiation Satisfied \_\_\_\_\_
- Criteria Regarding Test Sequence Satisfied \_\_\_\_\_
- Criteria Regarding Test Failures or Severe Anomalies  
 (If Any) Satisfied \_\_\_\_\_
- Criteria Regarding Functional Testing Satisfied \_\_\_\_\_
- Criteria Regarding Instrument Accuracy Satisfied \_\_\_\_\_
- Test Duration Margin (1 hour + Function Time) Satisfied \_\_\_\_\_
- Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I) \_\_\_\_\_

NRC QUALIFICATION CATEGORY

DESIGNATION:  
X = CATEGORY

- I.a Equipment Qualified \_\_\_\_\_ X
- I.b Equipment Qualification Pending Modification \_\_\_\_\_
- II.a Equipment Qualification Not Established \_\_\_\_\_
- II.b Equipment Not Qualified \_\_\_\_\_
- II.c Equipment Satisfies All Requirements Except Qualified Life  
 or Replacement Schedule Justified \_\_\_\_\_
- III.a Equipment Exempt From Qualification \_\_\_\_\_
- III.b Equipment Not in the Scope of the Qualification Review \_\_\_\_\_
- IV Documentation Not Made Available \_\_\_\_\_

FOR DETAILED EVALUATION SEE ITEM 2 , SHEETS 5a, THROUGH 5f.





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 4

LICENSEE RESPONSE TO NRC SER

4.2 Equipment Requiring Additional Information and/or Corrective Action  
(Appendix B)

The bulk of master list equipment was placed in this category and our review of deficiencies is based upon the following:

- Deletion of deficient listed equipment due to replacement programs carried out and reported in our 90-day, Revision 3 response dated February 1, 1981.
- Re-evaluation of CP&L's updated submittals by NRC Region II, Atlanta, GA, and reported in Environmental Qualification of Safety-Related Electrical Equipment IEB 79-01B. Technical Evaluation Report - Docket No. 50-261; Plant: H. B. Robinson 2, dated November 6, 1980 and Revised November 11, 1980.

Telecons with NRC, Bethesda, MD reviewing personnel July 29, 1981, et al.

Equipment reported as qualified within NRC TER Revision 1, dated November 11, 1980:

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model No.</u>	<u>Location</u>
10. solenoid valve <sup>1</sup>	ASCO	NP831665E	containment
11. solenoid valve <sup>1</sup>	ASCO	NP8316E35E	containment
12. solenoid valve <sup>1</sup>	ASCO	206-381-2U	containment

Notes:

<sup>1</sup>As reported in qualification test programs, components and/or materials will require replacement on a designated schedule to maintain qualification.

A. Solenoid Valve      ASCO                      206-381-2U              1              R,CS,A

<sup>A</sup>Items reported as qualified within NRC Region II revised TER, dated 11/7/80



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 4

3.2.6 Solenoid Valves

As reported in CP&L responses to NRC IE Bulletins 79-01 and 79-01B (45-day report), the listed solenoid valves in containment are to be replaced by qualified equipment. The in-place ASCO solenoid valves have not exhibited poor performance or required excessive maintenance. When manufactured and supplied, ASCO Company was not required to maintain the QC/QA procedures and programs necessary to allow traceability and certification needed for qualification.

The replacement valves are also ASCO Company equipment Model Nos. NP831665E, NP8316E35E and 206-381-2U used singly or in combination to achieve their valving function. These solenoid valve types were included in a qualification testing program to meet IEEE Standards 323, 344, and 382. Results of this testing are published in AUTOMATIC SWITCH COMPANY, Test Report No. AQS21678/TR, Revision A, entitled Qualification Tests of Solenoid Valves by Environmental Exposure to Elevated Temperature, Radiation, Wear Aging, Seismic Simulation, Vibration Endurance, Accident Radiation and LOCA Simulation.

The test parameters subjected the valves to a maximum temperature of 346°F, a maximum pressure of 125 PSIA, a relative humidity of 100%, a borated spray during the LOCA simulation and a total radiation of  $2.0 \times 10^6$  RADS. The test results are divided into two (2) parts--first the evaluation of the elastomers and coil materials and second the valve mechanisms and housing. The elastomers and coil materials, as reported, are qualified for a 4.4 year life (includes a 10% margin figure). The valve proper is qualified for a 40-year life.

This will require the coils and elastomers to be replaced on a scheduled basis to maintain the serviceability of the entire valve as well as its qualification. The proposed schedule is replacement of stated components on a four- (4) year cycle. Replacement will be performed during the closest outage or refueling to that time period.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 4

4.6

Solenoid Valves

Replacement of in-containment solenoid valves identified within this report has been performed during the 1980 refueling outage (August - October, 1980). The ASCO valves specified as replacements are considered qualified by similar type testing performed by the manufacturer and reported within available qualification reports (Paragraph 3.1, Reference 47).

Additional action required - Noted in the manufacturer's report is a certified life of 4.4 years for the coil and elastomers within these solenoid valves. These elements will be replaced on a four- (4) year cycle to maintain complete operational capability.

[15]



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 5

EQUIPMENT ITEM NO. 5  
 MOTORIZED VALVE ACTUATOR LOCATED IN THE CONTAINMENT, ELEV. 241'0"  
 LIMITORQUE MODEL SM800 WITH PEERLESS MOTOR, CLASS B INSULATION  
 REQUIRED OPERATING TIME: 1 HOUR  
 TER CHECKSHEET NO. 5  
 LICENSEE REFERENCE(S): 637, 639  
 FUNCTION (PLANT ID): ACTUATES HOT LEG INJECTION VALVES (V-866A, B)  
 LICENSEE SUBMITTAL: SCEW(S): 6 OF 25 [20]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

(R), T, QT, RT, P, H, (CS), (A), S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,  
 Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, 3b, 3c, 3d
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	5a, 5b, 5c, 5d, 5e, 5a <sub>1</sub> , 5b <sub>1</sub> , 5c <sub>1</sub> , 5d <sub>1</sub> , 5e <sub>1</sub> , 5f, 5g, 5h, 5i
Installed TMI Lessons Learned Implementation Equipment Summary	<del>6a, 6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 5

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (~~has/has not~~) provided a response to the SER concerns.
- The Licensee (~~has/has not~~) specifically stated that the equipment is qualified and/or will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (~~has/has not~~) proposed a corrective action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (~~has/has not~~) been provided by the Licensee for this equipment item.
- Corrective action specified by the Licensee:
  - Equipment replacement with qualified equipment
  - Equipment modification
  - Equipment relocation above submergence level
  - Relocate or shield equipment from radiation source
  - Verify qualification by additional (testing/analysis)
  - Equipment relocation to a mild environment
  - Qualification testing of equipment in progress
  - Other ( \_\_\_\_\_ )
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (~~has/has not~~) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |   |                                |
|---|--------------------------------|
| I.a Qualified                             | II.c Qualified Life Deficiency |
| I.b Modification                          | III.a Exempt                   |
| <u>II.a Qualification Not Established</u> | III.b Not in Scope             |
| II.b Not Qualified                        | IV Documentation Not Available |



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 5

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
 X = DEFICIENCY

Documented Evidence of Qualification Adequate	<u>X</u>
Adequate Similarity Between Equipment and Test Specimen Established	<u>   </u>
Aging Degradation Evaluated Adequately	<u>X</u>
Qualified Life or Replacement Schedule Established (If Required)	<u>X</u>
Program Established to Identify Aging Degradation	<u>X</u>
Criteria Regarding Aging Simulation Satisfied (If Required)	<u>X</u>
Criteria Regarding Temperature/Pressure Exposure:	
o Peak Temperature Adequate	<u>   </u>
o Peak Pressure Adequate	<u>   </u>
o Duration Adequate	<u>   </u>
o Required Profile Enveloped Adequately	<u>   </u>
o Steam Exposure (If Required) Adequate	<u>   </u>
Criteria Regarding Spray Satisfied	<u>   </u>
Criteria Regarding Submergence Satisfied	<u>   </u>
Criteria Regarding Radiation Satisfied	<u>X</u>
Criteria Regarding Test Sequence Satisfied	<u>X</u>
Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied	<u>   </u>
Criteria Regarding Functional Testing Satisfied	<u>   </u>
Criteria Regarding Instrument Accuracy Satisfied	<u>   </u>
Test Duration Margin (1 hour + Function Time) Satisfied	<u>   </u>
Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I)	<u>   </u>

NRC QUALIFICATION CATEGORY

DESIGNATION:  
 X = CATEGORY

I.a	Equipment Qualified	<u>   </u>
I.b	Equipment Qualification Pending Modification	<u>   </u>
II.a	Equipment Qualification Not Established	<u>X</u>
II.b	Equipment Not Qualified	<u>   </u>
II.c	Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified	<u>   </u>
III.a	Equipment Exempt From Qualification	<u>   </u>
III.b	Equipment Not in the Scope of the Qualification Review	<u>   </u>
IV	Documentation Not Made Available	<u>   </u>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 5

LICENSEE RESPONSE TO NRC SER

4.2 Equipment Requiring Additional Information and/or Corrective Action  
 (Appendix B)

The bulk of master list equipment was placed in this category and our review of deficiencies is based upon the following:

- Deletion of deficient listed equipment due to replacement programs carried out and reported in our 90-day, Revision 3 response dated February 1, 1981.
- Re-evaluation of CP&L's updated submittals by NRC Region II, Atlanta, GA, and reported in Environmental Qualification of Safety-Related Electrical Equipment IEB 79-01B. Technical Evaluation Report - Docket No. 50-261; Plant: H. B. Robinson 2, dated November 6, 1980 and Revised November 11, 1980.

Telecons with NRC, Bethesda, MD reviewing personnel July 29, 1981, et al.

Equipment reported as qualified within NRC TER Revision 1, dated November 11, 1980:

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model No.</u>	<u>Location</u>
<del>1. pump motor</del>	<del>Westinghouse</del>	<del>506UPZ</del>	<del>outside</del>
2. motor operator	Limitorque	SMB-00	containment
A. Motor Operator	Limitorque	SMB-00	1 R,CS,A

<sup>A</sup> Items reported as qualified within NRC Region II revised TER, dated 11/7/80.

[20]



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 5

LICENSEE RESPONSE TO NRC SER

The items within Appendix B not fully covered by either TER classification or SCEWS's are as follows:

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model No.</u>	<u>Location</u>
Motor Operator	Limatorque	SMB-3	containment
Transmitter	Rosemount	1153A	containment
Level Switch	Madison	5602	containment
Silicon Rubber Tape	3M	Scotch 70	containment

The Limatorque motor operators of type SMB-3 are operators with motor brakes. Two are in the master list - V744A and V744B. These operators were required by Westinghouse to be upgraded to special service by Limatorque before installation. Data is in file denoting the requirements and certification that these operators were modified for their intended service. Under review is the currently available SB Model Limatorque Operators which perform similar function without a motor brake. When completed, a recommendation and disposition will be made to the NRC. At the present time, the installed SMB-3 operators are considered adequate for their service and qualified for their environment.

[20]





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 5

3.2.3 Motor-Operated Valves [5]

Within containment at H. B. Robinson four (4) motor operators are used for valve actuation for the listed equipment in this report. They are: V-744A and V-744B, Auxiliary Cooling System and V-866A and V-866B, Safety Injection System. They are Limitorque Models SMB-00 (V-866A,B) and SMB-3, with motor brake (V-744A,B). Torque motors for V-744A&B have been wound with Class H insulation. V-866A&B Torque motors and V-744A&B motor brakes are wound with Class B insulation. Model SMB-00 has a Peerless built torque motor and Model SMB-3 has a Reliance built torque motor. (R)

Qualification testing of Limitorque motor operators was performed by Franklin Institute Research Laboratories and the test reports included in Westinghouse WCAP 7410-L, Environmental Testing of Engineered Safety Features Related Equipment. Limitorque Model SMB-0s, with and without motor brake, and Class B and Class H insulation were used during the tests. The results are applicable to the Models SMB-00 and SMB-3 used at H. B. Robinson as differences are dimensional and in torque rating only.

The qualification testing performed by FIRL encompasses the temperature, pressure, relative humidity and chemical spray parameters for H. B. Robinson; therefore, the Limitorque motor operations within containment are considered qualified per these parameters for H. B. Robinson operation.

Of concern was motor brake operation due to the results of FIRL Final Report F-C2485-01, Tests of a Limitorque Valve Operator and Motor Brake Assembly, Both with Class B Insulation Under Simulated Reactor Containment Post Accident Steam and Chemical Environments. Failure of the motor brake with sub-

sequent valve operator failure was reported as occurring after seven (7) days within the test program. Performance prior to this time was recorded as satisfactory. Since the H. B. Robinson application of the motor brake, valve operator combination occurs within five (5) minutes after LOCA initiation, it is concluded that the intended function of this equipment will be met by the installed equipment; no further qualifying or changeout is planned.

Radiation exposure and aging tests are described within Westinghouse WCAP 7744, Environmental Testing of Engineered Safety Features Related Equipment. Total irradiation to  $2 \times 10^8$  RADS and a thermal aging equivalent to forty (40) years is reported. Support data for these tests are on request from from Westinghouse and will be made available for review when received.



Franklin Research Center  
A Division of The Franklin Institute  
20th and Race Streets. Phila., Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
FRC Project No. C5257  
FRC Assignment No. 13  
FRC Task No. 511

Page  
3d

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 5

Outside of containment for long-term accident mitigation are additional Limitorque motor valve operators which will be exposed to elevated radiation levels only. These are CVC-381, V-860A, V-860B, V-861A, V-861B, V-863A, V-863B, V-869. The Limitorque models used are SMB-00 and SMB-1. No motor brakes are associated with these operators. As stated previously, Westinghouse WCAP 7744 reports a test which achieved irradiation levels of  $2 \times 10^6$  RADS with no failures encountered. CP&L has requested copies of the test data from Westinghouse, and it will be made available upon receipt. No other accident environment parameters are experienced at this location; therefore, CP&L considers these motor valve operations qualified for their intended use and location.

| R2



Franklin Research Center  
A Division of The Franklin Institute  
20th and Race Streets, Phila., Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
FRC Project No. C5257  
FRC Assignment No. 13  
FRC Task No. 511

Page  
5

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 5

Checksheets 5a, 2 thru 5e, 2 have been removed due to the  
proprietary nature of information contained therein.



Franklin Research Center

A Division of The Franklin Institute

20th and Race Streets, Phila., Pa. 19103 (215) 448-1000

NFIC Contract No. NRC-03-79-118

FRC Project No. C5257

FRC Assignment No. 13

FRC Task No. 511

Page

5

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 5

Checksheets 5f thru 5i have been removed due to the proprietary nature of information contained therein.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 6

EQUIPMENT ITEM NO. 6  
 MOTORIZED VALVE ACTUATOR LOCATED IN THE CONTAINMENT, ELEV. 245'  
 LIMITORQUE MODEL SMB3 WITH RELIANCE MOTOR, CLASS H INSULATION; MOTOR BRAKE,  
 CLASS B INSULATION  
 REQUIRED OPERATING TIME: 5 MINUTES  
 TER CHECKSHEET NO. 6  
 LICENSEE REFERENCE(S): 637, 639  
 FUNCTION (PLANT ID): ACTUATES REACTOR CORE DELUGE VALVES (V-744A, B)  
 LICENSEE SUBMITTAL: SCEW(S): 9 OF 25 [20]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

(R) T, QT, RT, P, H, (CS), (A), S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,  
 Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, 3b, 3c, 3d
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	5a, 5b, 5c, 5d, 5e, 5a <sub>1</sub> , 5b <sub>1</sub> , 5c <sub>1</sub> , 5d <sub>1</sub> , 5e <sub>1</sub> 5f, 5g, 5h, 5i, 5j <del>6a, 6b</del>
Installed TMI Lessons Learned Implementation Equipment Summary	
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 6

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/~~has not~~) provided a response to the SER concerns.
- The Licensee (has/~~has not~~) specifically stated that the equipment is qualified and/~~or~~ will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/has not) proposed a corrective action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
- Corrective action specified by the Licensee:
  - Equipment replacement with qualified equipment
  - Equipment modification
  - Equipment relocation above submergence level
  - Relocate or shield equipment from radiation source
  - Verify qualification by additional (testing/analysis)
  - Equipment relocation to a mild environment
  - Qualification testing of equipment in progress
  - Other ( \_\_\_\_\_ )
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |   |                                |
|---|--------------------------------|
| I.a Qualified                             | II.c Qualified Life Deficiency |
| I.b Modification                          | III.a Exempt                   |
| <u>II.a Qualification Not Established</u> | III.b Not in Scope             |
| II.b Not Qualified                        | IV Documentation Not Available |



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 6

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
 X = DEFICIENCY

Documented Evidence of Qualification Adequate	<u>X</u>
Adequate Similarity Between Equipment and Test Specimen Established	<u>      </u>
Aging Degradation Evaluated Adequately	<u>X</u>
Qualified Life or Replacement Schedule Established (If Required)	<u>X</u>
Program Established to Identify Aging Degradation	<u>X</u>
Criteria Regarding Aging Simulation Satisfied (If Required)	<u>X</u>
Criteria Regarding Temperature/Pressure Exposure:	
o Peak Temperature Adequate	<u>      </u>
o Peak Pressure Adequate	<u>      </u>
o Duration Adequate	<u>      </u>
o Required Profile Enveloped Adequately	<u>      </u>
o Steam Exposure (If Required) Adequate	<u>      </u>
Criteria Regarding Spray Satisfied	<u>      </u>
Criteria Regarding Submergence Satisfied	<u>      </u>
Criteria Regarding Radiation Satisfied	<u>X</u>
Criteria Regarding Test Sequence Satisfied	<u>X</u>
Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied	<u>      </u>
Criteria Regarding Functional Testing Satisfied	<u>      </u>
Criteria Regarding Instrument Accuracy Satisfied	<u>      </u>
Test Duration Margin (1 hour + Function Time) Satisfied	<u>X</u>
Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I)	<u>      </u>

NRC QUALIFICATION CATEGORY

DESIGNATION:  
 X = CATEGORY

I.a	Equipment Qualified	<u>      </u>
I.b	Equipment Qualification Pending Modification	<u>      </u>
II.a	Equipment Qualification Not Established	<u>X</u>
II.b	Equipment Not Qualified	<u>      </u>
II.c	Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified	<u>      </u>
III.a	Equipment Exempt From Qualification	<u>      </u>
III.b	Equipment Not in the Scope of the Qualification Review	<u>      </u>
IV	Documentation Not Made Available	<u>      </u>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 6

LICENSEE RESPONSE TO NRC SER

4.2 Equipment Requiring Additional Information and/or Corrective Action  
(Appendix B)

The bulk of master list equipment was placed in this category and our review of deficiencies is based upon the following:

- Deletion of deficient listed equipment due to replacement programs carried out and reported in our 90-day, Revision 3 response dated February 1, 1981.
- Re-evaluation of CP&L's updated submittals by NRC Region II, Atlanta, GA, and reported in Environmental Qualification of Safety-Related Electrical Equipment IEB 79-01B. Technical Evaluation Report - Docket No. 50-261; Plant: H. B. Robinson 2, dated November 6, 1980 and Revised November 11, 1980.

Telecons with NRC, Bethesda, MD reviewing personnel July 29, 1981, et al.

A. Motor Operator      Limitorque      SMB-3      \*      1      R,CS,A

<sup>A</sup> Items reported as qualified within NRC Region II revised TER, dated 11/7/80.

[20]





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 6

LICENSEE RESPONSE TO NRC SER (Continued)

The items within Appendix B not fully covered by either TER classification or SCEWS's are as follows:

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model No.</u>	<u>Location</u>
Motor Operator	Limatorque	SMB-3	containment
Transmitter	Rosemount	1153A	containment
Level Switch	Madison	5602	containment
Silicon Rubber Tape	3M	Scotch 70	containment

The Limatorque motor operators of type SMB-3 are operators with motor brakes. Two are in the master list - V744A and V744B. These operators were required by Westinghouse to be upgraded to special service by Limatorque before installation. Data is in file denoting the requirements and certification that these operators were modified for their intended service. Under review is the currently available SB Model Limatorque Operators which perform similar function without a motor brake. When completed, a recommendation and disposition will be made to the NRC. At the present time, the installed SMB-3 operators are considered adequate for their service and qualified for their environment.

[20]



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 6

3.2.3 Motor-Operated Valves [15]

Within containment at H. B. Robinson four (4) motor operators are used for valve actuation for the listed equipment in this report. They are: V-744A and V-744B, Auxiliary Cooling System and V-866A and V-866B, Safety Injection System. They are Limitorque Models SMB-00 (V-866A,B) and SMB-3, with motor brake (V-744A,B). Torque motors for V-744A&B have been wound with Class H insulation. V-866A&B Torque motors and V-744A&B motor brakes are wound with Class B insulation. Model SMB-00 has a Peerless built torque motor and Model SMB-3 has a Reliance built torque motor. | R1

Qualification testing of Limitorque motor operators was performed by Franklin Institute Research Laboratories and the test reports included in Westinghouse WCAP 7410-L, Environmental Testing of Engineered Safety Features Related Equipment. Limitorque Model SMB-0s, with and without motor brake, and Class B and Class H insulation were used during the tests. The results are applicable to the Models SMB-00 and SMB-3 used at H. B. Robinson as differences are dimensional and in torque rating only.

The qualification testing performed by FIRL encompasses the temperature, pressure, relative humidity and chemical spray parameters for H. B. Robinson; therefore, the Limitorque motor operations within containment are considered qualified per these parameters for H. B. Robinson operation.

Of concern was motor brake operation due to the results of FIRL Final Report F-C2485-01, Tests of a Limitorque Valve Operator and Motor Brake Assembly, Both with Class B Insulation Under Simulated Reactor Containment Post Accident Steam and Chemical Environments. Failure of the motor brake with sub-

sequent valve operator failure was reported as occurring after seven (7) days within the test program. Performance prior to this time was recorded as satisfactory. Since the H. B. Robinson application of the motor brake, valve operator combination occurs within five (5) minutes after LOCA initiation, it is concluded that the intended function of this equipment will be met by the installed equipment; no further qualifying or changeout is planned.

Radiation exposure and aging tests are described within Westinghouse WCAP 7744, Environmental Testing of Engineered Safety Features Related Equipment. Total irradiation to  $2 \times 10^8$  RADS and a thermal aging equivalent to forty (40) years is reported. Support data for these tests are on request from from Westinghouse and will be made available for review when received.



Franklin Research Center  
A Division of The Franklin Institute  
20th and Race Streets. Phila., Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
FRC Project No. C5257  
FRC Assignment No. 13  
FRC Task No. 511

Page  
3d

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 6

Outside of containment for long-term accident mitigation are additional Limitorque motor valve operators which will be exposed to elevated radiation levels only. These are CVC-381, V-860A, V-860B, V-861A, V-861B, V-863A, V-863B, V-869. The Limitorque models used are SMB-00 and SMB-1. No motor brakes are associated with these operators. As stated previously, Westinghouse WCAP 7744 reports a test which achieved irradiation levels of  $2 \times 10^8$  RADS with no failures encountered. CP&L has requested copies of the test data from Westinghouse, and it will be made available upon receipt. No other accident environment parameters are experienced at this location; therefore, CP&L considers these motor valve operations qualified for their intended use and location. ELSD

R2



Franklin Research Center  
A Division of The Franklin Institute  
20th and Race Streets. Phila., Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
FRC Project No. C5257  
FRC Assignment No. 13  
FRC Task No. 511

Page  
5

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 6

Checksheets 5a<sub>12</sub> thru 5e<sub>12</sub> have been removed due to the  
proprietary nature of information contained therein.



Franklin Research Center  
A Division of The Franklin Institute  
20th and Race Streets, Phila., Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
FRC Project No. C5257  
FRC Assignment No. 13  
FRC Task No. 511

Page  
**5**

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 6

Checksheets 5A thru 5J have been removed due to the  
proprietary nature of information contained therein.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 7

EQUIPMENT ITEM NO. 7  
 MOTORIZED VALVE ACTUATOR LOCATED IN THE REACTOR AUXILIARY BLDG.  
 LIMITORQUE MODEL SMB00  
 REQUIRED OPERATING TIME: NOT STATED  
 TER CHECKSHEET NO. 7  
 LICENSEE REFERENCE(S): 637, 639  
 FUNCTION (PLANT ID): ACTUATES HOT LEG INJECTION BORON INJECTION VALVE (V869)  
 LICENSEE SUBMITTAL: SCEW(S): 7 OF 25 [20]  
 FUNCTION (PLANT ID): ACTUATES RHR DISCHARGE TO SI SPRAY SYSTEM VALVES  
 (V863A, B)  
 LICENSEE SUBMITTAL: SCEW(S): 12 OF 25 [20]  
 FUNCTION (PLANT ID): ACTUATES REACTOR COOLANT PUMP SEAL WATER RETURN VALVE  
 (CVC-381)  
 LICENSEE SUBMITTAL: SCEW(S): 23 OF 25 [20]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

(R), T, QI, (RT), P, H, CS, (A), S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,

Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, 3b, 3c, <del>3d</del>
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	<del>5a, 5b, 5c, 5d, 5e, 5f,</del> 5g, 5h, <del>5i, 5j</del>
Installed TMI Lessons Learned Implementation Equipment Summary	<del>6a, 6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 7

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/~~has not~~) provided a response to the SER concerns.
- The Licensee (has/~~has not~~) specifically stated that the equipment is qualified and/or will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/has not) proposed a corrective action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
- Corrective action specified by the Licensee:
  - Equipment replacement with qualified equipment
  - Equipment modification
  - Equipment relocation above submergence level
  - Relocate or shield equipment from radiation source
  - Verify qualification by additional (testing/analysis)
  - Equipment relocation to a mild environment
  - Qualification testing of equipment in progress
  - Other ( \_\_\_\_\_ )
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |   |                                |
|---|--------------------------------|
| I.a Qualified                             | II.c Qualified Life Deficiency |
| I.b Modification                          | III.a Exempt                   |
| <b>II.a Qualification Not Established</b> | III.b Not in Scope             |
| II.b Not Qualified                        | IV Documentation Not Available |



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 7

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
X = DEFICIENCY

Documented Evidence of Qualification Adequate	<u>X</u>
Adequate Similarity Between Equipment and Test Specimen Established	<u>X</u>
Aging Degradation Evaluated Adequately	<u>X</u>
Qualified Life or Replacement Schedule Established (If Required)	<u>X</u>
Program Established to Identify Aging Degradation	<u>X</u>
Criteria Regarding Aging Simulation Satisfied (If Required)	<u>      </u>
Criteria Regarding Temperature/Pressure Exposure:	
o Peak Temperature Adequate	<u>      </u>
o Peak Pressure Adequate	<u>      </u>
o Duration Adequate	<u>      </u>
o Required Profile Enveloped Adequately	<u>      </u>
o Steam Exposure (If Required) Adequate	<u>      </u>
Criteria Regarding Spray Satisfied	<u>      </u>
Criteria Regarding Submergence Satisfied	<u>      </u>
Criteria Regarding Radiation Satisfied	<u>      </u>
Criteria Regarding Test Sequence Satisfied	<u>      </u>
Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied	<u>      </u>
Criteria Regarding Functional Testing Satisfied	<u>      </u>
Criteria Regarding Instrument Accuracy Satisfied	<u>      </u>
Test Duration Margin (1 hour + Function Time) Satisfied	<u>      </u>
Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I)	<u>      </u>

NRC QUALIFICATION CATEGORY

DESIGNATION:  
X = CATEGORY

I.a	Equipment Qualified	<u>      </u>
I.b	Equipment Qualification Pending Modification	<u>      </u>
II.a	Equipment Qualification Not Established	<u>X</u>
II.b	Equipment Not Qualified	<u>      </u>
II.c	Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified	<u>      </u>
III.a	Equipment Exempt From Qualification	<u>      </u>
III.b	Equipment Not in the Scope of the Qualification Review	<u>      </u>
IV	Documentation Not Made Available	<u>      </u>





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 7

LICENSEE RESPONSE TO NRC SER

4.2 Equipment Requiring Additional Information and/or Corrective Action  
(Appendix 2)

The bulk of master list equipment was placed in this category and our review of deficiencies is based upon the following:

- Deletion of deficient listed equipment due to replacement programs carried out and reported in our 90-day, Revision 3 response dated February 1, 1981.
- Re-evaluation of CP&L's updated submittals by NRC Region II, Atlanta, GA, and reported in Environmental Qualification of Safety-Related Electrical Equipment IEB 79-01B. Technical Evaluation Report - Docket No. 50-261; Plant: H. B. Robinson 2, dated November 6, 1980 and Revised November 11, 1980.

Telecons with NRC, Bethesda, MD reviewing personnel July 29, 1981, et al.

Equipment reported as qualified within NRC TER Revision 1, dated November 11, 1980:

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model No.</u>	<u>Location</u>
1. pump motor	Westinghouse	506UPZ	outside containment
2. motor operator	Limitorque	SMB-00	containment
3. motor operator	Limitorque	SMB-00	outside containment

A. Motor Operator      Limitorque      SMB-00      2      R,RT,A

<sup>A</sup> Items reported as qualified within NRC Region II revised TER, dated 11/7/80.

[20]



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 7

Motor-Operated Valves [15]

Within containment at H. B. Robinson four (4) motor operators are used for valve actuation for the listed equipment in this report. They are: V-744A and V-744B, Auxiliary Cooling System and V-866A and V-866B, Safety Injection System. They are Limitorque Models SMB-00 (V-866A,B) and SMB-3, with motor brake (V-744A,B). Torque motors for V-744A&B have been wound with Class H insulation. V-866A&B Torque motors and V-744A&B motor brakes are wound with Class B insulation. Model SMB-00 has a Peerless built torque motor and Model SMB-3 has a Reliance built torque motor. | R1

Qualification testing of Limitorque motor operators was performed by Franklin Institute Research Laboratories and the test reports included in Westinghouse WCAP 7410-L, Environmental Testing of Engineered Safety Features Related Equipment. Limitorque Model SMB-0s, with and without motor brake, and Class B and Class H insulation were used during the tests. The results are applicable to the Models SMB-00 and SMB-3 used at H. B. Robinson as differences are dimensional and in torque rating only.

The qualification testing performed by FIRL encompasses the temperature, pressure, relative humidity and chemical spray parameters for H. B. Robinson; therefore, the Limitorque motor operations within containment are considered qualified per these parameters for H. B. Robinson operation.

Of concern was motor brake operation due to the results of FIRL Final Report F-C2485-01, Tests of a Limitorque Valve Operator and Motor Brake Assembly, Both with Class B Insulation Under Simulated Reactor Containment Post Accident Steam and Chemical Environments. Failure of the motor brake with sub-

sequent valve operator failure was reported as occurring after seven (7) days within the test program. Performance prior to this time was recorded as satisfactory. Since the H. B. Robinson application of the motor brake, valve operator combination occurs within five (5) minutes after LOCA initiation, it is concluded that the intended function of this equipment will be met by the installed equipment; no further qualifying or changeout is planned.

Radiation exposure and aging tests are described within Westinghouse WCAP 7744, Environmental Testing of Engineered Safety Features Related Equipment. Total irradiation to  $2 \times 10^8$  RADS and a thermal aging equivalent to forty (40) years is reported. Support data for these tests are on request from from Westinghouse and will be made available for review when received.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 7

Outside of containment for long-term accident mitigation are additional Limitorque motor valve operators which will be exposed to elevated radiation levels only. These are CVC-381, V-860A, V-860B, V-861A, V-861B, V-863A, V-863B, V-869. The Limitorque models used are SMB-00 and SMB-1. No motor brakes are associated with these operators. As stated previously, Westinghouse WCAP 7744 reports a test which achieved irradiation levels of  $2 \times 10^8$  RADS with no failures encountered. CP&L has requested copies of the test data from Westinghouse, and it will be made available upon receipt. No other accident environment parameters are experienced at this location; therefore, CP&L considers these motor valve operations qualified for their intended use and location. (15)

| R2



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 7

NOTES:

1. The Licensee has cited PGR #637, WCAP-7744, as evidence of qualification for thermal aging and radiation. These tests were performed on half coil sections and not on similar equipment to that installed in the plant. Sufficient data is not available in PGR #637 to justify the claim of a 40 year qualified life. The Licensee has not provided an analysis which addresses any deviations between the installed motors and the tested equipment. Section 5.2.2 of the DOR Guidelines states,

"2. Test Specimen - The test specimen should be the same model as the equipment being qualified. The type test should only be considered valid for equipment identical in design and material construction to the test specimen. Any deviations should be evaluated as part of the qualification documentation (see also Section 8.0 below)."

2. PGR #662, Limiting Report B0003, can be used to support the radiation qualification, as well as other environmental parameters. The Licensee should investigate with the manufacturer the applicability of this report to



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 7

NOTES:

The installed equipment.

3. PGR #637 states that Thermal aging times of 25,000 hours were used in testing the motor insulation. No aging temperature has been stated. Also, the class of insulation is not mentioned, only the tradename is used. This tradename can apply to several classes of insulation. The Licensee should investigate with the manufacturer the information noted above and calculate a conservative qualified life estimate.
4. This equipment is assigned to NRC Category II.a



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 8

EQUIPMENT ITEM NO. 8  
 MOTORIZED VALVE ACTUATOR LOCATED IN THE REACTOR AUXILIARY BLDG.  
 LIMITORQUE MODEL SMB1  
 REQUIRED OPERATING TIME: NOT STATED  
 TER CHECKSHEET NO. 8  
 LICENSEE REFERENCE(S): 637, 639  
 FUNCTION (PLANT ID): ACTUATES CV SUMP TO RHR SUCTION VALVES (V860A, B)  
 LICENSEE SUBMITTAL: SCEW(S): 10 OF 25 [20]  
 FUNCTION (PLANT ID): ACTUATES CV SUMP TO RHR SUCTION VALVES (V861A, B)  
 LICENSEE SUBMITTAL: SCEW(S): 11 OF 25 [20]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

(R) T, QT, (RT) P, H, CS, (A) S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,

Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, 3b, 3c, <del>3d</del>
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	<del>5a, 5b, 5c, 5d, 5e, 5f,</del> 5g, 5h, <del>5i, 5j</del>
Installed TMI Lessons Learned Implementation Equipment Summary	<del>6a, 6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 8

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

The Licensee (has/~~has not~~) provided a response to the SER concerns.

The Licensee (has/~~has not~~) specifically stated that the equipment is qualified and/or will function when exposed to the applicable DBE environmental service conditions.

The Licensee has presented information which shows there are no outstanding qualification deficiencies.

The Licensee (has/has not) proposed a corrective action for this equipment item whose qualification has not been fully established.

Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.

Corrective action specified by the Licensee:

- Equipment replacement with qualified equipment
- Equipment modification
- Equipment relocation above submergence level
- Relocate or shield equipment from radiation source
- Verify qualification by additional (testing/analysis)
- Equipment relocation to a mild environment
- Qualification testing of equipment in progress
- Other ( \_\_\_\_\_ )

The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.

The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)

The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW

- CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

I.a Qualified

I.b Modification

II.a Qualification Not Established

II.b Not Qualified

II.c Qualified Life Deficiency

III.a Exempt

III.b Not in Scope

IV Documentation Not Available



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 8

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
X = DEFICIENCY

Documented Evidence of Qualification Adequate	<u>X</u>
Adequate Similarity Between Equipment and Test Specimen Established	<u>X</u>
Aging Degradation Evaluated Adequately	<u>X</u>
Qualified Life or Replacement Schedule Established (If Required)	<u>X</u>
Program Established to Identify Aging Degradation	<u>X</u>
Criteria Regarding Aging Simulation Satisfied (If Required)	<u>    </u>
Criteria Regarding Temperature/Pressure Exposure:	<u>    </u>
o Peak Temperature Adequate	<u>    </u>
o Peak Pressure Adequate	<u>    </u>
o Duration Adequate	<u>    </u>
o Required Profile Enveloped Adequately	<u>    </u>
o Steam Exposure (If Required) Adequate	<u>    </u>
Criteria Regarding Spray Satisfied	<u>    </u>
Criteria Regarding Submergence Satisfied	<u>    </u>
Criteria Regarding Radiation Satisfied	<u>    </u>
Criteria Regarding Test Sequence Satisfied	<u>    </u>
Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied	<u>    </u>
Criteria Regarding Functional Testing Satisfied	<u>    </u>
Criteria Regarding Instrument Accuracy Satisfied	<u>    </u>
Test Duration Margin (1 hour + Function Time) Satisfied	<u>    </u>
Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I)	<u>    </u>

NRC QUALIFICATION CATEGORY

DESIGNATION:  
X = CATEGORY

I.a	Equipment Qualified	<u>    </u>
I.b	Equipment Qualification Pending Modification	<u>    </u>
II.a	Equipment Qualification Not Established	<u>X</u>
II.b	Equipment Not Qualified	<u>    </u>
II.c	Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified	<u>    </u>
III.a	Equipment Exempt From Qualification	<u>    </u>
III.b	Equipment Not in the Scope of the Qualification Review	<u>    </u>
IV	Documentation Not Made Available	<u>    </u>





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 8

LICENSEE RESPONSE TO NRC SER

4.2 Equipment Requiring Additional Information and/or Corrective Action  
(Appendix B)

The bulk of master list equipment was placed in this category and our review of deficiencies is based upon the following:

- Deletion of deficient listed equipment due to replacement programs carried out and reported in our 90-day, Revision 3 response dated February 1, 1981.
- Re-evaluation of CP&L's updated submittals by NRC Region II, Atlanta, GA, and reported in Environmental Qualification of Safety-Related Electrical Equipment IEB 79-01B. Technical Evaluation Report - Docket No. 50-261; Plant: H. B. Robinson 2, dated November 6, 1980 and Revised November 11, 1980.

Telecons with NRC, Bethesda, MD reviewing personnel July 29, 1981, et al.

Equipment reported as qualified within NRC TER Revision 1, dated November 11, 1980:

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model No.</u>	<u>Location</u>
1. pump motor	Westinghouse	506UPZ	outside containment
2. motor operator	Limitorque	SMB-00	containment
3. motor operator	Limitorque	SMB-00	outside containment
4. motor operator	Limitorque	SMB-1	outside containment

A. Motor Operator      Limitorque      SMB-1      2      R,RT,A

<sup>A</sup> Items reported as qualified within NRC Region II revised TER, dated 11/7/80.

[20]



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 8

Motor-Operated Valves [15]

Within containment at H. B. Robinson four (4) motor operators are used for valve actuation for the listed equipment in this report. They are: V-744A and V-744B, Auxiliary Cooling System and V-866A and V-866B, Safety Injection System. They are Limitorque Models SMB-00 (V-866A,B) and SMB-3, with motor brake (V-744A,B). Torque motors for V-744A&B have been wound with Class H insulation. V-866A&B Torque motors and V-744A&B motor brakes are wound with Class B insulation. Model SMB-00 has a Peerless built torque motor and Model SMB-3 has a Reliance built torque motor.

Qualification testing of Limitorque motor operators was performed by Franklin Institute Research Laboratories and the test reports included in Westinghouse WCAP 7410-L, Environmental Testing of Engineered Safety Features Related Equipment. Limitorque Model SMB-0s, with and without motor brake, and Class B and Class H insulation were used during the tests. The results are applicable to the Models SMB-00 and SMB-3 used at H. B. Robinson as differences are dimensional and in torque rating only.

The qualification testing performed by FIRL encompasses the temperature, pressure, relative humidity and chemical spray parameters for H. B. Robinson; therefore, the Limitorque motor operations within containment are considered qualified per these parameters for H. B. Robinson operation.

Of concern was motor brake operation due to the results of FIRL Final Report F-C2485-01, Tests of a Limitorque Valve Operator and Motor Brake Assembly, Both with Class B Insulation Under Simulated Reactor Containment Post Accident Steam and Chemical Environments. Failure of the motor brake with subsequent valve operator failure was reported as occurring after seven (7) days within the test program. Performance prior to this time was recorded as satisfactory. Since the H. B. Robinson application of the motor brake, valve operator combination occurs within five (5) minutes after LOCA initiation, it is concluded that the intended function of this equipment will be met by the installed equipment; no further qualifying or changeout is planned.

Radiation exposure and aging tests are described within Westinghouse WCAP 7744, Environmental Testing of Engineered Safety Features Related Equipment. Total irradiation to  $2 \times 10^6$  RADS and a thermal aging equivalent to forty (40) years is reported. Support data for these tests are on request from from Westinghouse and will be made available for review when received.



Franklin Research Center  
A Division of The Franklin Institute  
20th and Race Streets. Phila., Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
FRC Project No. C5257  
FRC Assignment No. 13  
FRC Task No. 511

Page  
3c

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 8

Outside of containment for long-term accident mitigation are additional Limitorque motor valve operators which will be exposed to elevated radiation levels only. These are CVC-381, V-860A, V-860B, V-861A, V-861B, V-863A, V-863B, V-869. The Limitorque models used are SMB-00 and SMB-1. No motor brakes are associated with these operators. As stated previously, Westinghouse WCAP 7744 reports a test which achieved irradiation levels of  $2 \times 10^5$  RADS with no failures encountered. CP&L has requested copies of the test data from Westinghouse, and it will be made available upon receipt. No other accident environment parameters are experienced at this location; therefore, CP&L considers these motor valve operations qualified for their intended use and location. [15]



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 8

NOTES:

1. The Licensee has cited PGR #637, WCAP-7744, as evidence of qualification for Thermal aging and radiation. These tests were performed on half coil sections and not on similar equipment to that installed. Sufficient data is not available in PGR #637 to justify the claim of a 40 year qualified life. The Licensee has not provided an analysis which addresses any deviations between the installed motors and the tested equipment. Section 5.2.2 of The DOR Guidelines states,

"2. Test Specimen - The test specimen should be the same model as the equipment being qualified. The type test should only be considered valid for equipment identical in design and material construction to the test specimen. Any deviations should be evaluated as part of the qualification documentation (see also Section 8.0 below)."

2. PGR #662, Limit torque Report BΦΦΦ3, can be used to support the radiation claims, <sup>as well as other environmental parameters,</sup> The Licensee should investigate with the manufacturer the applicability of this report to the installed equipment.

3. PGR #637 states <sup>Thermal</sup> aging times of 25, ΦΦΦ hours were used when aging the coils,



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 8

NOTES:

but no temperature is mentioned. Also  
The class of insulation is not mentioned,  
only the trade-name is used. This  
tradename can apply to several classes of  
insulation. The Licensee should investigate  
with the manufacturer. The information  
noted above and then calculate a conser-  
vative qualified life estimate.

4. This equipment is assigned to NRC  
Category II.a



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 9

EQUIPMENT ITEM NO. 9  
 FLOW TRANSMITTER LOCATED IN THE REACTOR AUXILIARY BLDG.  
 FISCHER AND PORTER MODEL 10B2496PBBABBB  
 REQUIRED OPERATING TIME: 30 DAYS  
 TER CHECKSHEET NO. 9  
 LICENSEE REFERENCE(S): 637, 639  
 FUNCTION (PLANT ID): MONITORS SAFETY INJECTION HEADER HOT LEG FLOW (FT-940)  
 LICENSEE SUBMITTAL: SCEW(S): 1 OF 25 [20]  
 FUNCTION (PLANT ID): MONITORS SAFETY INJECTION HEADER HOT LEG FLOW (FT-943)  
 LICENSEE SUBMITTAL: SCEW(S): 2 OF 25 [20]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

(R), T, (QT), RT, P, H, CS, (A), S, (R), M, I, (QM), RPN, EXN, SEN, QI, RPS, None,  
 Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, 3b, 3c, <del>3d</del>
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	5a, 5b, <del>5c</del> , 5d, <del>5e</del> , 5f, 5g, 5h, <del>5i, 5j</del>
Installed TMI Lessons Learned Implementation Equipment Summary	<del>6a, 6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 2

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/~~has not~~) provided a response to the SER concerns.
- The Licensee (has/~~has not~~) specifically stated that the equipment is qualified and/or will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/has not) proposed a corrective action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
- Corrective action specified by the Licensee:
  - Equipment replacement with qualified equipment
  - Equipment modification
  - Equipment relocation above submergence level
  - Relocate or shield equipment from radiation source
  - Verify qualification by additional (testing/analysis)
  - Equipment relocation to a mild environment
  - Qualification testing of equipment in progress
  - Other ( \_\_\_\_\_ )
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |   |                                |
|---|--------------------------------|
| I.a Qualified                             | II.c Qualified Life Deficiency |
| I.b Modification                          | III.a Exempt                   |
| <u>II.a</u> Qualification Not Established | III.b Not in Scope             |
| II.b Not Qualified                        | IV Documentation Not Available |



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 9

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
 X = DEFICIENCY

Documented Evidence of Qualification Adequate	_____
Adequate Similarity Between Equipment and Test Specimen Established	_____X
Aging Degradation Evaluated Adequately	_____X
Qualified Life or Replacement Schedule Established (If Required)	_____X
Program Established to Identify Aging Degradation	_____
Criteria Regarding Aging Simulation Satisfied (If Required)	_____
Criteria Regarding Temperature/Pressure Exposure:	
o Peak Temperature Adequate	_____
o Peak Pressure Adequate	_____
o Duration Adequate	_____
o Required Profile Enveloped Adequately	_____
o Steam Exposure (If Required) Adequate	_____
Criteria Regarding Spray Satisfied	_____
Criteria Regarding Submergence Satisfied	_____
Criteria Regarding Radiation Satisfied	_____
Criteria Regarding Test Sequence Satisfied	_____
Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied	_____
Criteria Regarding Functional Testing Satisfied	_____
Criteria Regarding Instrument Accuracy Satisfied	_____X
Test Duration Margin (1 hour + Function Time) Satisfied	_____
Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I)	_____

NRC QUALIFICATION CATEGORY

DESIGNATION:  
 X = CATEGORY

I.a	Equipment Qualified	_____
I.b	Equipment Qualification Pending Modification	_____
II.a	Equipment Qualification Not Established	_____X
II.b	Equipment Not Qualified	_____
II.c	Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified	_____
III.a	Equipment Exempt From Qualification	_____
III.b	Equipment Not in the Scope of the Qualification Review	_____
IV	Documentation Not Made Available	_____





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 9

LICENSEE RESPONSE TO NRC SER

4.2 Equipment Requiring Additional Information and/or Corrective Action  
 (Appendix B)

The bulk of master list equipment was placed in this category and our review of deficiencies is based upon the following:

- Deletion of deficient listed equipment due to replacement programs carried out and reported in our 90-day, Revision 3 response dated February 1, 1981.
- Re-evaluation of CP&L's updated submittals by NRC Region II, Atlanta, GA, and reported in Environmental Qualification of Safety-Related Electrical Equipment IEB 79-01B. Technical Evaluation Report - Docket No. 50-261; Plant: H. B. Robinson 2, dated November 6, 1980 and Revised November 11, 1980.

Telecons with NRC, Bethesda, MD reviewing personnel July 29, 1981, et al.

Equipment reported as qualified within NRC TER Revision 1, dated November 11, 1980:

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model No.</u>	<u>Location</u>
1. pump motor	Westinghouse	506UPZ	outside containment
2. motor operator	Limitorque	SMB-00	containment
3. motor operator	Limitorque	SMB-00	outside containment
4. motor operator	Limitorque	SMB-1	outside containment
5. flow transmitter	Fisher & Porter	10B2496 PBBABBB	outside containment

A. Flow Transmitter Fischer & Porter 1082496P88A888 2 R,QT,A,QM

<sup>A</sup> Items reported as qualified within NRC Region II revised TER, dated 11/7/80.

Submergence of equipment outside of containment will also be studied. New modification of Auxiliary Building areas due to fire protection requirements need to be evaluated to establish drain paths and/or water accumulations. Existing reports indicate no detrimental water buildups due to HELB or small pipe breaks, but they do not account for building modification performed in recent months. A report on submergence of safety-related electrical equipment within harsh environment areas in the Auxiliary Building will be completed and submitted by the date established by the NRC for completion of qualification of safety-related electrical equipment. [20]



Franklin Research Center  
A Division of The Franklin Institute  
20th and Race Streets, Phila., Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
FRC Project No. C5257  
FRC Assignment No. 13  
FRC Task No. 511

Page  
3b

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 2

LICENSEE RESPONSE TO NRC SER (Continued)

Electronic Transmitters [15]

H. B. Robinson's original design and specification called for installation and use of Fisher and Porter electronic transmitter for the measurement of Pressure, Level and Flow parameters. As stated within CP&L response to NRC IE Bulletin 79-01 and the 45-day response to NRC IE Bulletin 79-01B CP&L preference, to obtain better operation and maintenance performance, is to change out the existing transmitters within containment--to be replaced by Rosemounts' Model No. 1153A.

Environmental tests performed on Fisher & Porter's transmitters (Model No. 10B2496) indicate failure occurs during the high temperature, steam/chemical spray testing stage while attempting to qualify to IEEE 323-1971 parameters. (Reference WCAP 9157 Environmental Qualification of Safety-Related Class IE Process Instrumentation).



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 9

For long-term accident mitigation, Fisher & Porter transmitters, Model Nos. 10B2496 and 50EP1041, located within the Reactor Auxiliary Building are used. Transmitter identification numbers are FT-940, FT-943, PT-934, PT-940 and PT-943. As these transmitters are not exposed to the LOCA accident environment, but will see the elevated radiation levels associated with reactor coolant recirculation, qualification is limited to their radiation withstand capability.

As previously stated, Fisher & Porter 10B2496 transmitters had failed environmental testing per IEEE 323-1971 requirements and reported in WCAP 9157. Failure occurred within six (6) minutes of operation when in the high temperature/high pressure/spray testing environment (Table A-7, WCAP 9157). It is noted, though, and stated, that the "trip" function time of operation for the transmitters was accomplished. This portion of the test program is not relevant to H. B. Robinson use of the listed Fisher & Porter transmitters as they are not within containment and, therefore, not required to function under the harsh environmental conditions which caused test failure. Within the same report, it is stated that Fisher & Porter transmitters had successfully operated during and after irradiation testing (Table A-6, WCAP 9157). As only a total radiation level of  $4 \times 10^4$  RADs were achieved, additional qualification was required to meet the radiation requirements established in Table 1.3.3.

R2

Westinghouse WCAP 7744, Environmental Testing of Engineered Safety Features Related Equipment states that transmitters, identified by Westinghouse as Fisher & Porter, Model 10B2496, had been successfully tested to a level of  $2.0 \times 10^6$  RADs. As the listed Fisher & Porter transmitters are exposed to a  $1.1 \times 10^6$  RAD level, they are considered qualified for the application and functions stated within this report. To further identify the transmitters in use at H. B. Robinson with those tested, Westinghouse has stated that instruments used were ordered as NS (nonstandard) from Fisher & Porter. Check of purchase order and manufacturer's fabrication instructions show that the listed H. B. Robinson Fisher & Porter transmitters were supplied as NS (nonstandard).

Westinghouse has been requested to supply the specific data and/or reports associated with the testing program, and it will be available for review after receipt. [15]



Franklin Research Center

A Division of The Franklin Institute

20th and Race Streets, Phila., Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118

FRC Project No. C5257

FRC Assignment No. 13

FRC Task No. 511

Page

5

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 2

Checksheets 5a, 5b, 5c, 5d thru 5h have been removed due to the proprietary nature of information contained therein.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 10

EQUIPMENT ITEM NO. 10  
 PRESSURE TRANSMITTER LOCATED IN THE REACTOR AUXILIARY BLDG.  
 FISCHER AND PORTER MODEL 50EP1041BCXA  
 REQUIRED OPERATING TIME: 30 DAYS  
 TER CHECKSHEET NO. 10  
 LICENSEE REFERENCE(S): 637, 639  
 FUNCTION (PLANT ID): BORON INJECTION TANK HEADER PRESSURE (PT-934)  
 LICENSEE SUBMITTAL: SCEW(S): 3 OF 25 [20]  
 FUNCTION (PLANT ID): SAFETY INJECTION TANK HEADER PRESSURE (PT-943)  
 LICENSEE SUBMITTAL: SCEW(S): 5 OF 25 [20]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

(R), T, (QT), RT, P, H, CS, (A), S, (R), M, I, (QM), RPN, EXN, SEN, QI, RPS, None,  
 Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, 3b, 3c, <del>3d</del>
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	<del>5a, 5b, 5c, 5d, 5e, 5f,</del> 5g, 5h, 5i, 5j
Installed TMI Lessons Learned Implementation Equipment Summary	<del>6a, 6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



**EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 10**

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/~~has not~~) provided a response to the SER concerns.
- The Licensee (has/~~has not~~) specifically stated that the equipment is qualified and ~~or~~ will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/has not) proposed a corrective action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
- Corrective action specified by the Licensee:
  - Equipment replacement with qualified equipment
  - Equipment modification
  - Equipment relocation above submergence level
  - Relocate or shield equipment from radiation source
  - Verify qualification by additional (testing/analysis)
  - Equipment relocation to a mild environment
  - Qualification testing of equipment in progress
  - Other ( \_\_\_\_\_ )
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |   |                                |
|---|--------------------------------|
| I.a Qualified                             | II.c Qualified Life Deficiency |
| I.b Modification                          | III.a Exempt                   |
| <u>II.a</u> Qualification Not Established | III.b Not in Scope             |
| II.b Not Qualified                        | IV Documentation Not Available |



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 10

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
X = DEFICIENCY

Documented Evidence of Qualification Adequate	_____
Adequate Similarity Between Equipment and Test Specimen Established	<u>X</u> _____
Aging Degradation Evaluated Adequately	<u>X</u> _____
Qualified Life or Replacement Schedule Established (If Required)	<u>X</u> _____
Program Established to Identify Aging Degradation	_____
Criteria Regarding Aging Simulation Satisfied (If Required)	_____
Criteria Regarding Temperature/Pressure Exposure:	
o Peak Temperature Adequate	_____
o Peak Pressure Adequate	_____
o Duration Adequate	_____
o Required Profile Enveloped Adequately	_____
o Steam Exposure (If Required) Adequate	_____
Criteria Regarding Spray Satisfied	_____
Criteria Regarding Submergence Satisfied	_____
Criteria Regarding Radiation Satisfied	_____
Criteria Regarding Test Sequence Satisfied	_____
Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied	_____
Criteria Regarding Functional Testing Satisfied	_____
Criteria Regarding Instrument Accuracy Satisfied	<u>X</u> _____
Test Duration Margin (1 hour + Function Time) Satisfied	_____
Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I)	_____

NRC QUALIFICATION CATEGORY

DESIGNATION:  
X = CATEGORY

I.a	Equipment Qualified	_____
I.b	Equipment Qualification Pending Modification	_____
II.a	Equipment Qualification Not Established	<u>X</u> _____
II.b	Equipment Not Qualified	_____
II.c	Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified	_____
III.a	Equipment Exempt From Qualification	_____
III.b	Equipment Not in the Scope of the Qualification Review	_____
IV	Documentation Not Made Available	_____

*For full evaluation, see equipment item 9*



**EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 10**

LICENSEE RESPONSE TO NRC SER

4.2 Equipment Requiring Additional Information and/or Corrective Action  
(Appendix B)

The bulk of master list equipment was placed in this category and our review of deficiencies is based upon the following:

- Deletion of deficient listed equipment due to replacement programs carried out and reported in our 90-day, Revision 3 response dated February 1, 1981.
- Re-evaluation of CP&L's updated submittals by NRC Region II, Atlanta, GA, and reported in Environmental Qualification of Safety-Related Electrical Equipment IEB 79-01B. Technical Evaluation Report - Docket No. 50-261; Plant: H. B. Robinson 2, dated November 6, 1980 and Revised November 11, 1980.

Telecons with NRC, Bethesda, MD reviewing personnel July 29, 1981, et al.

Equipment reported as qualified within NRC TER Revision 1, dated November 11, 1980:

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model No.</u>	<u>Location</u>
1. pump motor	Westinghouse	506UPZ	outside containment
2. motor operator	Limitorque	SMB-00	containment
3. motor operator	Limitorque	SMB-00	outside containment
4. motor operator	Limitorque	SMB-1	outside containment
5. flow transmitter	Fisher & Porter	10B2496 PBBABBB	outside containment
6. pressure transmitter	Fisher & Porter	50EP1041 BCXA	outside containment
A. Pressure Transmitter	Fischer & Porter	50EP1041BCXA	2 R,QT,A,QM

<sup>A</sup> Items reported as qualified within NRC Region II revised TER, dated 11/7/80.

[20]





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 10

LICENSEE RESPONSE TO NRC SER (Continued)

Submergence of equipment outside of containment will also be studied. New modification of Auxiliary Building areas due to fire protection requirements need to be evaluated to establish drain paths and/or water accumulations. Existing reports indicate no detrimental water buildups due to HELB or small pipe breaks, but they do not account for building modification performed in recent months. A report on submergence of safety-related electrical equipment within harsh environment areas in the Auxiliary Building will be completed and submitted by the date established by the NRC for completion of qualification of safety-related electrical equipment. [20]

Electronic Transmitters [15]

H. B. Robinson's original design and specification called for installation and use of Fisher and Porter electronic transmitter for the measurement of Pressure, Level and Flow parameters. As stated within CP&L response to NRC IE Bulletin 79-01 and the 45-day response to NRC IE Bulletin 79-01B CP&L preference, to obtain better operation and maintenance performance, is to change out the existing transmitters within containment--to be replaced by Rosemounts' Model No. 1153A.

Environmental tests performed on Fisher & Porter's transmitters (Model No. 10B2496) indicate failure occurs during the high temperature, steam/chemical spray testing stage while attempting to qualify to IEEE 323-1971 parameters. (Reference WCAP 9157 Environmental Qualification of Safety-Related Class IE Process Instrumentation).



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 10

LICENSEE RESPONSE TO NRC SER (Continued)

For long-term accident mitigation, Fisher & Porter transmitters, Model Nos. 10B2496 and 50EP1041, located within the Reactor Auxiliary Building are used. Transmitter identification numbers are FT-940, FT-943, PT-934, PT-940 and PT-943. As these transmitters are not exposed to the LOCA accident environment, but will see the elevated radiation levels associated with reactor coolant recirculation, qualification is limited to their radiation withstand capability.

As previously stated, Fisher & Porter 10B2496 transmitters had failed environmental testing per IEEE 323-1971 requirements and reported in WCAP 9157. Failure occurred within six (6) minutes of operation when in the high temperature/high pressure/spray testing environment (Table A-7, WCAP 9157). It is noted, though, and stated, that the "trip" function time of operation for the transmitters was accomplished. This portion of the test program is not relevant to H. B. Robinson use of the listed Fisher & Porter transmitters as they are not within containment and, therefore, not required to function under the harsh environmental conditions which caused test failure. Within the same report, it is stated that Fisher & Porter transmitters had successfully operated during and after irradiation testing (Table A-6, WCAP 9157). As only a total radiation level of  $4 \times 10^4$  RADs were achieved, additional qualification was required to meet the radiation requirements established in Table 1.3.3.

R2

Westinghouse WCAP 7744, Environmental Testing of Engineered Safety Features Related Equipment states that transmitters, identified by Westinghouse as Fisher & Porter, Model 10B2496, had been successfully tested to a level of  $2.0 \times 10^6$  RADs. As the listed Fisher & Porter transmitters are exposed to a  $1.1 \times 10^6$  RAD level, they are considered qualified for the application and functions stated within this report. To further identify the transmitters in use at H. B. Robinson with those tested, Westinghouse has stated that instruments used were ordered as NS (nonstandard) from Fisher & Porter. Check of purchase order and manufacturer's fabrication instructions show that the listed H. B. Robinson Fisher & Porter transmitters were supplied as NS (nonstandard).

Westinghouse has been requested to supply the specific data and/or reports associated with the testing program, and it will be available for review after receipt. [15]



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 11

EQUIPMENT ITEM NO. 11  
 PRESSURE TRANSMITTER LOCATED IN THE REACTOR AUXILIARY BLDG.  
 FISCHER AND PORTER MODEL 50EP1041  
 REQUIRED OPERATING TIME: 30 DAYS  
 TER CHECKSHEET NO. 11  
 LICENSEE REFERENCE(S): 637, 639  
 FUNCTION (PLANT ID): SAFETY INJECTION HOT LEG HEADER PRESSURE (PT-940)  
 LICENSEE SUBMITTAL: SCEW(S): 4 OF 25 [20]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

(R), T, (QT), RT, P, H, CS, (A), S, (R), M, I, (QM), RPN, EXN, SEN, QI, RPS, None,  
 Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, 3b, 3c, <del>3d</del>
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	<del>5a, 5b, 5c, 5d, 5e, 5f,</del> <del>5g, 5h, 5i, 5j</del>
Installed TMI Lessons Learned Implementation Equipment Summary	<del>6a, 6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



**EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 11**

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/~~has not~~) provided a response to the SER concerns.
- The Licensee (has/~~has not~~) specifically stated that the equipment is qualified and/or will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/has not) proposed a corrective action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
- Corrective action specified by the Licensee:
  - Equipment replacement with qualified equipment
  - Equipment modification
  - Equipment relocation above submergence level
  - Relocate or shield equipment from radiation source
  - Verify qualification by additional (testing/analysis)
  - Equipment relocation to a mild environment
  - Qualification testing of equipment in progress
  - Other ( \_\_\_\_\_ )
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend,

- |  |                                |
|--|--------------------------------|
| I.a Qualified                            | II.c Qualified Life Deficiency |
| I.b Modification                         | III.a Exempt                   |
| <u>I.a</u> Qualification Not Established | III.b Not in Scope             |
| II.b Not Qualified                       | IV Documentation Not Available |



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 11

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
X = DEFICIENCY

Documented Evidence of Qualification Adequate	_____
Adequate Similarity Between Equipment and Test Specimen Established	<u>X</u>
Aging Degradation Evaluated Adequately	<u>X</u>
Qualified Life or Replacement Schedule Established (If Required)	<u>X</u>
Program Established to Identify Aging Degradation	_____
Criteria Regarding Aging Simulation Satisfied (If Required)	_____
Criteria Regarding Temperature/Pressure Exposure:	
o Peak Temperature Adequate	_____
o Peak Pressure Adequate	_____
o Duration Adequate	_____
o Required Profile Enveloped Adequately	_____
o Steam Exposure (If Required) Adequate	_____
Criteria Regarding Spray Satisfied	_____
Criteria Regarding Submergence Satisfied	_____
Criteria Regarding Radiation Satisfied	_____
Criteria Regarding Test Sequence Satisfied	_____
Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied	_____
Criteria Regarding Functional Testing Satisfied	_____
Criteria Regarding Instrument Accuracy Satisfied	<u>X</u>
Test Duration Margin (1 hour + Function Time) Satisfied	_____
Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I)	_____

NRC QUALIFICATION CATEGORY

DESIGNATION:  
X = CATEGORY

I.a	Equipment Qualified	_____
I.b	Equipment Qualification Pending Modification	_____
II.a	Equipment Qualification Not Established	<u>X</u>
II.b	Equipment Not Qualified	_____
II.c	Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified	_____
III.a	Equipment Exempt From Qualification	_____
III.b	Equipment Not in the Scope of the Qualification Review	_____
IV	Documentation Not Made Available	_____

*For full evaluation see equipment item 9*



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 11

LICENSEE RESPONSE TO NRC SER

4.2 Equipment Requiring Additional Information and/or Corrective Action  
(Appendix B)

The bulk of master list equipment was placed in this category and our review of deficiencies is based upon the following:

- Deletion of deficient listed equipment due to replacement programs carried out and reported in our 90-day, Revision 3 response dated February 1, 1981.
- Re-evaluation of CP&L's updated submittals by NRC Region II, Atlanta, GA, and reported in Environmental Qualification of Safety-Related Electrical Equipment IEB 79-01B. Technical Evaluation Report - Docket No. 50-261; Plant: H. B. Robinson 2, dated November 6, 1980 and Revised November 11, 1980.

Telecons with NRC, Bethesda, MD reviewing personnel July 29, 1981, et al.

Equipment reported as qualified within NRC TER Revision 1, dated November 11, 1980:

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model No.</u>	<u>Location</u>
1. pump motor	Westinghouse	506UPZ	outside containment
2. motor operator	Limitorque	SMB-00	containment
3. motor operator	Limitorque	SMB-00	outside containment
4. motor operator	Limitorque	SMB-1	outside containment
5. flow transmitter	Fisher & Porter	10B2496 PBBABBB	outside containment
6. pressure transmitter	Fisher & Porter	50EP1041 BCXA	outside containment
A. Pressure Transmitter	Fischer & Porter	50EP1041BCXA	2 R,QT,A,QM

<sup>A</sup> Items reported as qualified within NRC Region II revised TER, dated 11/7/80.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 4

LICENSEE RESPONSE TO NRC SER (Continued)

Submergence of equipment outside of containment will also be studied. New modification of Auxiliary Building areas due to fire protection requirements need to be evaluated to establish drain paths and/or water accumulations. Existing reports indicate no detrimental water buildups due to HELB or small pipe breaks, but they do not account for building modification performed in recent months. A report on submergence of safety-related electrical equipment within harsh environment areas in the Auxiliary Building will be completed and submitted by the date established by the NRC for completion of qualification of safety-related electrical equipment. [20]

Electronic Transmitters [15]

H. B. Robinson's original design and specification called for installation and use of Fisher and Porter electronic transmitter for the measurement of Pressure, Level and Flow parameters. As stated within CP&L response to NRC IE Bulletin 79-01 and the 45-day response to NRC IE Bulletin 79-01B CP&L preference, to obtain better operation and maintenance performance, is to change out the existing transmitters within containment--to be replaced by Rosemounts' Model No. 1153A.

Environmental tests performed on Fisher & Porter's transmitters (Model No. 10B2496) indicate failure occurs during the high temperature, steam/chemical spray testing stage while attempting to qualify to IEEE 323-1971 parameters. (Reference WCAP 9157 Environmental Qualification of Safety-Related Class IE Process Instrumentation).



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 11

LICENSEE RESPONSE TO NRC SER (Continued)

For long-term accident mitigation, Fisher & Porter transmitters, Model Nos. 10B2496 and 50EP1041, located within the Reactor Auxiliary Building are used. Transmitter identification numbers are FT-940, FT-943, PT-934, PT-940 and PT-943. As these transmitters are not exposed to the LOCA accident environment, but will see the elevated radiation levels associated with reactor coolant recirculation, qualification is limited to their radiation withstand capability.

As previously stated, Fisher & Porter 10B2496 transmitters had failed environmental testing per IEEE 323-1971 requirements and reported in WCAP 9157. Failure occurred within six (6) minutes of operation when in the high temperature/high pressure/spray testing environment (Table A-7, WCAP 9157). It is noted, though, and stated, that the "trip" function time of operation for the transmitters was accomplished. This portion of the test program is not relevant to H. B. Robinson use of the listed Fisher & Porter transmitters as they are not within containment and, therefore, not required to function under the harsh environmental conditions which caused test failure. Within the same report, it is stated that Fisher & Porter transmitters had successfully operated during and after irradiation testing (Table A-6, WCAP 9157). As only a total radiation level of  $4 \times 10^4$  RADs were achieved, additional qualification was required to meet the radiation requirements established in Table 1.3.3.

R2

Westinghouse WCAP 7744, Environmental Testing of Engineered Safety Features Related Equipment states that transmitters, identified by Westinghouse as Fisher & Porter, Model 10B2496, had been successfully tested to a level of  $2.0 \times 10^6$  RADs. As the listed Fisher & Porter transmitters are exposed to a  $1.1 \times 10^6$  RAD level, they are considered qualified for the application and functions stated within this report. To further identify the transmitters in use at H. B. Robinson with those tested, Westinghouse has stated that instruments used were ordered as NS (nonstandard) from Fisher & Porter. Check of purchase order and manufacturer's fabrication instructions show that the listed H. B. Robinson Fisher & Porter transmitters were supplied as NS (nonstandard).

Westinghouse has been requested to supply the specific data and/or reports associated with the testing program, and it will be available for review after receipt. [15]





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 12

EQUIPMENT ITEM NO. 12  
 PRESSURE TRANSMITTER LOCATED IN THE CONTAINMENT  
 ROSEMOUNT MODEL 1153A  
 REQUIRED OPERATING TIME: 30 MIN (TABLE 1.3.3)  
 TER CHECKSHEET NO. 12  
 LICENSEE REFERENCE(S): 1764, 4423  
 FUNCTION (PLANT ID): PRESSURIZER PRESSURE CONTROL SIGNAL (PT-444)  
 FUNCTION (PLANT ID): PRESSURIZER PRESSURE SIGNAL FOR SIS INITIATION (PT-455)  
 FUNCTION (PLANT ID): FUNCTION NOT STATED (PT-445, -456, -457)  
 LICENSEE SUBMITTAL: SCEW(S): 19 OF 25 [20]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

R, T, QT, RT, P, H, CS, A, S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,  
 Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, 3b, 3c, 3d
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h, <del>5i, 5j</del> 5a <sub>1</sub> , 5b <sub>1</sub> , 5e <sub>1</sub> , 5f <sub>1</sub> , 5g <sub>1</sub> , 5h <sub>1</sub> , 5i <sub>1</sub> , 5a <sub>2</sub> , <del>6a, 6b</del> 5b <sub>2</sub> , 5c <sub>2</sub> , 5d <sub>2</sub>
Installed TMI Lessons Learned Implementation Equipment Summary	
Maintenance and Replacement Schedule Summary	7a, <del>7b, 7c</del>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 12

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/~~has not~~) provided a response to the SER concerns.
- The Licensee (has/~~has not~~) specifically stated that the equipment is qualified and/or will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/~~has not~~) proposed a corrective action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
- Corrective action specified by the Licensee:
  - Equipment replacement with qualified equipment
  - Equipment modification
  - Equipment relocation above submergence level
  - Relocate or shield equipment from radiation source
  - Verify qualification by additional (testing/analysis)
  - Equipment relocation to a mild environment
  - Qualification testing of equipment in progress
  - Other (replace O-ring each Calibration period, replace  
weld at 10-year intervals, follow Rosemount testing program.)
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/~~has not~~) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action Yearly.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |  |                                |
|--|--------------------------------|
| I.a Qualified  | II.c Qualified Life Deficiency |
| I.b Modification                                       | III.a Exempt                   |
| II.a Qualification Not Established                     | III.b Not in Scope             |
| <input checked="" type="checkbox"/> II.b Not Qualified | IV Documentation Not Available |



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 12

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
X = DEFICIENCY

Documented Evidence of Qualification Adequate	_____
Adequate Similarity Between Equipment and Test Specimen Established	_____
Aging Degradation Evaluated Adequately	<u>X</u>
Qualified Life or Replacement Schedule Established (If Required)	<u>X</u>
Program Established to Identify Aging Degradation	_____
Criteria Regarding Aging Simulation Satisfied (If Required)	_____
Criteria Regarding Temperature/Pressure Exposure:	
o Peak Temperature Adequate	_____
o Peak Pressure Adequate	_____
o Duration Adequate	_____
o Required Profile Enveloped Adequately	_____
o Steam Exposure (If Required) Adequate	_____
Criteria Regarding Spray Satisfied	_____
Criteria Regarding Submergence Satisfied	_____
Criteria Regarding Radiation Satisfied	_____
Criteria Regarding Test Sequence Satisfied	<u>X</u>
Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied	<u>X</u>
Criteria Regarding Functional Testing Satisfied	_____
Criteria Regarding Instrument Accuracy Satisfied	_____
Test Duration Margin (1 hour + Function Time) Satisfied	_____
Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I)	<u>X</u>

NRC QUALIFICATION CATEGORY

DESIGNATION:  
X = CATEGORY

I.a	Equipment Qualified	_____
I.b	Equipment Qualification Pending Modification	_____
II.a	Equipment Qualification Not Established	_____
II.b	Equipment Not Qualified	<u>X</u>
II.c	Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified	_____
III.a	Equipment Exempt From Qualification	_____
III.b	Equipment Not in the Scope of the Qualification Review	_____
IV	Documentation Not Made Available	_____

*See Conclusion on page 5a2, 5b2, 5c2  
 and 5d2.*



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 12

LICENSEE RESPONSE TO NRC SER

4.2 Equipment Requiring Additional Information and/or Corrective Action  
(Appendix B) [ 20 ]

The bulk of master list equipment was placed in this category and our review of deficiencies is based upon the following:

- Deletion of deficient listed equipment due to replacement programs carried out and reported in our 90-day, Revision 3 response dated February 1, 1981.
- Re-evaluation of CP&L's updated submittals by NRC Region II, Atlanta, GA, and reported in Environmental Qualification of Safety-Related Electrical Equipment IEB 79-01B. Technical Evaluation Report - Docket No. 50-261; Plant: H. B. Robinson 2, dated November 6, 1980 and Revised November 11, 1980.

Telecons with NRC, Bethesda, MD reviewing personnel July 29, 1981, et al.

Equipment deleted due to replacement programs completed at the plant. (Deficiency listings will not be addressed as these equipments are no longer in place or use at the plant).

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model No.</u>	<u>Location</u>
1. level transmitter	Fisher & Porter	10B2496	Containment
2. pressure transmitter	Fisher & Porter	50EP1041BCXA-NS	Containment
3. flow transmitter	Rosemount	1151	Containment
4. level transmitter	Fisher & Porter	13D2495	Containment
5. solenoid valve	ASCO	LB8211C32	Containment
6. solenoid valve	ASCO	LB8316B25	Containment
7. solenoid valve	ASCO	LB8316B15	Containment
8. solenoid valve	ASCO	LB8316B14	Containment
9. level transmitter	Fisher & Porter	13B2496	Containment

The Rosemount 1153A Transmitters are currently qualified to IEEE 323-1971. As reported in our 90-day responses these transmitters require a changeout cycle of ten (10) years with an O-Ring replacement after each calibration check to maintain their qualification level. CP&L is part of a utilities group which is underwriting transmitter qualification to IEEE-323-1974 standards. As these tests are ongoing, no recommendations or changeout program is being formulated at this time. Upon test completion, CP&L will determine any added transmitter changeout or modification program and report to the NRC its actions.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 1a2

Electronic Transmitters [15]

H. B. Robinson's original design and specification called for installation and use of Fisher and Porter electronic transmitter for the measurement of Pressure, Level and Flow parameters. As stated within CP&L response to NRC IE Bulletin 79-01 and the 45-day response to NRC IE Bulletin 79-01B CP&L preference, to obtain better operation and maintenance performance, is to change out the existing transmitters within containment--to be replaced by Rosemounts' Model No. 1153A.

Environmental tests performed on Fisher & Porter's transmitters (Model No. 10B2496) indicate failure occurs during the high temperature, steam/chemical spray testing stage while attempting to qualify to IEEE 323-1971 parameters. (Reference WCAP 9157 Environmental Qualification of Safety-Related Class IE Process Instrumentation).

Qualification testing of Rosemount Model 1153, Series A, per Rosemount Report No. 3788 states that the transmitter is qualified per the requirements of IEEE 323-1971. Missing from this report is the aging parameter not required for IEEE 323-1971 but necessary for complete LOCA qualification. Recent Rosemount testing to qualify a transmitter to meet IEEE 323-1974 requirements has resulted in failure. A combination of thermal aging, irradiation and chemical spray test specification parameters has resulted in failed components. The initial failed element was an O-ring comprised of sulphur cured polyethylene rubber. This allowed steam/chemical spray to affect electronic components. The O-ring mode of failure is attributed to high temperature vs. time necessary for the Arrhenius curve time compression to satisfy aging test requirements.

This testing failure does not preclude the use of the Rosemount 1153A within H. B. Robinson containment as it has successfully performed within the H. B. Robinson accident parameters of temperature, pressure and radiation levels. Transmitters located in containment will be required to perform within a maximum time period of twenty-four (24) hours following accident. O-ring failure due to high temperature should not occur during this time period. Reviewing Table C-1 of Appendix C, NRC IE Bulletin 79-01B, Thermal and Radiation Aging Degradation of Selected Materials, shows that polyethylene rubber has a potential for significant aging at ten (10) years and an allowable radiation susceptibility of 10<sup>7</sup> RADS before serious degradation occurs. Evaluating the above establishes the need to perform periodic changeout of transmitter O-rings.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 12

Additionally, the time span to which Rosemount will qualify its IEEE 373-1974 transmitters is ten (10) years. To assure that listed transmitters within H. B. Robinson containment remain qualified a ten- (10) year replacement cycle will be adopted. <sup>(1)</sup>

Replacement of in-containment transmitters identified within this report has been performed within the 1980 refueling outage (August - October, 1980). At this time, no fully qualified transmitter is available for nuclear plant in-containment operation. Rosemount 1153A transmitters, qualified to IEEE 323-1971 version, were used as replacements.

Additional action required - A program of periodic transmitter housing O-ring replacement (performed during yearly instrument calibration check) will provide boron spray protection capability if an accident ever occurs. (See Paragraph 3.2.2.) To assure operational capability, a ten- (10) year transmitter replacement schedule has been adopted, to be modified when Rosemount can certify, by test, longer life equipment is available. [15]



Franklin Research Center  
A Division of The Franklin Institute  
20th and Race Streets, Phila., Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
FRC Project No. C5257  
FRC Assignment No. 13  
FRC Task No. 511

Page  
3d

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 12

LICENSEE RESPONSE TO NRC SER (Continued)

SECTION III - Proposed Corrective Actions for Outstanding Items

Electronic transmitters qualified to IEEE-323-1974 are not currently available. CP&L is a participating member of the Wisconsin Electric Transmitter Evaluation Program to test and qualify electronic transmitters for nuclear plant use. Presently, CP&L has upgraded its master list transmitters within containment to Rosemount 1153A models which are qualified to IEEE-323-1972. After the current test program is complete - which extends into the fourth quarter of 1982 - CP&L will evaluate the results and decide on action(s) to be taken to provide fully qualified equipments. In the interim, CP&L has established a program which requires changeout of O-rings when yearly calibration checks are performed and a complete instrument changeout on ten-year cycles after installation dates, to maintain qualification level.

[20]



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 12

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW

Criteria: DOR Guidelines \_\_\_; NUREG-0588, Cat. I X; NUREG-0588, Cat. II \_\_\_.

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
--	-----------------------	--------------------------------	----------------------------------

EQUIPMENT DESCRIPTION

Equipment Type

TRANSMITTER

DIFFERENTIAL  
PRESSURE  
TRANSMITTER

Manufacturer's Name  
(5.2.2/-/-)

ROSEMOUNT

ROSEMOUNT

Model Number (5.2.2/-/-)

1153A

1153DAS

see note 1  
and note 4

Serial Number

N/A

106186 THRU 106188

Features/Mounting  
(5.2.6/-/-)

NOT STATED

1153 SERIES A

Connections/Interfaces  
(5.2.6/-/-)

NOT STATED

ROSEMOUNT  
MOUNTING BRACKET  
LOW SIDE PLUMBED  
TO ATMOSPHERIC

Location/Elevation

SEE Pg 1a

Equipment ID No.

SEE Pg 1a

N/A

QUALIFICATION REPORT

(8.0/5.0/5.0)

Report ID Number

3788

RMT 3788

[1764]

Report Date

N/A

March 23, 1978

Issued by

ROSEMOUNT

Rosemount

Prepared for

ROSEMOUNT

Rosemount

Referenced Reports

N/A

RMT 37821

[4423]

Qualification Method

(5.1, 5.3/2.1, 2.4/2.1, 2.4)

TEST

TYPE TEST

QUALIFICATION TEST PROGRAM

Functional Test Description

(5.2.5/2.2.9/2.2.9)

N/A

UNIT POWERED  
AND PRESSURIZED

Operating Conditions

(-/2.2.10/2.2.10)

Load/Cycles/Voltage/

Current/Freq.

N/A

0 - 750" H<sub>2</sub>O Range

4 - 20 ma.





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 12

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
Acceptance Criteria (5.2.5/2.2.1/2.2.1)	N/A	+5% @ 0.5 MPa/h, 40 MPa ±8% DURING STM TEST	
Accuracy (5.2.5/-/-)	N/A	MAX. OUTPUT SIGNAL DEVIATION +3.7% OF SPAN DURING RADIATION +6.95% STEAM	NOTE 2
Number of Specimens	N/A	3	
Test Instruments Calibrated	N/A	YES/NBS	
Safety Function (Active/ Passive) (-/2.1.3/2.1.3)	ACTIVE	N/A	
Test Duration (5.2.1/-/-)	N/A	64 HR 20 MIN	
Accident Duration (Envir. Above Normal) (5.2.1/-/-)	24 HR	N/A	
Required Function Time	24 HR	N/A	
Test Sequence (General) (5.2.3/2.3.1/2.3.1)	N/A	RADIATION/SEISMIC/ STEAM-PRESSURE/SPRAY	
Test Sequence (NUREG-0588, Cat. I) (-/2.3.1/-)	N/A	N/A	X
1. Representative Sample			
2. Baseline Data			
3. Performance Extremes			
4. Thermal Aging			
5. Radiation Aging		N/A	
6. Wear Aging			
7. Vibration/Seismic			
8. DBE Exposure			
9. Post-DBE Exposure			
10. Inspection			
Aging (5.2.4, 7.0/4.0/4.0)	NONE	NONE	X
Thermal Aging/Basis			
Material Aging Evaluation (7.0/-/-)		NONE	X
Materials Susceptible (Thermal) (5.2.4, 7.0/-/-)		NONE	X
Radiation Aging, Type		GAMMA Co <sup>60</sup>	



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 12

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
Radiation Aging, Dose (rd)	N/A	SEE ACCIDENT DOSE	
Radiation Aging, Dose Rate	N/A	SEE ACCIDENT DOSE	
Radiation Aging, Method	N/A	TEST	
Materials Susceptible (Radiation) (5.2.4, 7.0/-/-)	NOT STATED	NO	
Operational Aging (-/4.2/-)	N/A	N/A	
Other Age Conditioning (-/4.2/-)	N/A	N/A	
Qualified Life Claimed/ Established (5.2.4/4.10/-)	NONE	NOT STATED	X
Normal Ambient Temperature Normal Ambient Radiation Normal Ambient Humidity	see off A	N/A	
On-Going Surveillance and Preventive Maintenance (7.0/-/-)		NOT STATED	X
On-Going Analysis of Failures and Degradation (7.0/-/-)		NOT STATED	
Margin (General) (6.0/3.0/3.0)	N/A	10% ON RADIATION	X
Margin (NUREG-0588, Cat. I) (-/3.2/-)		N/A	
1. Temperature (+15°F)			
2. Pressure (+10%, 10 psig max)			
3. Radiation (not required)			
4. Time (+10%, +1 hour + function time minimum)			



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 12

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
<u>ACCIDENT CONDITIONS</u>			
LOCA/MSLB/HELB/Uncontrolled (4.1, 4.2, 4.3.1, 4.3.3/ 1.1, 1.2, 1.5/1.1, 1.2, 1.5)	LOCA	N/A	
Radiation Type	GAMMA	GAMMA C <sup>60</sup>	
Radiation Dose (rd) (4.1.2/1.4/1.4)	9.5 X 10 <sup>5</sup>	44 X 10 <sup>6</sup> RAD	
Radiation Dose Rate (rd/hr) Radiation Qual. Method (5.3.1/-/-)	NOT STATED	0.5 X 10 <sup>6</sup> R/HR TEST	
Proximity to Concentrated Radiation (4.1.2/1.4.6/1.4.6)	NO	N/A	
Equipment Susceptible to Beta Radiation (4.1.2/-/-)	NO	N/A	
Radiation Dose (Normal + Accident) (4.1.2/-/-)	1.0 X 10 <sup>6</sup>	44 X 10 <sup>6</sup> RAD	
Plateout Dose Considered (-/1.48/1.48)	N/A	N/A	
Gamma + Beta Dose (rd) (4.1.2/1.4.7/1.4.7)	N/A	N/A	



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 12

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE No.)
<u>ENVIRONMENTAL PROFILE OF ACCIDENT CONDITIONS</u>			
Rate of Temp./Press. Increase		1.5 %s / 0.67 psig/s	
Peak: °F/psig/RH/Time	264.7/42/100/3H	* 35°/120/100/0-10M	* 2 CYCLES in 3 hour INTERVAL
Decrease To: °F/psig/RH/Time	219/20/100/21H	303/55/100/8HR	
Decrease To: °F/psig/RH/Time	152/5/100/1D	25°/15/100/56HR	
Decrease To: °F/psig/RH/Time		ROOM TEMP.	
Equipment Surface Tempera- ture (MSLB) (-/1.2.5.C, 2.2.6/1.2.5.C, 2.2.6)	N/A	NONE	
Spray Qualification Method (5.3.2/1.3, 2.2.8/1.3, 2.2.8)	TEST	TEST	
Spray Composition (4.1.4/1.3, 2.2.8/ 1.3, 2.2.8)	H <sub>3</sub> BO <sub>3</sub> 1.7wt% NAOH 0.6wt% 9.3PH	H <sub>3</sub> BO <sub>3</sub> 15000 PPM NAOH PH 10.5 @ 77°F	
Spray Density (gpm/ft <sup>2</sup> )	NOT STATED	0.15 gpm/ft <sup>2</sup>	
Spray Duration	NOT STATED	10 - 24 hours	see note 3
Submergence Duration (4.1.3/2.2.5/2.2.5)	N/A	NONE	
In-Leakage Considered (5.2.6, 5.3.2/-/-)	N/A	NO LEAKAGE DETECTED	
Time to Submergence	N/A	N/A	
Dust Environment (-/2.2.11/2.2.11)	N/A	N/A	



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 12

NOTES:

Note 1. The test report stated the following:

These test units are representative of the whole 1153 Series A model line. The remainder of the model line differ by the spring constant (thickness) of the sensing diaphragm and by the process pressure level. The stiffness of the metal sensing diaphragm, whose movement is minute - .004 inches, does not constitute a significant design difference. Radiation, vibration, and steam temperatures would not effect diaphragm stiffness to the extent that performance would exceed the specified acceptance criteria limits. Also, all transmitters within the model line have a design capability of withstanding a process pressure proof load of 10,000 psi. This is more than twice the maximum operating pressure range of any transmitter. Hence, process pressure is a static load which is well below the design proof load and the effects of this static loading would not be significantly enhanced by exposure to the qualification testing.

Thus, the entire 1153 Series A model line is qualified to the acceptance levels specified in this document by virtue of similarity to the test units.

Model No.	Type	Span		Maximum Working, or Maximum Static
		Min.	Max.	
1153DA3	Differential	0-5" H <sub>2</sub> O	0-30" H <sub>2</sub> O	2000 psig
1153DA4	"	0-25" H <sub>2</sub> O	0-150" H <sub>2</sub> O	"
1153DA5	"	0-125" H <sub>2</sub> O	0-750" H <sub>2</sub> O	"
1153DA6	"	0-17 psid	0-100 psid	"
1153DA7	"	0-50 psid	0-300 psid	"
1153DA8	"	0-170 psid	0-1000 psid	"



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 12

1153HA4	Differential	0-25" H <sub>2</sub> O	0-150" H <sub>2</sub> O	4500 psig
1153HA5	"	0-125" H <sub>2</sub> O	0-750" H <sub>2</sub> O	"
1153HA6	"	0-17 psid	0-100 psid	"
1153HA7	"	0-50 psid	0-300 psid	"
1153AA5	Absolute	0-10" HgA	0-55" HgA	2000 psig
1153AA6	"	0-17 psia	0-100 psia	"
1153AA7	"	0-50 psia	0-300 psia	"
1153AA8	"	0-170 psia	0-1000 psia	"
1153AA9	"	0-500 psia	0-3000 psia	4500 psig
11536A3	Gauge	0-5" H <sub>2</sub> O	0-30" H <sub>2</sub> O	2000 psig
1153GA4	"	0-25" H <sub>2</sub> O	0-150" H <sub>2</sub> O	"
1153GA5	"	0-125" H <sub>2</sub> O	0-750" H <sub>2</sub> O	"
1153GA6	"	0-17 psig	0-100 psig	"
1153GA7	"	0-50 psig	0-300 psig	"
1153GA8	"	0-170 psig	0-1000 psig	"
1153GA9	"	0-500 psig	0-3000 psig	4500 psig

Note 2 - The report states:

Summary of Radiation Results

During the exposure period, the following worst case output signal deviations were noted: -.6%, +3.7%, and +1.5% of span for serial numbers 106186, 106187, and 106188; respectively. These results are well within the expected error band of ±5% upper range limit. The post-test calibration check indicates that all transmitters returned to near normal performance; all transmitters were within 0.5% of the pre-test data. No changes worthy of noting were seen in liftoff voltage or time constant parameters in the before to after comparison. The temperature coefficient data do indicate that radiation does have an effect on this parameter; however, the magnitude of this effect is small. The largest difference between the pre-to-post test data at the hot temperature (200°F) was only 1.3% of span.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 13

NOTES:

Note 3 - The report stated:

The deviation from procedure resulted from a problem with the filtration system for the chemical spray. The plumbing for the spray became clogged such that units 106186, 106187, and 106188 were sprayed for 10, 21, and 24 hours; respectively. The procedure originally specified 24 hours of chemical spray. This deviation does not impact the results of the test for three reasons. First, the transmitter design is one in which all exposed surfaces are of ferrous material and are chemically compactable with the spray. Second, the strip chart data for signal output and past development testing indicate that the output signal is unaffected by the spray introduced into the chamber. Third, unit 106188 did experience the required amount of spray and, therefore, demonstrates the design compactability with the 24 hours of spray.

It is concluded from the results present that all three units met the requirements of the steam/chemical test.

Note 4 - the report stated:

CONCLUSIONS

It is concluded from the data obtained from this type-test program, a summary of which is document in this report, that all three test units have successfully demonstrated the Rosemount Model 1153 Series A pressure transmitter to be qualified for Class 1E service in those applications requiring compliance with the 1971 IEEE standards.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 12

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW

Criteria: DOR Guidelines \_\_\_; NUREG-0588, Cat. I X; NUREG-0588, Cat. II \_\_\_.

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
--	-----------------------	--------------------------------	----------------------------------

EQUIPMENT DESCRIPTION

Equipment Type

GAUGE PRESSURE  
TRANSMITTER: TRANSMITTER

Manufacturer's Name  
(5.2.2/-/-)

ROSEMOUNT: ROSEMOUNT

Model Number (5.2.2/-/-)

1153A 1153 GA9

Serial Number

N/A 108584

Features/Mounting  
(5.2.6/-/-)

NOT STATED: NOT STATED

see note 1

Connections/Interfaces  
(5.2.6/-/-)

NOT STATED: NOT STATED

Location/Elevation

SEE Pg 1a N/A

Equipment ID No.

SEE Pg 1a N/A

QUALIFICATION REPORT

(8.0/5.0/5.0)

Report ID Number

37821

RMT NO. 37821 REV B [4423]

Report Date

N/A

24 AUG -78

Issued by

ROSEMOUNT

ROSEMOUNT

Prepared for

ROSEMOUNT

ROSEMOUNT

Referenced Reports

N/A

RMT NO. 3788

[1764]

Qualification Method

(5.1, 5.3/2.1, 2.4/2.1, 2.4)

TEST

TEST

QUALIFICATION TEST PROGRAM

Functional Test Description  
(5.2.5/2.2.9/2.2.9)

N/A

UNIT POWERED AND  
PRESSURIZED

see note 2  
and note 3  
and note 7

Operating Conditions

(-/2.2.10/2.2.10)

Load/Cycles/Voltage/  
Current/Freq.

N/A

0-3000 PSIG

NOT STATED





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 12

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
Acceptance Criteria (5.2.5/2.2.1/2.2.1)	N/A	± 8% of upper range	
Accuracy (5.2.5/-/-)	N/A	-3.25% of SPAN [50%] -2.60% of SPAN [20%]	see notes 5 and 7
Number of Specimens	N/A	ONE	
Test Instruments Calibrated	N/A	YES	
Safety Function (Active/ Passive) (-/2.1.3/2.1.3)	ACTIVE	N/A	
Test Duration (5.2.1/-/-)	N/A	3 hr 20 MIN.	
Accident Duration (Envir. Above Normal) (5.2.1/-/-)	24 hr	N/A	
Required Function Time	24 hr	N/A	
Test Sequence (General) (5.2.3/2.3.1/2.3.1)	N/A	STEAM/CHEMICAL SPRAY	
Test Sequence (NUREG-0588, Cat. I) (-/2.3.1/-)	N/A	N/A	X
1. Representative Sample			
2. Baseline Data			
3. Performance Extremes			
4. Thermal Aging			
5. Radiation Aging			
6. Wear Aging			
7. Vibration/Seismic			
8. DBE Exposure			
9. Post-DBE Exposure			
10. Inspection			
Aging (5.2.4, 7.0/4.0/4.0)			
Thermal Aging/Basis	NONE	NONE	X
Material Aging Evaluation (7.0/-/-)	NONE	NONE	X
Materials Susceptible (Thermal) (5.2.4, 7.0/-/-)		NOT STATED	
Radiation Aging, Type	N/A	N/A	



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 12

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE No.)
<u>ENVIRONMENTAL PROFILE OF ACCIDENT CONDITIONS</u>			
Rate of Temp./Press. Increase		1.5°/s / 0.67 psig/s	see note 4
Peak: °F/psig/RH/Time	264.7/42/100/3hr	*350/120/100/0-10M	* 2 cycles in 3 hr interval
Decrease To: °F/psig/RH/Time	219/20/100/21H	303/55/100/2 HR	
Decrease To: °F/psig/RH/Time	52/5/100/1d	250/15/100/1.5 HR	
Decrease To: °F/psig/RH/Time		ROOM TEMPERATURE	
Equipment Surface Tempera- ture (MSLB) (-/1.2.5.C, 2.2.6/1.2.5.C, 2.2.6)	N/A	NOT STATED	
Spray Qualification Method (5.3.2/1.3, 2.2.8/1.3, 2.2.8)	TEST	TEST	
Spray Composition (4.1.4/1.3, 2.2.8/ 1.3, 2.2.8)	H <sub>3</sub> BO <sub>3</sub> 1.7 WT % NaOH 0.6 WT %	BORIC ACID 15000 PPM	
Spray Density (gpm/ft <sup>2</sup> )	9.3 Ph	0.15 GPM/FT <sup>2</sup>	
Spray Duration	N/A	NOT STATED	
Submergence Duration (4.1.3/2.2.5/2.2.5)	N/A	N/A	
In-Leakage Considered (5.2.6, 5.3.2/-/-)	N/A	YES	see note 6
Time to Submergence	N/A	N/A	
Dust Environment (-/2.2.11/2.2.11)	N/A	N/A	



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 12

NOTES:

1. Report states that "new electronic circuit boards were used in each test". Also "new O-rings were installed between the electronic housing and cover for the second test". Assume "new" means "fresh" components.
2. Report states that "two tests were run - one with unit powered and pressurized at 50% full scale (1500 psig), and the second with the unit powered and pressurized at 20% full scale (600 psig)."
3. The report states that the goal of the testing was to assess the accuracy of the test specimens at the temperature level of 350, 303, 250 °F.
4. Report states that hold periods were terminated after transmitter signal had stabilized at a steady-state value. Hold periods: 350°F for 10M / 303°F for 2 hours, 250°F for 1.5 hours



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 12

NOTES:

5. *The report stated the following regarding accuracy.*

//

TEST RESULTS

Accuracy deviations at the input pressures of 50 and 20% full scale (F.S.) are plotted versus time in Figures 2 and 3. These data indicate the maximum output signal deviation occurs during the 10 minute hold period at 350°F. The worst errors from the 50% and 20% full scale pressure tests during this period were -3.25 and -2.60 percent of span, respectively. At the 303°F temperature, the accuracy deviations were less than +1.5 and -0.8% of span for the 50% and 20% F.S. tests. At the 250°F temperature, the deviations were less than +1.8 and -0.6% of span. //

6. *Concerning leakage, the report stated:*

//

Two anomalies developed during the testing. The first was a minor leak developed at the threads between the process fluid bleed valve body and the process flange. This joint is sealed using a Loctite thread sealant. The leak was minimal, only a few drops of fluid per minute. The bleed valve assembly was removed and re-installed using a tape thread sealant in order to expeditiously finish the performance testing. Subsequent to the steam testing, an evaluation was made to reaffirm the design adequacy of the Loctite thread sealant at 350°F and 3000 psig



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 12

NOTES:

fluid pressure. A set of four flanges were assembled with bleed valves by the Production Department per procedures for the Model 1153. These were then heated in an oven to 350°F for four hours. They were removed from the oven and immediately pressurized to 3000 psig for a period of 20 minutes. During the twenty minutes, they were visually checked for leakage; none was detected. It was concluded that Loctite is an adequate thread sealant for these conditions. "

7. *Test report stated the following regarding anomalous behavior during calibration check after cooldown:*

" The second anomaly involved the output signal at the 100% full scale pressure, i.e. 3000 psig. After the first test had been completed and the unit had cooled to room temperature, a calibration check was made at 20% F.S. intervals. The 100% F.S. signal exhibited anomalous behavior characterized by an erratic output to a level 1.25% of span below the expected reading. Immediate cycling between zero and full scale, 3 cycles, indicated the 100% F.S. output signal to be a normal steady value each time. The transmitter was then reworked for the second phase of testing; new electronics and new O-rings were installed.

A calibration check prior to subjecting the transmitter to the second steam test showed normal operation. Also, during the steam test the unit exhibited expected performance characteristics. However, after cooling at room temperature, the 100% F.S. reading again showed abnormal behavior after pressure cycling.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 12

NOTES:

ADDENDUM 1

INVESTIGATION INTO THE CAUSE OF  
THE PERFORMANCE ABNORMALITIES

Due to the abnormalities of the 100% output after the original steam test, an attempt was made to determine if the abnormalities were caused by the transmitter or by some other part of the test.

In an effort to determine what part of the transmitter wasn't working properly, the capacitance module was disconnected from the transmitter and its capacitance checked. While at room temperature, it was cycled at 80% F.S. pressure, 100% F.S. pressure, 110% F.S. pressure and 120% F.S. pressure; the cell acted erratically, changing its capacitance readings by up to 7.5% of the nominal readings. At the same time, a new capacitance module was subjected to the same test and performed perfectly. Thus, the abnormality can be traced to some problem with the original capacitance module used in the steam test.

After the electronics were replaced, the unit gave very smooth readings. The largest error seen was -3.13% of F.S. during the 350° temperature spike. The errors were -.95% of span during the 303°F phase of the test and -.44% of span during the 250°F portion.

CONCLUSION

The abnormalities that appeared in the original steam test were apparently caused by a defective capacitance module. An investigation was made to try to pinpoint the exact cause of the problem, but no conclusive results were ever obtained. However, due to the good performance of the new capacitance module when subjected to a steam test, it can be concluded that the problems with the original cell were of a random nature and that the transmitter will operate within the  $\pm 8\%$  of upper range limit specification. //



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 12

NOTES:

Overall Conclusion based on review of 4423 and 1764  
in addition to the Licenses' response:

- reference 1764 establishes the fact that all three 1153DA5 units represent the 1153 series A model line and the qualification program satisfies the applicable criteria of the DOR Guidelines except for the assessment of aging degradation and qualified life. The testing was under IEEE-323 (71) standards. The report established:

- Three differential range 1153DA5 transmitters were sequentially tested. These units are representative of the entire 1153 Series A model line. The remainder of the model line differs by the sensing diaphragm, spring thickness, and the process pressure rating. These differences are not significant with respect to qualification testing. Thus, the following model line is qualified by virtue of similarity:

1153DA3 through 8  
1153HA4 through 7  
1153AA5 through 9  
1154GA3 through 9

- The transmitters were exposed to a radiation exposure rate of 0.5 Mrd per hour for a total integrated dose of 44 Mrd. The maximum output signal deviation noted was +3.7% of span.

- The three transmitters were LOCA tested in a steam temperature/pressure/chemical-spray environment for 64 hours. The maximum error exhibited was +6.95% of span.

- Reference 4423 established that model 1153GA9 demonstrated accuracy within the  $\pm 8\%$  upper range acceptance criteria for given test conditions. Anomalies were traced to a random failure.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 12

NOTES:

o The transmitters are replacement units installed in late 1980. As such, the evaluation criteria is NUREG 0588 CAT(I) in accordance with section 2 of this report. Qualification deficiencies listed on page 2 reflect the results of the review in accordance with CAT(I) requirements.

o The Licensee states that the units require changeout every 10 years and an O-ring replacement each calibration. o The Licensee has committed to (1) periodic O-ring replacement during yearly instrument calibration checks and (2) 10 year transmitter replacement schedule (to be modified possibly by Rosemount testing).

o The Licensee states:

" Rosemount testing to qualify a transmitter to meet IEEE 323-1974 requirements has resulted in failure. A combination of thermal aging, irradiation and chemical spray test specification parameters has resulted in failed components. The initial failed element was an O-ring comprised of sulphur cured polyethylene rubber. This allowed steam/chemical spray to affect electronic components. The O-ring mode of failure is attributed to high temperature vs. time necessary for the Arrhenius curve time compression to satisfy aging test requirements.





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 12

NOTES:

\_\_\_\_\_ This testing failure does not preclude the use of the Rose- \_\_\_\_\_  
 \_\_\_\_\_ mount 1153A within H, B, Robinson containment as it has \_\_\_\_\_  
 \_\_\_\_\_ successfully performed within the H, B, Robinson accident \_\_\_\_\_  
 \_\_\_\_\_ parameters of temperature, pressure and radiation levels. \_\_\_\_\_  
 \_\_\_\_\_ Transmitters located in containment will be required to \_\_\_\_\_  
 \_\_\_\_\_ perform within a maximum time period of twenty-four (24) hours \_\_\_\_\_  
 \_\_\_\_\_ following accident. O-ring failure due to high temperature \_\_\_\_\_  
 \_\_\_\_\_ should not occur during this time period. Reviewing Table C-1 \_\_\_\_\_  
 \_\_\_\_\_ of Appendix C, NRC IE Bulletin 79-01B, Thermal and Radiation \_\_\_\_\_  
 \_\_\_\_\_ Aging Degradation of Selected Materials, shows that poly- \_\_\_\_\_  
 \_\_\_\_\_ ethylene rubber has a potential for significant aging at ten \_\_\_\_\_  
 \_\_\_\_\_ (10) years and an allowable radiation susceptibility of 10<sup>7</sup> \_\_\_\_\_  
 \_\_\_\_\_ RADS before serious degradation occurs. Evaluating the above \_\_\_\_\_  
 \_\_\_\_\_ establishes the need to perform periodic changeout of trans- \_\_\_\_\_  
 \_\_\_\_\_ mitter O-rings. \_\_\_\_\_

Electronic transmitters qualified to IEEE-323-1974 are not currently available. CP&L is a participating member of the Wisconsin Electric Transmitter Evaluation Program to test and qualify electronic transmitters for nuclear plant use. Presently, CP&L has upgraded its master list transmitters within containment to Rosemount 1153A models which are qualified to IEEE-323-1972. After the current test program is complete - which extends into the fourth quarter of 1982 - CP&L will evaluate the results and decide on action(s) to be taken to provide fully qualified equipments. In the interim, CP&L has established a program which requires changeout of O-rings when yearly calibration checks are performed and a complete instrument changeout on ten-year cycles after installation dates, to maintain qualification level. "



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 12

NOTES:

Based on the above considerations, this equipment item is placed in NRC qualification Category II because the licensee has reported current Rosemount testing which resulted in failure of the test specimen (IEEE-323 1974 criteria applied). The licensee has stated that the H.B. Robinson accident profiles were enveloped by successful transmitter testing (reference 1764 and 4423). The licensee has provided (1) an O-ring replacement schedule and (2) statement that current testing by Rosemount represents an "over-test condition" with regard to H.B. Robinson parameters. This provides a technically sound basis for justification for interim operation. However, because the current Rosemount test report is not available for review to allow verification independently, this equipment item is considered unqualified. Since all transmitters inside containment are Rosemount model 1153A, an assessment of the current Rosemount test program by NRC should be conducted.



Franklin Research Center  
A Division of The Franklin Institute  
20th and Race Streets. Phila. Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
FRC Project No. C5257  
FRC Assignment No. 13  
FRC Task No. 511

Page  
7a

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 12

MAINTENANCE AND REPLACEMENT SCHEDULE SUMMARY

The following information regarding the maintenance and replacement schedule(s) for components, sub-components, and materials has been provided by the Licensee.

"  
Additional action required - A program of periodic transmitter housing O-ring replacement (performed during yearly instrument calibration check) will provide boron spray protection capability if an accident ever occurs. (See Paragraph 3.2.2.) To assure operational capability, a ten- (10) year transmitter replacement schedule has been adopted, to be modified when Rosemount can certify, by test, longer life equipment is available. [15]"



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 13

EQUIPMENT ITEM NO. 13  
 LEVEL TRANSMITTER LOCATED IN THE CONTAINMENT  
 ROSEMOUNT MODEL 1153A  
 REQUIRED OPERATING TIME: 30 MIN  
 TER CHECKSHEET NO. 13  
 LICENSEE REFERENCE(S): 1764, 4423  
 FUNCTION (PLANT ID): NOT STATED (LT-475, -476, -485, -486, -495, -496, -497)  
 FUNCTION (PLANT ID): MONITORS STEAM GENERATOR A NARROW RANGE LEVEL (LT-474)  
 FUNCTION (PLANT ID): MONITORS STEAM GENERATOR A WIDE RANGE LEVEL (LT-477)  
 FUNCTION (PLANT ID): MONITORS STEAM GENERATOR B NARROW RANGE LEVEL (LT-484)  
 FUNCTION (PLANT ID): MONITORS STEAM GENERATOR B WIDE RANGE LEVEL (LT-487)  
 FUNCTION (PLANT ID): MONITORS STEAM GENERATOR C NARROW RANGE LEVEL (LT-494)  
 FUNCTION (PLANT ID): MONITORS STEAM GENERATOR C WIDE RANGE LEVEL (LT-491)  
 FUNCTION (PLANT ID): MONITORS PRESSURIZER LEVEL AND ACTUATES SIS (LT-459,  
 -460, -461)  
 LICENSEE SUBMITTAL: SCEW(S): 19 OF 25 [20]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

R, T, QT, RT, P, H, CS, A, S, (R), M, I, QM RPN, EXN, SEN, QI, RPS, None,  
 Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, 3b, 3c, 3d
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	<del>5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h, 5i, 5j</del>
Installed TMI Lessons Learned Implementation Equipment Summary	<del>6a, 6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 13

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/~~has not~~) provided a response to the SER concerns.
- The Licensee (has/~~has not~~) specifically stated that the equipment is qualified and/or will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/~~has not~~) proposed a corrective action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
- Corrective action specified by the Licensee:
  - re-evaluate submergence level*
  - Equipment replacement with qualified equipment
  - Equipment modification
  - Equipment relocation above submergence level
  - Relocate or shield equipment from radiation source
  - Verify qualification by additional (testing/analysis)
  - Equipment relocation to a mild environment
  - Qualification testing of equipment in progress
  - Other (*replace O-ring each calibration period, replace*  
*whit at 10 year intervals, follow Rosemount testing program*)
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/~~has not~~) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action yearly.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |   |                                |
|---|--------------------------------|
| I.a Qualified                                       | II.c Qualified Life Deficiency |
| I.b Modification                                    | III.a Exempt                   |
| II.a Qualification Not Established                  | III.b Not in Scope             |
| <input checked="" type="radio"/> II.b Not Qualified | IV Documentation Not Available |



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 13

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
X = DEFICIENCY

Documented Evidence of Qualification Adequate	_____
Adequate Similarity Between Equipment and Test Specimen Established	_____
Aging Degradation Evaluated Adequately	<u>X</u>
Qualified Life or Replacement Schedule Established (If Required)	<u>X</u>
Program Established to Identify Aging Degradation	_____
Criteria Regarding Aging Simulation Satisfied (If Required)	_____
Criteria Regarding Temperature/Pressure Exposure:	
o Peak Temperature Adequate	_____
o Peak Pressure Adequate	_____
o Duration Adequate	_____
o Required Profile Enveloped Adequately	_____
o Steam Exposure (If Required) Adequate	_____
Criteria Regarding Spray Satisfied	_____
Criteria Regarding Submergence Satisfied	<u>X</u>
Criteria Regarding Radiation Satisfied	_____
Criteria Regarding Test Sequence Satisfied	<u>X</u>
Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied	<u>X</u>
Criteria Regarding Functional Testing Satisfied	_____
Criteria Regarding Instrument Accuracy Satisfied	_____
Test Duration Margin (1 hour + Function Time) Satisfied	_____
Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I)	<u>X</u>

NRC QUALIFICATION CATEGORY

DESIGNATION:  
X = CATEGORY

I.a	Equipment Qualified	_____
I.b	Equipment Qualification Pending Modification	_____
II.a	Equipment Qualification Not Established	_____
II.b	Equipment Not Qualified	<u>X</u>
II.c	Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified	_____
III.a	Equipment Exempt From Qualification	_____
III.b	Equipment Not in the Scope of the Qualification Review	_____
IV	Documentation Not Made Available	_____

*For detailed evaluation see equipment item 12  
 evaluation.*

*The licensee is re-evaluating submergence test.*



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 13

LICENSEE RESPONSE TO NRC SER

4.2 Equipment Requiring Additional Information and/or Corrective Action  
(Appendix B) [ 20 ]

The bulk of master list equipment was placed in this category and our review of deficiencies is based upon the following:

- Deletion of deficient listed equipment due to replacement programs carried out and reported in our 90-day, Revision 3 response dated February 1, 1981.
- Re-evaluation of CP&L's updated submittals by NRC Region II, Atlanta, GA, and reported in Environmental Qualification of Safety-Related Electrical Equipment IEB 79-01B. Technical Evaluation Report - Docket No. 50-261; Plant: H. B. Robinson 2, dated November 6, 1980 and Revised November 11, 1980.

Telecons with NRC, Bethesda, MD reviewing personnel July 29, 1981, et al.

Equipment deleted due to replacement programs completed at the plant. (Deficiency listings will not be addressed as these equipments are no longer in place or use at the plant).

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model No.</u>	<u>Location</u>
1. level transmitter	Fisher & Porter	10B2496	Containment
2. pressure transmitter	Fisher & Porter	50EP1041BCXA-NS	Containment
3. flow transmitter	Rosemount	1151	Containment
4. level transmitter	Fisher & Porter	13D2495	Containment
5. solenoid valve	ASCO	LB8211C32	Containment
6. solenoid valve	ASCO	LB8316B25	Containment
7. solenoid valve	ASCO	LB8316B15	Containment
8. solenoid valve	ASCO	LB8316B14	Containment
9. level transmitter	Fisher & Porter	13B2496	Containment

The Rosemount 1153A Transmitters are currently qualified to IEEE 323-1971. As reported in our 90-day responses these transmitters require a changeout cycle of ten (10) years with an O-Ring replacement after each calibration check to maintain their qualification level. CP&L is part of a utilities group which is underwriting transmitter qualification to IEEE-323-1974 standards. As these tests are ongoing, no recommendations or changeout program is being formulated at this time. Upon test completion, CP&L will determine any added transmitter changeout or modification program and report to the NRC its actions.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 13

3.2.2 Electronic Transmitters [15]

H. B. Robinson's original design and specification called for installation and use of Fisher and Porter electronic transmitter for the measurement of Pressure, Level and Flow parameters. As stated within CP&L response to NRC IE Bulletin 79-01 and the 45-day response to NRC IE Bulletin 79-01B CP&L preference, to obtain better operation and maintenance performance, is to change out the existing transmitters within containment--to be replaced by Rosemounts' Model No. 1153A.

Environmental tests performed on Fisher & Porter's transmitters (Model No. 10B2496) indicate failure occurs during the high temperature, steam/chemical spray testing stage while attempting to qualify to IEEE 323-1971 parameters. (Reference WCAP 9157 Environmental Qualification of Safety-Related Class IE Process Instrumentation).

Qualification testing of Rosemount Model 1153, Series A, per Rosemount Report No. 3788 states that the transmitter is qualified per the requirements of IEEE 323-1971. Missing from this report is the aging parameter not required for IEEE 323-1971 but necessary for complete LOCA qualification. Recent Rosemount testing to qualify a transmitter to meet IEEE 323-1974 requirements has resulted in failure. A combination of thermal aging, irradiation and chemical spray test specification parameters has resulted in failed components. The initial failed element was an O-ring comprised of sulphur cured polyethylene rubber. This allowed steam/chemical spray to affect electronic components. The O-ring mode of failure is attributed to high temperature vs. time necessary for the Arrhenius curve time compression to satisfy aging test requirements.

This testing failure does not preclude the use of the Rosemount 1153A within H. B. Robinson containment as it has successfully performed within the H. B. Robinson accident parameters of temperature, pressure and radiation levels. Transmitters located in containment will be required to perform within a maximum time period of twenty-four (24) hours following accident. O-ring failure due to high temperature should not occur during this time period. Reviewing Table C-1 of Appendix C, NRC IE Bulletin 79-01B, Thermal and Radiation Aging Degradation of Selected Materials, shows that polyethylene rubber has a potential for significant aging at ten (10) years and an allowable radiation susceptibility of 10<sup>7</sup> RADS before serious degradation occurs. Evaluating the above establishes the need to perform periodic changeout of transmitter O-rings.





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 13

LICENSEE RESPONSE TO NRC SER (Continued)

Additionally, the time span to which Rosemount will qualify its IEEE 373-1974 transmitters is ten (10) years. To assure that listed transmitters within H. B. Robinson containment remain qualified a ten- (10) year replacement cycle will be adopted. (1)

Replacement of in-containment transmitters identified within this report has been performed within the 1980 refueling outage (August - October, 1980). At this time, no fully qualified transmitter is available for nuclear plant in-containment operation. Rosemount 1153A transmitters, qualified to IEEE 323-1971 version, were used as replacements.

Additional action required - A program of periodic transmitter housing O-ring replacement (performed during yearly instrument calibration check) will provide boron spray protection capability if an accident ever occurs. (See Paragraph 3.2.2.) To assure operational capability, a ten- (10) year transmitter replacement schedule has been adopted, to be modified when Rosemount can certify, by test, longer life equipment is available. [15]

SECTION III - Proposed Corrective Actions for Outstanding Items

Electronic transmitters qualified to IEEE-323-1974 are not currently available. CP&L is a participating member of the Wisconsin Electric Transmitter Evaluation Program to test and qualify electronic transmitters for nuclear plant use. Presently, CP&L has upgraded its master list transmitters within containment to Rosemount 1153A models which are qualified to IEEE-323-1972. After the current test program is complete - which extends into the fourth quarter of 1982 - CP&L will evaluate the results and decide on action(s) to be taken to provide fully qualified equipments. In the interim, CP&L has established a program which requires changeout of O-rings when yearly calibration checks are performed and a complete instrument changeout on ten-year cycles after installation dates, to maintain qualification level.

[20]



Franklin Research Center

A Division of The Franklin Institute

20th and Race Streets. Phila. Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118

FRC Project No. C5257

FRC Assignment No. 13

FRC Task No. 511

Page

3d

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 17

LICENSEE RESPONSE TO NRC SER (Continued)

The safety-related level transmitters (LT 459, LT 460, and LT 461) referred to in this paragraph provide pressurizer water level indication and are mounted in an instrument rack on the shield wall at elevation 230 ft within containment. These transmitters have been replaced with Rosemount Model 1153A transmitters during the August, 1980 outage at H.B. Robinson Unit 2. Instruction was given to remount as high as possible and practical in the instrument rack. A new measurement is required for re-evaluation of submergence level for these instruments. Additional study indicates their need time within the LOCA to be the first 30 minutes.

A study will be performed to evaluate the effect of new mounting, the rate of flood to determine useful time, and the effects of new emergency procedures on these instrumentation reading requirements. At this time, the statement that their assumed failure under submergence will not affect accident mitigation is still a valid one. This study will be completed by the date established by the NRC for completion of qualification of safety-related electrical equipment.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 13

MAINTENANCE AND REPLACEMENT SCHEDULE SUMMARY

The following information regarding the maintenance and replacement schedule(s) for components, sub-components, and materials has been provided by the Licensee.

1/  
Additional action required - A program of periodic transmitter housing O-ring replacement (performed during yearly instrument calibration check) will provide boron spray protection capability if an accident ever occurs. (See Paragraph 3.2.2.) To assure operational capability, a ten- (10) year transmitter replacement schedule has been adopted, to be modified when Rosemount can certify, by test, longer life equipment is available. [15]"



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 14

EQUIPMENT ITEM NO. 14  
 FLOW TRANSMITTER LOCATED IN THE CONTAINMENT  
 ROSEMOUNT MODEL 1153A  
 REQUIRED OPERATING TIME: 1 HOUR TO 1 DAY  
 TER CHECKSHEET NO. 14  
 LICENSEE REFERENCE(S): 1764, 4423  
 FUNCTION (PLANT ID): MONITORS MAIN STEAM FLOW LOOP A (FT-474, -475)  
 FUNCTION (PLANT ID): MONITORS MAIN STEAM FLOW LOOP B (FT-484, -485)  
 FUNCTION (PLANT ID): MONITORS MAIN STEAM FLOW LOOP C (FT-494, -495)  
 LICENSEE SUBMITTAL: SCEW(S): 19 OF 25 [20]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

R, T, QT, RT, P, H, CS, A, S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,  
 Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, 3b, 3c, <del>3d</del>
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	<del>5a, 5b, 5c, 5d, 5e, 5f,</del> <del>5g, 5h, 5i, 5j</del>
Installed TMI Lessons Learned Implementation Equipment Summary	<del>6a, 6b</del>
Maintenance and Replacement Schedule Summary	7a, <del>7b, 7c</del>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 14

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/~~has not~~) provided a response to the SER concerns.
- The Licensee (has/~~has not~~) specifically stated that the equipment is qualified and/or will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/~~has not~~) proposed a corrective action for this equipment item whose qualification has not been fully established.

Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.

Corrective action specified by the Licensee:

- Equipment replacement with qualified equipment
- Equipment modification
- Equipment relocation above submergence level
- Relocate or shield equipment from radiation source
- Verify qualification by additional (testing/analysis)
- Equipment relocation to a mild environment
- Qualification testing of equipment in progress

Other (*replace O-ring each calibration period, replace unit at 10-year intervals, follow Rosemount testing program*)

The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.

The Licensee (has/~~has not~~) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action yearly.)

The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |                                    |                                |
|------------------------------------|--------------------------------|
| I.a Qualified                      | II.c Qualified Life Deficiency |
| I.b Modification                   | III.a Exempt                   |
| II.a Qualification Not Established | III.b Not in Scope             |
| <u>II.b Not Qualified</u>          | IV Documentation Not Available |



**EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 14**

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
 X = DEFICIENCY

Documented Evidence of Qualification Adequate	_____
Adequate Similarity Between Equipment and Test Specimen Established	_____
Aging Degradation Evaluated Adequately	<u>X</u>
Qualified Life or Replacement Schedule Established (If Required)	<u>X</u>
Program Established to Identify Aging Degradation	_____
Criteria Regarding Aging Simulation Satisfied (If Required)	_____
Criteria Regarding Temperature/Pressure Exposure:	
o Peak Temperature Adequate	_____
o Peak Pressure Adequate	_____
o Duration Adequate	_____
o Required Profile Enveloped Adequately	_____
o Steam Exposure (If Required) Adequate	_____
Criteria Regarding Spray Satisfied	_____
Criteria Regarding Submergence Satisfied	_____
Criteria Regarding Radiation Satisfied	_____
Criteria Regarding Test Sequence Satisfied	<u>X</u>
Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied	<u>X</u>
Criteria Regarding Functional Testing Satisfied	_____
Criteria Regarding Instrument Accuracy Satisfied	_____
Test Duration Margin (1 hour + Function Time) Satisfied	_____
Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I)	<u>X</u>

NRC QUALIFICATION CATEGORY

DESIGNATION:  
 X = CATEGORY

I.a	Equipment Qualified	_____
I.b	Equipment Qualification Pending Modification	_____
II.a	Equipment Qualification Not Established	_____
II.b	Equipment Not Qualified	<u>X</u>
II.c	Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified	_____
III.a	Equipment Exempt From Qualification	_____
III.b	Equipment Not in the Scope of the Qualification Review	_____
IV	Documentation Not Made Available	_____

*See evaluation for equipment item 12 for full details*



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 14

LICENSEE RESPONSE TO NRC SER

4.2 Equipment Requiring Additional Information and/or Corrective Action  
 (Appendix B) [20]

The bulk of master list equipment was placed in this category and our review of deficiencies is based upon the following:

- Deletion of deficient listed equipment due to replacement programs carried out and reported in our 90-day, Revision 3 response dated February 1, 1981.
- Re-evaluation of CP&L's updated submittals by NRC Region II, Atlanta, GA, and reported in Environmental Qualification of Safety-Related Electrical Equipment IEB 79-01B. Technical Evaluation Report - Docket No. 50-261; Plant: H. B. Robinson 2, dated November 6, 1980 and Revised November 11, 1980.

Telecons with NRC, Bethesda, MD reviewing personnel July 29, 1981, et al.

Equipment deleted due to replacement programs completed at the plant. (Deficiency listings will not be addressed as these equipments are no longer in place or use at the plant).

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model No.</u>	<u>Location</u>
1. level transmitter	Fisher & Porter	10B2496	Containment
2. pressure transmitter	Fisher & Porter	50EP1041BCXA-NS	Containment
3. flow transmitter	Rosemount	1151	Containment
4. level transmitter	Fisher & Porter	13D2495	Containment
5. solenoid valve	ASCO	LB8211C32	Containment
6. solenoid valve	ASCO	LB8316B25	Containment
7. solenoid valve	ASCO	LB8316B15	Containment
8. solenoid valve	ASCO	LB8316B14	Containment
9. level transmitter	Fisher & Porter	13B2496	Containment

The Rosemount 1153A Transmitters are currently qualified to IEEE 323-1971. As reported in our 90-day responses these transmitters require a changeout cycle of ten (10) years with an O-Ring replacement after each calibration check to maintain their qualification level. CP&L is part of a utilities group which is underwriting transmitter qualification to IEEE-323-1974 standards. As these tests are ongoing, no recommendations or changeout program is being formulated at this time. Upon test completion, CP&L will determine any added transmitter changeout or modification program and report to the NRC its actions.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 14

3.2.2 Electronic Transmitters [15]

H. B. Robinson's original design and specification called for installation and use of Fisher and Porter electronic transmitter for the measurement of Pressure, Level and Flow parameters. As stated within CP&L response to NRC IE Bulletin 79-01 and the 45-day response to NRC IE Bulletin 79-01B CP&L preference, to obtain better operation and maintenance performance, is to change out the existing transmitters within containment--to be replaced by Rosemounts' Model No. 1153A.

Environmental tests performed on Fisher & Porter's transmitters (Model No. 10B2496) indicate failure occurs during the high temperature, steam/chemical spray testing stage while attempting to qualify to IEEE 323-1971 parameters. (Reference WCAP 9157 Environmental Qualification of Safety-Related Class IE Process Instrumentation).

Qualification testing of Rosemount Model 1153, Series A, per Rosemount Report No. 3788 states that the transmitter is qualified per the requirements of IEEE 323-1971. Missing from this report is the aging parameter not required for IEEE 323-1971 but necessary for complete LOCA qualification. Recent Rosemount testing to qualify a transmitter to meet IEEE 323-1974 requirements has resulted in failure. A combination of thermal aging, irradiation and chemical spray test specification parameters has resulted in failed components. The initial failed element was an O-ring comprised of sulphur cured polyethylene rubber. This allowed steam/chemical spray to affect electronic components. The O-ring mode of failure is attributed to high temperature vs. time necessary for the Arrhenius curve time compression to satisfy aging test requirements.

This testing failure does not preclude the use of the Rosemount 1153A within H. B. Robinson containment as it has successfully performed within the H. B. Robinson accident parameters of temperature, pressure and radiation levels. Transmitters located in containment will be required to perform within a maximum time period of twenty-four (24) hours following accident. O-ring failure due to high temperature should not occur during this time period. Reviewing Table C-1 of Appendix C, NRC IE Bulletin 79-01B, Thermal and Radiation Aging Degradation of Selected Materials, shows that polyethylene rubber has a potential for significant aging at ten (10) years and an allowable radiation susceptibility of 10<sup>7</sup> RADS before serious degradation occurs. Evaluating the above establishes the need to perform periodic changeout of transmitter O-rings.





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 14

Additionally, the time span to which Rosemount will qualify its IEEE 373-1974 transmitters is ten (10) years. To assure that listed transmitters within H. B. Robinson containment remain qualified a ten- (10) year replacement cycle will be adopted. <sup>(1)</sup>

Replacement of in-containment transmitters identified within this report has been performed within the 1980 refueling outage (August - October, 1980). At this time, no fully qualified transmitter is available for nuclear plant in-containment operation. Rosemount 1153A transmitters, qualified to IEEE 323-1971 version, were used as replacements.

Additional action required - A program of periodic transmitter housing O-ring replacement (performed during yearly instrument calibration check) will provide boron spray protection capability if an accident ever occurs. (See Paragraph 3.2.2.) To assure operational capability, a ten- (10) year transmitter replacement schedule has been adopted, to be modified when Rosemount can certify, by test, longer life equipment is available. [15]

SECTION III - Proposed Corrective Actions for Outstanding Items

Electronic transmitters qualified to IEEE-323-1974 are not currently available. CP&L is a participating member of the Wisconsin Electric Transmitter Evaluation Program to test and qualify electronic transmitters for nuclear plant use. Presently, CP&L has upgraded its master list transmitters within containment to Rosemount 1153A models which are qualified to IEEE-323-1972. After the current test program is complete - which extends into the fourth quarter of 1982 - CP&L will evaluate the results and decide on action(s) to be taken to provide fully qualified equipments. In the interim, CP&L has established a program which requires changeout of O-rings when yearly calibration checks are performed and a complete instrument changeout on ten-year cycles after installation dates, to maintain qualification level.

[20]



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 14

MAINTENANCE AND REPLACEMENT SCHEDULE SUMMARY

The following information regarding the maintenance and replacement schedule(s) for components, sub-components, and materials has been provided by the Licensee.

Additional action required - A program of periodic transmitter housing O-ring replacement (performed during yearly instrument calibration check) will provide boron spray protection capability if an accident ever occurs. (See Paragraph 3.2.2.) To assure operational capability, a ten- (10) year transmitter replacement schedule has been adopted, to be modified when Rosemount can certify, by test, longer life equipment is available. [15] "



Franklin Research Center  
 A Division of The Franklin Institute  
 20th and Race Streets, Phila., Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
 FRC Project No. C5257  
 FRC Assignment No. 13  
 FRC Task No. 511

Page  
 1a

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 15

EQUIPMENT ITEM NO. 15 (TMI ACTION PLAN ITEM II.F.2)  
 PRESSURE TRANSMITTER LOCATED IN THE CONTAINMENT  
 ROSEMOUNT MODEL 1153GA9  
 REQUIRED OPERATING TIME: NOT STATED  
 TER CHECKSHEET NO. 15  
 LICENSEE REFERENCE(S): 1764, 4423  
 FUNCTION (PLANT ID): DETECTION OF INADEQUATE CORE COOLING (PT-500, -501)  
 LICENSEE SUBMITTAL: SCEW(S): 6 OF 15 [15]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

R, T, QT, RT, P, H, CS, A, S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,  
Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, 3b, 3c, <del>5d</del>
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	<del>5a, 5b, 5c, 5d, 5e, 5f,</del> <del>5g, 5h, 5i, 5j</del>
Installed TMI Lessons Learned Implementation Equipment Summary	6a, 6b
Maintenance and Replacement Schedule Summary	7a, <del>7b, 7c</del>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 15

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/has not) provided a response to the SER concerns.
- The Licensee (has/has not) specifically stated that the equipment is qualified and/or will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/~~has not~~) proposed a corrective action for this equipment item whose qualification has not been fully established.
  - Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
  - Corrective action specified by the Licensee:
    - Equipment replacement with qualified equipment
    - Equipment modification
    - Equipment relocation above submergence level
    - Relocate or shield equipment from radiation source
    - Verify qualification by additional (testing/analysis)
    - Equipment relocation to a mild environment
    - Qualification testing of equipment in progress
    - Other (replace O-ring each calibration period, replace  
whit at 10 year intervals, follow Rossum testing program)
  - The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
  - The Licensee (has/~~has not~~) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action yearly.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |                                    |                                |
|------------------------------------|--------------------------------|
| I.a Qualified                      | II.c Qualified Life Deficiency |
| I.b Modification                   | III.a Exempt                   |
| II.a Qualification Not Established | III.b Not in Scope             |
| <u>II.b</u> Not Qualified          | IV Documentation Not Available |



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 15

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
X = DEFICIENCY

Documented Evidence of Qualification Adequate	_____
Adequate Similarity Between Equipment and Test Specimen Established	_____
Aging Degradation Evaluated Adequately	<u>X</u> _____
Qualified Life or Replacement Schedule Established (If Required)	<u>X</u> _____
Program Established to Identify Aging Degradation	_____
Criteria Regarding Aging Simulation Satisfied (If Required)	_____
Criteria Regarding Temperature/Pressure Exposure:	
o Peak Temperature Adequate	_____
o Peak Pressure Adequate	_____
o Duration Adequate	_____
o Required Profile Enveloped Adequately	_____
o Steam Exposure (If Required) Adequate	_____
Criteria Regarding Spray Satisfied	_____
Criteria Regarding Submergence Satisfied	_____
Criteria Regarding Radiation Satisfied	_____
Criteria Regarding Test Sequence Satisfied	<u>X</u> _____
Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied	<u>X</u> _____
Criteria Regarding Functional Testing Satisfied	_____
Criteria Regarding Instrument Accuracy Satisfied	_____
Test Duration Margin (1 hour + Function Time) Satisfied	_____
Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I)	<u>X</u> _____

NRC QUALIFICATION CATEGORY

DESIGNATION:  
X = CATEGORY

I.a	Equipment Qualified	_____
I.b	Equipment Qualification Pending Modification	_____
II.a	Equipment Qualification Not Established	_____
II.b	Equipment Not Qualified	<u>X</u> _____
II.c	Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified	_____
III.a	Equipment Exempt From Qualification	_____
III.b	Equipment Not in the Scope of the Qualification Review	_____
IV	Documentation Not Made Available	_____

*For evaluation see equipment item 12.*



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 15

*Licence Statement*

To be utilized during TMI-2 accident scenario per procedure  
See accident profile - Temperature - Figure 3.1.1  
See accident profile - Pressure - Figure 3.1.2  
In containment radiation level established for purchase of component  
Test performed prior to LOCA simulated environmental exposure  
Rosemount test to IEEE 323-1971 format, currently transmitters  
under test to meet IEEE 323-1974 requirements

[15]

The Rosemount 1153A Transmitters are currently qualified to IEEE 323-1971. As reported in our 90-day responses these transmitters require a changeout cycle of ten (10) years with an O-Ring replacement after each calibration check to maintain their qualification level. CP&L is part of a utilities group which is underwriting transmitter qualification to IEEE-323-1974 standards. As these tests are ongoing, no recommendations or changeout program is being formulated at this time. Upon test completion, CP&L will determine any added transmitter changeout or modification program and report to the NRC its actions.

[22]



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 15

3.2.2 Electronic Transmitters [15]

H. B. Robinson's original design and specification called for installation and use of Fisher and Porter electronic transmitter for the measurement of Pressure, Level and Flow parameters. As stated within CP&L response to NRC IE Bulletin 79-01 and the 45-day response to NRC IE Bulletin 79-01B CP&L preference, to obtain better operation and maintenance performance, is to change out the existing transmitters within containment--to be replaced by Rosemounts' Model No. 1153A.

Environmental tests performed on Fisher & Porter's transmitters (Model No. 10B2496) indicate failure occurs during the high temperature, steam/chemical spray testing stage while attempting to qualify to IEEE 323-1971 parameters. (Reference WCAP 9157 Environmental Qualification of Safety-Related Class IE Process Instrumentation).

Qualification testing of Rosemount Model 1153, Series A, per Rosemount Report No. 3788 states that the transmitter is qualified per the requirements of IEEE 323-1971. Missing from this report is the aging parameter not required for IEEE 323-1971 but necessary for complete LOCA qualification. Recent Rosemount testing to qualify a transmitter to meet IEEE 323-1974 requirements has resulted in failure. A combination of thermal aging, irradiation and chemical spray test specification parameters has resulted in failed components. The initial failed element was an O-ring comprised of sulphur cured polyethylene rubber. This allowed steam/chemical spray to affect electronic components. The O-ring mode of failure is attributed to high temperature vs. time necessary for the Arrhenius curve time compression to satisfy aging test requirements.

This testing failure does not preclude the use of the Rosemount 1153A within H. B. Robinson containment as it has successfully performed within the H. B. Robinson accident parameters of temperature, pressure and radiation levels. Transmitters located in containment will be required to perform within a maximum time period of twenty-four (24) hours following accident. O-ring failure due to high temperature should not occur during this time period. Reviewing Table C-1 of Appendix C, NRC IE Bulletin 79-01B, Thermal and Radiation Aging Degradation of Selected Materials, shows that polyethylene rubber has a potential for significant aging at ten (10) years and an allowable radiation susceptibility of 10<sup>7</sup> RADS before serious degradation occurs. Evaluating the above establishes the need to perform periodic changeout of transmitter O-rings.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 15

Additionally, the time span to which Rosemount will qualify its IEEE 373-1974 transmitters is ten (10) years. To assure that listed transmitters within H. B. Robinson containment remain qualified a ten- (10) year replacement cycle will be adopted. <sup>(1)</sup>

Replacement of in-containment transmitters identified within this report has been performed within the 1980 refueling outage (August - October, 1980). At this time, no fully qualified transmitter is available for nuclear plant in-containment operation. Rosemount 1153A transmitters, qualified to IEEE 323-1971 version, were used as replacements.

Additional action required - A program of periodic transmitter housing O-ring replacement (performed during yearly instrument calibration check) will provide boron spray protection capability if an accident ever occurs. (See Paragraph 3.2.2.) To assure operational capability, a ten- (10) year transmitter replacement schedule has been adopted, to be modified when Rosemount can certify, by test, longer life equipment is available. [15]

SECTION III - Proposed Corrective Actions for Outstanding Items

Electronic transmitters qualified to IEEE-323-1974 are not currently available. CP&L is a participating member of the Wisconsin Electric Transmitter Evaluation Program to test and qualify electronic transmitters for nuclear plant use. Presently, CP&L has upgraded its master list transmitters within containment to Rosemount 1153A models which are qualified to IEEE-323-1972. After the current test program is complete - which extends into the fourth quarter of 1982 - CP&L will evaluate the results and decide on action(s) to be taken to provide fully qualified equipments. In the interim, CP&L has established a program which requires changeout of O-rings when yearly calibration checks are performed and a complete instrument changeout on ten-year cycles after installation dates, to maintain qualification level.

[20]





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 15

INSTALLED TMI LESSONS LEARNED IMPLEMENTATION EQUIPMENT SUMMARY

NRC requested an evaluation of the environmental qualification of safety-related electrical equipment located in harsh environments required for TMI Lessons Learned Implementation. The objective is to evaluate qualification documentation of equipment within the scope of IE Bulletin 79-01B, Supplement 3 (item 2), in accordance with criteria established by the NRC (see Section 2 of this report) in a manner identical to the evaluation of all other safety-related electrical equipment. The scope of this review is limited to TMI Action Plan equipment associated with specific sections of NUREG-0737 which have an installation implementation date of January 1, 1981 (sections are identified below). Where applicable, a review is to be performed on installed equipment with implementation dates after January 1, 1981 if adequately identified by the licensee.

This plant is a PWR , BWR .

The NSSS Vendor is Westinghouse (W) , Babcox & Wilcox (B&W) ,  
Combustion Engineering (CE) , General Electric (GE) .

With respect to this equipment item, it is noted (applicable section checked):

- The Licensee does not provide adequate information with respect to identification of TMI Action Plan equipment installed as of 1/1/81.
- The Licensee has not provided the correlation of this equipment item with the specific sections of NUREG-0737. [The correlation is needed to ensure that all items are included in the review, e.g., if a transmitter is identified as a TMI Action Plan item, are the cable and the terminal blocks associated with the device also identified?]
- The Licensee has not provided the approximate installation date for the TMI Action Plan equipment items so that the appropriate qualification criteria (NUREG-0588 or DOR Guidelines) can be used in the EEQ evaluation.
- The Licensee has provided a standard Owners' Group position with respect to a NUREG-0737 technical area.
- The Licensee has requested extensions of implementation dates.
- The Licensee has stated that this equipment item is associated with the following section of NUREG-0737. (This list of applicable NUREG-0737 sections has been identified by NRC as sections within the scope of this review):
  - II.B.3 (ALL/1-1-81) Post-Accident Sampling Capability of Reactor Coolant and Containment
  - II.D.3 (ALL/1-1-81) Direct Indication of Relief and Safety Valve Position



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 15

- II.E.1.2 (PWR/1-1-81) Auxiliary Feedwater System Automatic Initiation and Flow Indication
- II.E.3.1 (PWR/1-1-81) Emergency Power Supply for Pressurizer Heaters (Safety-Grade Interfaces)
- II.E.4.1 (ALL/7-1-81) Dedicated Hydrogen Penetrations
- II.E.4.2 (ALL/1-1-81) Containment Isolation Dependability
- II.F.2 (PWR/1-1-81) Instrumentation for Detection of Inadequate Core Cooling
- II.G.1 (PWR/1-1-81) Emergency Power for Pressurizer Equipment (Safety-Grade Interfaces)
- II.K.2.10 (PWR/B&W/7-1-81) Safety-Grade Anticipatory Reactor Trip
- II.K.3.9 (PWR/W/1-1-81) PID Controller Modification (If Hardware Change Involved)
- II.K.3.12 (PWR/W/1-1-81) Anticipatory Reactor Trip upon Turbine Trip
- II.K.3.13 (BWR/GE/7-1-81) Separation of HPCI and RCIC Initiatica Signals
- II.K.3.15 (BWR/GE/7-1-81) Prevention of Spurious Isolation of HPCI and RCIC Systems
- II.K.3.19 (BWR/GE/7-1-81) Interlock on Recirculation Pump Loop
- II.K.3.21 (BWR/GE/7-1-81) Restart of Core Spray and LPCI Systems (If Hardware Charged Out)
- II.K.3.27 (BWR/GE/7-1-81) Provide Common Reference Level for Vessel Level Instrumentation (If Hardware Changed Out)



Franklin Research Center  
A Division of The Franklin Institute  
20th and Race Streets, Phila., Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
FRC Project No. C5257  
FRC Assignment No. 13  
FRC Task No. 511

Page  
7a

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 15

MAINTENANCE AND REPLACEMENT SCHEDULE SUMMARY

The following information regarding the maintenance and replacement schedule(s) for components, sub-components, and materials has been provided by the Licensee.

Additional action required - A program of periodic transmitter housing O-ring replacement (performed during yearly instrument calibration check) will provide boron spray protection capability if an accident ever occurs. (See Paragraph 3.2.2.) To assure operational capability, a ten- (10) year transmitter replacement schedule has been adopted, to be modified when Rosemount can certify, by test, longer life equipment is available. [15] "



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 16

EQUIPMENT ITEM NO. 16 (TMI ACTION PLAN ITEM II.F.1.5)  
 LEVEL TRANSMITTER LOCATED IN THE CONTAINMENT  
 GEMS MODEL XM52495  
 REQUIRED OPERATING TIME: NOT STATED  
 TER CHECKSHEET NO. 16  
 LICENSEE REFERENCE(S): 1887  
 FUNCTION (PLANT ID): CONTAINMENT SUMP WATER LEVEL (LT-801A, B, C, D)  
 LICENSEE SUBMITTAL: SCEW(S): 12 of 15 [15]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

R, T, QI, RT, P, H, CS, A, S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,  
 Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, <del>3b, 3c, 3d</del>
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	5a, 5b, 5c, 5d, 5e, 5f, 5g, <del>5h, 5i, 5j</del>
Installed TMI Lessons Learned Implementation Equipment Summary	6a, <del>6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



**EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 16**

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/~~has not~~) provided a response to the SER concerns.
- The Licensee (has/has not) specifically stated that the equipment is qualified and/or will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/has not) proposed a corrective action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
- ~~Corrective~~ action specified by the Licensee:
  - Equipment <sup>has been Replaced</sup> ~~replacement~~ with qualified equipment
  - Equipment modification
  - Equipment relocation above submergence level
  - Relocate or shield equipment from radiation source
  - Verify qualification by additional (testing/analysis)
  - Equipment relocation to a mild environment
  - Qualification testing of equipment in progress
  - Other ( \_\_\_\_\_ )
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |                                    |                                |
|------------------------------------|--------------------------------|
| I.a Qualified                      | II.c Qualified Life Deficiency |
| I.b Modification                   | III.a Exempt                   |
| II.a Qualification Not Established | III.b Not in Scope             |
| <b>II.b</b> Not Qualified          | IV Documentation Not Available |



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 16

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
 X = DEFICIENCY

Documented Evidence of Qualification Adequate	<u>X</u>
Adequate Similarity Between Equipment and Test Specimen Established	<u>X</u>
Aging Degradation Evaluated Adequately	<u>X</u>
Qualified Life or Replacement Schedule Established (If Required)	<u>X</u>
Program Established to Identify Aging Degradation	<u>X</u>
Criteria Regarding Aging Simulation Satisfied (If Required)	<u>X</u>
Criteria Regarding Temperature/Pressure Exposure:	
o Peak Temperature Adequate	<u>   </u>
o Peak Pressure Adequate	<u>   </u>
o Duration Adequate	<u>X</u>
o Required Profile Enveloped Adequately	<u>X</u>
o Steam Exposure (If Required) Adequate	<u>   </u>
Criteria Regarding Spray Satisfied	<u>X</u>
Criteria Regarding Submergence Satisfied	<u>X</u>
Criteria Regarding Radiation Satisfied	<u>   </u>
Criteria Regarding Test Sequence Satisfied	<u>X</u>
Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied	<u>   </u>
Criteria Regarding Functional Testing Satisfied	<u>X</u>
Criteria Regarding Instrument Accuracy Satisfied	<u>X</u>
Test Duration Margin (1 hour + Function Time) Satisfied	<u>   </u>
Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I)	<u>X</u>

NRC QUALIFICATION CATEGORY

DESIGNATION:  
 X = CATEGORY

I.a	Equipment Qualified	<u>   </u>
I.b	Equipment Qualification Pending Modification	<u>   </u>
II.a	Equipment Qualification Not Established	<u>   </u>
II.b	Equipment Not Qualified	<u>X</u>
II.c	Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified	<u>   </u>
III.a	Equipment Exempt From Qualification	<u>   </u>
III.b	Equipment Not in the Scope of the Qualification Review	<u>   </u>
IV	Documentation Not Made Available	<u>   </u>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 16

LICENSEE RESPONSE TO NRC SER

The level switch reported is for containment sump level indication and has been superceded in place by two GEMS level transmitters Model No. XM36495 as part of the TMI lessons learned action items. This system is currently reported in our response to the TMI Equipment requirement submitted in February, 1981.

[20]

(	Level Switch	Madison	5602	1	R,T,QT,RT,P,H, CS,A,QM	)
---	--------------	---------	------	---	---------------------------	---

[20]

See accident profile - Temperature - Figure 3.1.1  
 See accident profile - Pressure - Figure 3.1.2  
 To be utilized during TMI-2 accident scenario per procedure  
 Equipment tested to IEEE-323-1971  
 System designed to measure sequential flood levels

[5]



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 16

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW

Criteria: DOR Guidelines \_\_\_; NUREG-0588, Cat. I X; NUREG-0588, Cat. II \_\_\_.

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
<u>EQUIPMENT DESCRIPTION</u> Equipment Type	LEVEL TRANSMITTER	LEVEL TRANSMITTER	
Manufacturer's Name (5.2.2/-/-)	DELAVAL/GEMS	DELAVAL/GEMS	
Model Number (5.2.2/-/-)	XM52495	XM36495	X
Serial Number			
Features/Mounting (5.2.6/-/-)			
Connections/Interfaces (5.2.6/-/-)	ND	CONDUIT, GE RTV-60	
Location/Elevation	CONTAINMENT: 231.2'		
Equipment ID No.	LT801 LT802		
<u>QUALIFICATION REPORT</u> (8.0/5.0/5.0)			
Report ID Number	—	F-C3834, S-C3834	NOTE 1,2
Report Date		March, 1978	
Issued by		FIRL	
Prepared for		DELAVAL/GEMS	
Referenced Reports			
Qualification Method (5.1, 5.3/2.1, 2.4/2.1, 2.4)	—	TYPE TEST	
<u>QUALIFICATION TEST PROGRAM</u> Functional Test Description (5.2.5/2.2.9/2.2.9)			
Operating Conditions (-/2.2.10/2.2.10)			
Load/Cycles/Voltage/ Current/Freq.		10 VAC CIRCUIT VOLTAGE	





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 16

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
Acceptance Criteria (5.2.5/2.2.1/2.2.1)		EXCESSIVE OUTPUT ERROR	NOT MEASURED AS A % AGE NOTE 1
Accuracy (5.2.5/-/-)	ND	NOT STATED	
Number of Specimens		1	
Test Instruments Calibrated			
Safety Function (Active/ Passive) (-/2.1.3/2.1.3)	CONT. SUM. WATER LEVEL		
Test Duration (5.2.1/-/-)	-	14 DAYS	
Accident Duration (Envir. Above Normal) (5.2.1/-/-)			
Required Function Time	LONG TERM		
Test Sequence (General) (5.2.3/2.3.1/2.3.1)		SIMULTANEOUS	
Test Sequence (NUREG-0588, Cat. I) (-/2.3.1/-)			
1. Representative Sample			
2. Baseline Data			
3. Performance Extremes			
4. Thermal Aging			
5. Radiation Aging			
6. Wear Aging			
7. Vibration/Seismic			
8. DBE Exposure			
9. Post-DBE Exposure			
10. Inspection			
Aging (5.2.4, 7.0/4.0/4.0)		ND	NOTE 3
Thermal Aging/Basis			
Material Aging Evaluation (7.0/-/-)			
Materials Susceptible (Thermal) (5.2.4, 7.0/-/-)			
Radiation Aging, Type			



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 16

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
Radiation Aging, Dose (rd)	ND	25. x 10 <sup>6</sup>	
Radiation Aging, Dose Rate	50-200 rd/h	1.0 Mrd/hr.	
Radiation Aging, Method			
Materials Susceptible (Radiation) (5.2.4, 7.0/-/-)		SILICONE FLUID	
Operational Aging (-/4.2/-)			
Other Age Conditioning (-/4.2/-)			
Qualified Life Claimed/ Established (5.2.4/4.10/-)	ND	ND	NOTE 4
Normal Ambient Temperature	115°F		
Normal Ambient Radiation	50-200 rd/h		
Normal Ambient Humidity	NOT STATED		
On-Going Surveillance and Preventive Maintenance (7.0/-/-)	YES		PER CP&L PROGRAM
On-Going Analysis of Failures and Degradation (7.0/-/-)	YES		
Margin (General) (6.0/3.0/3.0)			
Margin (NUREG-0588, Cat. I) (-/3.2/-)			
1. Temperature (+15°F)			
2. Pressure (+10%, 10 psig max)			
3. Radiation (not required)			
4. Time (+10%, +1 hour + function time minimum)			



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 16

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
<u>ACCIDENT CONDITIONS</u>			
LOCA/MSLB/HELB/Uncontrolled (4.1, 4.2, 4.3.1, 4.3.3/ 1.1, 1.2, 1.5/1.1, 1.2, 1.5)	LOCA	LOCA	
Radiation Type	GAMMA	GAMMA	
Radiation Dose (rd) (4.1.2/1.4/1.4)		$175.0 \times 10^6$	
Radiation Dose Rate (rd/hr) Radiation Qual. Method (5.3.1/-/-)		$0.7 \times 10^6$	
Proximity to Concentrated Radiation (4.1.2/1.4.6/1.4.6)	CONTAINMENT SUMP		
Equipment Susceptible to Beta Radiation (4.1.2/-/-)			
Radiation Dose (Normal + Accident) (4.1.2/-/-)		$2.0 \times 10^8$	
Plateout Dose Considered (-/1.48/1.48)	$2.0 \times 10^8$ rd.		
Gamma + Beta Dose (rd) (4.1.2/1.4.7/1.4.7)			



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 16

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE No.)
<u>ENVIRONMENTAL PROFILE OF ACCIDENT CONDITIONS</u>			
Rate of Temp./Press. Increase	26.5°F/s; ~ 4.2 Psig/s	~ 20°F/s; 15 Psig/s	
Peak: °F/psig/RH/Time	265/42/100/3H	280/60/100/1 hr.	
Decrease To: °F/psig/RH/Time	219/20/100/21H	150/13.5/100/14 DAYS	
Decrease To: °F/psig/RH/Time	152/5/100/->		
Decrease To: °F/psig/RH/Time			
Equipment Surface Tempera- ture (MSLB) (-/1.2.5.C, 2.2.6/1.2.5.C, 2.2.6)			
Spray Qualification Method (5.3.2/1.3, 2.2.8/1.3, 2.2.8)		NO SPRAY IN TEST PROGRAM	NOTE 3
Spray Composition (4.1.4/1.3, 2.2.8/ 1.3, 2.2.8)	1.7wt. % BORIC ACID Ph = 9.3		
Spray Density (gpm/ft <sup>2</sup> )			
Spray Duration			
Submergence Duration (4.1.3/2.2.5/2.2.5)			
In-Leakage Considered (5.2.6, 5.3.2/-/-)			
Time to Submergence			
Dust Environment (-/2.2.11/2.2.11)			



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 16

NOTES:

1. FIRL test report F-C3834 is considered inconclusive for the following reasons:

- The test program lacks pass/fail criteria based on equipment specifications and operating requirements.
- The report did not include auditable data that would enable an independent reviewer to draw conclusions with regard to the equipments ability to perform its safety function.
- Output error was measured by fixing the sensor float, and measuring the controller dial deviation (in degrees), required to set 10 VAC across the sensor circuit. No attempt was made to relate controller deviation to erroneous indication.
- The test program did not address the ability of the level sensor to indicate level over its design range.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 17

NOTES:

• The test program did not include submergence. The DOR Guidelines require that specifying saturated steam as a service condition during type testing of equipment which becomes flooded in service is not an acceptable alternative for actually flooding the equipment during the test.

2. FIRC report S-C3834, supplement to F-C3834, consisted of extended steam exposure in accordance with the first 24 hours of the temperature/pressure profile of IEEE 323-74. During successful execution of the 24 hour steam exposure, the sensor functioned properly for less than 90 minutes, which is considered to be a failure.

3. The test program did not include thermal aging or chemical sprays.

4. No qualified life has been established for this equipment.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 66

INSTALLED TMI LESSONS LEARNED IMPLEMENTATION EQUIPMENT SUMMARY

NRC requested an evaluation of the environmental qualification of safety-related electrical equipment located in harsh environments required for TMI Lessons Learned Implementation. The objective is to evaluate qualification documentation of equipment within the scope of IE Bulletin 79-01B, Supplement 3 (item 2), in accordance with criteria established by the NRC (see Section 2 of this report) in a manner identical to the evaluation of all other safety-related electrical equipment. The scope of this review is limited to TMI Action Plan equipment associated with specific sections of NUREG-0737 which have an installation implementation date of January 1, 1981 (sections are identified below). Where applicable, a review is to be performed on installed equipment with implementation dates after January 1, 1981 if adequately identified by the licensee.

This plant is a PWR X, BWR \_\_\_\_.  
 The NSSS Vendor is Westinghouse (W) X, Babcox & Wilcox (B&W) \_\_\_\_,  
 Combustion Engineering (CE) \_\_\_\_, General Electric (GE) \_\_\_\_.

With respect to this equipment item, it is noted (applicable section checked):

- The Licensee does not provide adequate information with respect to identification of TMI Action Plan equipment installed as of 1/1/81.
- The Licensee has not provided the correlation of this equipment item with the specific sections of NUREG-0737. [The correlation is needed to ensure that all items are included in the review, e.g., if a transmitter is identified as a TMI Action Plan item, are the cable and the terminal blocks associated with the device also identified?]
- The Licensee has not provided the approximate installation date for the TMI Action Plan equipment items so that the appropriate qualification criteria (NUREG-0588 or DOR Guidelines) can be used in the EEQ evaluation.
- The Licensee has provided a standard Owners' Group position with respect to a NUREG-0737 technical area.
- The Licensee has requested extensions of implementation dates.
- The Licensee has stated that this equipment item is associated with the following section of NUREG-0737. (This list of applicable NUREG-0737 sections has been identified by NRC as sections within the scope of this review):
  - II.B.3 (ALL/1-1-81) Post-Accident Sampling Capability of Reactor Coolant and Containment
  - II.D.3 (ALL/1-1-81) Direct Indication of Relief and Safety Valve Position

X II.F.1.5 Containment Water Level



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 17

EQUIPMENT ITEM NO. 17  
 LEVEL TRANSMITTER LOCATED IN THE CONTAINMENT  
 GEMS MODEL XM36495  
 REQUIRED OPERATING TIME: NOT STATED  
 TER CHECKSHEET NO. 17  
 LICENSEE REFERENCE(S): 1887  
 FUNCTION (PLANT ID): CONTAINMENT SUMP WATER LEVEL (LT-802A, B, C, D)  
 LICENSEE SUBMITTAL: SCEW(S): 13 of 15 [15]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

R, T, QI, RT, P, H, CS, A, S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,  
 Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, <del>3b, 3c, 3d</del>
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	5a, 5b, 5c, 5d, 5e, 5f, 5g, <del>5h, 5i, 5j</del>
Installed TMI Lessons Learned Implementation Equipment Summary	6a, <del>6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 17

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/~~has not~~) provided a response to the SER concerns.
- The Licensee (has/has not) specifically stated that the equipment is qualified and/or will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/has not) proposed a corrective action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
- ~~Corrective~~ action specified by the Licensee:
  - Equipment <sup>has been replaced</sup> ~~replacement~~ with qualified equipment
  - Equipment modification
  - Equipment relocation above submergence level
  - Relocate or shield equipment from radiation source
  - Verify qualification by additional (testing/analysis)
  - Equipment relocation to a mild environment
  - Qualification testing of equipment in progress
  - Other ( \_\_\_\_\_ )
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |                                    |                                |
|------------------------------------|--------------------------------|
| I.a Qualified                      | II.c Qualified Life Deficiency |
| I.b Modification                   | III.a Exempt                   |
| II.a Qualification Not Established | III.b Not in Scope             |
| <u>II.b</u> Not Qualified          | IV Documentation Not Available |



**EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 17**

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
X = DEFICIENCY

Documented Evidence of Qualification Adequate	<u>X</u>
Adequate Similarity Between Equipment and Test Specimen Established	<u>X</u>
Aging Degradation Evaluated Adequately	<u>X</u>
Qualified Life or Replacement Schedule Established (If Required)	<u>X</u>
Program Established to Identify Aging Degradation	<u>X</u>
Criteria Regarding Aging Simulation Satisfied (If Required)	<u>X</u>
Criteria Regarding Temperature/Pressure Exposure:	
o Peak Temperature Adequate	<u>    </u>
o Peak Pressure Adequate	<u>    </u>
o Duration Adequate	<u>X</u>
o Required Profile Enveloped Adequately	<u>X</u>
o Steam Exposure (If Required) Adequate	<u>X</u>
Criteria Regarding Spray Satisfied	<u>X</u>
Criteria Regarding Submergence Satisfied	<u>X</u>
Criteria Regarding Radiation Satisfied	<u>    </u>
Criteria Regarding Test Sequence Satisfied	<u>X</u>
Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied	<u>    </u>
Criteria Regarding Functional Testing Satisfied	<u>X</u>
Criteria Regarding Instrument Accuracy Satisfied	<u>X</u>
Test Duration Margin (1 hour + Function Time) Satisfied	<u>    </u>
Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I)	<u>X</u>

NRC QUALIFICATION CATEGORY

DESIGNATION:  
X = CATEGORY

I.a	Equipment Qualified	<u>    </u>
I.b	Equipment Qualification Pending Modification	<u>    </u>
II.a	Equipment Qualification Not Established	<u>    </u>
II.b	Equipment Not Qualified	<u>X</u>
II.c	Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified	<u>    </u>
III.a	Equipment Exempt From Qualification	<u>    </u>
III.b	Equipment Not in the Scope of the Qualification Review	<u>    </u>
IV	Documentation Not Made Available	<u>    </u>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 17

LICENSEE RESPONSE TO NRC SER

Level Switch	Madison	5602	1	R,T,QT,RT,P,H, CS,A,QM
--------------	---------	------	---	---------------------------

The level switch reported is for containment sump level indication and has been superceded in place by two GEMS level transmitters Model No. XM36495 as part of the TMI lessons learned action items. This system is currently reported in our response to the TMI Equipment requirement submitted in February, 1981.

[20]

To be utilized during TMI-2 accident scenario per procedure  
 See accident profile - Temperature - Figure 3.1.1  
 See accident profile - Pressure - Figure 3.1.2  
 Equipment tested to IEEE 323-1971  
 System designed to measure sequential flood levels

[15]



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 17

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW

Criteria: DOR Guidelines \_\_\_; NUREG-0588, Cat. I X; NUREG-0588, Cat. II \_\_\_.

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
<u>EQUIPMENT DESCRIPTION</u> Equipment Type	LEVEL TRANSMITTER	LEVEL TRANSMITTER	
Manufacturer's Name (5.2.2/-/-)	DELAVAL/GEMS	DELAVAL/GEMS	
Model Number (5.2.2/-/-)	XM36495	XM36495	
Serial Number			
Features/Mounting (5.2.6/-/-)			
Connections/Interfaces (5.2.6/-/-)	ND	CONDUIT, GE RTV-60	
Location/Elevation	CONTAINMENT 231.2'		
Equipment ID No.	LT801 LT802		
<u>QUALIFICATION REPORT</u> (8.0/5.0/5.0)			
Report ID Number	—	F-C3834, S-C3834	NOTE 1,2
Report Date		March, 1978	
Issued by		FIRL	
Prepared for		DELAVAL/GEMS	
Referenced Reports			
Qualification Method (5.1, 5.3/2.1, 2.4/2.1, 2.4)	—	TYPE TEST	
<u>QUALIFICATION TEST PROGRAM</u> Functional Test Description (5.2.5/2.2.9/2.2.9)			
Operating Conditions (-/2.2.10/2.2.10)			
Load/Cycles/Voltage/ Current/Freq.		10 VAC CIRCUIT VOLTAGE	



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 17

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
Acceptance Criteria (5.2.5/2.2.1/2.2.1)	:	EXCESSIVE OUTPUT ERROR	NOT MEASURED AS A % AGE NOTE 1
Accuracy (5.2.5/-/-)	ND	NOT STATED	X
Number of Specimens	:	1	:
Test Instruments Calibrated	:	.	:
Safety Function (Active/ Passive) (-/2.1.3/2.1.3)	CONT. SUMP WATER LEVEL	:	:
Test Duration (5.2.1/-/-)	-	14 DAYS	:
Accident Duration (Envir. Above Normal) (5.2.1/-/-)	:	:	:
Required Function Time	LONG TERM	:	:
Test Sequence (General) (5.2.3/2.3.1/2.3.1)	:	SIMULTANEOUS	:
Test Sequence (NUREG-0588, Cat. I) (-/2.3.1/-)	:	:	X
1. Representative Sample	:	:	:
2. Baseline Data	:	:	:
3. Performance Extremes	:	:	:
4. Thermal Aging	:	:	:
5. Radiation Aging	:	:	:
6. Wear Aging	:	:	:
7. Vibration/Seismic	:	:	:
8. DBE Exposure	:	:	:
9. Post-DBE Exposure	:	:	:
10. Inspection	:	:	:
Aging	:	:	:
(5.2.4, 7.0/4.0/4.0) Thermal Aging/Basis	:	ND	NOTE 3
Material Aging Evaluation (7.0/-/-)	:	:	:
Materials Susceptible (Thermal) (5.2.4, 7.0/-/-)	:	:	:
Radiation Aging, Type	:	:	:



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 17

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
Radiation Aging, Dose (rd)	ND	25. x 10 <sup>6</sup>	
Radiation Aging, Dose Rate	50-200 rd/h	1.0 Mrd/hr.	
Radiation Aging, Method			
Materials Susceptible (Radiation) (5.2.4, 7.0/-/-)		SILICONE FLUID	
Operational Aging (-/4.2/-)			
Other Age Conditioning (-/4.2/-)			
Qualified Life Claimed/ Established (5.2.4/4.10/-)	ND	ND	NOTE 4.
Normal Ambient Temperature	115°F		
Normal Ambient Radiation	50-200 rd/h		
Normal Ambient Humidity	NOT STATED		
On-Going Surveillance and Preventive Maintenance (7.0/-/-)	YES		PER CP&L PROGRAM
On-Going Analysis of Failures and Degradation (7.0/-/-)	YES		
Margin (General) (6.0/3.0/3.0)			
Margin (NUREG-0588, Cat. I) (-/3.2/-)			X
1. Temperature (+15°F)			
2. Pressure (+10%, 10 psig max)			
3. Radiation (not required)			
4. Time (+10%, +1 hour + function time minimum)			



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 17

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
<u>ACCIDENT CONDITIONS</u>			
LOCA/MSLB/HELB/Uncontrolled (4.1, 4.2, 4.3.1, 4.3.3/ 1.1, 1.2, 1.5/1.1, 1.2, 1.5)	LOCA	LOCA	
Radiation Type	GAMMA	GAMMA	
Radiation Dose (rd) (4.1.2/1.4/1.4)		$175.0 \times 10^6$	
Radiation Dose Rate (rd/hr) Radiation Qual. Method (5.3.1/-/-)		$0.7 \times 10^6$	
Proximity to Concentrated Radiation (4.1.2/1.4.6/1.4.6)	CONTAINMENT SUMP		
Equipment Susceptible to Beta Radiation (4.1.2/-/-)			
Radiation Dose (Normal + Accident) (4.1.2/-/-)		$2.0 \times 10^8$	
Plateout Dose Considered (-/1.48/1.48)	$2.0 \times 10^8$ rd.		
Gamma + Beta Dose (rd) (4.1.2/1.4.7/1.4.7)			



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 17

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE No.)
<u>ENVIRONMENTAL PROFILE OF ACCIDENT CONDITIONS</u>			
Rate of Temp./Press. Increase	26.5 °F/s; ~ 4.2 Psig/s	~ 20 °F/s; 15 Psig/s	
Peak: °F/psig/RH/Time	265/42/100/3H	280/60/100/1hr.	
Decrease To: °F/psig/RH/Time	219/20/100/21H	150/13.5/100/14 DAYS	
Decrease To: °F/psig/RH/Time	152/5/100/->		
Decrease To: °F/psig/RH/Time			
Equipment Surface Tempera- ture (MSLB) (-/1.2.5.C, 2.2.6/1.2.5.C, 2.2.6)			
Spray Qualification Method (5.3.2/1.3, 2.2.8/1.3, 2.2.8)		NO SPRAY IN TEST PROGRAM	NOTE 3
Spray Composition (4.1.4/1.3, 2.2.8/ 1.3, 2.2.8)	1.7wt. % BORIC ACID Ph=9.3		
Spray Density (gpm/ft <sup>2</sup> )			
Spray Duration			
Submergence Duration (4.1.3/2.2.5/2.2.5)	CONTAINMENT SUMP	ND	X
In-Leakage Considered (5.2.6, 5.3.2/-/-)			
Time to Submergence			
Dust Environment (-/2.2.11/2.2.11)			





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 17

NOTES:

1. F.I.R.L test report F-C3834 is considered inconclusive for the following reasons:

- The test program lacks pass/fail criteria based on equipment specifications and operating requirements.

- The report did not include auditable data that would enable an independent reviewer to draw conclusions with regard to the equipment's ability to perform its safety function.

- Output error was measured by fixing the sensor float, and measuring the controller dial deviation (in degrees), required to set 10 VAC across the sensor circuit. No attempt was made to relate controller deviation to erroneous indication.

- The test program did not address the ability of the level sensor to indicate level over its design range.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 17

NOTES:

• The test program did not include submergence. The DOR Guidelines require that specifying saturated steam as a service condition during type testing of equipment which becomes flooded in service is not an acceptable alternative for actually flooding the equipment during the test.

2. FIRC report S-C3834, supplement to F-C3834, consisted of extended steam exposure in accordance with the first 24 hours of the temperature/pressure profile of IEEE 323-74. During successful execution of the 24-hour steam exposure, the sensor functioned properly for less than 90 minutes, which is considered to be a failure.

3. The test program did not include thermal aging or chemical sprays.

4. No qualified life has been established for this equipment.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 17

INSTALLED TMI LESSONS LEARNED IMPLEMENTATION EQUIPMENT SUMMARY

NRC requested an evaluation of the environmental qualification of safety-related electrical equipment located in harsh environments required for TMI Lessons Learned Implementation. The objective is to evaluate qualification documentation of equipment within the scope of IE Bulletin 79-01B, Supplement 3 (item 2), in accordance with criteria established by the NRC (see Section 2 of this report) in a manner identical to the evaluation of all other safety-related electrical equipment. The scope of this review is limited to TMI Action Plan equipment associated with specific sections of NUREG-0737 which have an installation implementation date of January 1, 1981 (sections are identified below). Where applicable, a review is to be performed on installed equipment with implementation dates after January 1, 1981 if adequately identified by the licensee.

This plant is a PWR , BWR .

The NSSS Vendor is Westinghouse (W) , Babcox & Wilcox (B&W) ,  
 Combustion Engineering (CE) , General Electric (GE) .

With respect to this equipment item, it is noted (applicable section checked):

- The Licensee does not provide adequate information with respect to identification of TMI Action Plan equipment installed as of 1/1/81.
- The Licensee has not provided the correlation of this equipment item with the specific sections of NUREG-0737. [The correlation is needed to ensure that all items are included in the review, e.g., if a transmitter is identified as a TMI Action Plan item, are the cable and the terminal blocks associated with the device also identified?]
- The Licensee has not provided the approximate installation date for the TMI Action Plan equipment items so that the appropriate qualification criteria (NUREG-0588 or DOR Guidelines) can be used in the EEQ evaluation.
- The Licensee has provided a standard Owners' Group position with respect to a NUREG-0737 technical area.
- The Licensee has requested extensions of implementation dates.
- The Licensee has stated that this equipment item is associated with the following section of NUREG-0737. (This list of applicable NUREG-0737 sections has been identified by NRC as sections within the scope of this review):
  - II.B.3 (ALL/1-1-81) Post-Accident Sampling Capability of Reactor Coolant and Containment
  - II.D.3 (ALL/1-1-81) Direct Indication of Relief and Safety Valve Position

*II.F.1.5 Containment Water Level Monitor.*



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 18

EQUIPMENT ITEM NO. 18  
 TEMPERATURE ELEMENT LOCATED IN THE CONTAINMENT, ELEV. 243'0"  
 ROSEMOUNT MODEL 176KF  
 REQUIRED OPERATING TIME: 1 HOUR  
 TER CHECKSHEET NO. 18  
 LICENSEE REFERENCE(S): 687  
 FUNCTION (PLANT ID): MAIN STEAM LINE BREAK DETECTION, LOOP 1 (TE-412B, D)  
 LICENSEE SUBMITTAL: SCEW(S): 14 OF 25 [20]  
 FUNCTION (PLANT ID): MAIN STEAM LINE BREAK DETECTION, LOOP 2 (TE-422B, D)  
 LICENSEE SUBMITTAL: SCEW(S): 15 OF 25 [20]  
 FUNCTION (PLANT ID): MAIN STEAM LINE BREAK DETECTION, LOOP 3 (TE-432B, D)  
 LICENSEE SUBMITTAL: SCEW(S): 16 OF 25 [20]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

(R), T, QT, RT, P, H, (CS), (A), S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,  
 Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, <del>3b, 3c, 3d</del>
System Consideration Review	4a, 4b, 4c, <del>4d, 4e, 4f</del>
Equipment Environmental Qualification Review	5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h, 5i, 5j
Installed TMI Lessons Learned Implementation Equipment Summary	<del>6a, 6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 18

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/~~has not~~) provided a response to the SER concerns.
- The Licensee (has/~~has not~~) specifically stated that the equipment is qualified and/~~or~~ will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/has not) proposed a corrective action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
- Corrective action specified by the Licensee:
  - Equipment replacement with qualified equipment
  - Equipment modification
  - Equipment relocation above submergence level
  - Relocate or shield equipment from radiation source
  - Verify qualification by additional (testing/analysis)
  - Equipment relocation to a mild environment
  - Qualification testing of equipment in progress
  - Other ( \_\_\_\_\_ )
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |   |                                |
|---|--------------------------------|
| I.a Qualified                             | II.c Qualified Life Deficiency |
| I.b Modification                          | III.a Exempt                   |
| <b>II.a</b> Qualification Not Established | III.b Not in Scope             |
| II.b Not Qualified                        | IV Documentation Not Available |



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 18

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
X = DEFICIENCY

Documented Evidence of Qualification Adequate	<u>X</u>
Adequate Similarity Between Equipment and Test Specimen Established	<u>   </u>
Aging Degradation Evaluated Adequately	<u>X</u>
Qualified Life or Replacement Schedule Established (If Required)	<u>X</u>
Program Established to Identify Aging Degradation	<u>   </u>
Criteria Regarding Aging Simulation Satisfied (If Required)	<u>   </u>
Criteria Regarding Temperature/Pressure Exposure:	
o Peak Temperature Adequate	<u>   </u>
o Peak Pressure Adequate	<u>   </u>
o Duration Adequate	<u>   </u>
o Required Profile Enveloped Adequately	<u>X</u>
o Steam Exposure (If Required) Adequate	<u>X</u>
Criteria Regarding Spray Satisfied	<u>   </u>
Criteria Regarding Submergence Satisfied	<u>   </u>
Criteria Regarding Radiation Satisfied	<u>   </u>
Criteria Regarding Test Sequence Satisfied	<u>   </u>
Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied	<u>   </u>
Criteria Regarding Functional Testing Satisfied	<u>X</u>
Criteria Regarding Instrument Accuracy Satisfied	<u>X</u>
Test Duration Margin (1 hour + Function Time) Satisfied	<u>   </u>
Criteria Regarding Margins Satisfied (NUREG-0583, Cat. I)	<u>   </u>

NRC QUALIFICATION CATEGORY

DESIGNATION:  
X = CATEGORY

I.a	Equipment Qualified	<u>   </u>
I.b	Equipment Qualification Pending Modification	<u>   </u>
II.a	Equipment Qualification Not Established	<u>X</u>
II.b	Equipment Not Qualified	<u>   </u>
II.c	Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified	<u>   </u>
III.a	Equipment Exempt From Qualification	<u>   </u>
III.b	Equipment Not in the Scope of the Qualification Review	<u>   </u>
IV	Documentation Not Made Available	<u>   </u>



Franklin Research Center  
A Division of The Franklin Institute  
20th and Race Streets. Phila., Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
FRC Project No. C5257  
FRC Assignment No. 13  
FRC Task No. 511

Page  
30

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 18

LICENSEE RESPONSE TO NRC SER

Equipment Description	Manufacturer	Model No.	Location <sup>1</sup>	Deficiency
A. Temperature Element	Rosemount	176KF	1	R,CS,A

<sup>A</sup> Items reported as qualified within NRC Region II revised TER, dated 11/7/80.

Not required for DBE - only used for outside containment

Main Steam Line Break protection

[20]



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 18

SYSTEM CONSIDERATION REVIEW

The Licensee has stated that this equipment item does not require environmental qualification and/or should be exempted from qualification. The Licensee's rationale has been evaluated and the reasons for ~~concurrence~~/non-concurrence with the technical basis of the Licensee's position are presented below.

Reason for Concurrence

- Equipment does not provide a safety function or mitigate the consequences of a design basis accident. Equipment Environmental Qualification is not required by the DOR Guidelines. (NRC Qualification Evaluation Category IIIa)
- Equipment is not exposed to a harsh environment by the accident it is intended to mitigate. See note (1) on page 4b. (NRC Qualification Evaluation Category IIIb)
- Backup (equipment/system) is available which completely performs the safety function. The backup (equipment/system) is environmentally qualified and appears to meet single active failure criterion. See note (1) on page 4b. (NRC Qualification Evaluation Category IIIa)

Reason for Non-Concurrence

- Backup (equipment/system) is not fully capable of performing the intended safety function or accident mitigating function.
- Backup (equipment/system) is not environmentally qualified and can be exposed to a hostile environment simultaneously with the primary equipment.
- Backup (equipment/system) is subject to a potentially disabling single active failure.
- Failure of the primary equipment can compromise the ability of other safety-related equipment to perform its specified safety function.
- X Failure of the primary equipment can result in erroneous indication which could mislead an operator.
- X Requirement for continued functioning throughout the post-accident period necessitates environmental qualification.





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 18

Reason for Concurrence

The equipment's accident mitigating function is completed prior to the onset of the hostile environment. No subsequent functions are necessary. See note (1) below. (NRC Qualification Evaluation Category IIIb)

Other (see page     )

Resultant NRC Qualification Evaluation Category (IIIa/IIIb)

Note 1: The Licensee (has/has not) stated that failure of the primary equipment will not affect other safety-related equipment or cause an operator to be misled. (See page     )

Reason for Non-Concurrence

Although backup equipment is available, it is not technically sound to relinquish defense-in-depth for this function.

Backup (equipment/system) is not safety-related.

This equipment is necessary for the operator to ensure an ESF system is performing its intended safety function.

The rationale presented by the Licensee is not supported by objective technical evidence.

Other (see page 16)

LICENSEE STATEMENT

See page 3a of this checksheet.

EVALUATION OF LICENSEE STATEMENT

The Licensee states that the Tave RTDs are not required for DBE but are used only for outside containment main steam line break protection. Also, a review of the Licensee's submittal indicates that these are the only reactor coolant system RTDs for which SCEW sheets have been submitted.

Reactor coolant system RTDs are required during initial phases of a design basis accident, during a cooldown to cold shutdown conditions, and during long-term cooling (under hot or cold conditions). Hot leg detectors aid in determining reactor system subcooling and in providing indication of natural circulation. Cold leg instruments also provide indication of natural circulation, provide input to heat balance calculations, and provide direct indication of ECCS injection. During plant cooldown, these detectors are necessary to ensure that cooldown rates are not being exceeded. They are also necessary to ensure



Franklin Research Center  
A Division of The Franklin Institute  
20th and Race Streets. Phila. Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
FRC Project No. C5257  
FRC Assignment No. 13  
FRC Task No. 511

Page  
4c

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 18

SYSTEM CONSIDERATION REVIEW

EVALUATION OF LICENSEE STATEMENT (Continued)

that the long-term cooling method is functioning properly.

Reactor coolant system indication, including the Tave instruments, should be environmentally qualified for long-term post-accident operation.



Franklin Research Center  
A Division of The Franklin Institute  
20th and Race Streets, Phila., Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
FRC Project No. C5257  
FRC Assignment No. 13  
FRC Task No. 511

Page  
5

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 18

Checksheets 5a thru 5j have been removed due to the  
proprietary nature of information contained therein.



Franklin Research Center  
 A Division of The Franklin Institute  
 20th and Race Streets, Phila., Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
 FRC Project No. C5257  
 FRC Assignment No. 13  
 FRC Task No. 511

Page  
 1a

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 19

EQUIPMENT ITEM NO. 19  
 LEVEL SWITCH LOCATED IN THE CONTAINMENT, ELEV. 228'0"  
 MADISON MODEL 5602  
 REQUIRED OPERATING TIME: CONTINUOUS  
 TER CHECKSHEET NO. 19  
 LICENSEE REFERENCE(S): NOT CITED  
 FUNCTION (PLANT ID): CONTAINMENT SUMP WATER LEVEL MEASUREMENT (LS-1925A, B)  
 LICENSEE SUBMITTAL: SCEW(S): 8 OF 25 [20]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

R, T, QT, RT, P, H, CS, A, S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,  
 Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, 3b, <del>3c, 3d</del>
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	<del>5a, 5b, 5c, 5d, 5e, 5f,</del> <del>5g, 5h, 5i, 5j</del>
Installed TMI Lessons Learned Implementation Equipment Summary	<del>6a, 6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 19

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/~~has not~~) provided a response to the SER concerns.
- The Licensee (has/has not) specifically stated that the equipment is qualified and/or will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/~~has not~~) proposed a corrective action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
- Corrective action specified by the Licensee:
  - Equipment replacement with qualified equipment
  - Equipment modification
  - Equipment relocation above submergence level
  - Relocate or shield equipment from radiation source
  - Verify qualification by additional (testing/analysis)
  - Equipment relocation to a mild environment
  - Qualification testing of equipment in progress
  - Other (Function replaced by qualified equipment)
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |                                    |                                |
|------------------------------------|--------------------------------|
| I.a Qualified                      | II.c Qualified Life Deficiency |
| <b>I.b Modification</b>            | III.a Exempt                   |
| II.a Qualification Not Established | III.b Not in Scope             |
| II.b Not Qualified                 | IV Documentation Not Available |



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 19

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
X = DEFICIENCY

Documented Evidence of Qualification Adequate	<u>X</u>
Adequate Similarity Between Equipment and Test Specimen Established	<u>    </u>
Aging Degradation Evaluated Adequately	<u>    </u>
Qualified Life or Replacement Schedule Established (If Required)	<u>    </u>
Program Established to Identify Aging Degradation	<u>    </u>
Criteria Regarding Aging Simulation Satisfied (If Required)	<u>    </u>
Criteria Regarding Temperature/Pressure Exposure:	
o Peak Temperature Adequate	<u>    </u>
o Peak Pressure Adequate	<u>    </u>
o Duration Adequate	<u>    </u>
o Required Profile Enveloped Adequately	<u>    </u>
o Steam Exposure (If Required) Adequate	<u>    </u>
Criteria Regarding Spray Satisfied	<u>    </u>
Criteria Regarding Submergence Satisfied	<u>    </u>
Criteria Regarding Radiation Satisfied	<u>    </u>
Criteria Regarding Test Sequence Satisfied	<u>    </u>
Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied	<u>    </u>
Criteria Regarding Functional Testing Satisfied	<u>    </u>
Criteria Regarding Instrument Accuracy Satisfied	<u>    </u>
Test Duration Margin (1 hour + Function Time) Satisfied	<u>    </u>
Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I)	<u>    </u>

NRC QUALIFICATION CATEGORY

DESIGNATION:  
X = CATEGORY

I.a	Equipment Qualified	<u>    </u>
I.b	Equipment Qualification Pending Modification	<u>X</u>
II.a	Equipment Qualification Not Established	<u>    </u>
II.b	Equipment Not Qualified	<u>    </u>
II.c	Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified	<u>    </u>
III.a	Equipment Exempt From Qualification	<u>    </u>
III.b	Equipment Not in the Scope of the Qualification Review	<u>    </u>
IV	Documentation Not Made Available	<u>    </u>

*See Items (16 and 17) and  
Page 3b*





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 19

3.2.7 Level Switches

[15]

As reported in CP&L's responses to NRC IE Bulletin 79-01 containment level switches (LS-1925A, LS-1925B) located within containment sump would be replaced with qualified equipment as the in-place equipment was never qualified. As supplied, the level switches are magnetic in operation and provided incremental one- (1) foot level data as water would rise in the sump. This equipment could operate completely submerged.

| R2

A market search did not uncover any source of qualified equipment for replacement purposes. However, a parallel investigative effort by CP&L to meet the requirements of NRC NUREG 0578, TMI Short-Term Lessons Learned, ACRS2 Containment Water Level Indication, has concluded that there should be an analog level signal generated for combined sump and containment water level to aid in reporting and mitigating TMI type accident conditions-- if ever experienced.

The current incremental level switches, Madison Model 5602 Switch Units with Type 316 Stainless Steel Stem, 10 ft. 6 inches long, with eight (8) 316 Stainless Steel Floats and one (1) Dry Contact Switch at each level, wired with 22AWG conductors with Silicone Rubber insulation, will remain in place. The function of these switches will be assumed by the analog system. The schedule for completion of installation is January 1, 1981. CP&L will take no further action on these level switches in conjunction with NRC IE Bulletin 79-01B.

4.7 Level Switches

Original plans for replacement of the nonqualified containment sump level switches with qualified equipment is no longer considered necessary. The function of level determination is being assumed by a dual analog system provided in the TMI Short-Term Lessons Learned Program (Equipment will be GEMS Level Sensor - Transmitter XM36496, XM36495 and Receiver RE36562.) The existing system will be left in place. Check of E.I.-1 procedure, Incident Involving Reactor Coolant System Depressurization, does not reference use of this equipment; therefore, no changes are required in this procedure when switchover is accomplished.

Additional action required - None.

[15]





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 20

EQUIPMENT ITEM NO. 20 (TMI ACTION PLAN ITEM II.D.3)  
 ACCELEROMETER LOCATED IN THE CONTAINMENT  
 ENDEVCO MODEL 2273AM20  
 REQUIRED OPERATING TIME: NOT STATED  
 TER CHECKSHEET NO. 20  
 LICENSEE REFERENCE(S): 1596  
 FUNCTION (PLANT ID): NOT STATED (A, B, C)  
 LICENSEE SUBMITTAL: SCEW(S): 2 OF 15 [15]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

R, T, QT, RT, P, H, CS, A, S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,  
 Not stated, Not applicable  
*New Item*

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, <del>3b, 3c, 3d</del>
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	<del>5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h, 5i, 5j</del>
Installed TMI Lessons Learned Implementation Equipment Summary	6a, <del>6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 20

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/has not) provided a response to the SER concerns.
- The Licensee (has/has not) specifically stated that the equipment is qualified and/or will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/~~has not~~) proposed a ~~corrective~~ action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
- ~~Corrective~~ action specified by the Licensee:
  - Equipment replacement with qualified equipment
  - Equipment modification
  - Equipment relocation above submergence level
  - Relocate or shield equipment from radiation source
  - Verify qualification by additional (testing/analysis)
  - Equipment relocation to a mild environment
  - Qualification testing of equipment in progress
  - Other ( \_\_\_\_\_ )
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |  |                                |
|--|--------------------------------|
| I.a Qualified                                | II.c Qualified Life Deficiency |
| <u>I.b Modification</u>                      | III.a Exempt                   |
| <del>I.a</del> Qualification Not Established | III.b Not in Scope             |
| II.b Not Qualified                           | IV Documentation Not Available |



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 20

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
 X = DEFICIENCY

- Documented Evidence of Qualification Adequate \_\_\_\_\_
- Adequate Similarity Between Equipment and Test Specimen Established \_\_\_\_\_
- Aging Degradation Evaluated Adequately \_\_\_\_\_
- Qualified Life or Replacement Schedule Established (If Required) \_\_\_\_\_
- Program Established to Identify Aging Degradation \_\_\_\_\_
- Criteria Regarding Aging Simulation Satisfied (If Required) \_\_\_\_\_
- Criteria Regarding Temperature/Pressure Exposure:
  - o Peak Temperature Adequate \_\_\_\_\_
  - o Peak Pressure Adequate \_\_\_\_\_
  - o Duration Adequate \_\_\_\_\_
  - o Required Profile Enveloped Adequately \_\_\_\_\_
  - o Steam Exposure (If Required) Adequate \_\_\_\_\_
- Criteria Regarding Spray Satisfied \_\_\_\_\_
- Criteria Regarding Submergence Satisfied \_\_\_\_\_
- Criteria Regarding Radiation Satisfied \_\_\_\_\_
- Criteria Regarding Test Sequence Satisfied \_\_\_\_\_
- Criteria Regarding Test Failures or Severe Anomalies  
 (If Any) Satisfied \_\_\_\_\_
- Criteria Regarding Functional Testing Satisfied \_\_\_\_\_
- Criteria Regarding Instrument Accuracy Satisfied \_\_\_\_\_
- Test Duration Margin (1 hour + Function Time) Satisfied \_\_\_\_\_
- Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I) \_\_\_\_\_

NRC QUALIFICATION CATEGORY

DESIGNATION:  
 X = CATEGORY

- I.a Equipment Qualified \_\_\_\_\_
- I.b Equipment Qualification Pending Modification X \_\_\_\_\_
- II.a Equipment Qualification Not Established \_\_\_\_\_
- II.b Equipment Not Qualified \_\_\_\_\_
- II.c Equipment Satisfies All Requirements Except Qualified Life  
 or Replacement Schedule Justified \_\_\_\_\_
- III.a Equipment Exempt From Qualification \_\_\_\_\_
- III.b Equipment Not in the Scope of the Qualification Review \_\_\_\_\_
- IV Documentation Not Made Available \_\_\_\_\_

THE LICENSEE HAS STATED THAT QUALIFICATION TESTING IS IN PROGRESS



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 20

- 1 (1) To be utilized during TMI-2 accident scenario per procedure
- 2 (3) See accident profile - Temperature - Figure 3.1.1
- 3 (4) See accident profile - Pressure - Figure 3.1.2
- 4 (5) Values proposed by testing laboratory (AETL) within Qual. Test Procedure 548-8955 Rev. A
- 5 (6) Qualification testing not yet completed

[15]



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 20

INSTALLED TMI LESSONS LEARNED IMPLEMENTATION EQUIPMENT SUMMARY

NRC requested an evaluation of the environmental qualification of safety-related electrical equipment located in harsh environments required for TMI Lessons Learned Implementation. The objective is to evaluate qualification documentation of equipment within the scope of IE Bulletin 79-01B, Supplement 3 (item 2), in accordance with criteria established by the NRC (see Section 2 of this report) in a manner identical to the evaluation of all other safety-related electrical equipment. The scope of this review is limited to TMI Action Plan equipment associated with specific sections of NUREG-0737 which have an installation implementation date of January 1, 1981 (sections are identified below). Where applicable, a review is to be performed on installed equipment with implementation dates after January 1, 1981 if adequately identified by the licensee.

This plant is a PWR , BWR .

The NSSS Vendor is Westinghouse (W) , Babcox & Wilcox (B&W) ,  
Combustion Engineering (CE) , General Electric (GE) .

With respect to this equipment item, it is noted (applicable section checked):

- The Licensee does not provide adequate information with respect to identification of TMI Action Plan equipment installed as of 1/1/81.
- The Licensee has not provided the correlation of this equipment item with the specific sections of NUREG-0737. [The correlation is needed to ensure that all items are included in the review, e.g., if a transmitter is identified as a TMI Action Plan item, are the cable and the terminal blocks associated with the device also identified?]
- The Licensee has not provided the approximate installation date for the TMI Action Plan equipment items so that the appropriate qualification criteria (NUREG-0588 or DOR Guidelines) can be used in the EEQ evaluation.
- The Licensee has provided a standard Owners' Group position with respect to a NUREG-0737 technical area.
- The Licensee has requested extensions of implementation dates.
- The Licensee has stated that this equipment item is associated with the following section of NUREG-0737. (This list of applicable NUREG-0737 sections has been identified by NRC as sections within the scope of this review):
  - II.B.3 (ALL/1-1-81) Post-Accident Sampling Capability of Reactor Coolant and Containment
  - II.D.3 (ALL/1-1-81) Direct Indication of Relief and Safety Valve Position



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 21

EQUIPMENT ITEM NO. 21 (TMI ACTION PLAN ITEM II.D.3)  
 AMPLIFIER LOCATED IN THE CONTAINMENT  
 UNHOLTZ-DICKIE MODEL 22CA2TR  
 REQUIRED OPERATING TIME: NOT STATED  
 TER CHECKSHEET NO. 21  
 LICENSEE REFERENCE(S): 1596  
 FUNCTION (PLANT ID): NOT STATED (A, B, C)  
 LICENSEE SUBMITTAL: SCEW(S): 3 OF 15 [15]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

R, T, Q1, RT, P, H, CS, A, S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,

Not stated, Not applicable  
New Item

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, <del>3b, 3c, 3d</del>
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	<del>5a, 5b, 5c, 5d, 5e, 5f,</del> <del>5g, 5h, 5i, 5j</del>
Installed TMI Lessons Learned Implementation Equipment Summary	6a, <del>6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 21

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/has not) provided a response to the SER concerns.
- The Licensee (has/has not) specifically stated that the equipment is qualified and/or will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/~~has not~~) proposed a ~~corrective~~ action for this equipment item whose qualification has not been fully established.
  - Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
  - ~~Corrective~~ action specified by the Licensee:
    - Equipment replacement with qualified equipment
    - Equipment modification
    - Equipment relocation above submergence level
    - Relocate or shield equipment from radiation source
    - Verify qualification by additional (testing/analysis)
    - Equipment relocation to a mild environment
    - Qualification testing of equipment in progress
    - Other ( \_\_\_\_\_ )
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |                                    |                                |
|------------------------------------|--------------------------------|
| <u>I.a</u> Qualified               | II.c Qualified Life Deficiency |
| <u>I.b</u> Modification            | III.a Exempt                   |
| II.a Qualification Not Established | III.b Not in Scope             |
| II.b Not Qualified                 | IV Documentation Not Available |



**EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 21**

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
X = DEFICIENCY

- Documented Evidence of Qualification Adequate \_\_\_\_\_
- Adequate Similarity Between Equipment and Test Specimen Established \_\_\_\_\_
- Aging Degradation Evaluated Adequately \_\_\_\_\_
- Qualified Life or Replacement Schedule Established (If Required) \_\_\_\_\_
- Program Established to Identify Aging Degradation \_\_\_\_\_
- Criteria Regarding Aging Simulation Satisfied (If Required) \_\_\_\_\_
- Criteria Regarding Temperature/Pressure Exposure:
  - o Peak Temperature Adequate \_\_\_\_\_
  - o Peak Pressure Adequate \_\_\_\_\_
  - o Duration Adequate \_\_\_\_\_
  - o Required Profile Enveloped Adequately \_\_\_\_\_
  - o Steam Exposure (If Required) Adequate \_\_\_\_\_
- Criteria Regarding Spray Satisfied \_\_\_\_\_
- Criteria Regarding Submergence Satisfied \_\_\_\_\_
- Criteria Regarding Radiation Satisfied \_\_\_\_\_
- Criteria Regarding Test Sequence Satisfied \_\_\_\_\_
- Criteria Regarding Test Failures or Severe Anomalies  
 (If Any) Satisfied \_\_\_\_\_
- Criteria Regarding Functional Testing Satisfied \_\_\_\_\_
- Criteria Regarding Instrument Accuracy Satisfied \_\_\_\_\_
- Test Duration Margin (1 hour + Function Time) Satisfied \_\_\_\_\_
- Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I) \_\_\_\_\_

NRC QUALIFICATION CATEGORY

DESIGNATION:  
X = CATEGORY

- I.a Equipment Qualified \_\_\_\_\_
- I.b Equipment Qualification Pending Modification X \_\_\_\_\_
- II.a Equipment Qualification Not Established \_\_\_\_\_
- II.b Equipment Not Qualified \_\_\_\_\_
- II.c Equipment Satisfies All Requirements Except Qualified Life  
 or Replacement Schedule Justified \_\_\_\_\_
- III.a Equipment Exempt From Qualification \_\_\_\_\_
- III.b Equipment Not in the Scope of the Qualification Review \_\_\_\_\_
- IV Documentation Not Made Available \_\_\_\_\_

THE LICENSEE HAS STATED THAT QUALIFICATION TESTING IS IN PROGRESS





Franklin Research Center  
A Division of The Franklin Institute  
20th and Race Streets, Phila., Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
FRC Project No. C5257  
FRC Assignment No. 13  
FRC Task No. 511

Page  
30

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 21

- 1 (2) To be utilized during TMI-2 accident scenario per procedure
- 2 (3) See accident profile - Temperature - Figure 3.1.1
- 3 (4) See accident profile - Pressure - Figure 3.1.2
- 4 (5) Values proposed by testing laboratory (AETL) within Qual. Test Procedure 548-8955 Rev. A
- 5 (6) Qualification testing not yet completed

[15]



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 21

INSTALLED TMI LESSONS LEARNED IMPLEMENTATION EQUIPMENT SUMMARY

NRC requested an evaluation of the environmental qualification of safety-related electrical equipment located in harsh environments required for TMI Lessons Learned Implementation. The objective is to evaluate qualification documentation of equipment within the scope of IF Bulletin 79-01B, Supplement 3 (item 2), in accordance with criteria established by the NRC (see Section 2 of this report) in a manner identical to the evaluation of all other safety-related electrical equipment. The scope of this review is limited to TMI Action Plan equipment associated with specific sections of NUREG-0737 which have an installation implementation date of January 1, 1981 (sections are identified below). Where applicable, a review is to be performed on installed equipment with implementation dates after January 1, 1981 if adequately identified by the licensee.

This plant is a PWR X, BWR \_\_\_\_.  
 The NSSS Vendor is Westinghouse (W) X, Babcox & Wilcox (B&W) \_\_\_\_,  
 Combustion Engineering (CE) \_\_\_\_, General Electric (GE) \_\_\_\_.

With respect to this equipment item, it is noted (applicable section checked):

- The Licensee does not provide adequate information with respect to identification of TMI Action Plan equipment installed as of 1/1/81.
- The Licensee has not provided the correlation of this equipment item with the specific sections of NUREG-0737. [The correlation is needed to ensure that all items are included in the review, e.g., if a transmitter is identified as a TMI Action Plan item, are the cable and the terminal blocks associated with the device also identified?]
- The Licensee has not provided the approximate installation date for the TMI Action Plan equipment items so that the appropriate qualification criteria (NUREG-0588 or DOR Guidelines) can be used in the EEQ evaluation.
- The Licensee has provided a standard Owners' Group position with respect to a NUREG-0737 technical area.
- The Licensee has requested extensions of implementation dates.
- The Licensee has stated that this equipment item is associated with the following section of NUREG-0737. (This list of applicable NUREG-0737 sections has been identified by NRC as sections within the scope of this review):
  - II.B.3 (ALL/1-1-81) Post-Accident Sampling Capability of Reactor Coolant and Containment
  - II.D.3 (ALL/1-1-81) Direct Indication of Relief and Safety Valve Position



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 22

EQUIPMENT ITEM NO. 22  
 ELECTRIC MOTOR LOCATED IN THE REACTOR AUXILIARY BLDG.  
 WESTINGHOUSE MODEL 506UPZ  
 REQUIRED OPERATING TIME: CONTINUOUS  
 TER CHECKSHEET NO. 22  
 LICENSEE REFERENCE(S): 606, 3184  
 FUNCTION (PLANT ID): DRIVES RHR PUMP - SIS (RHR-A, B)  
 LICENSEE SUBMITTAL: SCEW(S): 13 OF 25 [20]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

(R) (T) (QT) (RT) (P) (H) CS, (A), S, (R), (M), I, QM, RPN, EXN, SEN, QI, RPS, None,  
 Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, 3b, <del>3c, 3d</del>
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	<del>5a, 5b, 5c, 5d, 5e, 5f,</del> <del>5g, 5h, 5i, 5j</del>
Installed TMI Lessons Learned Implementation Equipment Summary	<del>6a, 6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



**EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 22**

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/~~has not~~) provided a response to the SER concerns.
- The Licensee (has/~~has not~~) specifically stated that the equipment is qualified and ~~it~~ will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/has not) proposed a corrective action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
- Corrective action specified by the Licensee:
  - Equipment replacement with qualified equipment
  - Equipment modification
  - Equipment relocation above submergence level
  - Relocate or shield equipment from radiation source
  - Verify qualification by additional (testing/analysis)
  - Equipment relocation to a mild environment
  - Qualification testing of equipment in progress
  - Other ( \_\_\_\_\_ )
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |   |                                |
|---|--------------------------------|
| I.a Qualified                             | II.c Qualified Life Deficiency |
| I.b Modification                          | III.a Exempt                   |
| <b>II.a</b> Qualification Not Established | III.b Not in Scope             |
| II.b Not Qualified                        | IV Documentation Not Available |



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 32

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
 X = DEFICIENCY

Documented Evidence of Qualification Adequate	<u>X</u>
Adequate Similarity Between Equipment and Test Specimen Established	<u>X</u>
Aging Degradation Evaluated Adequately	<u>X</u>
<del>Qualified Life or</del> Replacement Schedule Established (If Required)	<u>X</u>
Program Established to Identify Aging Degradation	<u>X</u>
Criteria Regarding Aging Simulation Satisfied (If Required)	_____
Criteria Regarding Temperature/Pressure Exposure:	
o Peak Temperature Adequate	_____
o Peak Pressure Adequate	_____
o Duration Adequate	_____
o Required Profile Enveloped Adequately	_____
o Steam Exposure (If Required) Adequate	_____
Criteria Regarding Spray Satisfied	_____
Criteria Regarding Submergence Satisfied	_____
Criteria Regarding Radiation Satisfied	_____
Criteria Regarding Test Sequence Satisfied	_____
Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied	_____
Criteria Regarding Functional Testing Satisfied	_____
Criteria Regarding Instrument Accuracy Satisfied	_____
Test Duration Margin (1 hour + Function Time) Satisfied	_____
Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I)	_____

NRC QUALIFICATION CATEGORY

DESIGNATION:  
 X = CATEGORY

I.a	Equipment Qualified	_____
I.b	Equipment Qualification Pending Modification	_____
II.a	Equipment Qualification Not Established	<u>X</u>
II.b	Equipment Not Qualified	_____
II.c	Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified	_____
III.a	Equipment Exempt From Qualification	_____
III.b	Equipment Not in the Scope of the Qualification Review	_____
IV	Documentation Not Made Available	_____



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 22

LICENSEE RESPONSE TO NRC SER

4.2 Equipment Requiring Additional Information and/or Corrective Action  
 (Appendix B) [20]

The bulk of master list equipment was placed in this category and our review of deficiencies is based upon the following:

- Deletion of deficient listed equipment due to replacement programs carried out and reported in our 90-day, Revision 3 response dated February 1, 1981.
- Re-evaluation of CP&L's updated submittals by NRC Region II, Atlanta, GA, and reported in Environmental Qualification of Safety-Related Electrical Equipment IEB 79-01B. Technical Evaluation Report - Docket No. 50-261; Plant: H. B. Robinson 2, dated November 6, 1980 and Revised November 11, 1980.

Telecons with NRC, Bethesda, MD reviewing personnel July 29, 1981, et al.

Equipment reported as qualified within NRC TER Revision 1, dated November 11, 1980:

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model No.</u>	<u>Location</u>
1. pump motor	Westinghouse	506UPZ	outside containment

A. Pump Motor	Westinghouse	506UPZ	2	R,T,QT,RT,P,H, A,M
---------------	--------------	--------	---	-----------------------

Location (1) Containment Building  
 Location (2) Auxiliary Building

A. Items reported as qualified within NRC Region II revised TER, dated 11/7/80.

[20]



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 22

3.2.8 Motors [15]

Within containment at H. B. Robinson included in the equipment list for the report is one (1) motor type. This is a Westinghouse Type 685.5-S used with the containment fans. There are four (4) fans mounted in containment designated HVH-1 through HVH-4.

Qualification testing on a complete motor/fan assembly and on individual motor elements has been performed by Westinghouse. Results are published within WCAP-9003, Fan Cooler Motor Unit Test, 1969; WCAP-7829, Fan Cooler Motor Unit Test, 1972. WCAP-9003 testing included: thermal preaging to an equivalent of seven (7) years, a maximum pressure of 95 psia, a maximum temperature of 315° F, and use of borated spray for thirty-five (35) hours. WCAP-7829 testing included: total irradiation of equipment/components to  $2 \times 10^8$  RADs, preaging to a 40-year life expectancy.

Evaluation of the test reports concludes that the H. B. Robinson accident parameters are covered by the test envelopes and parameters performed on the similar Westinghouse motor/components subjected to qualification testing. Therefore, the containment fan motors at H. B. Robinson are considered qualified.

Outside of containment, the RHR pump motors are in use during long-term mitigation of LOCA conditions. The only accident parameters experienced by these pumps/motors is radiation. The most susceptible elements/components of the motors are covered by the testing reported within WCAP-7829. Since the RHR pump motors are of a similar type and motor windings are Thermalastic Epoxy insulated, it is concluded that the RHR pump motor is qualified for the service intended and the environment experienced during post LOCA.

Data supporting the Westinghouse testing reported within the stated WCAPs has been requested from Westinghouse and will be available for review upon receipt.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 22

NOTES:

o Although WCAP-7829 does encompass radiation testing to 2.0 E08rds the report does not specifically identify the motor to lead splice materials. The licensee should identify the materials used in the installed motor and verify that these items are qualified to the environmental service conditions to which they are exposed

o The licensee should provide evidence that the grease used in the bearing lubrication system is the same as that used in the tested motor or provide qualification information to establish similarity of lubricating ability after exposure to the radiation service environment.

o The licensee should establish a replacement schedule for the grease and bearings in addition to an analysis extending the qualified life of the Thermolastic Epoxy Stator Insulation beyond the 7 years of continuous duty to an actual in plant service life.

• WCAP-8587 concerns the methodology used to qualify various equipment items only. It is not a qualification document.





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 23

EQUIPMENT ITEM NO. 23  
 ELECTRIC MOTOR LOCATED IN THE CONTAINMENT, ELEV. 275'0"  
 WESTINGHOUSE MODEL 685.5S  
 REQUIRED OPERATING TIME: 3 HOURS  
 TER CHECKSHEET NO. 23  
 LICENSEE REFERENCE(S): 639, 640  
 FUNCTION (PLANT ID): DRIVES CONTAINMENT FAN COOLER (HVH-1, -2, -3, -4)  
 LICENSEE SUBMITTAL: SCEW(S): 17 OF 25 [20]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

(R), T, QT, RT, P, H, (CS), (A), S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,  
 Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, 3b, <del>3c, 3d</del>
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	5a, 5b, 5c, 5d, 5e, 5f, 5g, <del>5h, 5i, 5j</del>
Installed TMI Lessons Learned Implementation Equipment Summary	<del>6a, 6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 23

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/~~has not~~) provided a response to the SER concerns.
- The Licensee (has/~~has not~~) specifically stated that the equipment is qualified ~~and/or~~ will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/has not) proposed a corrective action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
- Corrective action specified by the Licensee:
  - Equipment replacement with qualified equipment
  - Equipment modification
  - Equipment relocation above submergence level
  - Relocate or shield equipment from radiation source
  - Verify qualification by additional (testing/analysis)
  - Equipment relocation to a mild environment
  - Qualification testing of equipment in progress
  - Other ( \_\_\_\_\_ )
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |   |                                |
|---|--------------------------------|
| I.a Qualified                             | II.c Qualified Life Deficiency |
| I.b Modification                          | III.a Exempt                   |
| <u>II.a</u> Qualification Not Established | III.b Not in Scope             |
| II.b Not Qualified                        | IV Documentation Not Available |



**EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 23**

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
X = DEFICIENCY

Documented Evidence of Qualification Adequate	<u>X</u>
Adequate Similarity Between Equipment and Test Specimen Established	<u>X</u>
Aging Degradation Evaluated Adequately	<u>X</u>
Qualified Life or Replacement Schedule Established (If Required)	<u>X</u>
Program Established to Identify Aging Degradation	<u>X</u>
Criteria Regarding Aging Simulation Satisfied (If Required)	<u>    </u>
Criteria Regarding Temperature/Pressure Exposure:	
o Peak Temperature Adequate	<u>    </u>
o Peak Pressure Adequate	<u>    </u>
o Duration Adequate	<u>    </u>
o Required Profile Enveloped Adequately	<u>    </u>
o Steam Exposure (If Required) Adequate	<u>    </u>
Criteria Regarding Spray Satisfied	<u>    </u>
Criteria Regarding Submergence Satisfied	<u>    </u>
Criteria Regarding Radiation Satisfied	<u>    </u>
Criteria Regarding Test Sequence Satisfied	<u>    </u>
Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied	<u>    </u>
Criteria Regarding Functional Testing Satisfied	<u>    </u>
Criteria Regarding Instrument Accuracy Satisfied	<u>    </u>
Test Duration Margin (1 hour + Function Time) Satisfied	<u>    </u>
Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I)	<u>    </u>

NRC QUALIFICATION CATEGORY

DESIGNATION:  
X = CATEGORY

I.a	Equipment Qualified	<u>    </u>
I.b	Equipment Qualification Pending Modification	<u>    </u>
II.a	Equipment Qualification Not Established	<u>X</u>
II.b	Equipment Not Qualified	<u>    </u>
II.c	Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified	<u>    </u>
III.a	Equipment Exempt From Qualification	<u>    </u>
III.b	Equipment Not in the Scope of the Qualification Review	<u>    </u>
IV	Documentation Not Made Available	<u>    </u>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 23

LICENSEE RESPONSE TO NRC SER

Equipment reported as qualified within NRC TER Revision 1, dated November 11, 1980:

[20]

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model No.</u>	<u>Location</u>
<del>1. pump motor</del>	<del>Westinghouse</del>	<del>506UPZ</del>	<del>outside</del>
<del>2. motor operator</del>	<del>Limitorque</del>	<del>SMB 00</del>	<del>containment</del>
<del>3. motor operator</del>	<del>Limitorque</del>	<del>SMB 00</del>	<del>outside</del>
<del>4. motor operator</del>	<del>Limitorque</del>	<del>SMB-1</del>	<del>containment</del>
<del>5. flow transmitter</del>	<del>Fisher &amp; Porter</del>	<del>10B2496</del>	<del>outside</del>
<del>6. pressure transmitter</del>	<del>Fisher &amp; Porter</del>	<del>4BBABBB</del>	<del>containment</del>
<del>7. fan motor</del>	<del>Westinghouse</del>	<del>50EP1041</del>	<del>outside</del>
7. fan motor	Westinghouse	BCXA 685.5-S	containment

4.2 Equipment Requiring Additional Information and/or Corrective Action  
 (Appendix B)

The bulk of master list equipment was placed in this category and our review of deficiencies is based upon the following:

- Deletion of deficient listed equipment due to replacement programs carried out and reported in our 90-day, Revision 3 response dated February 1, 1981.
- Re-evaluation of CP&L's updated submittals by NRC Region II, Atlanta, GA, and reported in Environmental Qualification of Safety-Related Electrical Equipment IEB 79-01B. Technical Evaluation Report - Docket No. 50-261; Plant: H. B. Robinson 2, dated November 6, 1980 and Revised November 11, 1980.

Telecons with NRC, Bethesda, MD reviewing personnel July 29, 1981, et al.

B. Fan Motor                      Westinghouse                      685.5-S                      1                      R,CS,A

<sup>B</sup>Items reported as qualified in part, with additional testing underway to establish overall equipment qualification, within NRC Region II revised TER, dated 11/7/80.

[20]



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 23

3.2.8 Motors [15]

Within containment at H. B. Robinson included in the equipment list for the report is one (1) motor type. This is a Westinghouse Type 685.5-S used with the containment fans. There are four (4) fans mounted in containment designated HVH-1 through HVH-4.

Qualification testing on a complete motor/fan assembly and on individual motor elements has been performed by Westinghouse. Results are published within WCAP-9003, Fan Cooler Motor Unit Test, 1969; WCAP-7829, Fan Cooler Motor Unit Test, 1972. WCAP-9003 testing included: thermal preaging to an equivalent of seven (7) years, a maximum pressure of 95 psia, a maximum temperature of 315<sup>o</sup>F, and use of borated spray for thirty-five (35) hours. WCAP-7829 testing included: total irradiation of equipment/components to  $2 \times 10^8$  RADs, preaging to a 40-year life expectancy.

Evaluation of the test reports concludes that the H. B. Robinson accident parameters are covered by the test envelopes and parameters performed on the similar Westinghouse motor/components subjected to qualification testing. Therefore, the containment fan motors at H. B. Robinson are considered qualified.

Outside of containment, the RHR pump motors are in use during long-term mitigation of LOCA conditions. The only accident parameters experienced by these pumps/motors is radiation. The most susceptible elements/components of the motors are covered by the testing reported within WCAP-7829. Since the RHR pump motors are of a similar type and motor windings are Thermalastic Epoxy insulated, it is concluded that the RHR pump motor is qualified for the service intended and the environment experienced during post LOCA.

Data supporting the Westinghouse testing reported within the stated WCAPs has been requested from Westinghouse and will be available for review upon receipt.



Franklin Research Center  
A Division of The Franklin Institute  
20th and Race Streets. Phila. Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
FRC Project No. C5257  
FRC Assignment No. 13  
FRC Task No. 511

Page  
5

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 23

Checksheets 5a thru 5g have been removed due to the  
proprietary nature of information contained therein.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 24

EQUIPMENT ITEM NO. 24  
 ELECTRICAL PENETRATION LOCATED IN THE CONTAINMENT, ELEV. 234'-246'  
 CROUSE-HINDS MODELS 1.2.2 (745), 1.2.2 (747), 1.2.4 (749), 1.2.5 (751)  
 REQUIRED OPERATING TIME: CONTINUOUS  
 TER CHECKSHEET NO. 24  
 LICENSEE REFERENCE(S): 25, 2096  
 FUNCTION (PLANT ID): ELECTRICAL DISTRIBUTION (B-1, -2, -5, -9; C-1, -2, -3,  
 -4, -6, -8, -9; D-1, -2, -3, -5, -8, -9)  
 LICENSEE SUBMITTAL: SCEW(S): 18 OF 25 [20]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

(R) T, (QT) (RT) P, H, (CS) (A) S, (R), M, I, (M), RPN, EXN, SEN, QI, RPS, None,  
 Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, 3b, 3c, 3d, 3e
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	<del>5a, 5b, 5c, 5d, 5e, 5f,</del> <del>5g, 5h, 5i, 5j</del>
Installed TMI Lessons Learned Implementation Equipment Summary	<del>6a, 6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 24

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/~~has not~~) provided a response to the SER concerns.
- The Licensee (has/~~has not~~) specifically stated that the equipment is qualified and/or will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/has not) proposed a corrective action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
- Corrective action specified by the Licensee:
  - Equipment replacement with qualified equipment
  - Equipment modification
  - Equipment relocation above submergence level
  - Relocate or shield equipment from radiation source
  - Verify qualification by additional (testing/analysis)
  - Equipment relocation to a mild environment
  - Qualification testing of equipment in progress
  - Other ( \_\_\_\_\_ )
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |                                    |  |
|------------------------------------|--|
| I.a Qualified                      | II.c Qualified Life Deficiency   |
| I.b Modification                   | III.a Exempt   |
| II.a Qualification Not Established | III.b Not in Scope   |
| II.b Not Qualified                 | <span style="border: 1px solid black; padding: 2px;">IV Documentation Not Available</span> |





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 24

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
X = DEFICIENCY

- Documented Evidence of Qualification Adequate \_\_\_\_\_
- Adequate Similarity Between Equipment and Test Specimen Established \_\_\_\_\_
- Aging Degradation Evaluated Adequately \_\_\_\_\_
- Qualified Life or Replacement Schedule Established (If Required) \_\_\_\_\_
- Program Established to Identify Aging Degradation \_\_\_\_\_
- Criteria Regarding Aging Simulation Satisfied (If Required) \_\_\_\_\_
- Criteria Regarding Temperature/Pressure Exposure:
  - o Peak Temperature Adequate \_\_\_\_\_
  - o Peak Pressure Adequate \_\_\_\_\_
  - o Duration Adequate \_\_\_\_\_
  - o Required Profile Enveloped Adequately \_\_\_\_\_
  - o Steam Exposure (If Required) Adequate \_\_\_\_\_
- Criteria Regarding Spray Satisfied \_\_\_\_\_
- Criteria Regarding Submergence Satisfied \_\_\_\_\_
- Criteria Regarding Radiation Satisfied \_\_\_\_\_
- Criteria Regarding Test Sequence Satisfied \_\_\_\_\_
- Criteria Regarding Test Failures or Severe Anomalies  
 (If Any) Satisfied \_\_\_\_\_
- Criteria Regarding Functional Testing Satisfied \_\_\_\_\_
- Criteria Regarding Instrument Accuracy Satisfied \_\_\_\_\_
- Test Duration Margin (1 hour + Function Time) Satisfied \_\_\_\_\_
- Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I) \_\_\_\_\_

NRC QUALIFICATION CATEGORY

DESIGNATION:  
X = CATEGORY

- I.a Equipment Qualified \_\_\_\_\_
- I.b Equipment Qualification Pending Modification \_\_\_\_\_
- II.a Equipment Qualification Not Established \_\_\_\_\_
- II.b Equipment Not Qualified \_\_\_\_\_
- II.c Equipment Satisfies All Requirements Except Qualified Life  
 or Replacement Schedule Justified \_\_\_\_\_
- III.a Equipment Exempt From Qualification \_\_\_\_\_
- III.b Equipment Not in the Scope of the Qualification Review \_\_\_\_\_
- IV Documentation Not Made Available X

TEST REPORTS ON VARIOUS WESTINGHOUSE AND CROUSE-HINDS ELECTRICAL  
 PENETRATIONS HAVE BEEN PREVIOUSLY REVIEWED. HOWEVER, SINCE DOCUMENTS  
 REFERENCED BY THE LICENSEE AS 1, 2, 3, and 4 WERE NOT PROVIDED,  
 QUALIFICATION STATUS OF THE ROBINSON UNIT 2 PLANT CANNOT BE DETERMINED.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 24

LICENSEE RESPONSE TO NRC SER

4.2 Equipment Requiring Additional Information and/or Corrective Action  
 (Appendix B) [20]

The bulk of master list equipment was placed in this category and our review of deficiencies is based upon the following:

- Deletion of deficient listed equipment due to replacement programs carried out and reported in our 90-day, Revision 3 response dated February 1, 1981.
- Re-evaluation of CP&L's updated submittals by NRC Region II, Atlanta, GA, and reported in Environmental Qualification of Safety-Related Electrical Equipment IEB 79-01B. Technical Evaluation Report - Docket No. 50-261; Plant: H. B. Robinson 2, dated November 6, 1980 and Revised November 11, 1980.

Telecons with NRC, Bethesda, MD reviewing personnel July 29, 1981, et al.

B.	Electrical Penetration	Crouse-Hinds	1.2.2 (745)	1	R,QT,RT,CS,A
B.	Electrical Penetration	Crouse-Hinds	1.2.2 (747)	1	R,QT,RT,CS,A
B.	Electrical Penetration	Crouse-Hinds	1.2.4 (749)	1	R,QT,RT,CS,A
B.	Electrical Penetration	Crouse-Hinds	1.2.5 (751)	1	R,QT,RT,CS,A

<sup>B</sup> Items reported as qualified in part, with additional testing underway to establish overall equipment qualification, within NRC Region II revised TER, dated 11/7/80.

[20]



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 54

3.2 Electrical Equipment Qualification Evaluation

3.2.1 Electrical Penetrations and Connectors [15]

The H. B. Robinson Nuclear Power Plant electrical penetrations are cartridge types with provisions for continuous pressurization. They were manufactured by Crouse-Hinds Company (Syracuse, N. Y.) to a Westinghouse design and specification CPL-R2-E3. Location within containment forms a grid pattern extending from elevation 234 feet to 246 feet. This places the penetrations above the established containment flood level of 231.2 feet. The electrical penetrations utilized by identified safety class electrical equipment are designated: Low Voltage (600V) 500 MCM, Low Voltage (600V) 3/C 19/#22, Low Voltage Control and Power (600V) 2/C #16, 3/C #16, and Instrumentation (600V) 2/C #16, 4/C #16 shielded. These types consist of a mixture of one-, two- and three-conductor cable interfaces and appropriate shields. Individual conductors are carried through the penetration and end in either a 60-inch or 72-inch pigtail. 2/C #16 and 3/C #16 pigtails are grouped and attached to electrical connectors (Crouse-Hinds model number RPC-317-160-SOIN/SO8N) to provide the appropriate cable match. The connectors are located in cable trays and lie in the horizontal plane. The cable tray runs are located essentially on the outside diameter of the polar crane shield wall to route cable to the respective instrumentation or control equipment.

The electrical penetration material which is located within containment and exposed to accident environment conditions consists of stainless steel (container) ceramic plate (conductor spacer) PVC and Kerite formula (conductor insulation) and aluminum (electrical connectors).

By specification each penetration type was designed to perform under the LOCA environmental conditions of pressure and temperature depicted within the H. B. Robinson FSAR (shown as Figure 3.1.1 and 3.1.2 in this report). Test information is recorded in References 3 and 4.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 24

The CP&L Brunswick Nuclear Power Plant uses Westinghouse designed and fabricated electrical penetrations which are similar to those in use at H. B. Robinson. Both are cartridge type with stainless steel sleeves and both have potting compound seals for the internal connections of the feed-through solid copper conductors. Brunswick penetrations utilize heat-shrink tubing for small conductors internal insulation spliced to Okonite jacketed cables forming pigtailed for field cable hookup. H. B. Robinson penetrations use silicone rubber internal insulation spliced with heat-shrink tubing to two (2) types of jacketed insulation cables (PVC and Kerite) forming pigtailed for field cable hookup. Both use a ceramic seal to encapsulate pigtail entry and provide an impervious shield

R2

with the cartridge sleeve. A greater degree of testing was performed on Brunswick type penetrations with results found in Reference 43. Briefly summarized:

- Thermal cycling - 20°C to 135°C (5 cycles)
- Pre-aging - 524 hrs. @ 70°C (40 years)
- Radiation -  $2.13 \times 10^8$  RAD
- Steam Test - Temperature, Pressure, Humidity and Spray (per report)

Due to the dual nature of the electrical penetrations, one side in containment the other outside, mock-up of only the in-containment area was required for testing purposes. The test data recorded and referenced above should validate qualification of the cartridge portion of the H, B, Robinson electrical penetrations.

The electrical connectors (Crouse-Hinds Model Number ((RPC-317-160-S01N/S08N)) used with the penetrations consist of an extruded aluminum shell with a hard anodized finish. The connector pins/sockets are silver-plated copper. The insert material is mineral filled diallyl phthalate with a thin wafer of silicone rubber provided for sealing purposes.

R2

Mineral filled diallyl phthalate can withstand radiation exposure between  $10^8$  and  $10^{10}$  RADS with little or no permanent degradation. The silicone rubber seal wafer is positioned between two plugs of diallyl phthalate and will not be significantly affected by irradiation. The connector proper will not be affected by normal plant life operation of forty (40) years or the added accident radiation dosage as presented in Table 1.3.3.

R2



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 24

The aluminum shell is comprised of 6061 alloy which contains (%): .25 copper, .6 silicon, 1.0 magnesium and .25 chromium. A Martin hard-coat anodized finish is applied to a depth of 1.7 - 2.0 thousandths. The alloy used experiences a weight loss of 932 mg/dm<sup>2</sup> for the first day and an average of 370 mg/dm<sup>2</sup> per day thereafter when completely immersed in a NaOH adjusted boric acid solution (pH=9) heated to 200°F.<sup>(3)</sup> As the shell is anodized its corrosion resistance is improved. Additionally, the connectors will not be completely immersed in boric acid solution under spray conditions, nor will the high temperature be maintained for a thirty- (30) day period. Therefore, the worst case of loss of mass (.8 ounce per square decimeter after 30 days) will not be realized. Sufficient shell material will remain to preserve connector integrity.

R2

(2) See Appendix C to this report for reference information.

(3) WCAP 7153 Investigation of Chemical Additives for Reactor Containment Sprays. (Reference Table 8 and Figure 9.)

R2

As reported by Crouse-Hinds, the anodized finish provides protection sufficient to enable specifying connector to be corrosion resistant to salt spray for 300 days (in tests per MIL C-5015D and MIL-E-4970A). Per manufacturer's installation instructions, connector will provide watertight seal and will exclude water by hose spray or stream. During refueling (August-October, 1980), all connectors in containment were checked and tightened to provide watertight fit.

R2

A periodic check of connector clamp and shell cover screw tightness will be established and performed to assure connectors will function for the LOCA prescribed operation time of the penetrations (see Table 1.3.3). As the clamp seal was able to maintain connector operability after a three-hundred (300) day salt spray test per stated MIL SPECS, it is concluded that properly maintained clamp seals will provide chemical spray protection for the required operational times of electrical penetration connector circuits (thirty (30) minutes to one (1) day).



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 24

No significant degradation due to thermal aging will be experienced by the connector during operation plant life due to materials used in design and/or fabrication. The connector design temperature range is -80°F to 275°F and is sufficient to meet the operating and LOCA temperature range established for H. B. Robinson.

The electrical penetrations utilize a combination of five- (5) and six- (6) foot lengths of single or multiconductor cable to connect the penetration feed-through conductors to the field cable inside and outside containment. These "pigtail" cable were installed by the manufacturer and sleeved at the penetration end with heat-shrink tubing. For selective conductors, connectors were installed while the majority of pigtail cables required butt-style splicing for field cable connection.

| R1

The cabling used for pigtails was provided by CP&L/Ebasco specification/purchase and shipped to Crouse-Hinds Company for fabrication use. For the Low Voltage Power, (600V) electrical penetrations, 500 MCM Kerite cable with HI TEMP conductor insulation was provided (see Section 3.2.4 for qualification evaluation). For Low Voltage Control and Power (600V) electrical penetrations, 3/C #16 and 2/C #16 Kerite cable with FR conductor insulation was provided (see Section 3.2.4 for qualification evaluation). For Instrumentation (600V) electrical penetrations 2/C #16 (shielded) and 4/C #16 (shielded), Continental Wire and Cable Company cable with PVC conductor insulation was provided. No qualification data is available for this cable. CP&L has initiated a qualification test program to determine the ability of this cable to meet IEEE 323-1974 requirements using FSAR established accident parameters. Spare pigtails will be used and cable splices per Section 3.2.5 will be utilized to maintain plant configuration during tests. Wyle Laboratories will perform the tests per Qualification Plan 543/4464/ES dated July 10, 1980. Testing and reporting will require thirty-five (35) weeks--after Receipt of Order. Major time factor will be thermal aging to achieve forty- (40) years' operating life before LOCA testing can be performed. After review of results, a report will be sent to NRC detailing any action by CP&L dictated by these tests.

| R1

| R1

These PVC insulated pigtails are used for instrumentation or within circuits which must perform their functions after short elapsed time periods; therefore, their long-term operability problems should not affect plant response to accident conditions. Results of the qualification test program will determine the ultimate disposition of these pigtails. If replacement is required, a plan and schedule for accomplishment will be included in the report already stated above. [15]

| R1



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 25

EQUIPMENT ITEM NO. 25  
 ELECTRICAL CABLE LOCATED IN THE CONTAINMENT  
 CONTINENTAL WIRE AND CABLE MODEL CC2115  
 REQUIRED OPERATING TIME: CONTINUOUS  
 TER CHECKSHEET NO. 25  
 LICENSEE REFERENCE(S): 2818  
 FUNCTION (PLANT ID): INSTRUMENTATION CABLE  
 LICENSEE SUBMITTAL: SCEW(S): 21 OF 25 [20]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

R, T, QT, RT, P, H, CS, A, S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,  
 Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, 3b, <del>3c, 3d</del>
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	5a, 5b, 5c, 5d, 5e, 5f, 5g, <del>5h, 5i, 5j</del>
Installed TMI Lessons Learned Implementation Equipment Summary	<del>6a, 6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 25

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/~~has not~~) provided a response to the SER concerns.
- The Licensee (has/~~has not~~) specifically stated that the equipment is qualified and ~~or~~ will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/has not) proposed a corrective action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
- Corrective action specified by the Licensee:
  - Equipment replacement with qualified equipment
  - Equipment modification
  - Equipment relocation above submergence level
  - Relocate or shield equipment from radiation source
  - Verify qualification by additional (testing/analysis)
  - Equipment relocation to a mild environment
  - Qualification testing of equipment in progress
  - Other ( \_\_\_\_\_ )
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |   |                                |
|---|--------------------------------|
| I.a Qualified                             | II.c Qualified Life Deficiency |
| I.b Modification                          | III.a Exempt                   |
| <u>II.a Qualification Not Established</u> | III.b Not in Scope             |
| II.b Not Qualified                        | IV Documentation Not Available |





**EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 25**

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
 X = DEFICIENCY

Documented Evidence of Qualification Adequate	_____
Adequate Similarity Between Equipment and Test Specimen Established	_____
Aging Degradation Evaluated Adequately	<u>X</u>
Qualified Life or Replacement Schedule Established (If Required)	<u>X</u>
Program Established to Identify Aging Degradation	_____
Criteria Regarding Aging Simulation Satisfied (If Required)	_____
Criteria Regarding Temperature/Pressure Exposure.	_____
o Peak Temperature Adequate	_____
o Peak Pressure Adequate	_____
o Duration Adequate	<u>X</u>
o Required Profile Enveloped Adequately	<u>X</u>
o Steam Exposure (If Required) Adequate	_____
Criteria Regarding Spray Satisfied	<u>X</u>
Criteria Regarding Submergence Satisfied	_____
Criteria Regarding Radiation Satisfied	_____
Criteria Regarding Test Sequence Satisfied	_____
Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied	_____
Criteria Regarding Functional Testing Satisfied	_____
Criteria Regarding Instrument Accuracy Satisfied	_____
Test Duration Margin (1 hour + Function Time) Satisfied	_____
Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I)	_____

NRC QUALIFICATION CATEGORY

DESIGNATION:  
 X = CATEGORY

I.a	Equipment Qualified	_____
I.b	Equipment Qualification Pending Modification	_____
II.a	Equipment Qualification Not Established	<u>X</u>
II.b	Equipment Not Qualified	_____
II.c	Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified	_____
III.a	Equipment Exempt From Qualification	_____
III.b	Equipment Not in the Scope of the Qualification Review	_____
IV	Documentation Not Made Available	_____

*see page 5 a through g and i.*



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 25

LICENSEE RESPONSE TO NRC SER

4.2 Equipment Requiring Additional Information and/or Corrective Action  
(Appendix B) [20]

The bulk of master list equipment was placed in this category and our review of deficiencies is based upon the following:

- Deletion of deficient listed equipment due to replacement programs carried out and reported in our 90-day, Revision 3 response dated February 1, 1981.
- Re-evaluation of CP&L's updated submittals by NRC Region II, Atlanta, GA, and reported in Environmental Qualification of Safety-Related Electrical Equipment IEB 79-01B. Technical Evaluation Report - Docket No. 50-261; Plant: H. B. Robinson 2, dated November 6, 1980 and Revised November 11, 1980.

Telecons with NRC, Bethesda, MD reviewing personnel July 29, 1981, et al.

Equipment reported as qualified within NRC TER Revision 1, dated November 11, 1980:

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model No.</u>	<u>Location</u>
<del>1. pump motor</del>	<del>Westinghouse</del>	<del>506UPZ</del>	<del>outside</del>
<del>2. motor operator</del>	<del>Limitorque</del>	<del>SMB-00</del>	<del>containment</del>
<del>3. motor operator</del>	<del>Limitorque</del>	<del>SMB-00</del>	<del>outside</del>
<del>4. motor operator</del>	<del>Limitorque</del>	<del>SMB-1</del>	<del>containment</del>
<del>5. flow transmitter</del>	<del>Fisher &amp; Porter</del>	<del>10B2496</del>	<del>outside</del>
<del>6. pressure transmitter</del>	<del>Fisher &amp; Porter</del>	<del>PBBABBB</del>	<del>containment</del>
<del>7. fan motor</del>	<del>Westinghouse</del>	<del>50EP1041</del>	<del>outside</del>
<del>8. cable</del>	<del>Continental Wire &amp; Cable</del>	<del>CC2115</del>	<del>containment</del>

A. Cable Continental Wire & Cable CC2115 1 R,RT,P,H,CS,A

<sup>A</sup> Items reported as qualified within NRC Region II revised TER, dated 11/7/80.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 25

3.2.4 Electrical Cable

The electrical equipment in containment and reported within the equipment list of this report is connected by either single conductors or multiconductor cables. These cables run via cable trays and conduit from the electrical penetrations to the equipment. Connections to the electrical penetrations are made by individual or grouped cable splices, or by electrical connectors. At the equipment end, formal component terminals with overall tape or crimped terminals with overall tape are used for connection.

The connectors used (Crouse-Hinds Model No. RPC-117-150-POIN/PO8N) were supplied with the electrical penetrations and mounted on the matching cable during construction. For details concerning qualification of this connector, see Section 3.2.1. For details concerning cable splices and terminals see Section 3.2.5.

For instrumentation within containment, a silicon rubber conductor insulation with glass binder, an untinned bare copper drain wire and an overall silicon rubber jacket cable is used. The manufacturer, Continental Wire and Cable Company, used their formulated insulation type CC-2115. This formulation has been tested by the Franklin Institute Research Laboratories under Continental Wire and Cable Company instruction. Final Report F-C2935 dated, October 1970 with addendum dated November 1970, details the testing specifics which included a preconditioning (aging) period of six (6) hours at 151°F, and a subsequent test achieved exposures of  $1 \times 10^6$  RADS. Also included was a chemical spray for one hundred and twenty (120) hours. The combined data for this cable insulation material indicates there should be no problems associated with LOCA pressure, temperature, humidity, spray, or radiation. At this time aging is the only unknown variable. Basically, silicon rubber cable insulation is designed and recommended for high temperature applications. CP&L has no plans to conduct separate testing to further qualify this cable.

[15]



Franklin Research Center  
A Division of The Franklin Institute  
20th and Race Streets. Phila., Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
FRC Project No. C5257  
FRC Assignment No. 13  
FRC Task No. 511

Page  
5

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 25

Checksheets 5a thru 5g and 5i have been removed due to the proprietary nature of information contained therein.



Franklin Research Center  
 A Division of The Franklin Institute  
 20th and Race Streets, Phila. Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
 FRC Project No. C5257  
 FRC Assignment No. 13  
 FRC Task No. 511

Page  
 1a

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 26

EQUIPMENT ITEM NO. 26  
 ELECTRICAL CABLE LOCATED IN THE CONTAINMENT  
 KERITE MODEL HIGH TEMPERATURE, FIRE RESISTANT  
 REQUIRED OPERATING TIME: CONTINUOUS  
 TER CHECKSHEET NO. 26  
 LICENSEE REFERENCE(S): 27, 4281, 4282  
 FUNCTION (PLANT ID): CONTROL AND LOW POWER CABLE  
 LICENSEE SUBMITTAL: SCEW(S): 22 OF 25 [20]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

(R), T, QT, (RT), (P), (H), (CS), (A), S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,  
 Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, 3b, 3c, 3d
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	5a, 5b, 5c, 5d, 5e, 5f, 5g, <del>5h</del> , 5i, 5i <sub>2</sub>
Installed TMI Lessons Learned Implementation Equipment Summary	<del>6a, 6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



**EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 26**

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/~~has not~~) provided a response to the SER concerns.
- The Licensee (has/~~has not~~) specifically stated that the equipment is qualified and/or will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/has not) proposed a corrective action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
- Corrective action specified by the Licensee:
  - Equipment replacement with qualified equipment
  - Equipment modification
  - Equipment relocation above submergence level
  - Relocate or shield equipment from radiation source
  - Verify qualification by additional (testing/analysis)
  - Equipment relocation to a mild environment
  - Qualification testing of equipment in progress
  - Other ( \_\_\_\_\_ )
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |                                    |                                |
|------------------------------------|--------------------------------|
| <u>I.a Qualified</u>               | II.c Qualified Life Deficiency |
| I.b Modification                   | III.a Exempt                   |
| II.a Qualification Not Established | III.b Not in Scope             |
| II.b Not Qualified                 | IV Documentation Not Available |



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 26

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
X = DEFICIENCY

- Documented Evidence of Qualification Adequate \_\_\_\_\_
- Adequate Similarity Between Equipment and Test Specimen Established \_\_\_\_\_
- Aging Degradation Evaluated Adequately \_\_\_\_\_
- Qualified Life or Replacement Schedule Established (If Required) \_\_\_\_\_
- Program Established to Identify Aging Degradation \_\_\_\_\_
- Criteria Regarding Aging Simulation Satisfied (If Required) \_\_\_\_\_
- Criteria Regarding Temperature/Pressure Exposure: \_\_\_\_\_
  - o Peak Temperature Adequate \_\_\_\_\_
  - o Peak Pressure Adequate \_\_\_\_\_
  - o Duration Adequate \_\_\_\_\_
  - o Required Profile Enveloped Adequately \_\_\_\_\_
  - o Steam Exposure (If Required) Adequate \_\_\_\_\_
- Criteria Regarding Spray Satisfied \_\_\_\_\_
- Criteria Regarding Submergence Satisfied \_\_\_\_\_
- Criteria Regarding Radiation Satisfied \_\_\_\_\_
- Criteria Regarding Test Sequence Satisfied \_\_\_\_\_
- Criteria Regarding Test Failures or Severe Anomalies  
 (If Any) Satisfied \_\_\_\_\_
- Criteria Regarding Functional Testing Satisfied \_\_\_\_\_
- Criteria Regarding Instrument Accuracy Satisfied \_\_\_\_\_
- Test Duration Margin (1 hour + Function Time) Satisfied \_\_\_\_\_
- Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I) \_\_\_\_\_

NRC QUALIFICATION CATEGORY

DESIGNATION:  
X = CATEGORY

- I.a Equipment Qualified \_\_\_\_\_ X
- I.b Equipment Qualification Pending Modification \_\_\_\_\_
- II.a Equipment Qualification Not Established \_\_\_\_\_
- II.b Equipment Not Qualified \_\_\_\_\_
- II.c Equipment Satisfies All Requirements Except Qualified Life  
 or Replacement Schedule Justified \_\_\_\_\_
- III.a Equipment Exempt From Qualification \_\_\_\_\_
- III.b Equipment Not in the Scope of the Qualification Review \_\_\_\_\_
- IV Documentation Not Made Available \_\_\_\_\_

*see pages 5a thru 5c*



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 26

LICENSEE RESPONSE TO NRC SER

4.2 Equipment Requiring Additional Information and/or Corrective Action  
(Appendix B) [20]

The bulk of master list equipment was placed in this category and our review of deficiencies is based upon the following:

- Deletion of deficient listed equipment due to replacement programs carried out and reported in our 90-day, Revision 3 response dated February 1, 1981.
- Re-evaluation of CP&L's updated submittals by NRC Region II, Atlanta, GA, and reported in Environmental Qualification of Safety-Related Electrical Equipment TER 79-01B. Technical Evaluation Report - Docket No. 50-261; Plant: H. B. Robinson 2, dated November 6, 1980 and Revised November 11, 1980.

Telecons with NRC, Bethesda, MD reviewing personnel July 29, 1981, et al.

Equipment reported as qualified within NRC TER Revision 1, dated November 11, 1980:

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model No.</u>	<u>Location</u>
<del>1. pump motor</del>	<del>Westinghouse</del>	<del>600NPZ</del>	<del>outside containment</del>
<del>2. motor operator</del>	<del>Limitorque</del>	<del>5MB-00</del>	<del>containment</del>
<del>3. motor operator</del>	<del>Limitorque</del>	<del>5MB-00</del>	<del>outside containment</del>
<del>4. motor operator</del>	<del>Limitorque</del>	<del>5MB-1</del>	<del>outside containment</del>
<del>5. flow transmitter</del>	<del>Fisher &amp; Porter</del>	<del>10B2406</del>	<del>outside containment</del>
<del>6. pressure transmitter</del>	<del>Fisher &amp; Porter</del>	<del>50EP1041</del>	<del>outside containment</del>
<del>7. fan motor</del>	<del>Westinghouse</del>	<del>683-5-S</del>	<del>containment</del>
<del>8. cable</del>	<del>Continental Wire</del>	<del>CC21-1</del>	<del>containment</del>
9. cable	Kerite	RT FR	containment

A. Cable                      Kerite                      High temp, fire resistant                      1                      R, RT, P, H, CS, A

<sup>A</sup> Items reported as qualified within NRC Region II revised TER, dated 11/7/80.





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 26

3.2.4 Electrical Cable *WJ*

The electrical equipment in containment and reported within the equipment list of this report is connected by either single conductors or multiconductor cables. These cables run via cable trays and conduit from the electrical penetrations to the equipment. Connections to the electrical penetrations are made by individual or grouped cable splices, or by electrical connectors. At the equipment end, formal component terminals with overall tape or crimped terminals with overall tape are used for connection.

The connectors used (Crouse-Hinds Model No. RPC-117-150-POIN/PO8N) were supplied with the electrical penetrations and mounted on the matching cable during construction. For details concerning qualification of this connector, see Section 3.2.1. For details concerning cable splices and terminals see Section 3.2.5.

The electrical cable used for equipment hookup is divided into three (3) classifications:

- o multiconductor - 2/C #16, 3/C #16, 3/C 19/#22
- o multiconductor - 2/C #16, 4/C #16 (single drain wire utilized as shield)
- o single conductor - 500 MCM

The unshielded multiconductor cable is used to power the identified motor-operated valves (3C 19/#22), control the identified solenoid valves and provide limit switch outputs (2/C #16, 3/C #16). The shielded multiconductor cable is used for analog signals obtained from the listed transmitter and the listed RTD temperature elements (2/C #16, 4/C #16 shielded). The single conductor cable (500 MCM) provides power for the containment fans (HVH-1 through HVH-4). The shielded cables used for containment instrumentation utilize the provided electrical connectors at the penetration end.

Inspection of in-containment field cable hookup to limit switches and solenoid valves performed the week of August 18, 1980 through August 22, 1980 determined that Kerite fire-resistant conductor insulation with overall fire-resistant jacket cable is used.

| R1



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 26

The Kerite Company has attested to the ability of this cable supplied for H. B. Robinson to withstand the FSAR LOCA conditions of temperature, pressure and radiation. In addition, test qualification included forty- (40) year aging, borated spray and 100% relative humidity to meet IEEE 323-1974 and IEEE 383-1974 requirements. Referenced reports are:

FIRL Report F-C4020-1 dated March 1975.

Kerite Proprietary Engineering Memo No. 178 entitled, "Determining Temperature Ratings of Cables and Pre-aging Requirements for LOCA Simulation Tests," dated December 27, 1974 (superseded by EM178A dated May 1, 1979).

For motor power required for valve operation, a Kerite HI TEMP conductor insulation with asbestos fillers, nylon binder tape, neoprene treated tape, with fire-resistant jacket reinforced with a cotton-sleeve cable is in use within containment.

For containment fan power, a Kerite HI TEMP conductor insulation with overall fire-resistant jacket, reinforced by cotton-sleeve cable is in use within containment.

The Kerite Company has attested to the ability of this cable supplied for H. B. Robinson to withstand the FSAR LOCA conditions of temperature, pressure and radiation. In addition, test qualification included forty- (40) year aging, borated spray and 100% relative humidity exposure to meet IEEE 323-1974 and IEEE 383-1974 requirements. Referenced reports are:

FIRL Report F-C4020-2 dated March 1975.

Proprietary Engineering Memo No. 178 entitled, "Determining Temperature Ratings of Cables and Pre-aging Requirements for LOCA Simulation Tests" dated December 27, 1974 (superseded by EM 178A dated May 1, 1979 and EM 178B dated December 1, 1979).

To provide protection for cable termination at equipment end, when no formal termination method was provided, a silicone rubber tape was used. SCOTCH 70, high temperature silicone rubber tape, is used for safety-related terminations. This product has undergone radiation testing by the manufacturer, Minnesota Mining & Manufacturing Company (3M) up to  $1.0 \times 10^8$  RADs at 40°C temperature with no major degradation of performance.

R1

R1

R2



Franklin Research Center

A Division of The Franklin Institute

20th and Race Streets. Phila. Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118

FRC Project No. C5257

FRC Assignment No. 13

FRC Task No. 511

Page

3d

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 26

A more comprehensive testing program to meet IEEE 323, 1974, requirements has been performed by Kerite Company utilizing SCOTCH 70 tape and Kerite Cable within LOCA testing chamber. Kerite has certified the use of SCOTCH 70 as detailed in Reference Number 50.

To assure tape qualification for H, B, Robinson application, SCOTCH 70 tape will be used in conjunction with test control cables during qualification testing of the electrical penetrations PVC pigtail cable being performed at Wyle Laboratories. Results will be documented and available after completion of PVC cable testing.

R2

[15]



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 26

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW

Criteria: DOR Guidelines X; NUREG-0588, Cat. I    ; NUREG-0588, Cat. II    .

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
<u>EQUIPMENT DESCRIPTION</u>			
Equipment Type	Electrical Cable	Electrical Cable	
Manufacturer's Name (5.2.2/-/-)	Kerite	The Kerite Company	
Model Number (5.2.2/-/-)	HT/FR 3/C #16	See Note 1 on pages 5i1 and 5i2	
Serial Number	2/c #16 3/c 19/#22		
Features/Mounting (5.2.6/-/-)	500MCM	1000V power Cable 600V Control Cable	
Connections/Interfaces (5.2.6/-/-)	Splice	Splices on Power Cable	
Location/Elevation	Various in containment	See Note 2 Page 5i3	Note - 2 Not applicable
Equipment ID No.	NA	Not Applicable	
<u>QUALIFICATION REPORT</u> (8.0/5.0/5.0)			
Report ID Number	F-C4020-1 F-C4020-2	F-C4020-1 F-C4020-2	
Report Date	3/75	March 1975	
Issued by	FIRL	Franklin Institute Research Laboratories	
Prepared for	Kerite	The Kerite Company	
Referenced Reports	Not stated	Not Applicable	
Qualification Method (5.1, 5.3/2.1, 2.4/2.1, 2.4)	TEST	Simultaneous Test	
<u>QUALIFICATION TEST PROGRAM</u>			
Functional Test Description (5.2.5/2.2.9/2.2.9)	NA	Insulation Resistance During Test	
Operating Conditions (-/2.2.10/2.2.10)	Not stated	1000V/50A-Power Cables 600V/12A-Control Cables	
Load/Cycles/Voltage/ Current/Freq.			



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 26

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
Acceptance Criteria (5.2.5/2.2.1/2.2.1)	<i>Not stated</i>	Maintain Current carrying capability	
Accuracy (5.2.5/-/-)	<i>N.A.</i>	Not Applicable	
Number of Specimens	<i>N.A.</i>	10	
Test Instruments Calibrated	<i>N.A.</i>	Yes	
Safety Function (Active/ Passive) (-/2.1.3/2.1.3)	<i>Carry current</i>	Carry current	
Test Duration (5.2.1/-/-)	<i>NA</i>	100 Days	
Accident Duration (Envir. Above Normal) (5.2.1/-/-)	<i>&gt;1 to 30 days</i>	Not Applicable	
Required Function Time	<i>Continuous</i>	Not Applicable	
Test Sequence (General) (5.2.3/2.3.1/2.3.1)	<i>NA</i>		
Test Sequence (NUREG-0588, Cat. I) (-/2.3.1/-)	<i>NA</i>		
1. Representative Sample		Yes Per IEEE-383-74	
2. Baseline Data		Not Applicable	
3. Performance Extremes	<i>NA</i>	Rated Current/Voltage	
4. Thermal Aging		Both Aged and Unaged	
5. Radiation Aging		Simulated 40 years	
6. Wear Aging		Not Applicable	
7. Vibration/Seismic		Not Applicable	
8. DBE Exposure		Per IEEE-323-74 & 383-74	
9. Post-DBE Exposure		Simultaneous Gamma	
10. Inspection		Visual/Megger/HiPot	
Aging (5.2.4, 7.0/4.0/4.0)			
Thermal Aging/Basis	<i>N.A.</i>	101 hours @ 150°C Arrhenius	
Material Aging Evaluation (7.0/-/-)	<i>N.A.</i>	See Note 3 Page 5f	
Materials Susceptible (Thermal) (5.2.4, 7.0/-/-)	<i>N.A.</i>	Not Stated	
Radiation Aging, Type	<i>Gamma</i>	Gamma	



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 26

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-1/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
Radiation Aging, Dose (rd)	<i>Not stated</i>	48.9 to 50.4 Megarads	
Radiation Aging, Dose Rate	<i>50-200rd/hr</i>	327 to 337 Kilorads/hour	
Radiation Aging, Method	<i>N.A.</i>	Test	
Materials Susceptible (Radiation) (5.2.4, 7.0/-/-)	<i>Not stated</i>	Not Stated	
Operational Aging (-/4.2/-)	<i>N.A.</i>	Current Maintained during Radiation test	
Other Age Conditioning (-/4.2/-)	<i>NA</i>	Not Stated	
Qualified Life Claimed/ Established (5.2.4/4.10/-)	<i>40 years</i>	40 Years See note 2 page 5f	
Normal Ambient Temperature	<i>115°F Ave.</i>	Not Applicable	
Normal Ambient Radiation	<i>50-200 rd/h.</i>	Not Applicable	
Normal Ambient Humidity	<i>Not stated</i>	Not Applicable	
On-Going Surveillance and Preventive Maintenance (7.0/-/-)	<i>Yes</i>	Not Applicable	
On-Going Analysis of Failures and Degradation (7.0/-/-)	<i>Yes</i>	Not Applicable	
Margin (General) (6.0/3.0/3.0)	<i>NA</i>	Not Stated	
Margin (NUREG-0588, Cat. I) (-/3.2/-)		Not Stated	
1. Temperature (+15°F)			
2. Pressure (+10%, 10 psig max)			
3. Radiation (not required)			
4. Time (+10%, +1 hour + function time minimum)			



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 26

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
<u>ACCIDENT CONDITIONS</u>			
LOCA/MSLB/HELB/Uncontrolled (4.1, 4.2, 4.3.1, 4.3.3/ 1.1, 1.2, 1.5/1.1, 1.2, 1.5)	Loc A	LOCA/MSLB	
Radiation Type	Gamma	Gamma	
Radiation Dose (rd) (4.1.2/1.4/1.4)	14 Mrd	148.9-155.6 Megarads	
Radiation Dose Rate (rd/hr) Radiation Qual. Method (5.3.1/-/-)	Not stated	337 - 352 Kilorads/Hour	
Proximity to Concentrated Radiation (4.1.2/1.4.6/1.4.6)	Not stated	Not Applicable	
Equipment Susceptible to Beta Radiation (4.1.2/-/-)	Not stated	Not Stated	
Radiation Dose (Normal + Accident) (4.1.2/-/-) p	Not stated	Not Applicable	
Plateout Dose Considered (-/1.48/1.48)	Not stated	Not Applicable	
Gamma + Beta Dose (rd) (4.1.2/1.4.7/1.4.7)	Not stated	Not Applicable	



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 26

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE No.)
<u>ENVIRONMENTAL PROFILE OF ACCIDENT CONDITIONS</u>			
Rate of Temp./Press. Increase	26.5°F; 4 psi/sec	28°F; 7Psi/second	
Peak: °F/psig/RH/Time	264/42/100/3h	346/113/100%/6hours	2 peaks 3hrs each
Decrease To: °F/psig/RH/Time	219/20/100/21h	335/95/100%/3hrs	
Decrease To: °F/psig/RH/Time	152/0.5/100/-	315/69/100%/4hrs	
Decrease To: °F/psig/RH/Time		265/28/100%/4.5 days	
Equipment Surface Tempera- ture (MSLB) (-/1.2.5.C, 2.2.6/1.2.5.C, 2.2.6)	N.A.	212/5-9/100%/96 days Not Applicable	*
Spray Qualification Method (5.3.2/1.3, 2.2.8/1.3, 2.2.8)	N.A.	Test	
Spray Composition (4.1.4/1.3, 2.2.8/ 1.3, 2.2.8)	1.7 wt % Boric Acid 0.6 wt % NaOH PH 9.3	0.28 Molar H <sub>3</sub> BO <sub>3</sub> pH 10.5 0.064 Molar Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>	*
Spray Density (gpm/ft <sup>2</sup> )	Not stated	0.15	
Spray Duration	Not stated	98.5days	
Submergence Duration (4.1.3/2.2.5/2.2.5)	Not stated	Not Applicable	
In-Leakage Considered (5.2.6, 5.3.2/-/-)	Not stated	Not Applicable	
Time to Submergence	Not stated	Not Applicable	
Dust Environment (-/2.2.11/2.2.11)	Not stated	Not Applicable	

\*Interrupted at 23 days to remove  
test chamber from Hot Cell.





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 26

NOTES: *Note 3*

- a) Two of the cable samples, one with a splice and one without a splice, were preaged in a circulating hot air oven for approximately 100 hours at 150°C. The time-temperature necessary to preage these cables to the equivalent of forty years' service was obtained from proprietary Arrhenius data presented in Kerite Engineering Memorandum No. 178 dated December 27, 1974.
- a) One of the 50 foot samples and one of the 10 foot samples was preaged in a circulating hot air oven for approximately 100 hours at 150°C. The time-temperature necessary to preage these cables to the equivalent of forty years' service was obtained from proprietary Arrhenius data presented in Kerite Engineering Memorandum No. 178, dated December 27, 1974.

*Conclusion - The test parameters envelop all parameters identified for the H.B. Robinson plant. The equipment is therefore considered qualified.*



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 26

NOTES: *Note 1*

2. SPECIMEN DESCRIPTION

This report covers six cables, E, F, G, H, I and J, which are described in Table 1. Cables F, H and J were thermally preaged by the Kerite Company prior to receipt by FIRC.

Table 1. Description of Specimens

Cable No.	Description (a)	No. of Conductors	Wire Size AWG	Pre-Aged (a) Condition	Energizing Potential (Vac)	Current Load (A)
E	600 V control cable, 30 mils HTK, 20 mils FR (N-98/HI-70) insulation, 65 mils FR (HC-711) jacket, 0.75-in. O.D., 50 ft length. (b)	7	12	Unaged	600	12
F	600 V control cable, 30 mils HTK, 20 mils FR (N-98/HI-70) insulation, 65 mils FR (HC-711) jacket, 0.75-in. O.D., 50 ft length. (b)	7	12	Aged 101 hrs @ 150°C	600	12
G	1000 V power cable, 4/64 HTK (N-98) insulation, 65 mils FR (HC-711) jacket, 0.50-in. O.D., 50 ft length. (b)	1	6	Unaged	1000	50
H	1000 V power cable, 4/64 HTK (N-98) insulation, 65 mils FR (HC-711) jacket, 0.50-in. O.D., 50 ft length. (b)	1	6	Aged 101 hrs @ 150°C	1000	50
I	1000 V spliced power cable, 4/64 HTK (N-98) insulation, 65 mils FR (HC-711) jacket, 0.50-in. O.D., 10 ft length. (b)	1	6	Unaged	1000	50
J	1000 V spliced power cable, 4/64 HTK (N-98) insulation, 65 mils FR (HC-711) jacket, 0.50-in. O.D., 10 ft length. (b)	1	6	Aged 101 hrs @ 150°C	1000	50

NOTES: (a) Cable descriptions were provided by the Kerite Company.

(b) Length inside pressure vessel.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 26

NOTES:

Note 1, (cont'd)

2. SPECIMEN DESCRIPTION

This report covers four cables, A, B, C and D, which are described in Table 1. Cables B and D were thermally preaged by The Kerite Company prior to receipt by FIRL.

Cable No.	Description <sup>(1)</sup>	No. of Conductors	Wire Size AWG	Pre-Aged <sup>(1)</sup> Condition	Energizing Potential (Vac)	Current Load (A)
A	600 V control cable, 50 mils FR (HI-70) insulation, 65 mils FR (HC-711) jacket, <sup>(2)</sup> 0.74-in. O.D., 50 ft length	7	12	Unaged	600	12
B	600 V control cable, 50 mils FR (HI-70) insulation, 65 mils FR (HC-711) jacket, <sup>(2)</sup> 0.74-in. O.D., 50 ft length	7	12	Thermally aged for 101 hours @ 150°C	600	12
C	600 V spliced control cable, 50 mils FR (HI-70) insulation, 65 mils FR (HC-711) jacket, <sup>(2)</sup> 0.74-in. O.D., 10 ft length	7	12	Unaged	600	12
D	600 V spliced control cable, 50 mils FR (HI-70) insulation, 65 mils FR (HC-711) jacket, <sup>(2)</sup> 0.74-in. O.D., 10 ft length	7	12	Thermally aged for 101 hours @ 150°C	600	12

(1) As reported by The Kerite Company.

(2) Length inside pressure vessel.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 27

EQUIPMENT ITEM NO. 27 (TMI ACTION PLAN ITEM-ALL)  
 ELECTRICAL CABLE LOCATED IN THE CONTAINMENT  
 ROCKBESTOS, MODEL NOT STATED  
 REQUIRED OPERATING TIME: NOT STATED  
 TER CHECKSHEET NO. 27  
 LICENSEE REFERENCE(S): 1391  
 FUNCTION (PLANT ID): ELECTRICAL DISTRIBUTION, TMI EQUIPMENT  
 LICENSEE SUBMITTAL: SCEW(S): 14 OF 15 [15]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

R, T, QT, RT, P, H, CS, A, S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,

Not stated, Not applicable

*New Item*

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, <del>3b, 3c, 3d</del>
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	5a, 5b, 5c, 5d, 5e, 5f, <del>5g, 5h, 5i, 5j</del>
Installed TMI Lessons Learned Implementation Equipment Summary	6a, 6b
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 27

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/has not) provided a response to the SER concerns.
- The Licensee (has/has not) specifically stated that the equipment is qualified and/or will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/has not) proposed a corrective action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
- Corrective action specified by the Licensee:
  - Equipment replacement with qualified equipment
  - Equipment modification
  - Equipment relocation above submergence level
  - Relocate or shield equipment from radiation source
  - Verify qualification by additional (testing/analysis)
  - Equipment relocation to a mild environment
  - Qualification testing of equipment in progress
  - Other ( \_\_\_\_\_ )
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |                                    |                                |
|------------------------------------|--------------------------------|
| <u>I.a</u> Qualified               | II.c Qualified Life Deficiency |
| I.b Modification                   | III.a Exempt                   |
| II.a Qualification Not Established | III.b Not in Scope             |
| II.b Not Qualified                 | IV Documentation Not Available |



**EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 27**

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
X = DEFICIENCY

- Documented Evidence of Qualification Adequate \_\_\_\_\_
- Adequate Similarity Between Equipment and Test Specimen Established \_\_\_\_\_
- Aging Degradation Evaluated Adequately \_\_\_\_\_
- Qualified Life or Replacement Schedule Established (If Required) \_\_\_\_\_
- Program Established to Identify Aging Degradation \_\_\_\_\_
- Criteria Regarding Aging Simulation Satisfied (If Required) \_\_\_\_\_
- Criteria Regarding Temperature/Pressure Exposure:
  - o Peak Temperature Adequate \_\_\_\_\_
  - o Peak Pressure Adequate \_\_\_\_\_
  - o Duration Adequate \_\_\_\_\_
  - o Required Profile Enveloped Adequately \_\_\_\_\_
  - o Steam Exposure (If Required) Adequate \_\_\_\_\_
- Criteria Regarding Spray Satisfied \_\_\_\_\_
- Criteria Regarding Submergence Satisfied \_\_\_\_\_
- Criteria Regarding Radiation Satisfied \_\_\_\_\_
- Criteria Regarding Test Sequence Satisfied \_\_\_\_\_
- Criteria Regarding Test Failures or Severe Anomalies  
 (If Any) Satisfied \_\_\_\_\_
- Criteria Regarding Functional Testing Satisfied \_\_\_\_\_
- Criteria Regarding Instrument Accuracy Satisfied \_\_\_\_\_
- Test Duration Margin (1 hour + Function Time) Satisfied \_\_\_\_\_
- Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I) \_\_\_\_\_

NRC QUALIFICATION CATEGORY

DESIGNATION:  
X = CATEGORY

- I.a Equipment Qualified \_\_\_\_\_ **X**
- I.b Equipment Qualification Pending Modification \_\_\_\_\_
- II.a Equipment Qualification Not Established \_\_\_\_\_
- II.b Equipment Not Qualified \_\_\_\_\_
- II.c Equipment Satisfies All Requirements Except Qualified Life  
 or Replacement Schedule Justified \_\_\_\_\_
- III.a Equipment Exempt From Qualification \_\_\_\_\_
- III.b Equipment Not in the Scope of the Qualification Review \_\_\_\_\_
- IV Documentation Not Made Available \_\_\_\_\_

*See pages 5 a thru 5 f*



Franklin Research Center  
A Division of The Franklin Institute  
20th and Race Streets, Phila., Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
FRC Project No. C5257  
FRC Assignment No. 13  
FRC Task No. 5/1

Page  
30

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 27

- (1) To be utilized during TMI-2 accident scenario per procedure
- (2) See accident profile - Temperature - Figure 3.1.1
- (3) See accident profile - Pressure - Figure 3.1.2
- (4) In containment radiation level established for purchase of component
- (5) Radiation exposure split into two parts - half before LOCA simulated environment test and half after

[15]



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 27

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW

Criteria: DOR Guidelines \_\_\_; NUREG-0588, Cat. I X; NUREG-0588, Cat. II \_\_\_.

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
<u>EQUIPMENT DESCRIPTION</u> Equipment Type	ELECTRICAL CABLE	ELECTRICAL CABLE POWER/INSTRUMENT/CONTROL	
Manufacturer's Name (5.2.2/-/-)	ROCKBESTOS	ROCKBESTOS Co.	
Model Number (5.2.2/-/-)		FIREWALL III	
Serial Number	2/C #14 5/C #14	POWER 600V (1/C, #6, AWG, 45 MIL, FR, XLPE)	
Features/Mounting (5.2.6/-/-)	2/C SH #14 3/C SH #16	INSTRUMENT 300V (1/C #16 AWG, 20 MIL, FR, XLPE)	NOTE 1
Connections/Interfaces (5.2.6/-/-)	4/C SH #16	CONTROL 600V (1/C, #12 AWG, 30 MIL, FR, XLPE)	
Location/Elevation	CONTAINMENT		
Equipment ID No.			
<u>QUALIFICATION REPORT</u> (8.0/5.0/5.0)			
Report ID Number	—	—	
Report Date	—	7-7-77	
Issued by	—	ROCKBESTOS Co.	
Prepared for	—	ROCKBESTOS Co.	
Referenced Reports	—	ND	
Qualification Method (5.1, 5.3/2.1, 2.4/2.1, 2.4)	—	TYPE TEST	
<u>QUALIFICATION TEST PROGRAM</u> Functional Test Description (5.2.5/2.2.9/2.2.9)		5 MINUTE DIELECTRIC WITHSTAND TEST, TAP WATER IMMERSION 80 VAC/MIL	
Operating Conditions (-/2.2.10/2.2.10)		600 VAC, 70 A (POWER)	
Load/Cycles/Voltage/ Current/Freq.		300 VAC, 22 A (INSTRUMENT) 600 VAC, 30 A (CONTROL)	





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 27

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
Acceptance Criteria (5.2.5/2.2.1/2.2.1)	—	PASS 80 VAC/MIL VOLTAGE W/STAND TEST	
Accuracy (5.2.5/-/-)	—	NA	
Number of Specimens		18 TEST SAMPLES	NOTE 2
Test Instruments Calibrated			
Safety Function (Active/ Passive) (-/2.1.3/2.1.3)	TMI-AP ELECTRICAL EQUIPMENT	—	
Test Duration (5.2.1/-/-)			
Accident Duration (Envir. Above Normal) (5.2.1/-/-)			
Required Function Time	LONG TERM		
Test Sequence (General) (5.2.3/2.3.1/2.3.1)	—	TA/RAD/STM+CHSP/ POST LOCA SIMULATION	B SAMPLES (NOTE 2)
Test Sequence (NUREG-0588, Cat. I) (-/2.3.1/-)			
1. Representative Sample 2. Baseline Data 3. Performance Extremes 4. Thermal Aging 5. Radiation Aging 6. Wear Aging 7. Vibration/Seismic 8. DBE Exposure 9. Post-DBE Exposure 10. Inspection			
Aging (5.2.4, 7.0/4.0/4.0) Thermal Aging/Basis		1300 HR. @ 150°C/ 40 yr. @ OPERATING TEMPERATURE OF 90°C	
Material Aging Evaluation (7.0/-/-)		ARRHENIUS DATA	
Materials Susceptible (Thermal) (5.2.4, 7.0/-/-)		INSULATING MATERIALS	
Radiation Aging, Type		GAMMA	



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 27

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
Radiation Aging, Dose (rd)		50.0 x 10 <sup>6</sup>	
Radiation Aging, Dose Rate		0.65 Mrd/h	
Radiation Aging, Method		TEST	
Materials Susceptible (Radiation) (5.2.4, 7.0/-/-)			
Operational Aging (-/4.2/-)		NA	
Other Age Conditioning (-/4.2/-)		ND	
Qualified Life Claimed/ Established (5.2.4/4.10/-)		40 yr. / 40 yr.	
Normal Ambient Temperature	120°F MAX.		
Normal Ambient Radiation	0.1 → 200 rd/h		
Normal Ambient Humidity	ND		
On-Going Surveillance and Preventive Maintenance (7.0/-/-)			
On-Going Analysis of Failures and Degradation (7.0/-/-)			
Margin (General) (6.0/3.0/3.0)			
Margin (NUREG-0588, Cat. I) (-/3.2/-)			
1. Temperature (+15°F)			
2. Pressure (+10%, 10 psig max)			
3. Radiation (not required)			
4. Time (+10%, +1 hour + function time minimum)			



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 27

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
<u>ACCIDENT CONDITIONS</u>			
LOCA/MSLB/HELB/Uncontrolled (4.1, 4.2, 4.3.1, 4.3.3/ 1.1, 1.2, 1.5/1.1, 1.2, 1.5)	LOCA	LOCA	
Radiation Type	GAMMA	GAMMA	
Radiation Dose (rd) (4.1.2/1.4/1.4)	$2.0 \times 10^8$ rd.	$1.5 \times 10^8$ rd	
Radiation Dose Rate (rd/hr) Radiation Qual. Method (5.3.1/-/-)	—	0.8 Mrd/h	
Proximity to Concentrated Radiation (4.1.2/1.4.6/1.4.6)	—		
Equipment Susceptible to Beta Radiation (4.1.2/-/-)			
Radiation Dose (Normal + Accident) (4.1.2/-/-)			
Plateout Dose Considered (-/1.48/1.48)			
Gamma + Beta Dose (rd) (4.1.2/1.4.7/1.4.7)			



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 27

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE No.)
<u>ENVIRONMENTAL PROFILE OF ACCIDENT CONDITIONS</u>			
Rate of Temp./Press. Increase	26.5 °F/s ~ 8.4 psig/s	140-346/0-113 IN < 5 MIN.	
Peak: °F/psig/RH/Time	264.7/42/100/3h	346/113/100/3 HR	
Decrease To: °F/psig/RH/Time	219/20/100/21h	335/93/100/3 HR	
Decrease To: °F/psig/RH/Time	152/5.0/100/→	315/69/100/4 HR	
Decrease To: °F/psig/RH/Time		265/28/100/81 HR.	
Equipment Surface Tempera- ture (MSLB) (-/1.2.5.C, 2.2.6/1.2.5.C, 2.2.6)		90 °C	
Spray Qualification Method (5.3.2/1.3, 2.2.8/1.3, 2.2.8)		SIMULTANEOUS TEST	
Spray Composition (4.1.4/1.3, 2.2.8/ 1.3, 2.2.8)	1.7 wt % H <sub>3</sub> BO <sub>3</sub> NaOH (6.4 wt %) PH 9.3	H <sub>3</sub> BO <sub>3</sub> , 3000 PPM BORON PH = 10.5	
Spray Density (gpm/ft <sup>2</sup> )	-	0.15	
Spray Duration	-	24 HR	
Submergence Duration (4.1.3/2.2.5/2.2.5)	-		
In-Leakage Considered (5.2.6, 5.3.2/-/-)	-	ND	
Time to Submergence	-		
Dust Environment (-/2.2.11/2.2.11)	-	NA	

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 27

## NOTES:

1. The samples tested are representative cable low type testing as outlined by IEEE STD. 383-74 (TABLE 1).

2. Three sets of cable samples (A, B and C) were tested. Each set consisted of two 10 ft lengths of cable. Testing was performed on the A, B and C samples to simulate the following conditions:

A - normal 40 yr. service life

B - LOCA late in installed life

C - LOCA early in installed life

All samples were subjected to and passed an 80 VAC/MIL voltage withstand test in accordance with IEEE STD 383-74 section 2.3.3.4

The LOCA tests were performed with the cable energized at rated voltage and current.

The B samples were exposed to an additional 100 days at 200°F and 100%rh, and passed another voltage withstand test following this exposure.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 27

INSTALLED TMI LESSONS LEARNED IMPLEMENTATION EQUIPMENT SUMMARY

NRC requested an evaluation of the environmental qualification of safety-related electrical equipment located in harsh environments required for TMI Lessons Learned Implementation. The objective is to evaluate qualification documentation of equipment within the scope of IE Bulletin 79-01B, Supplement 3 (item 2), in accordance with criteria established by the NRC (see Section 2 of this report) in a manner identical to the evaluation of all other safety-related electrical equipment. The scope of this review is limited to TMI Action Plan equipment associated with specific sections of NUREG-0737 which have an installation implementation date of January 1, 1981 (sections are identified below). Where applicable, a review is to be performed on installed equipment with implementation dates after January 1, 1981 if adequately identified by the licensee.

This plant is a PWR       , BWR       .  
 The NSSS Vendor is Westinghouse (W)       , Babcox & Wilcox (B&W)       ,  
 Combustion Engineering (CE)       , General Electric (GE)       .

With respect to this equipment item, it is noted (applicable section checked):

- The Licensee does not provide adequate information with respect to identification of TMI Action Plan equipment installed as of 1/1/81.
- The Licensee has not provided the correlation of this equipment item with the specific sections of NUREG-0737. [The correlation is needed to ensure that all items are included in the review, e.g., if a transmitter is identified as a TMI Action Plan item, are the cable and the terminal blocks associated with the device also identified?]
- The Licensee has not provided the approximate installation date for the TMI Action Plan equipment items so that the appropriate qualification criteria (NUREG-0588 or DOR Guidelines) can be used in the EEQ evaluation.
- The Licensee has provided a standard Owners' Group position with respect to a NUREG-0737 technical area.
- The Licensee has requested extensions of implementation dates.
- The Licensee has stated that this equipment item is associated with the following section of NUREG-0737. (This list of applicable NUREG-0737 sections has been identified by NRC as sections within the scope of this review):
  - II.B.3 (ALL/1-1-81) Post-Accident Sampling Capability of Reactor Coolant and Containment
  - II.D.3 (ALL/1-1-81) Direct Indication of Relief and Safety Valve Position

*X all installed TMI/AP equipment*



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 28

EQUIPMENT ITEM NO. 28 (TMI ACTION PLAN ITEM-ALL)  
 ELECTRICAL CABLE LOCATED IN THE REACTOR AUXILIARY BLDG.  
 ROCKBESTOS, MODEL NOT STATED  
 REQUIRED OPERATING TIME: NOT STATED  
 TER CHECKSHEET NO. 28  
 LICENSEE REFERENCE(S): 1391  
 FUNCTION (PLANT ID): ELECTRICAL DISTRIBUTION, TMI EQUIPMENT  
 LICENSEE SUBMITTAL: SCEW(S): 14 OF 15 [15]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

R, T, QT, RT, P, H, CS, A, S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,

Not stated, Not applicable  
New Item

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, <del>3b, 3c, 3d</del>
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	5a, 5b, 5c, 5d, 5e, 5f, <del>5g, 5h, 5i, 5j</del>
Installed TMI Lessons Learned Implementation Equipment Summary	6a, <del>6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 28

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/has not) provided a response to the SER concerns.
- The Licensee (has/has not) specifically stated that the equipment is qualified and/or will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/has not) proposed a corrective action for this equipment item whose qualification has not been fully established.
  - Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
  - Corrective action specified by the Licensee:
    - Equipment replacement with qualified equipment
    - Equipment modification
    - Equipment relocation above submergence level
    - Relocate or shield equipment from radiation source
    - Verify qualification by additional (testing/analysis)
    - Equipment relocation to a mild environment
    - Qualification testing of equipment in progress
    - Other ( \_\_\_\_\_ )
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

I.a Qualified

I.b Modification

II.a Qualification Not Established

II.b Not Qualified

II.c Qualified Life Deficiency

III.a Exempt

III.b Not in Scope

IV Documentation Not Available





**EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 28**

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
X = DEFICIENCY

Documented Evidence of Qualification Adequate	___
Adequate Similarity Between Equipment and Test Specimen Established	___
Aging Degradation Evaluated Adequately	___
Qualified Life or Replacement Schedule Established (If Required)	___
Program Established to Identify Aging Degradation	___
Criteria Regarding Aging Simulation Satisfied (If Required)	___
Criteria Regarding Temperature/Pressure Exposure:	
o Peak Temperature Adequate	___
o Peak Pressure Adequate	___
o Duration Adequate	___
o Required Profile Enveloped Adequately	___
o Steam Exposure (If Required) Adequate	___
Criteria Regarding Spray Satisfied	___
Criteria Regarding Submergence Satisfied	___
Criteria Regarding Radiation Satisfied	___
Criteria Regarding Test Sequence Satisfied	___
Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied	___
Criteria Regarding Functional Testing Satisfied	___
Criteria Regarding Instrument Accuracy Satisfied	___
Test Duration Margin (1 hour + Function Time) Satisfied	___
Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I)	___

NRC QUALIFICATION CATEGORY

DESIGNATION:  
X = CATEGORY

I.a	Equipment Qualified	<u>X</u>
I.b	Equipment Qualification Pending Modification	___
II.a	Equipment Qualification Not Established	___
II.b	Equipment Not Qualified	___
II.c	Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified	___
III.a	Equipment Exempt From Qualification	___
III.b	Equipment Not in the Scope of the Qualification Review	___
IV	Documentation Not Made Available	___

*See pages 5a thru f.*



Franklin Research Center  
A Division of The Franklin Institute  
20th and Race Streets, Phila., Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
FRC Project No. C5257  
FRC Assignment No. 13  
FRC Task No. 511

Page  
30

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 28

- (1) To be utilized during TMI-2 accident scenario per procedure
- (2) See accident profile - Temperature - Figure 3.1.1
- (3) See accident profile - Pressure - Figure 3.1.2
- (4) In containment radiation level established for purchase of component
- (5) Radiation exposure split into two parts - half before LOCA simulated environment test and half after

[51]



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 28

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW

Criteria: DOR Guidelines \_\_\_; NUREG-0588, Cat. I X; NUREG-0588, Cat. II \_\_\_.

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/C-88-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
<u>EQUIPMENT DESCRIPTION</u> Equipment Type	ELECTRICAL CABLE	ELECTRICAL CABLE POWER/INSTRUMENT/CONTROL	
Manufacturer's Name (5.2.2/-/-)	ROCKBESTOS	ROCKBESTOS Co.	
Model Number (5.2.2/-/-)		FIREWALL III	
S umber	2/C # 14 5/C # 14	POWER 600V (1/C, # 6, AWG, 45 MIL, FR, XLPE)	
Features/Mounting (5.2.6/-/-)	2/C SH # 16 2/C SH # 14	INSTRUMENT 300V (1/C, # 16 AWG, 20 MIL, FR, XLPE)	NOTE 1
Connections/Interfaces (5.2.6/-/-)	3/C SH # 16 4/C SH # 16	CONTROL 600V (1/C, # 12 AWG, 30 MIL, FR, XLPE)	
Location/Elevation	REACTOR AUXILIARY BUILDING		
Equipment ID No.			
<u>QUALIFICATION REPORT</u> (8.0/5.0/5.0)			
Report ID Number	—	—	
Report Date	—	7-7-77	
Issued by	—	ROCKBESTOS Co.	
Prepared for	—	ROCKBESTOS Co.	
Referenced Reports	—	ND	
Qualification Method (5.1, 5.3/2.1, 2.4/2.1, 2.4)	—	TYPE TEST	
<u>QUALIFICATION TEST PROGRAM</u> Functional Test Description (5.2.5/2.2.9/2.2.9)	—	5 MINUTE DIELECTRIC WITHSTAND TEST, TAP WATER IMMERSION 80 VAC/MIL	
Operating Conditions (-/2.2.10/2.2.10) Load/Cycles/Voltage/ Current/Freq.	—	600 VAC, 70 A (POWER) 300 VAC, 22 A (INSTRUMENT) 600 VAC, 30A (CONTROL)	



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 28

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
Acceptance Criteria (5.2.5/2.2.1/2.2.1)		PASS 80 VAC/MIL VOLTAGE W/STAND TEST	
Accuracy (5.2.5/-/-)		NA	
Number of Specimens		18 TEST SAMPLES	NOTE 2
Test Instruments Calibrated	TMI-AP ELECTRICAL SERVICE		
Safety Function (Active/ Passive) (-/2.1.3/2.1.3)		---	
Test Duration (5.2.1/-/-)	---		
Accident Duration (Envir. Above Normal) (5.2.1/-/-)			
Required Function Time	LONG TERM		
Test Sequence (General) (5.2.3/2.3.1/2.3.1)	---	TA/RAD/STM+CHSP/ POST LOCA SIMULATION	B SAMPLES (NOTE 2)
Test Sequence (NUREG-0588, Cat. I) (-/2.3.1/-)	---		
1. Representative Sample			
2. Baseline Data			
3. Performance Extremes			
4. Thermal Aging			
5. Radiation Aging			
6. Wear Aging			
7. Vibration/Seismic			
8. DBE Exposure			
9. Post-DBE Exposure			
10. Inspection			
Aging (5.2.4, 7.0/4.0/4.0)	---	1300 HR. @ 150°C / 40 yr. @ OPERATING TEMPERATURE OF 90°C	
Thermal Aging/Basis			
Material Aging Evaluation (7.0/-/-)	---	ARRHENIUS DATA	
Materials Susceptible (Thermal) (5.2.4, 7.0/-/-)	---	INSULATING MATERIALS	
Radiation Aging, Type	-	GAMMA	



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 28

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0538-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
Radiation Aging, Dose (rd)		50.0 x 10 <sup>6</sup>	
Radiation Aging, Dose Rate		0.65 Mrd/h	
Radiation Aging, Method		TEST	
Materials Susceptible (Radiation) (5.2.4, 7.0/-/-)			
Operational Aging (-/4.2/-)		NA	
Other Age Conditioning (-/4.2/-)		ND	
Qualified Life Claimed/ Established (5.2.4/4.10/-)	ND	40 yr. / 40 yr.	
Normal Ambient Temperature	AMBIENT		
Normal Ambient Radiation	AMBIENT		
Normal Ambient Humidity	AMBIENT		
On-Going Surveillance and Preventive Maintenance (7.0/-/-)			
On-Going Analysis of Failures and Degradation (7.0/-/-)			
Margin (General) (6.0/3.0/3.0)			
Margin (NUREG-0588, Cat. I) (-/3.2/-)			
1. Temperature (+15°F)			
2. Pressure (+10%, 10 psig max)			
3. Radiation (not required)			
4. Time (+10%, +1 hour + function time minimum)			



Franklin Research Center  
 A Division of The Franklin Institute  
 20th and Race Streets, Phila., Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
 FRC Project No. C5257  
 FRC Assignment No. 13  
 FRC Task No. 5ij

5d

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 28

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
<u>ACCIDENT CONDITIONS</u>			
LOCA/MSLB/HELB/Uncontrolled (4.1, 4.2, 4.3.1, 4.3.3/ 1.1, 1.2, 1.5/1.1, 1.2, 1.5)	LOCA	LOCA	
Radiation Type	GAMMA	GAMMA	
Radiation Dose (rd) (4.1.2/1.4/1.4)	$2.0 \times 10^8$	$1.5 \times 10^8$ rd	
Radiation Dose Rate (rd/hr) Radiation Qual. Method (5.3.1/-/-)	—	0.8 Mrd/h	
Proximity to Concentrated Radiation (4.1.2/1.4.6/1.4.6)			
Equipment Susceptible to Beta Radiation (4.1.2/-/-)			
Radiation Dose (Normal + Accident) (4.1.2/-/-)			
Plateout Dose Considered (-/1.48/1.48)			
Gamma + Beta Dose (rd) (4.1.2/1.4.7/1.4.7)			



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 28

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE No.)
<u>ENVIRONMENTAL PROFILE OF ACCIDENT CONDITIONS</u>	NA		
Rat. of Temp./Press. Increase		140-346/0-113 IN $\leq$ 5 MIN.	
Peak: °F/psig/RH/Time		346/113/100/3 HR	
Decrease To: °F/psig/RH/Time		335/93/100/3 HR	
Decrease To: °F/psig/RH/Time		315/69/100/4 HR	
Decrease To: °F/psig/RH/Time		265/28/100/81 HR.	
Equipment Surface Tempera- ture (MSLB) (-/1.2.5.C, 2.2.6/1.2.5.C, 2.2.6)		90°C	
Spray Qualification Method (5.3.2/1.3, 2.2.8/1.3, 2.2.8)		SIMULTANEOUS TEST	
Spray Composition (4.1.4/1.3, 2.2.8/ 1.3, 2.2.8)	H <sub>3</sub> BO <sub>3</sub> NaOH	H <sub>3</sub> BO <sub>3</sub> , 3000 PPM BORON PH = 10.5	
Spray Density (gpm/ft <sup>2</sup> )		0.15	
Spray Duration		24 HR	
Submergence Duration (4.1.3/2.2.5/2.2.5)			
In-Leakage Considered (5.2.6, 5.3.2/-/-)		ND	
Time to Submergence			
Dust Environment (-/2.2.11/2.2.11)		NA	



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 28

NOTES:

1. The samples tested are representative cable low type testing as outlined by IEEE STD. 383-74 (TABLE 1).

2. Three sets of cable samples (A, B and C) were tested. Each set consisted of two 10 ft lengths of cable. Testing was performed on the A, B and C samples to simulate the following conditions:

A - normal 40 yr. service life

B - LOCA late in installed life

C - LOCA early in installed life

All samples were subjected to and passed an 80 VAC/MIL voltage withstand test in accordance with IEEE STD 383-74 section 2.3.3.4

The LOCA tests were performed with the cable energized at rated voltage and current.

The B samples were exposed to an additional 100 days at 200°F and 100%rh, and passed another voltage withstand test following this exposure.





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 28

INSTALLED TMI LESSONS LEARNED IMPLEMENTATION EQUIPMENT SUMMARY

NRC requested an evaluation of the environmental qualification of safety-related electrical equipment located in harsh environments required for TMI Lessons Learned Implementation. The objective is to evaluate qualification documentation of equipment within the scope of IE Bulletin 79-01B, Supplement 3 (item 2), in accordance with criteria established by the NRC (see Section 2 of this report) in a manner identical to the evaluation of all other safety-related electrical equipment. The scope of this review is limited to TMI Action Plan equipment associated with specific sections of NUREG-0737 which have an installation implementation date of January 1, 1981 (sections are identified below). Where applicable, a review is to be performed on installed equipment with implementation dates after January 1, 1981 if adequately identified by the licensee.

This plant is a PWR X, BWR \_\_\_\_.  
 The NSSS Vendor is Westinghouse (W) X, Babcox & Wilcox (B&W) \_\_\_\_,  
 Combustion Engineering (CE) \_\_\_\_, General Electric (GE) \_\_\_\_.

With respect to this equipment item, it is noted (applicable section checked):

- The Licensee does not provide adequate information with respect to identification of TMI Action Plan equipment installed as of 1/1/81.
- The Licensee has not provided the correlation of this equipment item with the specific sections of NUREG-0737. [The correlation is needed to ensure that all items are included in the review, e.g., if a transmitter is identified as a TMI Action Plan item, are the cable and the terminal blocks associated with the device also identified?]
- The Licensee has not provided the approximate installation date for the TMI Action Plan equipment items so that the appropriate qualification criteria (NUREG-0588 or DOR Guidelines) can be used in the EEQ evaluation.
- The Licensee has provided a standard Owners' Group position with respect to a NUREG-0737 technical area.
- The Licensee has requested extensions of implementation dates.
- The Licensee has stated that this equipment item is associated with the following section of NUREG-0737. (This list of applicable NUREG-0737 sections has been identified by NRC as sections within the scope of this review):
  - II.B.3 (ALL/1-1-81) Post-Accident Sampling Capability of Reactor Coolant and Containment
  - II.D.3 (ALL/1-1-81) Direct Indication of Relief and Safety Valve Position

X all installed TMI/AP equipment



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 29

EQUIPMENT ITEM NO. 29 (TMI ACTION PLAN ITEM-ALL)  
 ELECTRICAL CABLE LOCATED IN THE CONTAINMENT  
 SAMUEL MOORE, THERMOCOUPLE EXTENSION  
 REQUIRED OPERATING TIME: NOT STATED  
 TER CHECKSHEET NO. 29  
 LICENSEE REFERENCE(S): 677  
 FUNCTION (PLANT ID): ELECTRICAL DISTRIBUTION, TMI EQUIPMENT  
 LICENSEE SUBMITTAL: SCEW(S): 15 OF 15 [15]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

R, T, QT, RT, P, H, CS, A, S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,

Not stated, Not applicable  
New Item

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, <del>3b, 3c, 3d</del>
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	5a, 5b, 5c, 5d, 5e, 5f, <del>5g, 5h, 5i</del> , 5i <sub>2</sub>
Installed TMI Lessons Learned Implementation Equipment Summary	6a, <del>6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 29

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/has not) provided a response to the SER concerns.
- The Licensee (has/has not) specifically stated that the equipment is qualified and/or will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/has not) proposed a corrective action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
- Corrective action specified by the Licensee:
  - Equipment replacement with qualified equipment
  - Equipment modification
  - Equipment relocation above submergence level
  - Relocate or shield equipment from radiation source
  - Verify qualification by additional (testing/analysis)
  - Equipment relocation to a mild environment
  - Qualification testing of equipment in progress
  - Other ( \_\_\_\_\_ )
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |                                    |                                       |
|------------------------------------|---------------------------------------|
| I.a Qualified                      | <u>II.c Qualified Life Deficiency</u> |
| I.b Modification                   | III.a Exempt                          |
| II.a Qualification Not Established | III.b Not in Scope                    |
| II.b Not Qualified                 | IV Documentation Not Available        |



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 29

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
X = DEFICIENCY

Documented Evidence of Qualification Adequate	_____
Adequate Similarity Between Equipment and Test Specimen Established	_____
Aging Degradation Evaluated Adequately	<u>X</u> _____
Qualified Life or Replacement Schedule Established (If Required)	<u>X</u> _____
Program Established to Identify Aging Degradation	_____
Criteria Regarding Aging Simulation Satisfied (If Required)	_____
Criteria Regarding Temperature/Pressure Exposure:	
o Peak Temperature Adequate	_____
o Peak Pressure Adequate	_____
o Duration Adequate	_____
o Required Profile Enveloped Adequately	_____
o Steam Exposure (If Required) Adequate	_____
Criteria Regarding Spray Satisfied	_____
Criteria Regarding Submergence Satisfied	_____
Criteria Regarding Radiation Satisfied	_____
Criteria Regarding Test Sequence Satisfied	_____
Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied	_____
Criteria Regarding Functional Testing Satisfied	_____
Criteria Regarding Instrument Accuracy Satisfied	_____
Test Duration Margin (1 hour + Function Time) Satisfied	_____
Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I)	_____

NRC QUALIFICATION CATEGORY

DESIGNATION:  
X = CATEGORY

I.a	Equipment Qualified	_____
I.b	Equipment Qualification Pending Modification	_____
II.a	Equipment Qualification Not Established	_____
II.b	Equipment Not Qualified	_____
II.c	Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified	<u>X</u> _____
III.a	Equipment Exempt From Qualification	_____
III.b	Equipment Not in the Scope of the Qualification Review	_____
IV	Documentation Not Made Available	_____



Franklin Research Center  
A Division of The Franklin Institute  
20th and Race Streets, Phila., Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
FRC Project No. C5257  
FRC Assignment No. 13  
FRC Task No. 511

Page  
30

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 29

- (1) To be utilized during TMI-2 accident scenario per procedure
- (2) See accident profile - Temperature - Figure 3.1.1
- (3) See accident profile - Pressure - Figure 3.1.2
- (4) In containment radiation level established for purchase of component
- (5) Radiation exposure split into two parts - half before LOCA simulated environment and half after

[51]



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 29

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW

Criteria: DOR Guidelines    ; NUREG-0588, Cat. I X; NUREG-0588, Cat. II    .

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
<u>EQUIPMENT DESCRIPTION</u>			
Equipment Type	<i>Electrical Cable</i>	Electrical Cable	
Manufacturer's Name (5.2.2/-/-)	<i>Samuel B. Moore</i>	Samuel Moore and Company	
Model Number (5.2.2/-/-)	<i>2 1/2 shielded</i>	See Note 1 Pages 5i <sub>1</sub> & 5i <sub>2</sub>	
Serial Number	<i>#16</i>	Not Applicable	
Features/Mounting (5.2.6/-/-)	<i>Not stated</i>	Trade Name - DEKORON	
Connections/Interfaces (5.2.6/-/-)	<i>Not stated</i>	Not Stated	
Location/Elevation	<i>Containment</i>	Not Stated (wound on Mandrel in Autocalve)	
Equipment ID No.		Not Applicable	
<u>QUALIFICATION REPORT</u> (8.0/5.0/5.0)			
Report ID Number	<i>F-C 3683</i>	F-C3683	
Report Date	<i>11/73</i>	November 1973	
Issued by	<i>FIRL</i>	Franklin Institute Research Laboratories	
Prepared for	<i>S. Moore</i>	Samuel Moore and Company Dekoron Division	
Referenced Reports	<i>Not stated</i>	Not Stated	
Qualification Method (5.1, 5.3/2.1, 2.4/2.1, 2.4)	<i>NA</i>	Sequential Test	
<u>QUALIFICATION TEST PROGRAM</u>			
Functional Test Description (5.2.5/2.2.9/2.2.9)	<i>N.A</i>	Visual Inspection/ Insulation Resistance	
Operating Conditions (-/2.2.10/2.2.10) Load/Cycles/Voltage/ Current/Freq.	<i>Not stated</i>	Not Stated	



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 29

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
Acceptance Criteria (5.2.5/2.2.1/2.2.1)	<i>Not stated</i>	No Specific Criteria Provided	
Accuracy (5.2.5/-/-)	<i>Not applicable</i>	Not Applicable	
Number of Specimens	<i>N.A.</i>	7	
Test Instruments Calibrated	<i>N.A.</i>	Yes	
Safety Function (Active/ Passive) (-/2.1.3/2.1.3)	<i>Carry Current</i>	Carry Current	
Test Duration (5.2.1/-/-)	<i>N.A.</i>	30 Days	
Accident Duration (Envir. Above Normal) (5.2.1/-/-)	<i>&gt;1 day up to 30 days</i>	Not Applicable	
Required Function Time	<i>Not stated</i>	not Applicable	
Test Sequence (General) (5.2.3/2.3.1/2.3.1)	<i>N.A.</i>	Visual/Insulation Resistance	
Test Sequence (NUREG-0588, Cat. I) (-/2.3.1/-)	<i>NA</i>	Thermal Aging Irradiation LOCA Simulation	
1. Representative Sample		Irradiation	
2. Baseline Data		Inspection	
3. Performance Extremes			
4. Thermal Aging			
5. Radiation Aging			
6. Wear Aging			
7. Vibration/Seismic			
8. DBE Exposure			
9. Post-DBE Exposure			
10. Inspection			
Aging (5.2.4, 7.0/4.0/4.0)	<i>Not stated</i>	7 days @ 250°?	<i>X</i>
Thermal Aging/Basis		Basis Not Stated	<i>Note 2</i>
Material Aging Evaluation (7.0/-/-)	<i>Not stated</i>	Not Stated	
Materials Susceptible (Thermal) (5.2.4, 7.0/-/-)	<i>Not stated</i>	Not Stated	
Radiation Aging, Type	Gamma	Gamma	



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 29

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
Radiation Aging, Dose (rd)	<i>not stated</i>	100 Megarads	
Radiation Aging, Dose Rate	<i>50 to 200 rd/hr</i>	1 to 1.5 Mrd/hr	
Radiation Aging, Method	<i>N.A.</i>	Test	
Materials Susceptible (Radiation) (5.2.4, 7.0/-/-)	<i>not stated</i>	Not Stated	
Operational Aging (-/4.2/-)	<i>N.A.</i>	Not Stated	
Other Age Conditioning (-/4.2/-)	<i>N.A.</i>	Not Stated	
Qualified Life Claimed/ Established (5.2.4/4.10/-)	<i>not stated</i>	Not Stated	
Normal Ambient Temperature	<i>115°F Ave.</i>	Not Applicable	
Normal Ambient Radiation	<i>50-200 rd/hr</i>	Not Applicable	
Normal Ambient Humidity	<i>not stated</i>	Not Applicable	
On-Going Surveillance and Preventive Maintenance (7.0/-/-)	<i>Yes</i>	Not Applicable	
On-Going Analysis of Failures and Degradation (7.0/-/-)	<i>Yes</i>	Not Applicable	
Margin (General) (6.0/3.0/3.0)	<i>N.A.</i>	Not Stated	
Margin (NUREG-0588, Cat. I) (-/3.2/-)		Not Stated	
1. Temperature (+15°F)			
2. Pressure (+10%, 10 psig max)			
3. Radiation (not required)			
4. Time (+10%, +1 hour + function time minimum)			





Franklin Research Center  
A Division of The Franklin Institute  
20th and Race Streets. Phila., Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
FRC Project No. C5257  
FRC Assignment No. 13  
FRC Task No. 511

Page  
5d

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 29

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
<u>ACCIDENT CONDITIONS</u>			
LOCA/MSLB/HELB/Uncontrolled (4.1, 4.2, 4.3.1, 4.3.3/ 1.1, 1.2, 1.5/1.1, 1.2, 1.5)	<i>LOCA</i>	LOCA / MSLB	
Radiation Type	<i>Gamma</i>	Gamma	
Radiation Dose (rd) (4.1.2/1.4/1.4)	<i>2 x 10<sup>8</sup></i>	100 to 130 Mrd	<i>Note 3</i>
Radiation Dose Rate (rd/hr) Radiation Qual. Method (5.3.1/-/-)	<i>not stated</i>	1 to 1.15 Mrd/hr	
Proximity to Concentrated Radiation (4.1.2/1.4.6/1.4.6)	<i>not stated</i>	Not Applicable	
Equipment Susceptible to Beta Radiation (4.1.2/-/-)	<i>not stated</i>	Not Stated	
Radiation Dose (Normal + Accident) (4.1.2/-/-)	<i>not stated</i>	Not Applicable	
Plateout Dose Considered (-/1.48/1.48)	<i>not stated</i>	Not Applicable	
Gamma + Beta Dose (rd) (4.1.2/1.4.7/1.4.7)	<i>not stated</i>	Not Applicable	



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 29

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE No.)
<u>ENVIRONMENTAL PROFILE OF ACCIDENT CONDITIONS</u>			
Rate of Temp./Press. Increase	26.5°F; 4psi/sec	25°F; 7.5 Psi / second	
Peak: °F/psig/RH/Time	264/42/100/3h	340/105/100%/3 Hrs	
Decrease To: °F/psig/RH/Time	219/20/100/20h	320/75/100%/3hrs	
Decrease To: °F/psig/RH/Time	152/15/100/-	250/15/100%/ 3.75 Days	
Decrease To: °F/psig/RH/Time		200/0/100%/26 Days	
Equipment Surface Tempera- ture (MSLB) (-/1.2.5.C, 2.2.6/1.2.5.C, 2.2.6)	NA	Not Stated	
Spray Qualification Method (5.3.2/1.3, 2.2.8/1.3, 2.2.8)	NA	Test	
Spray Composition (4.1.4/1.3, 2.2.8/ 1.3, 2.2.8)	17 wt % Boric acid 26% wt NaOH pH 9.3	2000 ppm Boron as Boric Acid buffered with NaOH to a pH of 9 to 11	
Spray Density (gpm/ft <sup>2</sup> )	Not stated	0.15	
Spray Duration	Not stated	30 Days	
Submergence Duration (4.1.3/2.2.5/2.2.5)	Not stated	Not Applicable	
In-Leakage Considered (5.2.6, 5.3.2/-/-)	Not stated	Not Applicable	
Time to Submergence	Not stated	Not Applicable	
Dust Environment (-/2.2.11/2.2.11)	Not stated	Not Applicable	



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 29

NOTES:

Note 2. The Licensee has not provided any evaluation of Age related degradation nor estimated the qualified lif of this equipment.

Note 3. The total test dose consists of the aging dose of 100 Mrd plus the accident dose of 100to130 Mrd for a total of 200 to 230 Mrd. The Licensee SCEW sheet provides a specified dose of  $2 \times 10^8$  which is in excess of any of the radiation dose values provided in the table of doses calculated for Robinson Plant . The Table is reproduced in Appendix A of the TER.

Conclusion: The cited test report envelopes all of the licensee provided environmental conditions with the exception of age related degradation. Therefore the equipment is assigned to category IIc.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 29

NOTES:

2. SAMPLE IDENTIFICATION

<u>Sample Number</u>	<u>Conductor Nos. or Color*</u>	<u>Description</u>
1	Red and Yellow	<u>Samuel Moore and Company Type 1902 - 636</u> 16 gauge solid thermocouple wire 30-mil EPDM I insulation, 15-mil Hypalon I conductor Jacket 45-mil Hypalon I overall jacket
2	Black and White	<u>Samuel Moore and Company Type 1952 - 686</u> 16 gauge 7-strand tinned copper conductors 30-mil EPDM I insulation, 15-mil Hypalon I conductor jacket 45-mil Hypalon I overall jacket
3	Black and White	<u>Samuel Moore and Company Type 1952 - 686</u> 16 gauge 7-strand tinned copper conductors 20-mil EPDM I insulation, 10-mil Hypalon II conductor jacket 45-mil Hypalon II overall jacket
4	1 and 2	<u>Samuel Moore and Company Type 1952 - 686</u> 16 gauge 7-strand tinned copper conductors 30-mil EPDM II insulation, 15-mil Hypalon II conductor jacket 45-mil Hypalon II overall jacket



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 29

NOTES:

<u>Sample Number</u>	<u>Conductor Nos. or Color*</u>	<u>Description</u>
5	1 and 2	<u>Samuel Moore Splice and Repair            Evaluation Cable</u> A. Single Splice No. I-Self-fusing EPDM Scotch Electrical tape #23 B. Single Splice No. II-Polyimide- silicone Scotch Electrical tape #92 C. Overall Jacket repair - Samuel Moore Hypalon repair tape
6		Combination 4 pair special bundle. Silicone rubber-fiberglass fire barrier tape. 60-mil Hypalon I overall jacket. Individual Pairs:
	1 and 2	15-mil EPDM I, 10-mil Hypalon I on 20 gauge JX thermocouple wire
	3 and 4	20-mil EPDM I, 15-mil Hypalon I on 18 gauge 7 strand tinned copper conductors
	5 and 6	30-mil EPDM I, 15-mil Hypalon I on 16 gauge 7 strand tinned copper conductors
	7 and 8	20-mil EPDM I, 10-mil Hypalon I on 16 gauge 7 strand tinned copper conductors
7		Combination 4 pair special bundle. Asbestos-glass fire barrier tape. 20-mil Hypalon I pair jacket. 60-mil Hypalon I overall jacket. Individual Pairs:
	1 and 2	15-mil EPDM I, 10-mil Hypalon I on 20 gauge JX thermocouple wire
	3 and 4	20-mil EPDM I, 10-mil Hypalon I on 16 gauge, 7 strand tinned copper conductors
	5 and 6	20-mil EPDM I, 15-mil Hypalon I on 13 gauge, 7 strand tinned copper conductors
	7 and 8	20-mil EPDM I, 10-mil Hypalon I on 16 gauge 7 strand tinned copper conductors

All cable lengths were approximately 35 ft.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 29

INSTALLED TMI LESSONS LEARNED IMPLEMENTATION EQUIPMENT SUMMARY

NRC requested an evaluation of the environmental qualification of safety-related electrical equipment located in harsh environments required for TMI Lessons Learned Implementation. The objective is to evaluate qualification documentation of equipment within the scope of IE Bulletin 79-01B, Supplement 3 (item 2), in accordance with criteria established by the NRC (see Section 2 of this report) in a manner identical to the evaluation of all other safety-related electrical equipment. The scope of this review is limited to TMI Action Plan equipment associated with specific sections of NUREG-0737 which have an installation implementation date of January 1, 1981 (sections are identified below). Where applicable, a review is to be performed on installed equipment with implementation dates after January 1, 1981 if adequately identified by the licensee.

This plant is a PWR , BWR .  
 The NSSS Vendor is Westinghouse (W) , Babcox & Wilcox (B&W) ,  
 Combustion Engineering (CE) , General Electric (GE) .

With respect to this equipment item, it is noted (applicable section checked):

- The Licensee does not provide adequate information with respect to identification of TMI Action Plan equipment installed as of 1/1/81.
- The Licensee has not provided the correlation of this equipment item with the specific sections of NUPEG-0737. [The correlation is needed to ensure that all items are included in the review, e.g., if a transmitter is identified as a TMI Action Plan item, are the cable and the terminal blocks associated with the device also identified?]
- The Licensee has not provided the approximate installation date for the TMI Action Plan equipment items so that the appropriate qualification criteria (NUREG-0588 or DOR Guidelines) can be used in the EEQ evaluation.
- The Licensee has provided a standard Owners' Group position with respect to a NUREG-0737 technical area.
- The Licensee has requested extensions of implementation dates.
- The Licensee has stated that this equipment item is associated with the following section of NUREG-0737. (This list of applicable NUREG-0737 sections has been identified by NRC as sections within the scope of this review):
  - II.B.3 (ALL/1-1-81) Post-Accident Sampling Capability of Reactor Coolant and Containment
  - II.D.3 (ALL/1-1-81) Direct Indication of Relief and Safety Valve Position

*X all T/C applications for TMI action Plan.*



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 30

EQUIPMENT ITEM NO. 30  
 ELECTRICAL CABLE SPLICE LOCATED IN THE CONTAINMENT, ELEV. 234'-246'  
 RAYCHEM, MODEL NOT STATED  
 REQUIRED OPERATING TIME: CONTINUOUS  
 TER CHECKSHEET NO. 30  
 LICENSEE REFERENCE(S): 815  
 FUNCTION (PLANT ID): SINGLE CONDUCTOR AND MULTICONDUCTOR CABLE SPLICING  
 LICENSEE SUBMITTAL: SCEW(S): 24 OF 25 [20]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

(R), (T), QT, (RT), (P), (H), (CS), (A), S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,  
 Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, 3b, 3c <del>3d</del>
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h, 5i, 5i <sub>2</sub>
Installed TMI Lessons Learned Implementation Equipment Summary	<del>6a, 6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 30

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/~~has not~~) provided a response to the SER concerns.
- The Licensee (has/~~has not~~) specifically stated that the equipment is qualified and/or will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/has not) proposed a corrective action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
- Corrective action specified by the Licensee:
  - Equipment replacement with qualified equipment
  - Equipment modification
  - Equipment relocation above submergence level
  - Relocate or shield equipment from radiation source
  - Verify qualification by additional (testing/analysis)
  - Equipment relocation to a mild environment
  - Qualification testing of equipment in progress
  - Other (\_\_\_\_\_)
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |                                    |                                       |
|------------------------------------|---------------------------------------|
| I.a Qualified                      | <u>II.c Qualified Life Deficiency</u> |
| I.b Modification                   | III.a Exempt                          |
| II.a Qualification Not Established | III.b Not in Scope                    |
| II.b Not Qualified                 | IV Documentation Not Available        |





**EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 30**

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
X = DEFICIENCY

Documented Evidence of Qualification Adequate	_____
Adequate Similarity Between Equipment and Test Specimen Established	_____
Aging Degradation Evaluated Adequately	<u>X</u> _____
Qualified Life or Replacement Schedule Established (If Required)	<u>X</u> _____
Program Established to Identify Aging Degradation	_____
Criteria Regarding Aging Simulation Satisfied (If Required)	_____
Criteria Regarding Temperature/Pressure Exposure:	
o Peak Temperature Adequate	_____
o Peak Pressure Adequate	_____
o Duration Adequate	_____
o Required Profile Enveloped Adequately	_____
o Steam Exposure (If Required) Adequate	_____
Criteria Regarding Spray Satisfied	_____
Criteria Regarding Submergence Satisfied	_____
Criteria Regarding Radiation Satisfied	_____
Criteria Regarding Test Sequence Satisfied	_____
Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied	_____
Criteria Regarding Functional Testing Satisfied	_____
Criteria Regarding Instrument Accuracy Satisfied	_____
Test Duration Margin (1 hour + Function Time) Satisfied	_____
Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I)	_____

NRC QUALIFICATION CATEGORY

DESIGNATION:  
X = CATEGORY

I.a	Equipment Qualified	_____
I.b	Equipment Qualification Pending Modification	_____
II.a	Equipment Qualification Not Established	_____
II.b	Equipment Not Qualified	_____
II.c	Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified	<u>X</u> _____
III.a	Equipment Exempt From Qualification	_____
III.b	Equipment Not in the Scope of the Qualification Review	_____
IV	Documentation Not Made Available	_____

*See pages 5c through 5f.*



**EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 30**

LICENSEE RESPONSE TO NRC SER

4.2 Equipment Requiring Additional Information and/or Corrective Action  
(Appendix B) [20]

The bulk of master list equipment was placed in this category and our review of deficiencies is based upon the following:

- Deletion of deficient listed equipment due to replacement programs carried out and reported in our 90-day, Revision 3 response dated February 1, 1981.
- Re-evaluation of CP&L's updated submittals by NRC Region II, Atlanta, GA, and reported in Environmental Qualification of Safety-Related Electrical Equipment IEB 79-01B. Technical Evaluation Report - Docket No. 50-261; Plant: H. B. Robinson 2, dated November 6, 1980 and Revised November 11, 1980.

Telecons with NRC, Bethesda, MD reviewing personnel July 29, 1981, et al.

Equipment reported as qualified within NRC TER Revision 1, dated November 11, 1980:

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model No.</u>	<u>Location</u>
13. cable splices <sup>4</sup>	Raychem	1000-12N	containment
14. cable splices <sup>2</sup>	Raychem	500-12N	containment
15. cable splices <sup>2</sup>	Raychem	300-12N	containment
16. cable splices <sup>2</sup>	Raychem	200-12N	containment
17. cable splices <sup>2</sup>	Raychem	115-6N	containment
18. cable splices <sup>2</sup>	Raychem	070-6N	containment
19. cable terminals <sup>2</sup> and splices	AMP	53548-1	containment

<sup>2</sup>These items also included in conductor pig-tail qualification test (Wyle Qualification Test Plan 45307-1) to supply acceptable aging, radiation, and LOCA test data for H. B. Robinson qualification.

A.	Cable Splices	Raychem	1000-12N	1	R,T,RT,P,H,CS,A
A.	Cable Splices	Raychem	500-12N	1	R,T,RT,P,H,CS,A
A.	Cable Splices	Raychem	300-12N	1	R,T,RT,P,H,CS,A
A.	Cable Splices	Raychem	200-12N	1	R,T,RT,P,H,CS,A
A.	Cable Splices	Raychem	115-6N	1	R,T,RT,P,H,CS,A
A.	Cable Splices	Raychem	070-6N	1	R,T,RT,P,H,CS,A

<sup>A</sup>Items reported as qualified within NRC Region II revised TER, dated 11/7/80.

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 303.2.5 Cable Terminals and Splices [15]

As no qualification information could be obtained on the current in containment cable splices to the listed electrical equipment, it was decided to change out the splices with qualified components, prescribed tools and approved procedure. This changeout was completed during the plant refueling outage (August - October) 1980.

Individual conductor splices will utilize AMP Radiation Resistant/150°C Preinsulated Splices (#53548-1), T&B 2-way Cable Connectors for Copper Cable, 500 MCM and T&B 2-way Cable Connectors for Copper Cable, #9 AWG. The splice/connector component will be crimped to the designated conductors using the manufacturer's specified crimping tool.

An appropriate sized RAYCHEM SHRINK TUBING will be applied over the individual conductor cable splice and heat shrunk using the manufacturer's specified torch. For the two- (2) and three- (3) conductor cables after the individual conductors are spliced using AMP PIDG (53548-1) splices, an overall jacket RAYCHEM SHRINK TUBING will be applied and heat shrunk.

The work described above has been detailed within H. B. Robinson S.E.P. Modification and Setpoint Revision Form No. M-521 (revised) and will be the means to sign off the completed work.

Original splices specified as AMP Nuclear Preinsulated Environmentally Sealed Splices (#52979) were found to be incompatible with the conductor insulation thickness of installed cable. Therefore, another butt-splice component, AMP Radiation resistant/150°C preinsulated splice (#53548-1) was ordered and installed. AMP Qualification Test Report 110-11002 dated October 1, 1978 describes a program that included total radiation exposure of  $2.0 \times 10^8$  RADs, maximum temperature of 350°F, maximum pressure of 137 PSIA and a borated chemical spray lasting four (4) days. To assure qualification of the H. B. Robinson in-containment splices, cable undergoing testing at Wyle Laboratories will be connected with AMP PIDG terminals Raychem thermofit (heat shrink) tubing overall per the Installation Procedure M-521, Safety-Related Cable Splices Inside Containment. Appropriate matrix combinations of splice/cable and individual cables and splices will assure identification of any single component failure which could occur during qualification testing. Each

component has sufficient manufacturer-supplied test data to assure qualification by analytical means. The opportunity to obtain actual test results is available and will be used.



Franklin Research Center  
A Division of The Franklin Institute  
20th and Race Streets, Phila., Pa. 19103 (215) 448-1000

NRC Contract No. NRC-03-79-118  
FRC Project No. C5257  
FRC Assignment No. 13  
FRC Task No. 511

Page  
3c

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 30

RAYCHEM Thermofit Insulation Systems (heat-shrink tubing) used to complete the replacement splice have been qualified per the H. B. Robinson accident parameters. Franklin Institute Research Laboratories Technical Report F-C4033-3 dated January 1975 describes a program that included 40-year aging, total irradiation exposure of  $2.1 \times 10^6$  RADS, maximum temperature of  $351^{\circ}\text{F}$ , maximum pressure of 85 PSIA and a borated spray in excess of nine days. The results of this documented test are acceptable to CP&L that the heat-shrink tubing to be used in changeover is fully qualified.

[15]



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 30

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW

Criteria: DOR Guidelines ; NUREG-0588, Cat. I ; NUREG-0588, Cat. II .

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
<u>EQUIPMENT DESCRIPTION</u>			
Equipment Type	Cable splice	Electrical Cable Splice	
Manufacturer's Name (5.2.2/-/-)	Raychem	Raychem Corporation	
Model Number (5.2.2/-/-)	Thermofit	Raychem Thermofit WCSF...N	
Serial Number	NA.	Not Applicable	
Features/Mounting (5.2.6/-/-)	Not stated	On Mandrel In Autoclave	
Connections/Interfaces (5.2.6/-/-)	Not stated	Test Item Is a Cable Splice (Note 1 p 5i1&5i2)	
Location/Elevation	Various	Not Applicable	
Equipment ID No.	Not Applicable	Not Applicable	
<u>QUALIFICATION REPORT</u> (8.0/5.0/5.0)			
Report ID Number	F-C4033-3	F-C4033-3	
Report Date	Jan. 1975	January 1975	
Issued by	FIRL	Franklin Institute Research Laboratories	
Prepared for	Raychem	Raychem Corporation	
Referenced Reports	Nine	Not Applicable	
Qualification Method (5.1, 5.3/2.1, 2.4/2.1, 2.4)	NA	Simultaneous Test	
<u>QUALIFICATION TEST PROGRAM</u>			
Functional Test Description (5.2.5/2.2.9/2.2.9)	NA	Insulation Resistance/ Current Carrying Capability and HiPot	
Operating Conditions (-/2.2.10/2.2.10)	Not stated	See Note 1 p 5i1 & 5i2	
Load/Cycles/Voltage/ Current/Freq.			



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 30

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
Acceptance Criteria (5.2.5/2.2.1/2.2.1)	<i>Not Stated</i>	Not Stated	
Accuracy (5.2.5/-/-)	<i>N.A.</i>	Not Applicable	
Number of Specimens	<i>N.A.</i>	30	
Test Instruments Calibrated	<i>N.A.</i>	Yes	
Safety Function (Active/ Passive) (-/2.1.3/2.1.3)	<i>Active</i>	Active..Carry current	
Test Duration (5.2.1/-/-)	<i>NA.</i>	30 Days	
Accident Duration (Envir. Above Normal) (5.2.1/-/-)	<i>&gt;1 up to 30d.</i>	Not Applicable	
Required Function Time	<i>Continuous</i>	Not Applicable	
Test Sequence (General) (5.2.3/2.3.1/2.3.1)	<i>NA</i>	Visual Inspection Insulation Resistance Thermal/Radiation Aging	
Test Sequence (NUREG-0588, Cat. I) (-/2.3.1/-)	<i>NA</i>	Visual Inspection Insulation Resistance LOCA Simulation Visual Inspection/ Insulation Resistance/ HiPot	
1. Representative Sample			
2. Baseline Data			
3. Performance Extremes			
4. Thermal Aging			
5. Radiation Aging			
6. Wear Aging			
7. Vibration/Seismic			
8. DBE Exposure			
9. Post-DBE Exposure			
10. Inspection			
Aging (5.2.4, 7.0/4.0/4.0) Thermal Aging/Basis	<i>Not stated</i>	7 Days @ 150°C Not Stated	<i>Noted B5f</i>
Material Aging Evaluation (7.0/-/-)	<i>Not stated</i>	Visual Inspection/ Insulation Resistance	
Materials Susceptible (Thermal) (5.2.4, 7.0/-/-)	<i>Not stated</i>	Not Stated	
Radiation Aging, Type	<i>Gamma</i>	Gamma	



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 30

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
Radiation Aging, Dose (rd)	Not stated	5x10 <sup>7</sup>	
Radiation Aging, Dose Rate	50-200 rd/h	Not Stated	
Radiation Aging, Method	NA	Test	
Materials Susceptible (Radiation) (5.2.4, 7.0/-/-)	Not stated	Not Stated	
Operational Aging (-/4.2/-)	Not stated	Not Stated	
Other Age Conditioning (-/4.2/-)	NA	Not Stated	
Qualified Life Claimed/ Established (5.2.4/4.10/-)	Not stated	Not Stated in Test Report	Note 2 p-5f
Normal Ambient Temperature	115°F max.	Not Applicable	
Normal Ambient Radiation	50-200 rd/h	Not Applicable	
Normal Ambient Humidity	Not stated	Not Applicable	
On-Going Surveillance and Preventive Maintenance (7.0/-/-)	Yes	Not Applicable	
On-Going Analysis of Failures and Degradation (7.0/-/-)	Yes	Not Applicable	
Margin (General) (6.0/3.0/3.0)	NA	Not Stated	
Margin (NUREG-0588, Cat. I) (-/3.0/-)		Not Stated	
1. Temperature (+15°F)			
2. Pressure (+10%, 10 psig max)			
3. Radiation (not required)			
4. Time (+10%, +1 hour + function time minimum)			



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 30

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
<u>ACCIDENT CONDITIONS</u>			
LOCA/MSLB/HELB/Uncontrolled (4.1, 4.2, 4.3.1, 4.3.3/ 1.1, 1.2, 1.5/1.1, 1.2, 1.5)	LOCA	LOCA/ MSLB	
Radiation Type	Gamma	Gamma	
Radiation Dose (rd) (4.1.2/1.4/1.4)	14 Mrd.	197.7-209.8 Megarads	
Radiation Dose Rate (rd/hr) Radiation Qual. Method (5.3.1/-/-)	Not stated	Not Stated Test	
Proximity to Concentrated Radiation (4.1.2/1.4.6/1.4.6)	Not stated	Not Applicable	
Equipment Susceptible to Beta Radiation (4.1.2/-/-)	Not stated	Not Stated	
Radiation Dose (Normal + Accident) (4.1.2/-/-)	Not stated	Not Applicable	
Plateout Dose Considered (-/1.48/1.48)	Not stated	Not Applicable	
Gamma + Beta Dose (rd) (4.1.2/1.4.7/1.4.7)	Not stated	Not Applicable	





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 30

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE No.)
<u>ENVIRONMENTAL PROFILE OF ACCIDENT CONDITIONS</u>			
Rate of Temp./Press. Increase	26.5°; 4psi/sec	10°F; 7Psi/second	*
Peak: °F/psig/RH/Time	264/42/100/24h	357/70/100%/10 hrs	
Decrease To: °F/psig/RH/Time	219/20/100/11h	357-275/70-31/100%/2hrs	
Decrease To: °F/psig/RH/Time	152/5/100/-	275/31/100%/4days	
Decrease To: °F/psig/RH/Time		212/10/100%/26 days	
Equipment Surface Tempera- ture (MSLB) (-/1.2.5.C, 2.2.6/1.2.5.C, 2.2.6)	NA	Not Applicable	
Spray Qualification Method (5.3.2/1.3, 2.2.8/1.3, 2.2.8)	NA	Test	
Spray Composition (4.1.4/1.3, 2.2.8/ 1.3, 2.2.8)	1.7 wt% Boric Acid 0.6 wt% NaOH pH - 9.3	3000 ppm Boron 0.064 Molar Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> NaOH for pH of 10.5	
Spray Density (gpm/ft <sup>2</sup> )	Not Stated	0.15	
Spray Duration	Not Stated	30 days	
Submergence Duration (4.1.3/2.2.5/2.2.5)	Not Stated	Not Applicable	
In-Leakage Considered (5.2.6, 5.3.2/-/-)	Not Stated	Not Applicable	
Time to Submergence	Not Stated	Not Applicable	
Dust Environment (-/2.2.11/2.2.11)	Not Stated	Not Applicable	

\* deviation in rate of temperature increase is not considered significant for this equipment



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 30

NOTES:

Note 2. The test conditions reported on pages 5a through 5e envelop the  
accident conditions described by the Licensee for the Robinson Plant.  
It is therefore concluded that the equipment is qualified for the  
application described on the Licensee SCEW sheet. However, the licensee  
has not identified a qualified life nor evaluated age related degradation  
applicable to the Robinson Plant conditions from the accelerated  
aging test data.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 30

NOTES:

2. TEST SPECIMENS

tested and also shows the energizing voltage and currents levels.

Table 1 presents a description of the specimens

Table 1 Test Specimens

Specimen Description *	Number <sup>†</sup>	Length (ft) <sup>‡</sup>	Electrical Loading	
			Voltage (Vrms - 60 Hz)	Initial Current (A) <sup>§</sup>
Raychem Thermofit <sup>®</sup> In-Containment Field Splice Cable - Raychem Adverse Service Coaxial Cable, AWG 22 conductor 1st insulation layer - 8 mil wall of Alkane-imide polymer 2nd insulation layer - 49 mil wall of Rayolin R <sup>™</sup> radiation cross-linked polyolefin Braided Copper Shield Raychem Flamtrol <sup>™</sup> Jacket - 34 mil nominal wall Part No. 10483 Run No. J7-5-10-72-6 Splice Components for one splice Raychem Thermofit <sup>®</sup> WCSF-115-6-N Soldered connection (See Figure 1)	9X	20	600	0
Raychem Thermofit <sup>®</sup> In-Containment Field Splices Cable AWG 4 insulated with EPR- neoprene (not a Raychem product) Splice Components for six splices (Note 1) Raychem Thermofit <sup>®</sup> WCSF-200-6-N 2 each of compression connectors: Burndy Hylink YS4C-L T&B 2F-4 3M #4	13	35	2000	70
Raychem Thermofit <sup>®</sup> In-Containment Field Splices Cable AWG 6 insulated with Raychem Flamtrol <sup>™</sup> Splice Components for six splices (Note 1) Raychem WCSF-200-6-N 6 each of compression connectors: Burndy Hylink YS6C-L	14	37	1000	65
Raychem Thermofit <sup>®</sup> In-Containment Field Splices Cable AWG 12 insulated with EPR neoprene (not a Raychem product) Splice Components for six splices (Note 1) Raychem WCSF-115-6-N 3 each of compression connectors: Burndy Hylink YSV10 T&B 2C-10	15	32	2000	25
Raychem Thermofit <sup>®</sup> In-Containment Field Splices. Six splices, Same construction as Sample #15 except that Raychem Flamtrol <sup>™</sup> wire was used	16	33	1000	25



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 30

NOTES:

Table 1 Test Specimens (continued)

Specimen Description*	Number†	Length (ft)‡	Electrical Loading	
			Voltage (Vrms - 60 Hz)	Initial Current (A)¶
Raychem Thermofit® In-Containment Transition Splices Cable AWG 6 insulated with Raychem Flamtrol™, spliced to three cables of AWG 12 insulated with Raychem Flamtrol™ and reconnected to an AWG 6 cable insulated with Raychem Flamtrol™ Splice Components for two splices (Note 1) Raychem Thermofit® WCSF-200-6-N Raychem Thermofit® heat-shrinkable 3-finger cable breakout (Part Number 403A112-4/83) used to provide seal at the transition between the AWG 6 and the three AWG 12 cables. 2 each of compression connectors: Burdny Hylink YS6C-L	17	23	1000	65

- ® and ™ Trademarks of Raychem Corporation
  - \* Description of specimens provided by Raychem
  - † Specimens 1 thru 8 and 10 thru 12 were other test specimens supplied by Raychem. The test results on these specimens are presented in report numbers F-C4033-1 and -2.
  - ‡ Specimens cut to lengths shown. Approximately 4 ft of the length extended outside of the test vessel (2 ft on each end of the specimen).
  - ¶ Initial currents were applied at room temperature, and allowed to drop to a lower level during combined radiation and thermal aging and simultaneous LOCA-simulation testing. See text for discussion.
- Note 1 - Each in-line splice or transition was covered with tinned copper wire mesh to aid in providing a close proximity ground plane as shown in Figure 2.



**EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 31**

EQUIPMENT ITEM NO. 31  
 ELECTRICAL CONNECTOR LOCATED IN THE CONTAINMENT, ELEV. 234'-246'  
 AMP MODEL 535481, WIRE SIZE 16  
 REQUIRED OPERATING TIME: CONTINUOUS  
 TER CHECKSHEET NO. 31  
 LICENSEE REFERENCE(S): 2068  
 FUNCTION (PLANT ID): CONDUCTOR BUTT SPLICE  
 LICENSEE SUBMITTAL: SCEW(S): 25 OF 25 [20]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

(R), (T), (QT), (RT), (P), (H), (CS), (A) S, (R), M, I, (QM) RPN, EXN, SEN, (QI) RPS, None,  
 Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, 3b, <del>3c, 3d</del>
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	<del>5a, 5b, 5c, 5d, 5e, 5f,</del> <del>5g, 5h, 5i, 5j</del>
Installed TMI Lessons Learned Implementation Equipment Summary	<del>6a, 6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 31

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

The Licensee (has/~~has not~~) provided a response to the SER concerns.

The Licensee (has/~~has not~~) specifically stated that the equipment is qualified and/or will function when exposed to the applicable DBE environmental service conditions.

The Licensee has presented information which shows there are no outstanding qualification deficiencies.

The Licensee (has/has not) proposed a corrective action for this equipment item whose qualification has not been fully established.

Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.

Corrective action specified by the Licensee:

Equipment replacement with qualified equipment

Equipment modification

Equipment relocation above submergence level

Relocate or shield equipment from radiation source

Verify qualification by additional (testing/analysis)

Equipment relocation to a mild environment

Qualification testing of equipment in progress

Other ( \_\_\_\_\_ )

The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.

The Licensee (~~has~~/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)

The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

I.a Qualified

I.b Modification

II.a Qualification Not Established

II.b Not Qualified

II.c Qualified Life Deficiency

III.a Exempt

III.b Not in Scope

IV Documentation Not Available



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 31

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
 X = DEFICIENCY

- Documented Evidence of Qualification Adequate \_\_\_\_\_
- Adequate Similarity Between Equipment and Test Specimen Established \_\_\_\_\_X\_\_\_\_\_
- Aging Degradation Evaluated Adequately \_\_\_\_\_
- Qualified Life or Replacement Schedule Established (If Required) \_\_\_\_\_
- Program Established to Identify Aging Degradation \_\_\_\_\_
- Criteria Regarding Aging Simulation Satisfied (If Required) \_\_\_\_\_
- Criteria Regarding Temperature/Pressure Exposure: \_\_\_\_\_
  - o Peak Temperature Adequate \_\_\_\_\_
  - o Peak Pressure Adequate \_\_\_\_\_
  - o Duration Adequate \_\_\_\_\_
  - o Required Profile Enveloped Adequately \_\_\_\_\_
  - o Steam Exposure (If Required) Adequate \_\_\_\_\_
- Criteria Regarding Spray Satisfied \_\_\_\_\_
- Criteria Regarding Submergence Satisfied \_\_\_\_\_
- Criteria Regarding Radiation Satisfied \_\_\_\_\_
- Criteria Regarding Test Sequence Satisfied \_\_\_\_\_
- Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied \_\_\_\_\_
- Criteria Regarding Functional Testing Satisfied \_\_\_\_\_
- Criteria Regarding Instrument Accuracy Satisfied \_\_\_\_\_
- Test Duration Margin (1 hour + Function Time) Satisfied \_\_\_\_\_
- Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I) \_\_\_\_\_

NRC QUALIFICATION CATEGORY

DESIGNATION:  
 X = CATEGORY

- I.a Equipment Qualified \_\_\_\_\_
- I.b Equipment Qualification Pending Modification \_\_\_\_\_X\_\_\_\_\_
- II.a Equipment Qualification Not Established \_\_\_\_\_
- II.b Equipment Not Qualified \_\_\_\_\_
- II.c Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified \_\_\_\_\_
- III.a Equipment Exempt From Qualification \_\_\_\_\_
- III.b Equipment Not in the Scope of the Qualification Review \_\_\_\_\_
- IV Documentation Not Made Available \_\_\_\_\_

*See pages 3b and 5f*



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 31

LICENSEE RESPONSE TO NRC SER

4.2 Equipment Requiring Additional Information and/or Corrective Action  
 (Appendix B) [20]

The bulk of master list equipment was placed in this category and our review of deficiencies is based upon the following:

- Deletion of deficient listed equipment due to replacement programs carried out and reported in our 90-day, Revision 3 response dated February 1, 1981.
- Re-evaluation of CP&L's updated submittals by NRC Region II, Atlanta, GA, and reported in Environmental Qualification of Safety-Related Electrical Equipment IEB 79-01B. Technical Evaluation Report - Docket No. 50-261; Plant: H. B. Robinson 2, dated November 6, 1980 and Revised November 11, 1980.

Telecons with NRC, Bethesda, MD reviewing personnel July 29, 1981, et al.

Equipment reported as qualified within NRC TER Revision 1, dated November 11, 1980:

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model No.</u>	<u>Location</u>
19. cable terminals <sup>2</sup> and splices	AMP	53548-1	containment

<sup>2</sup>These items also included in conductor pig-tail qualification test (Wyle Qualification Test Plan 45307-1) to supply acceptable aging, radiation, and LOCA test data for H. B. Robinson qualification.

A. Cable Terminals and Splices	AMP	53548-1	1	R,T,RT,P,H,CS, A,QM,QI
-----------------------------------	-----	---------	---	---------------------------

<sup>A</sup>Items reported as qualified within NRC Region II revised TER, dated 11/7/80.

[20]





EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 31

Cable Terminals and Splices

[15]

As no qualification information could be obtained on the current in containment cable splices to the listed electrical equipment, it was decided to change out the splices with qualified components, prescribed tools and approved procedure. This changeout was completed during the plant refueling outage (August - October) 1980.

Individual conductor splices will utilize AMP Radiation Resistant/150°C Preinsulated Splices (#53548-1), T&B 2-way Cable Connectors for Copper Cable, 500 MCM and T&B 2-way Cable Connectors for Copper Cable, #9 AWG. The splice/connector component will be crimped to the designated conductors using the manufacturer's specified crimping tool.

An appropriate sized RAYCHEM SHRINK TUBING will be applied over the individual conductor cable splice and heat shrunk using the manufacturer's specified torch. For the two- (2) and three- (3) conductor cables after the individual conductors are spliced using AMP PIDG (53548-1) splices, an overall jacket RAYCHEM SHRINK TUBING will be applied and heat shrunk.

The work described above has been detailed within H. B. Robinson S.E.P. Modification and Setpoint Revision Form No. M-521 (revised) and will be the means to sign off the completed work.

Original splices specified as AMP Nuclear Preinsulated Environmentally Sealed Splices (#52979) were found to be incompatible with the conductor insulation thickness of installed cable. Therefore, another butt-splice component, AMP Radiation resistant/150°C preinsulated splice (#53548-1) was ordered and installed. AMP Qualification Test Report 110-11002 dated October 1, 1978 describes a program that included total radiation exposure of  $2.0 \times 10^6$  RADs, maximum temperature of 350°F, maximum pressure of 137 PSIA and a borated chemical spray lasting four (4) days. To assure qualification of the H. B. Robinson in-containment splices, cable undergoing testing at Wyle Laboratories will be connected with AMP PIDG terminals Raychem thermofit (heat shrink) tubing overall per the Installation Procedure M-521, Safety-Related Cable Splices Inside Containment. Appropriate matrix combinations of splice/cable and individual cables and splices will assure identification of any single component failure which could occur during qualification testing. Each component has sufficient manufacturer-supplied test data to assure qualification by analytical means. The opportunity to obtain actual test results is available and will be used.

R2

R2



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 31

NOTES:

The Licensee states that AMP preinsulated splices model #53548-1 have been installed at H.B. Robinson. The Licensee states that AMP Qualification Test Report 110-11002 provides evidence of qualification testing for the installed equipment. The test Report describes the samples as F/N 53408-1. The licensee has not provided any information which demonstrates that the models tested and the models installed are equivalent.

The Licensee also states in reference 15 that Splices in the installed configuration are undergoing test in conjunction with the penetration pigtail cables. When the tests are completed actual test results will be used.

Therefore this equipment is assigned to NRC Category Ib because the Licensee states that qualification testing to plant conditions is in progress.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 32

EQUIPMENT ITEM NO. 32  
 ELECTRICAL TAPE LOCATED IN THE CONTAINMENT  
 3M/ELECTRO PRODUCTS MODEL SCOTCH 70 (SILICON RUBBER)  
 REQUIRED OPERATING TIME: CONTINUOUS  
 TER CHECKSHEET NO. 32  
 LICENSEE REFERENCE(S): NOT CITED  
 FUNCTION (PLANT ID): CABLE TERMINATION PROTECTION  
 LICENSEE SUBMITTAL: SCEW(S): 25A OF 25 [20]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:  
 (See Section 3 of this TER for Legend)

R, T, QT, RT, P, H, CS, A, S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,

Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, 3b, <del>3c, 3d</del>
System Consideration Review	<del>4a, 4b, 4c, 4d, 4e, 4f</del>
Equipment Environmental Qualification Review	<del>5a, 5b, 5c, 5d, 5e, 5f,</del> <del>5g, 5h, 5i, 5j</del>
Installed TMI Lessons Learned Implementation Equipment Summary	<del>6a, 6b</del>
Maintenance and Replacement Schedule Summary	<del>7a, 7b, 7c</del>



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 32

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/~~has not~~) provided a response to the SER concerns.
- The Licensee (has/~~has not~~) specifically stated that the equipment is qualified ~~and/or~~ will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/~~has not~~) proposed a corrective action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (has/~~has not~~) been provided by the Licensee for this equipment item.
- Corrective action specified by the Licensee:
  - Equipment replacement with qualified equipment
  - Equipment modification
  - Equipment relocation above submergence level
  - Relocate or shield equipment from radiation source
  - Verify qualification by additional (testing/analysis)
  - Equipment relocation to a mild environment
  - Qualification testing of equipment in progress
  - Other ( \_\_\_\_\_ )
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation *in the January 1981 submittal [15]*
- The Licensee (~~has~~/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action \_\_\_\_\_.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- |                                    |                                |
|------------------------------------|--------------------------------|
| I.a Qualified                      | II.c Qualified Life Deficiency |
| <u>I.b Modification</u>            | III.a Exempt                   |
| II.a Qualification Not Established | III.b Not in Scope             |
| II.b Not Qualified                 | IV Documentation Not Available |



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 32

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:  
 X = DEFICIENCY

Documented Evidence of Qualification Adequate	_____
Adequate Similarity Between Equipment and Test Specimen Established	_____X
Aging Degradation Evaluated Adequately	_____
Qualified Life or Replacement Schedule Established (If Required)	_____
Program Established to Identify Aging Degradation	_____
Criteria Regarding Aging Simulation Satisfied (If Required)	_____
Criteria Regarding Temperature/Pressure Exposure:	
o Peak Temperature Adequate	_____
o Peak Pressure Adequate	_____
o Duration Adequate	_____
o Required Profile Enveloped Adequately	_____
o Steam Exposure (If Required) Adequate	_____
Criteria Regarding Spray Satisfied	_____
Criteria Regarding Submergence Satisfied	_____
Criteria Regarding Radiation Satisfied	_____
Criteria Regarding Test Sequence Satisfied	_____
Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied	_____
Criteria Regarding Functional Testing Satisfied	_____
Criteria Regarding Instrument Accuracy Satisfied	_____
Test Duration Margin (1 hour + Function Time) Satisfied	_____
Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I)	_____

NRC QUALIFICATION CATEGORY

DESIGNATION:  
 X = CATEGORY

I.a	Equipment Qualified	_____
I.b	Equipment Qualification Pending Modification	_____X
II.a	Equipment Qualification Not Established	_____
II.b	Equipment Not Qualified	_____
II.c	Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified	_____
III.a	Equipment Exempt From Qualification	_____
III.b	Equipment Not in the Scope of the Qualification Review	_____
IV	Documentation Not Made Available	_____

*See evaluation of Kerite splices in Item 26. Since the licensee did not provide reference 50 [28] it cannot be determined that the tested and installed systems are the same.*



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 32

LICENSEE RESPONSE TO NRC SER

Silicon Rubber Tape	3M/Electric Products Division	Scotch 70	1	R, T, QT, RT, P, H, CS, A, QM, QI
------------------------	-------------------------------------	-----------	---	--------------------------------------

The items within Appendix B not fully covered by either TER classification or SCEWS's are as follows:

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model No.</u>	<u>Location</u>
Motor Operator	Limitorque	SMB-3	containment
Transmitter	Rosemount	1153A	containment
Level Switch	Madison	5602	containment
Silicon Rubber Tape	3M	Scotch 70	containment

The Scotch 70, silicon rubber tape used as part of our splicing procedure has been tested within the containment cable qualification test program reported for Appendix A listed equipment. Complete splice materials, per CP&L splice procedure M-521 (Rev. 0), were installed on both containment cable under test and known qualified control cable to establish qualification per H. B. Robinson environmental parameters. When this test report is reviewed, CP&L will inform the NRC of any additional actions, if any are required concerning Scotch 70 tape.

[20]

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 32

The Kerite Company has attested to the ability of this cable supplied for H. B. Robinson to withstand the FSAR LOCA conditions of temperature, pressure and radiation. In addition, test qualification included forty- (40) year aging, borated spray and 100% relative humidity exposure to meet IEEE 323-1974 and IEEE 383-1974 requirements. Referenced reports are:

R1

FIRL Report F-C4020-2 dated March 1975.

Proprietary Engineering Memo No. 178 entitled, "Determining Temperature Ratings of Cables and Pre-aging Requirements for LOCA Simulation Tests" dated December 27, 1974 (superseded by EM 178A dated May 1, 1979 and EM 178B dated December 1, 1979).

To provide protection for cable termination at equipment end, when no formal termination method was provided, a silicone rubber tape was used. SCOTCH 70, high temperature silicone rubber tape, is used for safety-related terminations. This product has undergone radiation testing by the manufacturer, Minnesota Mining & Manufacturing Company (3M) up to  $1.0 \times 10^6$  RADs at 40°C temperature with no major degradation of performance.

R2

A more comprehensive testing program to meet IEEE 323, 1974, requirements has been performed by Kerite Company utilizing SCOTCH 70 tape and Kerite Cable within LOCA testing chamber. Kerite has certified the use of SCOTCH 70 as detailed in Reference Number 50. *[unclear]*

To assure tape qualification for H. B. Robinson application, SCOTCH 70 tape will be used in conjunction with test control cables during qualification testing of the electrical penetrations PVC pigtail cable being performed at Wyle Laboratories. Results will be documented and available after completion of PVC cable testing.

R2

[15]

## 5. CONCLUSIONS

The tabulations in Section 4.2 represent a summary of the results of the equipment environmental qualification (EEQ) assessment conducted in accordance with the methodology presented in Section 3. The evaluations are based on the available qualification documentation provided by the Licensee, complemented in several cases by other relevant technical information. The major qualification deficiencies that have been identified and the results of the evaluation are shown in the Equipment Environmental Qualification Summary Forms (Tables 4-1, 4-2, 4-3, and 4-4).

Although Sections 4.3, 4.4, and Appendix C of this report present a detailed evaluation of (1) the Licensee's qualification methodology, (2) the equipment environmental qualification of each equipment item, and (3) the Licensee's response to the NRC SER, it is appropriate to highlight for the Licensee and the NRC certain conclusions and concerns reached as a result of the review which require special attention. These concerns are summarized below.

- o Section 4.1 of the NRC SER [16] identified the following concern:

"4.1 Equipment Requiring Immediate Corrective Action

Appendix A identifies equipment (if any) in this category. The licensee was asked to review the facility's safety-related electrical equipment. The licensee's review has concluded that the conductor pigtailed of some electrical penetrations are unqualified, and a licensee event report (LER) number RSEP 80-1037, addressing this issue, was submitted to the NRC on July 3, 1980. A qualification testing program, which is scheduled to be completed by May 1981, has been initiated by the licensee, and results will be submitted to the NRC. The results will enable the licensee to determine whether further action is required. The licensee further stated that analysis of operating-time radiation exposure led to the conclusion that the plant can continue operation until the testing is completed and the results reviewed. In this review, the staff has not identified any safety-related electrical equipment which is not able to perform its intended safety function during the time in which it must operate."



In response, the Licensee stated [20]:

"4.1 Equipment Requiring Immediate Corrective Action (Appendix A)

Conductor Pigtails of Electrical Penetrations, B-1, B-2, B-5, B-9,  
C-1, C-2, C-3, C-4, C-6, C-8, C-9, D-1, D-2, D-3, D-5, D-8, D-9  
Manufacturer: Continental Wire and Cable Company  
Jacket Material: PVC

Test Laboratory: Wyle Laboratories, Huntsville, Alabama  
Qualification Test Plan: 45307-1 dated January 12, 1981

Status: All test sequences stated within the Final Qualification Test Plan (45307-1) were completed on July 17, 1981. The test cables, test control cables and splices were removed from the LOCA test chamber on July 20, 1981 and are undergoing evaluation. A test report is scheduled for issuance September 1, 1981. Review of this report will be made before final disposition of this matter will be made to the NRC. Preliminary data indicates no failure of the cable or splices which would require any immediate corrective action by the plant. Therefore, the statement found at the end of the SER Appendix A . . . 'Licensee integrated dose assessment provides justification for continued operation until testing is completed and analyzed' remains valid."

It is concluded that the Licensee's approach is satisfactory.

- o Equipment Items 12, 13, 14, and 15 (Rosemount transmitter Model 1153A) have been placed in NRC Qualification Category II.b because the Licensee has reported current Rosemount testing which resulted in failure of the test specimen (IEEE-323 1974 criteria applied). The Licensee has stated that the H. B. Robinson accident profiles were enveloped by successful transmitter testing (References 1764 and 4423). The Licensee has provided (1) an O-ring replacement schedule and (2) a statement that current testing by Rosemount represents an "over-test condition" with regard to H. B. Robinson parameters. This provides a technically sound basis for justification for interim operation. However, because the current Rosemount test report is not available for review to allow independent verification, this equipment item is considered unqualified. Since all transmitters inside containment are Rosemount Model 1153A, an assessment of the current Rosemount test program should be conducted by the NRC.
- o Equipment Items 16 and 17 (Gems level sensor Models XM 36495 and XM52495) were placed in Category II.b because the referenced test report (FIRL F-C3834) was considered inconclusive and the equipment failed to meet the requirements of NUREG-0588 Rev. 1 Category 1 and the DOR Guidelines. A supplement to the referenced report (FIRL S-C3834) indicates that the equipment failed to operate satisfactorily during testing.

- o It appears that the Licensee has not resolved the NRC concern regarding temperature, pressure, and humidity conditions inside containment. Since the Licensee is responsible for identifying the environments, the parameters identified by the Licensee have been used in the evaluations contained in this Technical Evaluation Report. These parameters are reproduced in Appendix A (see Section 4.3.2.2).
- o The Licensee has not resolved the NRC concern regarding submergence, but is currently in the process of evaluating the concern (see Section 4.3.3).
- o A review of the SCEWS for instruments reveals that the specified operating times for several key instruments are too short. For example, pressurizer pressure transmitters have required operating times of 1 hour to 1 day. A further review of the SCEWS does not reveal any RCS pressure transmitter which will be available for long-term monitoring of reactor coolant system pressure. Additionally, the Licensee states that steam generator level transmitters are required to operate for only 30 minutes. While these transmitters are not necessarily required for long-term monitoring, these operating times are not consistent with the general requirements for achieving long-term shutdown cooling modes and do not adequately reflect the potential need to remain in a hot-shutdown condition for an interim period before reaching a stable long-term cooling condition. (See Appendix C of this report for further details.)

With respect to justification for continued operation, the Licensee stated [20]:

"SECTION IV - Justification for Continued Operation

Based upon our review of the items listed within Appendix B of the NRC issued Environmental Qualification of Safety-Related Electrical Equipment - Safety Evaluation Report as herein reported (Section I) and noting that no deficiency resolution alters the status of the equipment covered, the concluding statement within the SER should continue to be valid:

'The staff further concludes that there is reasonable assurance of continued safe operation of this facility pending completion of these corrective actions. This conclusion is based on the following:

- (1) That there are no outstanding items which would require immediate corrective action to assure safety of plant operation.
- (2) Some of the items found deficient have been or are being replaced or relocated, thus improving the facility's capability to function following a LOCA or HELB.

- (3) The harsh environmental conditions for which this equipment must be qualified result from low-probability events; events which might reasonably be anticipated during this very limited period would lead to less demanding service conditions for this equipment.'

CP&L is confident the master listed and reviewed equipment will work in an accident environment, we have documented our opinion, and qualification testing will be completed by the date established by the NRC for conclusion of qualification of safety-related electrical equipment."

The review of the Licensee's rationale presented as justification for interim operation is presented in Appendix D of this report.

With respect to TMI Action Plan items, the Licensee has provided the following information [15]:

"7.0 TMI Action Plan Equipment

TMI-2 Lessons Learned Task Force Status Report and Short-Term Recommendations, NUREG-0578, dated July 1979, contained twenty-three (23) specific recommendations in twelve (12) broad areas (nine (9) design and analysis and three (3) operations). Based on these recommendations, a TMI Task Force at HBR reviewed equipment and operations to either record current or propose new means to comply where or when required.

In response to NRC IE Bulletin 79-01B and subsequent supplements, the 'TMI-2 Lessons Learned' electrical equipment installed to date at HBR has been reviewed for qualification and reported herein. A listing of modifications resulting from the Task Force review is shown in Table 7.1. Included are the NUREG 0578 paragraph numbers to which these modifications apply and the installation status to date. From the bill of materials for each installed modification, the electrical items determined to be reportable under 79-01B are compiled within a Master List of TMI Action Plan Equipment and presented in paragraph 7.1. The Master List also identified those items in containment (harsh environment) and those items outside of containment (non-harsh environment).

Paragraph 7.2, Environmental Qualification of Electrical Equipment Required for TMI-2 Lessons Learned Modifications (Installed) contains a System Component Evaluation Work Sheet for each of the Master List items--both harsh and non-harsh environments. The major difference for TMI lessons learned equipment and accident condition equipment is the source radiation exposure postulation. For this report, a total radiation integrated dose, as determined by a Reactor Building Radiation Shielding Design Review (HBR-2) performed by Ebasco Services

for CP&L, is utilized for each outside-of-containment identified item. Also, the figures utilized for qualification in designated areas are conservative in that after installation of identified shielding or new equipment the radiation levels are significantly reduced.

Another posculation is that components exposed to radiation levels equal to or less than  $1 \times 10^4$  R, total integrated dose, due to location need not undergo special qualification in that materials utilized are not affected during a forty- (40) year life and accident mitigation conditions by these levels of radiation.

Table 7.1 TMI-2 Lessons Learned Modifications (HBR)

<u>Modification No.</u>	<u>Title</u>	<u>NUREG 0578 No.</u>	<u>Status</u>
M 501	Core Subcooling Monitor	2.1.3b [II.F.2*]	Installed
M 502	Direct Position Indicator of Pressurizer Safety Relief Valves	2.1.3a [II.D.3]	Installed
M 504	Auxiliary Feedwater Flow Indication to Steam Generators	2.1.4b [II.E.1.2.2]	Installed
M 505	Interior Plant Vent High Radiation Monitor	2.1.8b [II.F.1]	Installed
M 506	Fuel Handling Bldg. Basement Exhaust High Radiation Monitor	2.1.8b [II.F.1]	Installed
M 509	Auto Trip of Pressurizer Heater Breakers Under Blackout Conditions	2.1.1 [II.E.3.1 & II.G.1]	Installed
M 510	Containment Isolation	2.1.4 [II.E.4.2]	Installed
M 520	High Point Venting	2.1.9 [II.B.1] Denton *1	Installed (but iso- lated from primary)
M 525	Containment Vessel Water Level	ACRS-2 [II.F.1.5]	Installed
M 530	Alarm Indication for Opening of Pressurizer PORVs	2.1.3a [II.D.3]	Installed
M 532	Tech Support Center Radiation Monitor		Suspended Pending issuance of NUREG 0696
M 542	PRT/RCDT Sample Lines to Gas Analyzer	2.1.4 [II.B.3]	Installed"

\* Numbers in brackets, added to table for reference purposes, indicate applicable NUREG-0737 section.

## 6. REFERENCES

The references listed in this section of the report were used to develop the Equipment Environmental Qualification evaluation for this plant. The references have been separated into two lists: (1) Plant-Specific References and (2) Plant Generic References. All non-generic documents are listed on the "Plant-Specific References" list. All qualification documents that could be applicable to equipment installed in several plants were listed on the "Plant Generic References" list. These documents include topical reports, test reports, component and material analyses, etc. cited by the Licensee as evidence of qualification in accordance with the documentation reference instructions established by IE Bulletin 79-01B. Since these documents were compiled by a computer data base, the citation numbering was computer generated and the same document has the same generic reference number in all Technical Evaluation Reports prepared under this equipment qualification program.

Throughout the text of the report, references are designated by a bracketed number; the reference numbers are not presented in sequential order.

## PLANT-SPECIFIC REFERENCES

1. L. W. Eury  
Letter to J. P. O'Reilly, NRC. Subject: H. B.  
Robinson Steam Electric Plant, Unit No. 2,  
IE Bulletin 79-01B - Ninety-Day Report  
Carolina Power & Light Co., 07-Jul-80  
Serial No. 80-1004
2. Environmental Qualification of Electrical Equipment - H. B.  
Robinson E. G. Plant Unit 2. NRC IE Bulletin 79-01B  
(90-Day Report)  
Carolina Power & Light Co, 00-Jun-80
3. Environmental Qualification of Electrical Equipment - H. B.  
Robinson E. G. Plant, Unit 2. NRC IE Bulletin 79-01B  
(90-Day Report), Revision 2.  
Carolina Power & Light Co., 01-Nov-80
4. B. J. Furr  
Letter to N. C. Moseley, NRC. Subject: IE  
Bulletin 79-01B Revisions - Additional copies  
Carolina Power & Light Co., 21-Nov-80  
Serial No. 80-1691
5. G. Lainas  
Letter to A. Schwencer, NRC. Subject: Electrical  
Equipment Environmental Qualification  
USNRC, 19-Feb-80
6. Environmental Qualification of Electrical Equipment  
USNRC/IE, 14-Jan-80  
IEB 79-01B
7. Environmental Qualification of Class 1E Equipment  
USNRC, 29-Feb-80  
IEB 79-01B, Supp. 1
8. N. C. Moseley  
Letter to B. H. Grier et al., NRC. Subject: Supplement  
No. 2 to Bulletin 79-01B, Environmental Qualification of  
Class 1E Equipment  
USNRC, 29-Sep-80

9. N. C. Moseley  
Letter to B. H. Grier et al., NRC. Subject: Supplement  
No. 3 to Bulletin 79-01B, Environmental Qualification  
of Class 1E Equipment  
USNRC, 24-Oct-80
10. S. J. Chilk  
Memorandum and Order pursuant to Union of Concerned  
Scientists Petition for Emergency and Remedial Relief  
USNRC, 23-May-80  
CLI-80-21
11. D. G. Eisenhut  
Letter to All Power Reactor Licensees, Applicants, Vendors.  
Subject: Environmental Qualification of Safety-Related  
Electrical Equipment; NRC Staff Positions  
USNRC, 20-Apr-82  
Gen. Ltr. 82-09
12. A. J. Szukiewicz  
Interim Staff Position on Environmental Qualification of  
Safety-Related Electrical Equipment; Including Staff  
Responses to Public Comments  
USNRC, 00-Jul-81  
NUREG-0588, Rev. 1
13. Clarification of TMI Action Plan Requirements  
USNRC, 00-Nov-80  
NUREG-0737
14. B. J. Furr  
Letter to J. P. O'Reilly, NRC. Subject: H. B. Robinson Steam  
Electric Plant, Unit No. 2, Revision 3 to IE Bulletin  
79-01B Ninety-Day Report.  
Carolina Power & Light, 30-Jan-81  
Serial: NO-81-12
15. Environmental Qualification of Electrical Equipment;  
H. B. Robinson E. G. Plant Unit 2; NRC - IE Bulletin 79-01B  
(90 Day Report) (Supplement No.2) (Supplement No.3). Rev. 3  
Carolina Power & Light, 01-Feb-81
16. Office of Nuclear Reactor Regulation  
Safety Evaluation Report for H. B. Robinson Unit 2  
USNRC, 21-May-81



17. E. E. Utley  
Letter to C. Crane, FRC. Subject: H. B. Robinson Steam Electric Plant Unit No. 2, Environmental Qualification, with Attachments Carolina Power & Light Co., 31-Jul-81
18. Postulated Pipe Failure Analysis Outside of Containment  
Westinghouse, 09-Nov-73
19. Steps Contained in H. B. Robinson General Procedure GP-6, Plant Cooldown from Hot Shutdown to Cold Shutdown Conditions Carolina Power & Light Co.  
GP-6
20. E. E. Utley and M. A. McDuffie  
Letter to S. A. Varga, NRC. Subject: H. B. Robinson Steam Electric Plant, Unit No. 2 - Response to May 21, 1981 letter and Safety Evaluation Report  
Carolina Power & Light Co., 31-Aug-81  
NO-81-1432
21. R. B. Starkey, Jr.  
Letter to J. P. O'Reilly, NRC. Subject: H. B. Robinson Steam Electric Plant, Unit No. 2; Licensee Event Report 80-014, Update Report No. 1  
Carolina Power & Light Co., 19-Oct-81  
RSEP/81-1617
22. Environmental Qualification of Electrical Equipment.  
H. B. Robinson E. G. Plant Unit 2. NRC IE Bulletin 79-01B (45-day Report)  
Carolina Power & Light Co., 00-Mar-80
23. S. A. Varga  
Letter to C. J. Crane, FRC. Subject: Transmittal of WCAP-8587, and Correction of Limitorque Test Report Number as listed in Robinson 2 RFI  
USNRC, 25-Jan-82
24. E. E. Utley  
Letter D. G. Eisenhut, NRC. Subject: H. B. Robinson Steam Electric Plant, Unit No. 2 Request for Additional Information - Environmental Qualification  
Carolina Power & Light Co., 01-Mar-82
25. Westinghouse letter CPL-77-550
26. Emergency Instructions (E.I. - 1) Incident Involving Reactor Coolant System Depressurization

27. Kerite Company letter dated August 5, 1980
28. Kerite Company letter dated October 21, 1980, regarding Qualification Data on use of Scotch 70 Silicone Rubber Tape
29. H. B. Robinson Steam Electric Plant Unit 2; TMI Project Modification Design Criteria  
Carolina Power & Light, 01-Jun-80
30. Request for Additional Information: Equipment Environmental Qualification (EEQ); Review of Licensees' Resolution of Outstanding Issues from NRC Equipment Environmental Qualification Safety Evaluation Reports (SER) and TMI Action Plan Installed Equipment; Carolina Power & Light Company, H. B. Robinson Steam Electric Plant Unit No. 2  
FRC, 24-Nov-81
31. Request for Additional Information: Equipment Environmental Qualification (EEQ); Review of Licensees' Resolution of Outstanding Issues from NRC Equipment Environmental Qualification Safety Evaluation Reports (SER) and TMI Action Plan Installed Equipment; Carolina Power & Light Company, H. B. Robinson Steam Electric Plant Unit No. 2; Revision 1  
FRC, 01-Feb-82
32. Request for Additional Information: Equipment Environmental Qualification (EEQ); Review of Licensees' Resolution of Outstanding Issues from NRC Equipment Environmental Qualification Safety Evaluation Reports (SER) and TMI Action Plan Installed Equipment; Carolina Power & Light Company, H. B. Robinson Steam Electric Plant Unit No. 2; Revision 2  
FRC, 07-Apr-82
33. C. J. Crane and J. A. Murphy  
Telecon with J. Sheppard and B. Schwager, CPL. Subject: Request for Additional Information  
FRC, 21-Jul-81

## PLANT GENERIC REFERENCES

606. C. V. Fields  
Fan Cooler Motor Unit Test  
Westinghouse, 00-Apr-72  
WCAP-7829
637. J. Locante and E. G. Igne  
Topical Report: Environmental Testing of Engineered  
Safety Features Related Equipment (NSSS -  
Nonstandard Scope). Volumes I and II.  
Westinghouse, 00-Sep-70  
WCAP-7744
639. J. Locante  
Topical Report: Environmental Testing of Engineered  
Safety Features Related Equipment  
(NSSS - Nonstandard Scope). Volumes I and II.  
Westinghouse, 00-Dec-70  
WCAP-7410-L, Proprietary
640. C. V. Fields  
Fan Cooler Motor Unit Test  
Westinghouse, 00-Jan-69  
WCAP-9003, Proprietary
645. J. P. Waggener and L. E. Witcher  
Qualification Tests of Pressure and Differential  
Pressure Transmitters Under Simulated Post-Accident  
Nuclear Reactor Containment Environmental Conditions  
FIRL, 00-Nov-69  
F-C2639
649. Qualification Tests of Solenoid Valves by Environmental Ex-  
posure to Elevated Temperature, Radiation, Wear Aging, Seis-  
mic Simulation, Vibration Endurance, Accident Radiation ...  
Isomedix Inc., 00-Jul-79  
AQS21678/TR, Rev. A, Proprietary
662. T. Hess, Jr.  
Qualification Type Test Report: Limitorque Valve  
Actuators for Class 1E Service Outside Primary  
Containment in Nuclear Power Station Service  
Limitorque Corp., 28-May-76  
B0003

663. S. P. Carfagno, L. E. Witcher, and W. H. Steigelmann  
Qualification Test of Limitorque Valve Actuator  
in a Steam Environment  
FIRL, 00-Feb-72  
F-C3271, Proprietary
677. Report: Qualification Tests of Electric Cables Under  
Conditions Simulating Normal Reactor Containment  
Service and a Loss-of-Coolant Accident  
FIRL, 00-Nov-73  
F-C3683
687. A. E. Ellis and R. B. Miller  
Environmental Qualification of Safety Related  
Class 1E Process Instrumentation  
Westinghouse, 00-Sep-77  
WCAP-9157, Proprietary
688. R. M. Satterfield  
Letter to J. F. Stolz, NRC. Subject: Westinghouse  
Topical Report WCAP-9157  
USNRC, 28-Sep-79
815. L. E. Witcher and D. V. Paulson  
Tests of Raychem Thermofit Insulation Systems Under  
Simultaneous Exposure to Heat, Gamma Radiation, Steam,  
and Chemical Spray While Electrically Energized  
FIRL, 00-Jan-75  
F-C4033-3
1391. G. S. Buettner and J. R. Marth  
Qualification of Firewall III, Class 1E  
Electrical Cables  
Rockbestos Co., 07-Jul-77
1596. S. H. Wood and L. S. Eytel  
Nuclear Qualification Test Procedure... For Babcock and  
Wilcox Valve Monitoring System  
Approved Engineering Test Lab, 07-Jan-81  
QTP 548-8955, Rev. A
1764. H. Nordeen  
Qualification Test Report for Rosemount Pressure Transmitter  
Model 1153 Series A  
Rosemount Inc., 23-Mar-78  
3788

1887. N. M. Burstein and L. E. Witcher  
Technical Report: Test of a Liquid Level Sensor Under Conditions Simulating a Loss-of-Coolant Accident within the Containment of a Nuclear Power Generating Station  
FIRL, 00-Mar-74  
F-C3834
1888. Supplementary Test of a Liquid Level Sensor Under Conditions Simulating a Loss-of-Coolant Accident within the Containment of a Nuclear Power Generating Station  
FIRL, 00-Mar-74  
F-C3834, Suppl.
2068. AMP Radiation Resistant PIDG Terminals  
AMP Incorporated, 01-Oct-78  
110-11002 (formerly GPR 575-98)
2096. A. Bereza  
Qualification Tests for a Modular Penetration 5" Diameter (Prototype B1)  
Westinghouse, 12-Nov-73  
AB-11/12/73
2818. S. P. Carfagno and L. E. Witcher  
Technical Report: Test of Electrical Cables under Simulated Post-Accident Reactor Containment Service  
FIRL, 00-Oct-70  
F-C2935, Proprietary
2850. Qualification Specification for Automatic Switch Co. (ASCO) of Florham Park, N. J. for Solenoid Valves  
Isomedix Inc.  
AQS-21678/Rev. B
3184. G. Butterworth and R. B. Miller  
Methodology for Qualifying Westinghouse WRD Supplied NSSS Safety Related Electrical Equipment  
Westinghouse, 00-Feb-79  
WCAP-8587, Rev. 2
4281. K. E. Fleming  
LOCA Qualification of Kerite 1000 Volt FR/FR Control Cable, Pilgrim Nuclear Power Station  
Kerite Co., 18-Jul-80
4282. R. E. Fleming  
LOCA Qualification of Kerite 1000 Volt HTK/FR Power Cable, Pilgrim Nuclear Power Station  
Kerite Co., 18-Jul-80

4423. H. Nordeen  
Nuclear Steam Test Performance Evaluation; Model 1153 GA9  
Rosemount Inc., 24-Aug-78  
37821, Rev. B

## APPENDIX A - ENVIRONMENTAL SERVICE CONDITIONS

This appendix contains a summary of the information concerning expected environmental service conditions in various plant locations, as provided in References 17 and 20. Figure A-1 depicts the arrangement of the reactor containment and defines specific locations where radiation levels are measured.

Based on these considerations, each equipment item was evaluated with respect to the environmental service conditions presented in this appendix.

Within ContainmentNormal Operation [17]

## Temperature:

At full power	120°F (specified maximum)
At shutdown	88°F (estimated)
Average	115°F*

## Radiation:

See Figure A-1, Figure A-6, and Table A-2.

The following are typical nuclear radiation exposures:

Components physically contacting the RC loop	200 rd/h
Components in close proximity to RC loop	50 rd/h
Components outside RC loop compartment shield (crane) wall	0.1 rd/h

\*This value is based on a plant availability of 84% and "is conservative because the temperature is maintained below the specified maximum temperature during operation."

### Accident Conditions

For PWR plants, the Guidelines (Section 4) state that the environmental service conditions inside containment for the loss-of-coolant accident (LOCA) should be established by the Licensee based on the Final Safety Analysis Report (FSAR) analysis. In addition, for plants equipped with automatic containment spray systems not subject to single component failure or delayed initiation, the Guidelines state that equipment qualified for the LOCA environment is also considered qualified for the postulated main-steam-line-break accident (MSLB). The design of the H. B. Robinson Unit 2 plant satisfies these criteria.

In addition, the Licensee has stated the following with regard to the environmental parameters used for the assessment of qualification of equipment inside containment [20]:

"The SER requires the licensee to verify that the containment spray system is not subjected to a disabling single-component failure and therefore satisfies the requirements of Section 4.2.1 of the DOR Guidelines. H. B. Robinson FSAR Section 6.4.3, Design Evaluation, describes the capabilities of the containment spray system and addresses the single failure analysis for this system within Table 6.4-4 entitled, Single Failure Analysis - Containment Spray System, (See Appendix A).

As this system is not subject to a single component failure affecting its performance the MSLB accident environment is not the limiting parameter for qualification per the DOR Guidelines Section 4.2.1. To further support this conclusion a study performed for NRC IE Bulletin 80-04, Analysis of a PWR Main Steam Line Break with Continued Feedwater Addition indicates a maximum containment pressure of 34.4 psig and a temperature of 257°F for the feedwater augmented MSLB."

With respect to in-containment temperature/pressure profiles, the Licensee stated [20]:

"The SER questions the pressure value as stated in our submittals and found within the H. B. Robinson FSAR. Apparently, a comparison with other plants' specified pressure values is used as the basis for this questioning. As reported in our prior responses to IE Bulletin 79-01B, the H. B. Robinson containment volume is  $2.1 \times 10^6$  ft<sup>3</sup>. This effectively accounts for both a lower pressure value and radiation level when defining LOCA parameters. Therefore, it is not practical to use comparisons in determining H. B. Robinson adequacy. Our FSAR has been reviewed by the U. S. Atomic Energy Commission and after several



exchanges requiring amendments to this document, a Safety Evaluation Report was issued on May 18, 1970 accepting the LOCA evaluation as presented for operation. Further review of LOCA conditions was performed by the AEC when the plant requested permission to increase power. A Safety Evaluation Report was issued on May 20, 1974 accepting the LOCA conditions and approving power increase. Per the DOR Guidelines Section 4.1.1 Service Conditions Inside Containment for a Loss of Coolant Accident (LOCA), Temperature and Pressure Steam Conditions, the FSAR analysis for containment temperature and pressure conditions is used for establishing the qualification of electrical equipment located within containment.

The service condition analysis was performed by Westinghouse Electric Company and the method utilized was reported to the AEC and subsequently enclosed as a Status Report by the Directorate of Licensing, dated October 15, 1974 within the Safety Evaluation Report by the Directorate of Licensing, U.S. Atomic Energy Commission for CP&L H. B. Robinson Unit #2, dated December 27, 1974. See Appendix B, Westinghouse ECCS Evaluation Model).

Of further note, the H. B. Robinson calculated maximum pressure associated with a double-ended break is 38 psig (peaking at 12 seconds after LOCA and reducing to 32 psig after 3000 seconds). The stated 42 psig within our IE Bulletin 79-01B responses refers to the containment design pressure; therefore, a margin of approximately 11% above the conservative value of the blowdown peaks is available. H. B. Robinson Unit 2 FSAR, Section 14.3.4, Containment Integrity Evaluation, contains data and parameters associated with containment pressure. See Figure 14.3.4-2, Containment Pressure Transients for a Range of Break Sizes, Figure 14.3.4-4, Structural Heat Transfer Coefficient, and Figure 14.2.4-6, Containment Capability Study, All Available Energy for graphic presentation of H. B. Robinson LOCA profiles.

Per the above, we do not believe it is justified to recalculate the LOCA pressure and temperature profiles. The conservatism involved with the values and the tested values for equipment as recorded on the System Component Evaluation Work Sheets indicate there are no conflicting or questionable pressure and/or temperature values involved.

Addressing stratification within Containment, the upper regions where stratification may affect temperature do not contain any instrumentation or equipment related to IE Bulletin 79-01B. Only the containment fans are located on the crane deck level (elevation 275') and their test temperature exceeds LOCA temperature by 16% (11% if the saturation temperature associated with LOCA is considered)."

Temperature	Figure A-2
Pressure	Figure A-3
Pressure (Transients)	Figure A-4
Pressure (Available Energy)	Figure A-5
Humidity	100% (nominal)
Spray	Solution of sodium hydroxide and boric acid in water (see note 1)
Radiation	See Table A-1, Note 2, Figure A-7, and Figure A-8
Flood Depth	3.2 feet (elev. 231.2 feet)

## Note 1:

"The chemical spray consists of sodium hydroxide, boric acid, and refueling water. Mixing of the refueling water from the refueling water storage tank, the boric acid from the boric acid tank, the borated water contained within the accumulators, and primary coolant will bring the weight percent solution caustic and 1.7 weight percent boric acid. This maintains a pH of at least 9.3. Spray additive educators are designed to provide enough sodium hydroxide in the mixture so as not to exceed pH 10 during the injection phase."

## Note 2:

With respect to radiation inside containment, the Licensee stated [20]:

"The SER second paragraph for Section 3.8 states that the values submitted within CP&L's H. B. Robinson 90-day response do not envelop the DOR Guidelines ( $4 \times 10^7$  rads) requirement and therefore are not acceptable.

Radiation values listed on the submitted System Component Evaluation Work Sheets within the specification column reflect a series of calculations based upon containment volume, internal shielding, and instrumentation/equipment location. These calculations follow the procedures referenced as acceptable in the DOR Guidelines and provided within Appendix B. Sample calculations and representative nomogram use were presented as Appendix A within CP&L 90-day submittals; Rev. 0, Rev. 1, Rev. 2, and Rev. 3.

Of note is the reduced level radiation number due to oversized containment volume ( $2.1 \times 10^6$  ft<sup>3</sup>) and shield wall thickness (36 inches) when using the nomograms. Each instrument or equipment as represented on the work sheets was dimensioned by level within containment or Reactor Auxiliary Building and located by compartment or shield wall to determine the maximum radiation level experienced under LOCA conditions. This figure was added to the normal operating radiation dose (40 year life) and a margin assigned. Section 1.3.2 of the H. B. Robinson 90-day Rev. 3 report provides additional insight into the assigned radiation levels. Individual dosages used on the work sheets

are summarized and listed in Table 1.3.3 of the above mentioned report. For review purposes, response submitted figures and tables are included in this section to aid in evaluation of our radiation assignments.

When operating time for equipment/instrumentation was less than one (1) hour, a minimum of one (1) hour was picked for establishing dosage reduction based on the nomogram entitled 30 Day Dose Connection Factor vs. Time Required to Remain Functional (HRS). This should establish sufficient margin and encompass existing test data.

For items located close to sump water flooding levels an additional radiation dosage was assigned based on actual operating time. As stated in Table 1.3.3 Notes (8) & (9), data used can be found in NUREG-0588, Appendix D, Table D-8, Containment Sump Gamma Dose Rates and Integrated Dose Versus Time.

Beta radiation was considered using Appendix C, Table D-6, Beta Dose Rates and Integrated Doses at the Containment Center Versus Time in Air. Based on the time of operation, equipment location, shield wall absorption, compartment wall absorption, insulation thickness, instrumentation housing absorption, motor case shielding, et. al., beta contribution is less than 10% of the total gamma dose experienced by the listed equipment. This is a conservative assumption based on the DOR Guidelines requirement of the beta dose to be less than or equal to 10% of the total gamma dose to which an item of equipment has been qualified.

The above is the basis, assumptions, and basic analysis of the option chosen to justify the choice of lower service conditions than the generalized screening radiation service value stated in the SER and presented at the NRC 79-01B meeting held in Bethesda, Maryland on July 7-10, 1981. Sample calculations as included in our 90-day, Revision 3 response to IE Bulletin 79-01B are repeated as Appendix C of this report."

#### Outside Containment

With respect to environmental service conditions outside containment, the Licensee stated [20]:

- o "As stated in the SER, ambient temperature conditions have been used in some areas outside containment. As H. B. Robinson 2 has master listed equipment located on the turbine deck which is an open air area, it is impractical to utilize an arbitrary value such as ambient saturation temperature for qualification purposes. Therefore, the System Component Work Sheets listing turbine Deck Area location will not be summarily revised.

Considering the Auxiliary Building, the following quote from the Report entitled: H. B. Robinson No. 2 Postulated Pipe Failure Analysis Outside of Containment, Section 10.0 Description of Compartment Environmental Effects Analysis, indicates only one

enclosed volume subject to pressure and temperature buildup following rupture. This is the pipe penetration gallery. An analysis indicates a calculated pressure buildup of 0.2 psi and a maximum temperature increase of 2.4°F. This consequence is the result of the limiting postulated steam generator blowdown line rupture. These limiting environmental conditions will have no effect on the structural adequacy of the auxiliary building or on plant operation. It would be arbitrary to assume the ambient saturation temperature for equipment qualification purposes. Review of the System Component Work Sheets designated within the Reactor Auxiliary Building show qualification temperatures well in excess of the area requirement. Therefore, the System Component Work Sheets for the Reactor Auxiliary Building will not be changed to reflect a screening number when actual conditions have been calculated."

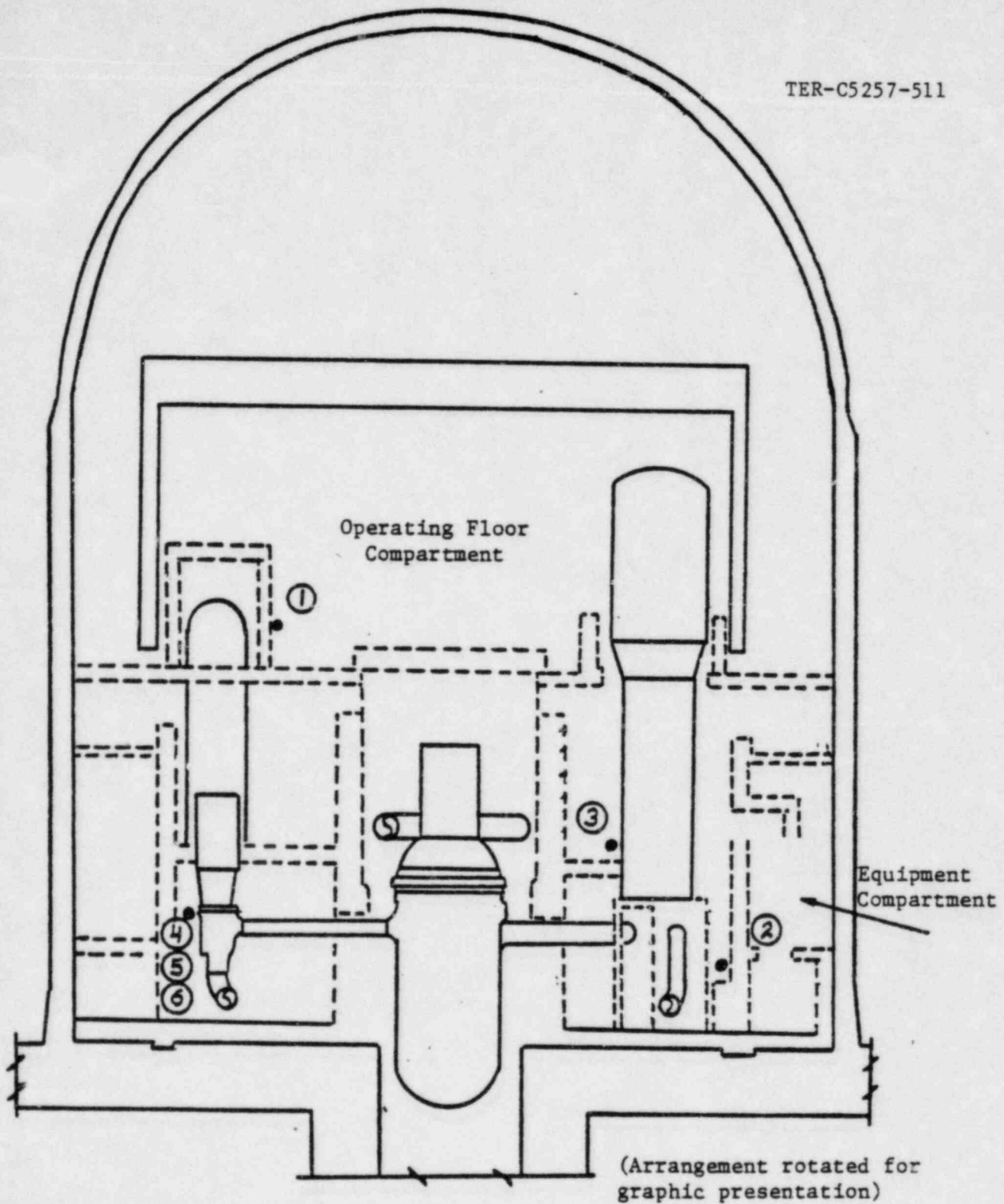
- o "Temperature in the control room and electronic equipment areas is maintained at 70°F  $\pm$  10°F by air conditioning. When considered over the plant life, the down time of air conditioning is negligible. Therefore, the 40 year average ambient temperature of these areas is less than 80°F.

For other areas outside containment in which safety related equipment may be located such as the auxiliary building the ambient temperature is subject to seasonal variation. The estimated 40 year average ambient temperature is 85°F in these areas. This estimate assumes 100°F summer and 70°F winter temperatures.

Normal radiation in the control and electronic equipment rooms is less than 0.2 milli-rad per hour and is therefore insignificant and does not degrade any component over the 40 year plant life. The radiation environment at majority of other Class 1E equipment locations outside the containment is correspondingly insignificant. However, the radiation parameters will be considered in the qualification of any additional Class 1E equipment which may be located in a significant radiation field [17]."

#### Pipe Penetration Gallery (Auxiliary Building)

Temperature	Ambient + 2.4°F
Pressure	Ambient + 0.2 psi



- 1 CV Operating Deck (Pressurizer)
- 2 CV Lower Level Polar Crane Wall (Regen. Heat Exchanger)
- 3 CV Second Level Seal Trole Room
- 4 Reactor Coolant Pump Bay A
- 5 Reactor Coolant Pump Bay B
- 6 Reactor Coolant Pump Bay C

**FIGURE SUPPLIED  
BY THE LICENSEE**

Figure A-1. H. B. Robinson Reactor Containment Radiation Level Measurement Locations

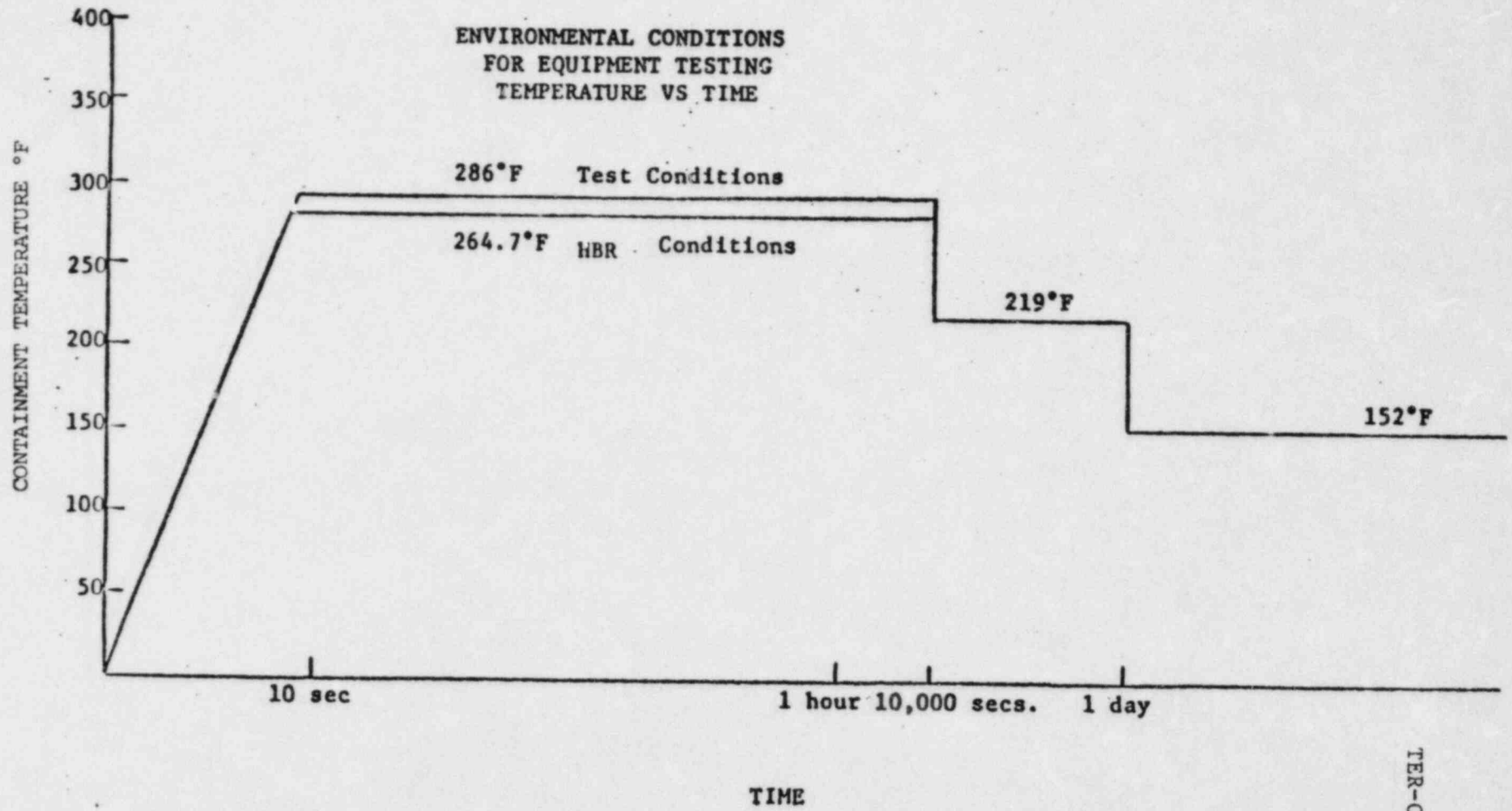


Figure A-2. Containment Temperature vs. Time Following LOCA/MSLB [17]

TER-C5257-511

FIGURE SUPPLIED

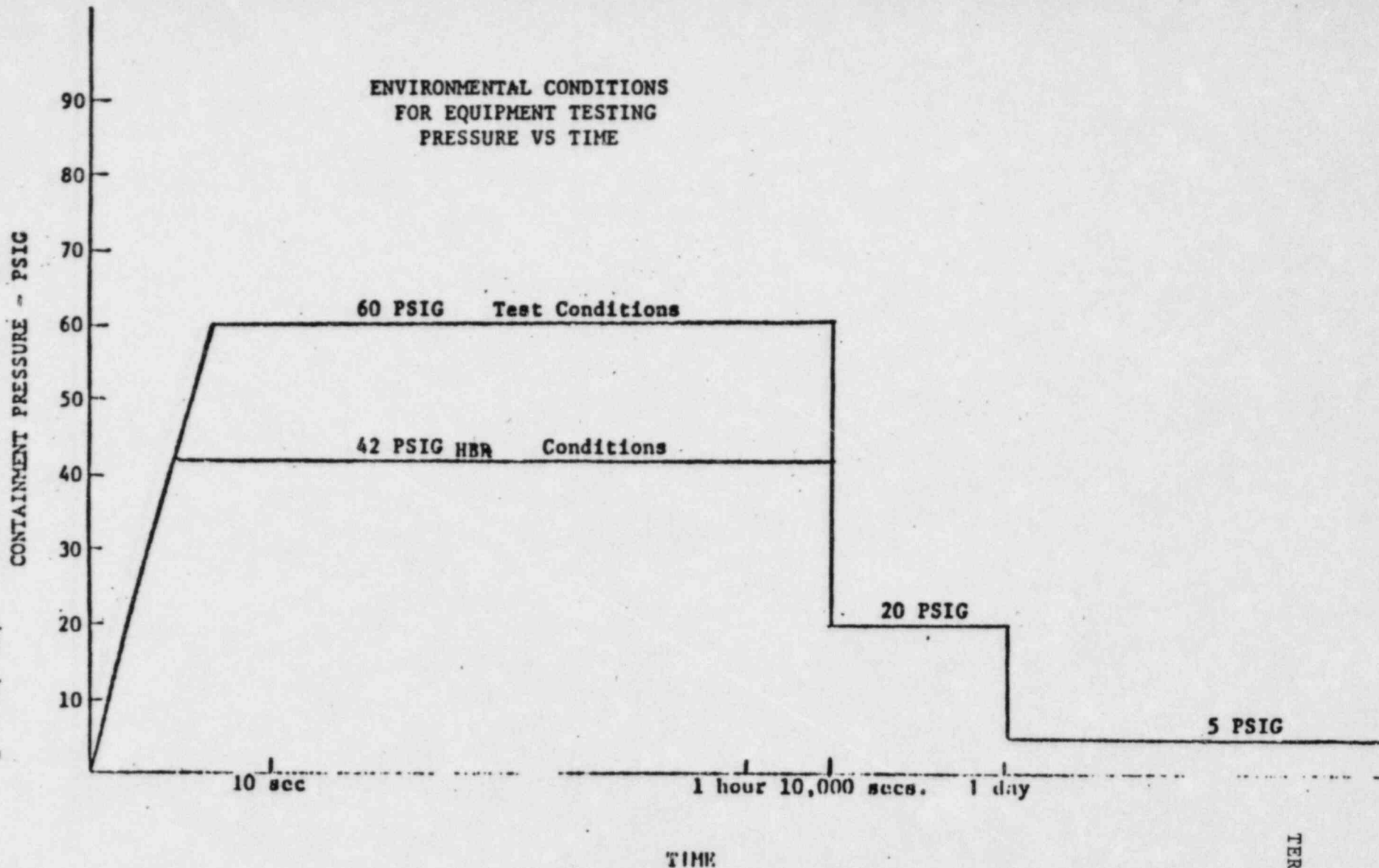
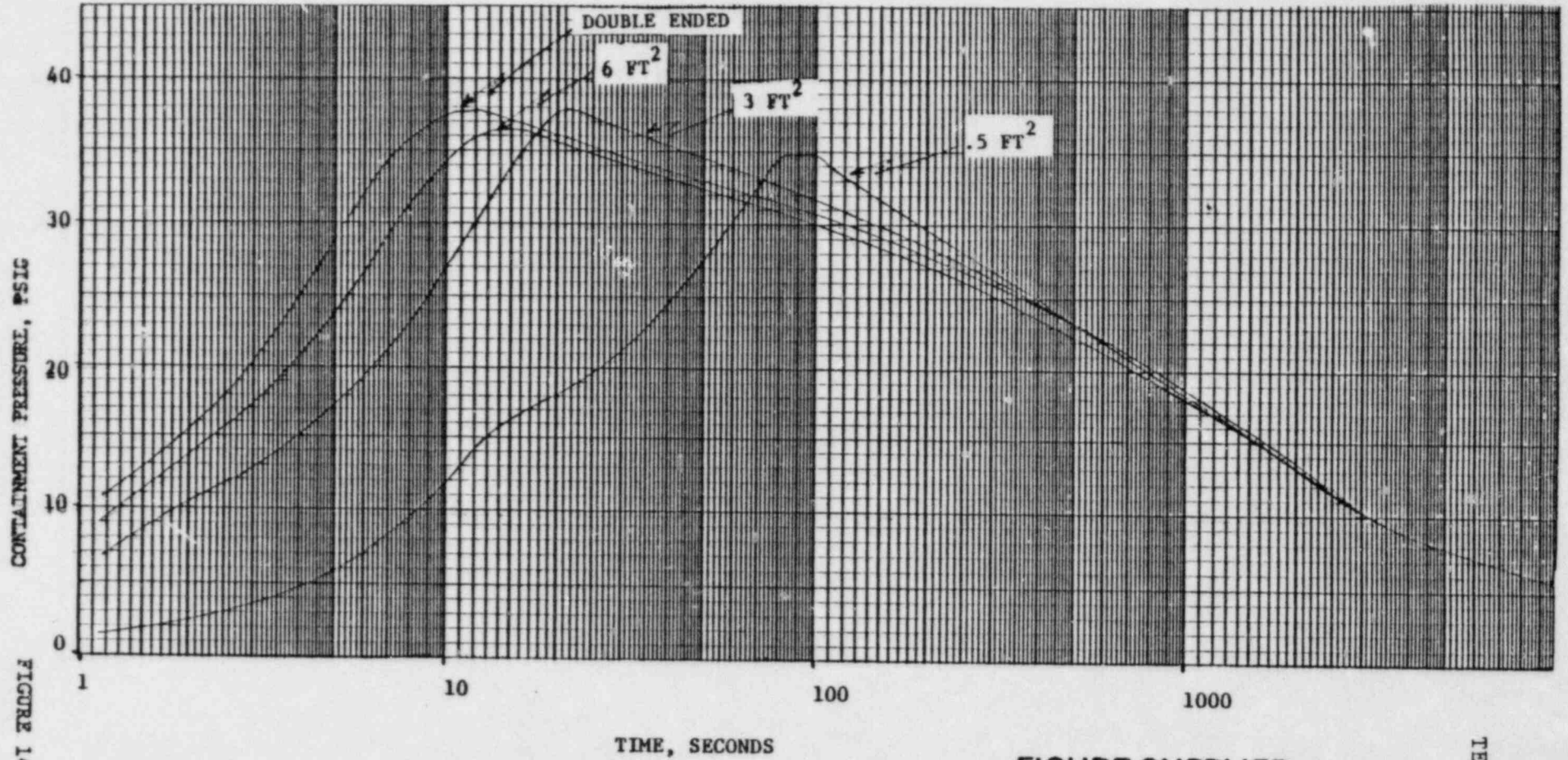


Figure A-3. Containment Pressure vs. Time Following LOCA/MSLB [17]

**FIGURE SUPPLIED  
BY THE LICENSEE**

CONTAINMENT PRESSURE TRANSIENTS  
FOR A RANGE OF BREAK SIZES (MIN. SAFETY FEATURES OPERATING)



A-10

FIGURE 14.3.4-2

FIGURE SUPPLIED  
BY THE LICENSEE

Figure A-4. Containment Pressure Transients [17]

TER-C5257-511



CONTAINMENT CAPABILITY STUDY  
ALL AVAILABLE ENERGY

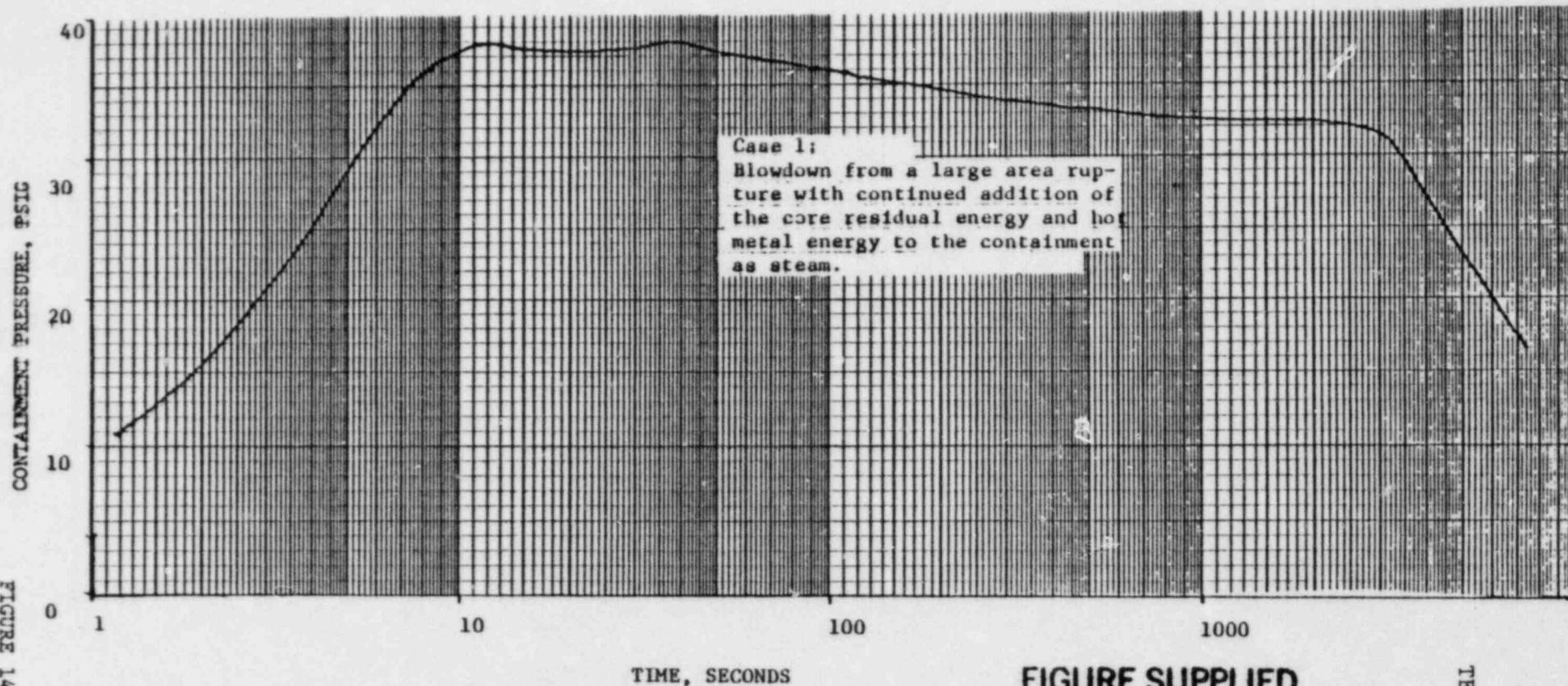


FIGURE 14.3.4-6

FIGURE SUPPLIED  
BY THE LICENSEE

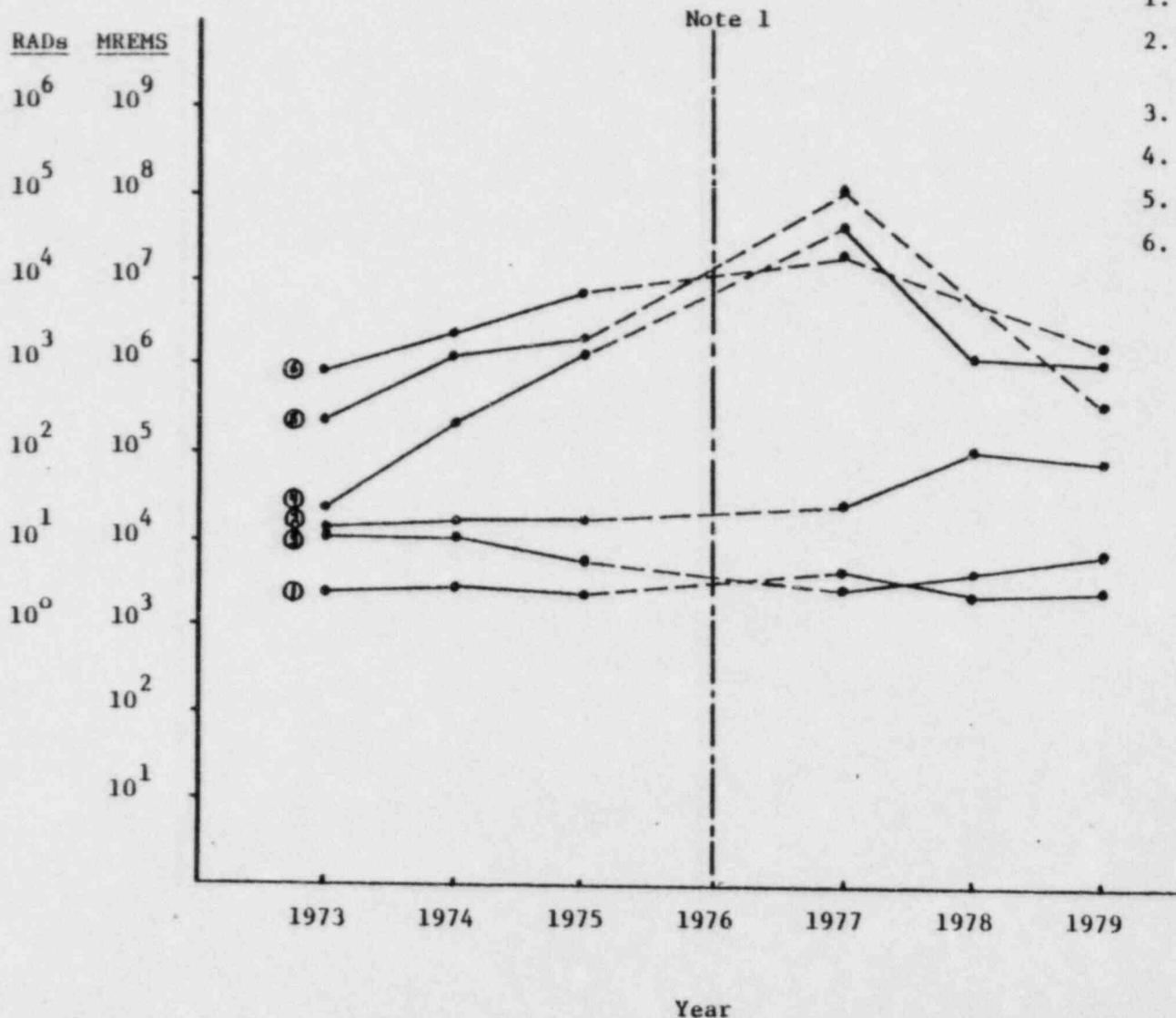
Figure A-5. Containment Pressure (all available energy)

TER-C5257-511

H. B. ROBINSON CONTAINMENT RADIATION LEVEL MEASUREMENTS

Recording Stations

1. CV Operating Deck (pressurizer)
2. CV Lower Level Polar Crane Wall (Regen. Heat Exchanger)
3. CV Second Level - Seal Table Room
4. Reactor Coolant Pump BAY-A
5. Reactor Coolant Pump BAY-B
6. Reactor Coolant Pump BAY-C



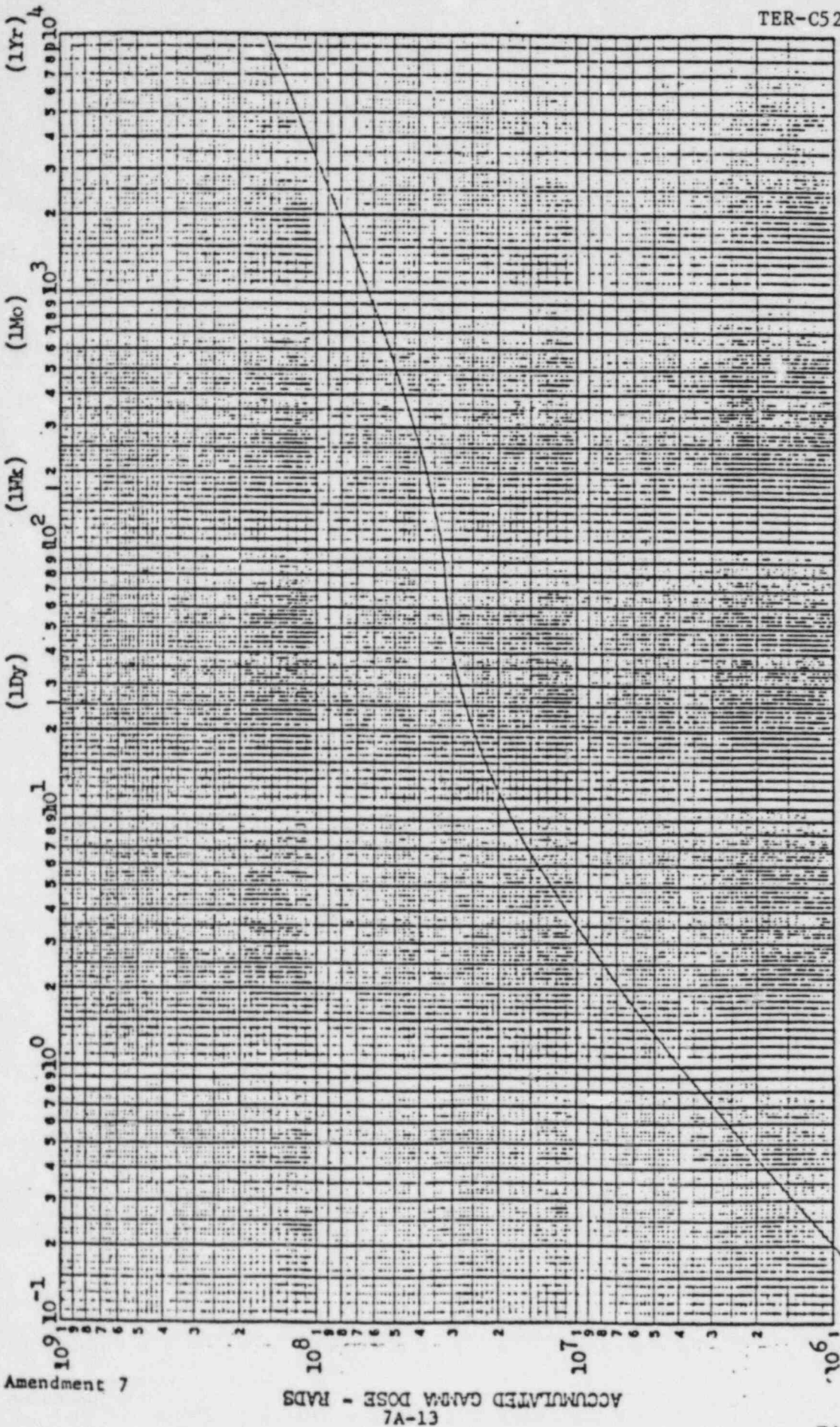
Notes:

1 No data recorded for the year 1976

- Known data
- - -· Extrapolated data

**FIGURE SUPPLIED  
BY THE LICENSEE**

Figure A-6. Containment Radiation Level Measurements



Amendment 7

ACCUMULATED GAMMA DOSE - RADS  
7A-13

Figure A-7. Integrated Gamma Dose Level Inside the Containment as a Function of Time After Release [17]

**FIGURE SUPPLIED  
BY THE LICENSEE**

Figure 3.1.4

TIME AFTER RELEASE - HRS.

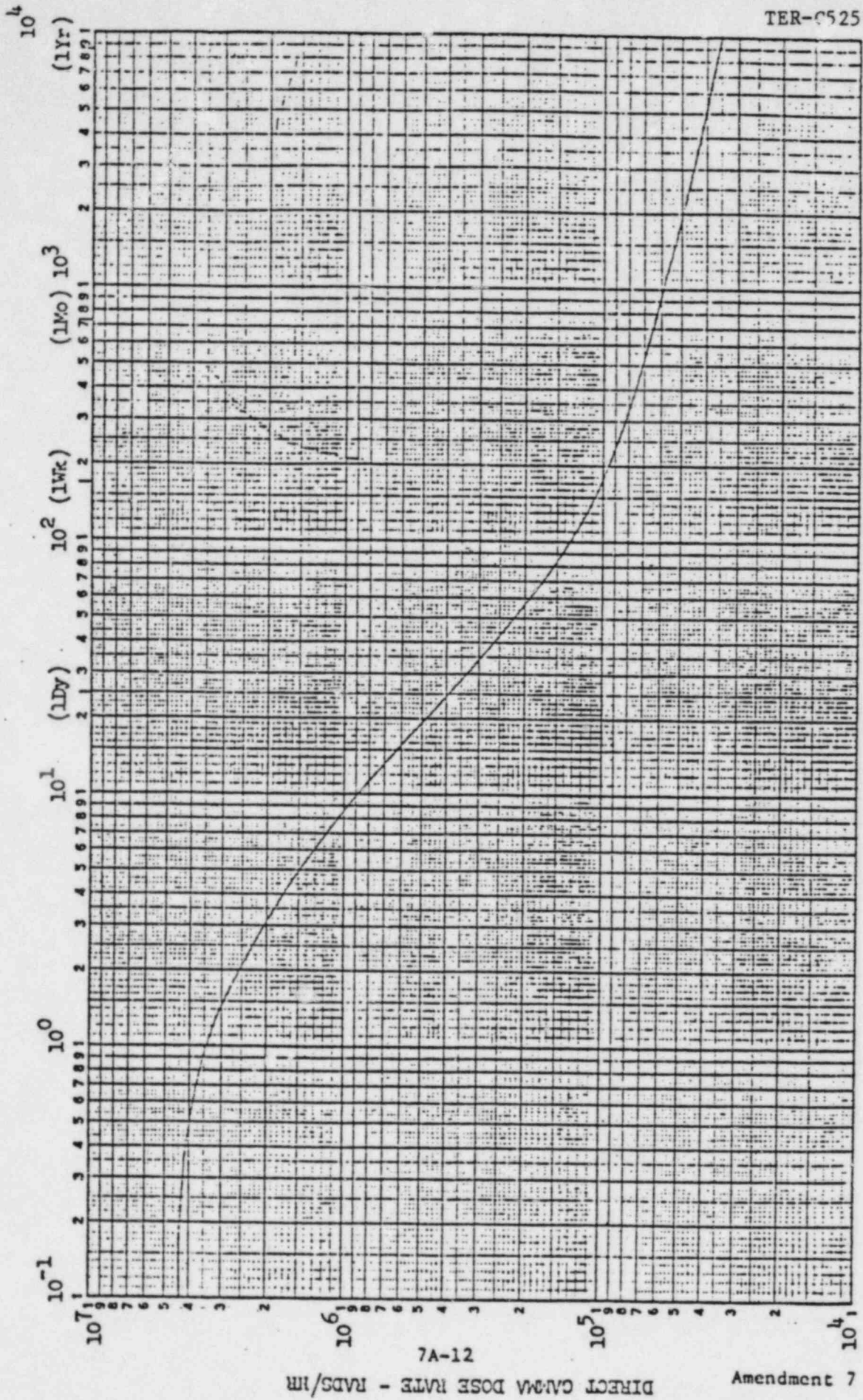


Figure A-8. Instantaneous Gamma Dose Rate Inside the Containment as a Function of Time After Release

FIGURE SUPPLIED BY THE LICENSEE

Table A-1. Equipment Total Radiation Accumulation [17]

EQUIPMENT TOTAL RADIATION ACCUMULATION BY LOCATION  
AND LOCA OPERATING TIME

TER-C5257-511

Component	Location	Level(ft) (Approx.)	Time Of Operation	Radiation Exp. (40 yrs) <sup>(1)</sup>	Accident <sup>(2)</sup> Radiation Exp.	Margin (10%)	Total Anticipated Radiation Exposure
<b>TRANSMITTERS</b>							
FT-444 <sup>(2)</sup>	CV	231.5	30 MIN. <sup>(4)</sup>	$2.3 \times 10^3$	$9.5 \times 10^5$	-	$1.0 \times 10^6$ <sup>(8)</sup>
FT-445 <sup>(2)</sup>	CV	231.5	30 MIN. <sup>(4)</sup>	$2.3 \times 10^3$	$9.5 \times 10^5$	-	$1.0 \times 10^6$ <sup>(8)</sup>
FT-456 <sup>(2)</sup>	CV	231.5	30 MIN. <sup>(4)</sup>	$2.3 \times 10^3$	$9.5 \times 10^5$	-	$1.0 \times 10^6$ <sup>(8)</sup>
FT-457 <sup>(2)</sup>	CV	231.5	30 MIN. <sup>(4)</sup>	$2.3 \times 10^3$	$9.5 \times 10^5$	-	$1.0 \times 10^6$ <sup>(8)</sup>
FT-455	CV	231.5	30 MIN. <sup>(4)</sup>	$2.3 \times 10^3$	$9.5 \times 10^5$	-	$1.0 \times 10^6$ <sup>(8)</sup>
LT-474	CV	233	1 DAY	$2.3 \times 10^3$	$3.5 \times 10^6$	$3.5 \times 10^5$	$3.8 \times 10^6$
LT-475	CV	233	1 DAY	$2.3 \times 10^3$	$3.5 \times 10^6$	$3.5 \times 10^5$	$3.8 \times 10^6$
LT-476	CV	233	1 DAY	$2.3 \times 10^3$	$3.5 \times 10^6$	$3.5 \times 10^5$	$3.8 \times 10^6$
LT-477	CV	233	1 DAY	$2.3 \times 10^3$	$3.5 \times 10^6$	$3.5 \times 10^5$	$3.8 \times 10^6$
LT-484	CV	233	1 DAY	$2.3 \times 10^3$	$3.5 \times 10^6$	$3.5 \times 10^5$	$3.8 \times 10^6$
LT-485	CV	233	1 DAY	$2.3 \times 10^3$	$3.5 \times 10^6$	$3.5 \times 10^5$	$3.8 \times 10^6$
LT-486	CV	233	1 DAY	$2.3 \times 10^3$	$3.5 \times 10^6$	$3.5 \times 10^5$	$3.8 \times 10^6$
LT-487	CV	233	1 DAY	$2.3 \times 10^3$	$3.5 \times 10^6$	$3.5 \times 10^5$	$3.8 \times 10^6$
LT-494	CV	233	1 DAY	$2.3 \times 10^3$	$3.5 \times 10^6$	$3.5 \times 10^5$	$3.8 \times 10^6$
LT-495	CV	233	1 DAY	$2.3 \times 10^3$	$3.5 \times 10^6$	$3.5 \times 10^5$	$3.8 \times 10^6$
LT-496	CV	233	1 DAY	$2.3 \times 10^3$	$3.5 \times 10^6$	$3.5 \times 10^5$	$3.8 \times 10^6$
LT-497	CV	233	1 DAY	$2.3 \times 10^3$	$3.5 \times 10^6$	$3.5 \times 10^5$	$3.8 \times 10^6$
LT-459 <sup>(2)</sup>	CV	230	30 MIN. <sup>(4)</sup>	$2.3 \times 10^3$	$9.5 \times 10^5$	-	$9.5 \times 10^5$
LT-460 <sup>(2)</sup>	CV	230	30 MIN. <sup>(4)</sup>	$2.3 \times 10^3$	$9.5 \times 10^5$	-	$9.5 \times 10^5$
LT-461 <sup>(2)</sup>	CV	230	30 MIN. <sup>(4)</sup>	$2.3 \times 10^3$	$9.5 \times 10^5$	-	$9.5 \times 10^5$
FT-474	CV	231.5	1 DAY	$2.3 \times 10^3$	$3.5 \times 10^6$	$3.5 \times 10^5$	$5.0 \times 10^6$ <sup>(9)</sup>
FT-475	CV	231.5	1 DAY	$2.3 \times 10^3$	$3.5 \times 10^6$	$3.5 \times 10^5$	$5.0 \times 10^6$ <sup>(9)</sup>
FT-484	CV	231.5	1 DAY	$2.3 \times 10^3$	$3.5 \times 10^6$	$3.5 \times 10^5$	$5.0 \times 10^6$ <sup>(9)</sup>
FT-485	CV	231.5	1 DAY	$2.3 \times 10^3$	$3.5 \times 10^6$	$3.5 \times 10^5$	$5.0 \times 10^6$ <sup>(9)</sup>
FT-494	CV	231.5	1 DAY	$2.3 \times 10^3$	$3.5 \times 10^6$	$3.5 \times 10^5$	$5.0 \times 10^6$ <sup>(9)</sup>
FT-495	CV	231.5	1 DAY	$2.3 \times 10^3$	$3.5 \times 10^6$	$3.5 \times 10^5$	$5.0 \times 10^6$ <sup>(9)</sup>
FT-940	RAB	230	30 DAYS	-	$1.0 \times 10^5$ <sup>(6)</sup>	$1.0 \times 10^5$	$1.1 \times 10^6$
FT-943	RAB	230	30 DAYS	-	$1.0 \times 10^5$ <sup>(6)</sup>	$1.0 \times 10^5$	$1.1 \times 10^6$
FT-934	RAB	230	30 DAYS	-	$1.0 \times 10^5$ <sup>(6)</sup>	$1.0 \times 10^5$	$1.1 \times 10^6$
FT-940	RAB	230	30 DAYS	-	$1.0 \times 10^5$ <sup>(6)</sup>	$1.0 \times 10^5$	$1.1 \times 10^6$
FT-943	RAB	230	30 DAYS	-	$1.0 \times 10^5$ <sup>(6)</sup>	$1.0 \times 10^5$	$1.1 \times 10^6$
<b>MOV</b>							
V-866A	CV	241	1 HR.	$2.3 \times 10^3$	$9.5 \times 10^5$	$9.5 \times 10^4$	$1.0 \times 10^6$
V-866B	CV	241	1 HR.	$2.3 \times 10^3$	$9.5 \times 10^5$	$9.5 \times 10^4$	$1.0 \times 10^6$
V869	RAB	241	30 DAYS	-	$1.0 \times 10^6$	$1.0 \times 10^5$	$1.1 \times 10^6$
V-744A	CV	240	5 MIN. <sup>(4)</sup>	$2.3 \times 10^3$	$9.5 \times 10^5$	-	$9.5 \times 10^5$
V-744B	CV	240	5 MIN. <sup>(4)</sup>	$2.3 \times 10^3$	$9.5 \times 10^5$	-	$9.5 \times 10^5$

R1, R2

R1

R2

Table A-1. (Cont.)

EQUIPMENT TOTAL RADIATION ACCUMULATION BY LOCATION  
AND LOCA OPERATING TIME

TER-C5257-511

Component	Location	Level(ft) (Approx.)	Time Of Operation	Radiation Exp. (40 yrs) <sup>(1)</sup>	Accident <sup>(3)</sup> Radiation Exp.	Margin (10%)	Total Anticipated Radiation Exposure
V-860A	RAB	212	30 DAYS	-	$1.0 \times 10^6$	$1.0 \times 10^5$	$1.1 \times 10^6$
V-860B	RAB	212	30 DAYS	-	$1.0 \times 10^6$	$1.0 \times 10^5$	$1.1 \times 10^6$
V-861A	RAB	212	30 DAYS	-	$1.0 \times 10^6$	$1.1 \times 10^5$	$1.1 \times 10^6$
V-861B	RAB	212	30 DAYS	-	$1.0 \times 10^6$	$1.1 \times 10^5$	$1.1 \times 10^6$
V-863A	RAB	212	30 DAYS	-	$1.0 \times 10^6$	$1.1 \times 10^5$	$1.1 \times 10^6$
V-863B	RAB	212	30 DAYS	-	$1.0 \times 10^6$	$1.1 \times 10^5$	$1.1 \times 10^6$
CVC-381	RAB	240	30 DAYS	-	$1.0 \times 10^6$	$1.1 \times 10^5$	$1.1 \times 10^6$
<u>SOLENOIDS</u>							
V12-7	CV	233	5 MIN. <sup>(4)</sup>	$2.3 \times 10^3$	$9.5 \times 10^5$	-	$9.5 \times 10^5$
V12-9	CV	233	5 MIN. <sup>(4)</sup>	$2.3 \times 10^3$	$9.5 \times 10^5$	-	$9.5 \times 10^5$
V12-11	CV	233	5 MIN. <sup>(4)</sup>	$2.3 \times 10^3$	$9.5 \times 10^5$	-	$9.5 \times 10^5$
V12-13	CV	233	5 MIN. <sup>(4)</sup>	$2.3 \times 10^3$	$9.5 \times 10^5$	-	$9.5 \times 10^5$
<u>MOTORS</u>							
HVB-1	CV	275	3 HRS.	$1.9 \times 10^2$	$3.1 \times 10^6$	$3.1 \times 10^5$	$3.4 \times 10^6$
HVB-2	CV	275	3 HRS.	$1.9 \times 10^2$	$3.1 \times 10^6$	$3.1 \times 10^5$	$3.4 \times 10^6$
HVB-3	CV	275	3 HRS.	$1.9 \times 10^2$	$3.1 \times 10^6$	$3.1 \times 10^5$	$3.4 \times 10^6$
HVB-4	CV	275	3 HRS.	$1.9 \times 10^2$	$3.1 \times 10^6$	$3.1 \times 10^5$	$3.4 \times 10^6$
<u>ELECTRICAL PENETRATIONS</u>							
Type 2	CV	234 -246	30 DAYS	$2.3 \times 10^3$	-	-	$1.4 \times 10^7$ <sup>(5)</sup>
<u>TEMPERATURE ELEMENTS</u>							
TE-412B	CV	243	(7)	$1.1 \times 10^6$	-	-	$1.5 \times 10^7$ <sup>(5)</sup>
TE-412D	CV	243	(7)	$1.1 \times 10^6$	-	-	$1.5 \times 10^7$ <sup>(5)</sup>
TE-422B	CV	243	(7)	$1.1 \times 10^6$	-	-	$1.5 \times 10^7$ <sup>(5)</sup>
TE-422D	CV	243	(7)	$1.1 \times 10^6$	-	-	$1.5 \times 10^7$ <sup>(5)</sup>
TE-432B	CV	243	(7)	$1.1 \times 10^6$	-	-	$1.5 \times 10^7$ <sup>(5)</sup>
TE-432D	CV	243	(7)	$1.1 \times 10^6$	-	-	$1.5 \times 10^7$ <sup>(5)</sup>

(1) Extrapolated from plant data (See Table 1.3.1)

(2) Equipment located in instrument cabinets.

(3) Calculation based on IE Bulletin 79-018, Appendix B. CHARTS/GRAPHS, Procedures for Evaluating Gamma Radiation Service Conditions.

(4) Charts/Graphs per IE Bulletin 79-018, Appendix B allow calculation to a minimum of 1 hour exposure. This figure is conservative--no margin required.

(5) Total Integrated Radiation for accident condition (30 days) per IE Bulletin 79-018, Appendix B. CHARTS/GRAPHS.

(6) Calculation based on Accident Radiation figure -  $2 \times 10^7$  RADS.

(7) Not required for DBE--used only for outside containment HSLB protection.

(8) Includes added  $7.9 \times 10^6$  RADS for 1 hour total integrated gamma dose at the surface of containment sump water ( Per Appendix D, Table D-8, NUREG 0538).(9) Includes added  $1.15 \times 10^6$  RADN for 1 day total integrated gamma dose at the surface of containment sump water ( Per Appendix D, Table D-8, NUREG 0538).

R2

Table A-2. Calculated Radiation Accumulation

TABLE 1.3.1

## H. B. ROBINSON CALCULATED RADIATION ACCUMULATION

AREA (1)	YR. ACCUM. (2)	40 YR. ACCUM. (2)	ELEV.(ft)	R1
1. CV Operating Deck (Pressurizer)	$4.8 \times 10^0$	$1.9 \times 10^2$	280	
2. CV Lower Level Polar Crane	$5.7 \times 10^1$	$2.3 \times 10^3$	233	
3. CV Second Level-Seal Table Rm.	$8.5 \times 10^0$	$3.4 \times 10^2$	254	
4. Reactor Coolant Pump - Bay A	$1.1 \times 10^4$	$4.4 \times 10^5$	243	
5. Reactor Coolant Pump - Bay B	$2.8 \times 10^4$	$1.1 \times 10^6$	243	
6. Reactor Coolant Pump - Bay C	$9.6 \times 10^3$	$3.9 \times 10^5$	243	
	$7.2 \times 10^3$ (3)	$2.9 \times 10^5$ (3)		

- (1) See figure 1.3.1 for locations.  
 (2) Calculations in (RADs)  
 (3) Total Containment (Averaged)

TABLE 1.3.2

## REACTOR COOLANT SYSTEM DOSES

LOCATION	DOSE r/hr
PIPE CENTER	820
PIPE ID	470
PIPE OD	200
GENERAL AREA	50

**FIGURE SUPPLIED  
BY THE LICENSEE**

## APPENDIX B - LISTING OF SAFETY-RELATED ELECTRICAL EQUIPMENT

The following table lists the groupings of safety-related electrical equipment items for the H. B. Robinson Unit 2 Nuclear Power Plant. Equipment items provided in the table are used in the detailed equipment environmental qualification evaluation presented in Section 4.4 and summarized in Section 4.2. This table was generated from the lists of equipment provided by the Licensee [15, 20].

The Licensee identified an extensive list of safety-related electrical equipment in various locations of the plant. The equipment listed by the Licensee was analyzed, and all identical equipment located within plant areas that are exposed to the same environmental service conditions was grouped together and designated an "equipment item." In this report, the term "equipment item" refers to a specific type of electrical equipment, designated by manufacturer and model, which is representative of all identical equipment in a plant area exposed to the same environmental service conditions (e.g., Flow Transmitter, Fischer & Porter, Model 10B2496, located within containment). This analysis resulted in a reduced listing of equipment (equipment items) that formed the basis for the review. This appendix contains the tabulation of the equipment items, locations, function, plant identification numbers, required operating time, and applicable qualification documentation references.



EQUIPMENT ITEM NO. 1 (TMI ACTION PLAN ITEM II.E.4.2)  
SOLENOID VALVE LOCATED IN THE REACTOR AUXILIARY BLDG.  
ASCO MODEL LB8320A185  
REQUIRED OPERATING TIME: NOT STATED  
TER CHECKSHEET NO. 1  
LICENSEE REFERENCE(S): 2850  
FUNCTION (PLANT ID): FUNCTION AND PLANT ID NOT STATED  
LICENSEE SUBMITTAL: SCEW(S): 8 OF 15 [15]

EQUIPMENT ITEM NO. 2  
SOLENOID VALVE LOCATED IN THE CONTAINMENT, ELEV. 283'0"  
ASCO MODEL NP831665E  
REQUIRED OPERATING TIME: 5 MINUTES  
TER CHECKSHEET NO. 2  
LICENSEE REFERENCE(S): 40, 649  
FUNCTION (PLANT ID): NOT STATED (V12-7, -9, -11, -13; CVC-200A, B, C)  
LICENSEE SUBMITTAL: SCEW(S): 20 OF 25 [20]

EQUIPMENT ITEM NO. 3  
SOLENOID VALVE LOCATED IN THE CONTAINMENT, ELEV. 283'0"  
ASCO MODEL NP8316E35E  
REQUIRED OPERATING TIME: 5 MINUTES  
TER CHECKSHEET NO. 3  
LICENSEE REFERENCE(S): 40, 649  
FUNCTION (PLANT ID): NOT STATED (V12-7, -9, -11, -13; CVC-200A, B, C)  
LICENSEE SUBMITTAL: SCEW(S): 20 OF 25 [20]

EQUIPMENT ITEM NO. 4  
SOLENOID VALVE LOCATED IN THE CONTAINMENT, ELEV. 283'0"  
ASCO MODEL 2063812U  
REQUIRED OPERATING TIME: 5 MINUTES  
TER CHECKSHEET NO. 4  
LICENSEE REFERENCE(S): 40, 649  
FUNCTION (PLANT ID): NOT STATED (V12-7, -9, -11, -13; CVC-200A, B, C)  
LICENSEE SUBMITTAL: SCEW(S): 20 OF 25 [20]

EQUIPMENT ITEM NO. 5  
MOTORIZED VALVE ACTUATOR LOCATED IN THE CONTAINMENT, ELEV. 241'0"  
LIMITORQUE MODEL SMBOO WITH PEERLESS MOTOR, CLASS B INSULATION  
REQUIRED OPERATING TIME: 1 HOUR  
TER CHECKSHEET NO. 5  
LICENSEE REFERENCE(S): 637, 639  
FUNCTION (PLANT ID): ACTUATES HOT LEG INJECTION VALVES (V-866A, B)  
LICENSEE SUBMITTAL: SCEW(S): 6 OF 25 [20]

## EQUIPMENT ITEM NO. 6

MOTORIZED VALVE ACTUATOR LOCATED IN THE CONTAINMENT, ELEV. 245'  
 LIMITORQUE MODEL SMB3 WITH RELIANCE MOTOR, CLASS H INSULATION; MOTOR BRAKE,  
 CLASS B INSULATION  
 REQUIRED OPERATING TIME: 5 MINUTES  
 TER CHECKSHEET NO. 6  
 LICENSEE REFERENCE(S): 637, 639  
 FUNCTION (PLANT ID): ACTUATES REACTOR CORE DELUGE VALVES (V-744A, B)  
 LICENSEE SUBMITTAL: SCEW(S): 9 OF 25 [20]

## EQUIPMENT ITEM NO. 7

MOTORIZED VALVE ACTUATOR LOCATED IN THE REACTOR AUXILIARY BLDG.  
 LIMITORQUE MODEL SMB00  
 REQUIRED OPERATING TIME: NOT STATED  
 TER CHECKSHEET NO. 7  
 LICENSEE REFERENCE(S): 637, 639  
 FUNCTION (PLANT ID): ACTUATES HOT LEG INJECTION BORON INJECTION VALVE (V869)  
 LICENSEE SUBMITTAL: SCEW(S): 7 OF 25 [20]  
 FUNCTION (PLANT ID): ACTUATES RHR DISCHARGE TO SI SPRAY SYSTEM VALVES  
 (V863A, B)  
 LICENSEE SUBMITTAL: SCEW(S): 12 OF 25 [20]  
 FUNCTION (PLANT ID): ACTUATES REACTOR COOLANT PUMP SEAL WATER RETURN VALVE  
 (CVC-381)  
 LICENSEE SUBMITTAL: SCEW(S): 23 OF 25 [20]

## EQUIPMENT ITEM NO. 8

MOTORIZED VALVE ACTUATOR LOCATED IN THE REACTOR AUXILIARY BLDG.  
 LIMITORQUE MODEL SMB1  
 REQUIRED OPERATING TIME: NOT STATED  
 TER CHECKSHEET NO. 8  
 LICENSEE REFERENCE(S): 637, 639  
 FUNCTION (PLANT ID): ACTUATES CV SUMP TO RHR SUCTION VALVES (V860A, B)  
 LICENSEE SUBMITTAL: SCEW(S): 10 OF 25 [20]  
 FUNCTION (PLANT ID): ACTUATES CV SUMP TO RHR SUCTION VALVES (V861A, B)  
 LICENSEE SUBMITTAL: SCEW(S): 11 OF 25 [20]

## EQUIPMENT ITEM NO. 9

FLOW TRANSMITTER LOCATED IN THE REACTOR AUXILIARY BLDG.  
 FISCHER AND PORTER MODEL 10B2496PBBABBB  
 REQUIRED OPERATING TIME: 30 DAYS  
 TER CHECKSHEET NO. 9  
 LICENSEE REFERENCE(S): 637, 639  
 FUNCTION (PLANT ID): MONITORS SAFETY INJECTION HEADER HOT LEG FLOW (FT-94C)  
 LICENSEE SUBMITTAL: SCEW(S): 1 OF 25 [20]  
 FUNCTION (PLANT ID): MONITORS SAFETY INJECTION HEADER HOT LEG FLOW (FT-943)  
 LICENSEE SUBMITTAL: SCEW(S): 2 OF 25 [20]

EQUIPMENT ITEM NO. 10  
 PRESSURE TRANSMITTER LOCATED IN THE REACTOR AUXILIARY BLDG.  
 FISCHER AND PORTER MODEL 50EP1041BCXA  
 REQUIRED OPERATING TIME: 30 DAYS  
 TER CHECKSHEET NO. 10  
 LICENSEE REFERENCE(S): 637, 639  
 FUNCTION (PLANT ID): BOPON INJECTION TANK HEADER PRESSURE (PT-934)  
 LICENSEE SUBMITTAL: SCEW(S): 3 OF 25 [20]  
 FUNCTION (PLANT ID): SAFETY INJECTION TANK HEADER PRESSURE (PT-943)  
 LICENSEE SUBMITTAL: SCEW(S): 5 OF 25 [20]

EQUIPMENT ITEM NO. 11  
 PRESSURE TRANSMITTER LOCATED IN THE REACTOR AUXILIARY BLDG.  
 FISCHER AND PORTER MODEL 50EP1041  
 REQUIRED OPERATING TIME: 30 DAYS  
 TER CHECKSHEET NO. 11  
 LICENSEE REFERENCE(S): 637, 639  
 FUNCTION (PLANT ID): SAFETY INJECTION HOT LEG HEADER PRESSURE (PT-940)  
 LICENSEE SUBMITTAL: SCEW(S): 4 OF 25 [20]

EQUIPMENT ITEM NO. 12  
 PRESSURE TRANSMITTER LOCATED IN THE CONTAINMENT  
 ROSEMOUNT MODEL 1153A  
 REQUIRED OPERATING TIME: 30 MIN (TABLE 1.3.3)  
 TER CHECKSHEET NO. 12  
 LICENSEE REFERENCE(S): 1764, 4423  
 FUNCTION (PLANT ID): PRESSURIZER PRESSURE CONTROL SIGNAL (PT-444)  
 FUNCTION (PLANT ID): PRESSURIZER PRESSURE SIGNAL FOR SIS INITIATION (PT-455)  
 FUNCTION (PLANT ID): FUNCTION NOT STATED (PT-445, -456, -457)  
 LICENSEE SUBMITTAL: SCEW(S): 19 OF 25 [20]

EQUIPMENT ITEM NO. 13  
 LEVEL TRANSMITTER LOCATED IN THE CONTAINMENT  
 ROSEMOUNT MODEL 1153A  
 REQUIRED OPERATING TIME: 30 MIN  
 TER CHECKSHEET NO. 13  
 LICENSEE REFERENCE(S): 1764, 4423  
 FUNCTION (PLANT ID): NOT STATED (LT-475, -476, -485, -486, -495, -496, -497)  
 FUNCTION (PLANT ID): MONITORS STEAM GENERATOR A NARROW RANGE LEVEL (LT-474)  
 FUNCTION (PLANT ID): MONITORS STEAM GENERATOR A WIDE RANGE LEVEL (LT-477)  
 FUNCTION (PLANT ID): MONITORS STEAM GENERATOR B NARROW RANGE LEVEL (LT-484)  
 FUNCTION (PLANT ID): MONITORS STEAM GENERATOR B WIDE RANGE LEVEL (LT-487)  
 FUNCTION (PLANT ID): MONITORS STEAM GENERATOR C NARROW RANGE LEVEL (LT-494)  
 FUNCTION (PLANT ID): MONITORS STEAM GENERATOR C WIDE RANGE LEVEL (LT-491)  
 FUNCTION (PLANT ID): MONITORS PRESSURIZER LEVEL AND ACTUATES SIS (LT-459, -460, -51)  
 LICENSEE SUBMITTAL: SCEW(S): 19 OF 25 [20]

EQUIPMENT ITEM NO. 14  
FLOW TRANSMITTER LOCATED IN THE CONTAINMENT  
ROSEMOUNT MODEL 1153A  
REQUIRED OPERATING TIME: 1 HOUR TO 1 DAY  
TER CHECKSHEET NO. 14  
LICENSEE REFERENCE(S): 1764, 4423  
FUNCTION (PLANT ID): MONITORS MAIN STEAM FLOW LOOP A (FT-474, -475)  
FUNCTION (PLANT ID): MONITORS MAIN STEAM FLOW LOOP B (FT-484, -485)  
FUNCTION (PLANT ID): MONITORS MAIN STEAM FLOW LOOP C (FT-494, -495)  
LICENSEE SUBMITTAL: SCEW(S): 19 OF 25 [20]

EQUIPMENT ITEM NO. 15 (TMI ACTION PLAN ITEM II.F.2)  
PRESSURE TRANSMITTER LOCATED IN THE CONTAINMENT  
ROSEMOUNT MODEL 1153GA9  
REQUIRED OPERATING TIME: NOT STATED  
TER CHECKSHEET NO. 15  
LICENSEE REFERENCE(S): 1764, 4423  
FUNCTION (PLANT ID): DETECTION OF INADEQUATE CORE COOLING (PT-500, -501)  
LICENSEE SUBMITTAL: SCEW(S): 6 OF 15 [15]

EQUIPMENT ITEM NO. 16 (TMI ACTION PLAN ITEM II.F.1.5)  
LEVEL TRANSMITTER LOCATED IN THE CONTAINMENT  
GEMS MODEL XM52495  
REQUIRED OPERATING TIME: NOT STATED  
TER CHECKSHEET NO. 16  
LICENSEE REFERENCE(S): 1887  
FUNCTION (PLANT ID): CONTAINMENT SUMP WATER LEVEL (LT-801A, B, C, D)  
LICENSEE SUBMITTAL: SCEW(S): 12 of 15 [15]

EQUIPMENT ITEM NO. 17  
LEVEL TRANSMITTER LOCATED IN THE CONTAINMENT  
GEMS MODEL XM36495  
REQUIRED OPERATING TIME: NOT STATED  
TER CHECKSHEET NO. 17  
LICENSEE REFERENCE(S): 1887  
FUNCTION (PLANT ID): CONTAINMENT SUMP WATER LEVEL (LT-802A, B, C, D)  
LICENSEE SUBMITTAL: SCEW(S): 13 of 15 [15]

EQUIPMENT ITEM NO. 18  
TEMPERATURE ELEMENT LOCATED IN THE CONTAINMENT, ELEV. 243'0"  
ROSEMOUNT MODEL 176KF  
REQUIRED OPERATING TIME: 1 HOUR  
TER CHECKSHEET NO. 18  
LICENSEE REFERENCE(S): 687  
FUNCTION (PLANT ID): MAIN STEAM LINE BREAK DETECTION, LOOP 1 (TE-412B, D)  
LICENSEE SUBMITTAL: SCEW(S): 14 OF 25 [20]  
FUNCTION (PLANT ID): MAIN STEAM LINE BREAK DETECTION, LOOP 2 (TE-422B, D)  
LICENSEE SUBMITTAL: SCEW(S): 15 OF 25 [20]  
FUNCTION (PLANT ID): MAIN STEAM LINE BREAK DETECTION, LOOP 3 (TE-432B, D)  
LICENSEE SUBMITTAL: SCEW(S): 16 OF 25 [20]

EQUIPMENT ITEM NO. 19  
LEVEL SWITCH LOCATED IN THE CONTAINMENT, ELEV. 228'0"  
MADISON MODEL 5602  
REQUIRED OPERATING TIME: CONTINUOUS  
TER CHECKSHEET NO. 19  
LICENSEE REFERENCE(S): NOT CITED  
FUNCTION (PLANT ID): CONTAINMENT SUMP WATER LEVEL MEASUREMENT (LS-1925A, B)  
LICENSEE SUBMITTAL: SCEW(S): 8 OF 25 [20]

EQUIPMENT ITEM NO. 20 (TMI ACTION PLAN ITEM II.D.3)  
ACCELEROMETER LOCATED IN THE CONTAINMENT  
ENDEVCO MODEL 2273AM20  
REQUIRED OPERATING TIME: NOT STATED  
TER CHECKSHEET NO. 20  
LICENSEE REFERENCE(S): 1596  
FUNCTION (PLANT ID): NOT STATED (A, B, C)  
LICENSEE SUBMITTAL: SCEW(S): 2 OF 15 [15]

EQUIPMENT ITEM NO. 21 (TMI ACTION PLAN ITEM II.D.3)  
AMPLIFIER LOCATED IN THE CONTAINMENT  
UNHOLTZ-DICKIE MODEL 22CA2TR  
REQUIRED OPERATING TIME: NOT STATED  
TER CHECKSHEET NO. 21  
LICENSEE REFERENCE(S): 1596  
FUNCTION (PLANT ID): NOT STATED (A, B, C)  
LICENSEE SUBMITTAL: SCEW(S): 3 OF 15 [15]

EQUIPMENT ITEM NO. 22  
ELECTRIC MOTOR LOCATED IN THE REACTOR AUXILIARY BLDG.  
WESTINGHOUSE MODEL 506UPZ  
REQUIRED OPERATING TIME: CONTINUOUS  
TER CHECKSHEET NO. 22  
LICENSEE REFERENCE(S): 606, 3184  
FUNCTION (PLANT ID): DRIVES RHR PUMP - SIS (RHR-A, B)  
LICENSEE SUBMITTAL: SCEW(S): 13 OF 25 [20]

EQUIPMENT ITEM NO. 23  
ELECTRIC MOTOR LOCATED IN THE CONTAINMENT, ELEV. 275'0"  
WESTINGHOUSE MODEL 685.5S  
REQUIRED OPERATING TIME: 3 HOURS  
TER CHECKSHEET NO. 23  
LICENSEE REFERENCE(S): 639, 640  
FUNCTION (PLANT ID): DRIVES CONTAINMENT FAN COOLER (HVH-1, -2, -3, -4)  
LICENSEE SUBMITTAL: SCEW(S): 17 OF 25 [20]

EQUIPMENT ITEM NO. 24  
ELECTRICAL PENETRATION LOCATED IN THE CONTAINMENT, ELEV. 234'-246'  
CROUSE-HINDS MODELS 1.2.2 (745), 1.2.2 (747), 1.2.4 (749), 1.2.5 (751)  
REQUIRED OPERATING TIME: CONTINUOUS  
TER CHECKSHEET NO. 24  
LICENSEE REFERENCE(S): 25, 2096  
FUNCTION (PLANT ID): ELECTRICAL DISTRIBUTION (B-1, -2, -5, -9; C-1, -2, -3,  
-4, -6, -8, -9; D-1, -2, -3, -5, -8, -9)  
LICENSEE SUBMITTAL: SCEW(S): 18 OF 25 [20]

EQUIPMENT ITEM NO. 25  
ELECTRICAL CABLE LOCATED IN THE CONTAINMENT  
CONTINENTAL WIRE AND CABLE MODEL CC2115  
REQUIRED OPERATING TIME: CONTINUOUS  
TER CHECKSHEET NO. 25  
LICENSEE REFERENCE(S): 2818  
FUNCTION (PLANT ID): INSTRUMENTATION CABLE  
LICENSEE SUBMITTAL: SCEW(S): 21 OF 25 [20]

EQUIPMENT ITEM NO. 26  
ELECTRICAL CABLE LOCATED IN THE CONTAINMENT  
KERITE MODEL HIGH TEMPERATURE, FIRE RESISTANT  
REQUIRED OPERATING TIME: CONTINUOUS  
TER CHECKSHEET NO. 26  
LICENSEE REFERENCE(S): 27, 4281, 4282  
FUNCTION (PLANT ID): CONTROL AND LOW POWER CABLE  
LICENSEE SUBMITTAL: SCEW(S): 22 OF 25 [20]

EQUIPMENT ITEM NO. 27 (TMI ACTION PLAN ITEM-ALL)  
ELECTRICAL CABLE LOCATED IN THE CONTAINMENT  
ROCKBESTOS, MODEL NOT STATED  
REQUIRED OPERATING TIME: NOT STATED  
TER CHECKSHEET NO. 27  
LICENSEE REFERENCE(S): 1391  
FUNCTION (PLANT ID): ELECTRICAL DISTRIBUTION, TMI EQUIPMENT  
LICENSEE SUBMITTAL: SCEW(S): 14 OF 15 [15]

EQUIPMENT ITEM NO. 28 (TMI ACTION PLAN ITEM-ALL)  
ELECTRICAL CABLE LOCATED IN THE REACTOR AUXILIARY BLDG.  
ROCKBESTOS, MODEL NOT STATED  
REQUIRED OPERATING TIME: NOT STATED  
TER CHECKSHEET NO. 28  
LICENSEE REFERENCE(S): 1391  
FUNCTION (PLANT ID): ELECTRICAL DISTRIBUTION, TMI EQUIPMENT  
LICENSEE SUBMITTAL: SCEW(S): 14 OF 15 [15]

EQUIPMENT ITEM NO. 29 (TMI ACTION PLAN ITEM-ALL)  
ELECTRICAL CABLE LOCATED IN THE CONTAINMENT  
SAMUEL MOORE, THERMOCOUPLE EXTENSION  
REQUIRED OPERATING TIME: NOT STATED  
TER CHECKSHEET NO. 29  
LICENSEE REFERENCE(S): 677  
FUNCTION (PLANT ID): ELECTRICAL DISTRIBUTION, TMI EQUIPMENT  
LICENSEE SUBMITTAL: SCEW(S): 15 OF 15 [15]

EQUIPMENT ITEM NO. 30  
ELECTRICAL CABLE SPLICE LOCATED IN THE CONTAINMENT, ELEV. 234'-246'  
RAYCHEM, MODEL NOT STATED  
REQUIRED OPERATING TIME: CONTINUOUS  
TER CHECKSHEET NO. 30  
LICENSEE REFERENCE(S): 815  
FUNCTION (PLANT ID): SINGLE CONDUCTOR AND MULTICONDUCTOR CABLE SPLICING  
LICENSEE SUBMITTAL: SCEW(S): 24 OF 25 [20]

EQUIPMENT ITEM NO. 31  
ELECTRICAL CONNECTOR LOCATED IN THE CONTAINMENT, ELEV. 234'-246'  
AMP MODEL 535481, WIRE SIZE 16  
REQUIRED OPERATING TIME: CONTINUOUS  
TER CHECKSHEET NO. 31  
LICENSEE REFERENCE(S): 2068  
FUNCTION (PLANT ID): CONDUCTOR BUTT SPLICE  
LICENSEE SUBMITTAL: SCEW(S): 25 OF 25 [20]

TER-C5257-511

EQUIPMENT ITEM NO. 32  
ELECTRICAL TAPE LOCATED IN THE CONTAINMENT  
3M/ELECTRO PRODUCTS MODEL SCOTCH 70 (SILICON RUBBER)  
REQUIRED OPERATING TIME: CONTINUOUS  
TER CHECKSHEET NO. 32  
LICENSEE REFERENCE(S): NOT CITED  
FUNCTION (PLANT ID): CABLE TERMINATION PROTECTION  
LICENSEE SUBMITTAL: SCEW(S): 25A OF 25 [20]



## APPENDIX C - PLANT SAFETY-RELATED SYSTEMS AND DISPLAY INSTRUMENTATION

## C.1 LIST OF SAFETY-RELATED SYSTEMS

In accordance with IE Bulletin 79-01B or NUREG-0588, the Licensee was required to (1) establish a list of systems and equipment required to mitigate the consequences of a loss-of-coolant accident (LOCA) and a high energy line break (HELB) and (2) identify components needed to perform the functions of safety-related display information, post-accident sampling and monitoring, and radiation monitoring.

The list of safety-related systems provided by the Licensee was reviewed by the NRC staff against a staff-developed master list. The NRC staff had developed a generic master list based upon a review of plant safety analyses and emergency procedures. 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 instrumentation selected included that needed to monitor overall plant performance as well as to monitor the performance of systems on the list.

Based upon information in the Licensee's submittal, the equipment location references, and in some cases conversations with the Licensee, the NRC staff verified that the systems included in the Licensee's submittal were 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 surrounding environment. With the exception of items deferred for later review (cold-shutdown equipment and TMI Lessons-Learned modifications), the staff concluded that the systems identified by the Licensee were acceptable. The list of systems identified by the Licensee and accepted by the NRC staff is reproduced in this appendix.

<u>Function</u>	<u>System<sup>1</sup></u>
Emergency Reactor Shutdown	Reactor Protection
	Engineered Safeguards Actuation
	Chemical and Volume Control
	Reactor Coolant
Containment Isolation	Main and Auxiliary Steam
	Main and Auxiliary Feedwater
	Containment Ventilation
	Chemical and Volume Control
	Safety Injection
	Residual Heat Removal
	Cooling Water
	Intake Cooling Water
Reactor Core Cooling	Safety Injection System
Containment Heat Removal	Containment Spray
	Containment Air Recirculation
Core Residual Heat Removal	Residual Heat Removal
	Main Feedwater
	Auxiliary Feedwater
	Main Steam
	Safety Injection
	Cooling Water

1. The NRC staff recognized that there are differences in nomenclature of systems because of plant vintage and engineering design; consequently, some systems performing identical or similar functions may have different names. In those instances it was necessary to verify the function of the system(s) with the responsible IE regional reviewer and/or the licensee.

<u>Function</u>	<u>System<sup>1</sup></u>
Prevention of Significant Release of Radioactive Material to Environment	Containment Air Purification <sup>2</sup>
	Containment Combustible Gas Control <sup>2</sup>
	Post-Accident Sampling and Monitoring
Supporting Systems	Emergency Power
	HVAC

## C.2 SAFETY-RELATED INSTRUMENTATION

In Section 3.1 of the NRC SER [16], the NRC made the following statement:

"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."

In Reference 20, the Licensee provided the following response:

"The reference to display instrumentation requirements within the SER appears to limit the current need to instrumentation within the harsh environment and/or as mentioned in the LOCA or HELB emergency procedures. Instrumentation within harsh environment would be limited to those transmitters, switches, and RTD's already reported on SCEWS."

2. Covered as part of TMI-2 Lessons Learned.

At present, CP&L is to develop new Emergency Instructions incorporating TMI emergency guidelines as part of a TMI action item requirement. These new instructions are scheduled for 1983 implementation. When reviewed and accepted for plant operational use, they will be reviewed for components and display instrumentation within plant harsh environment. If new instrumentation is required to meet these emergency procedures or if additional instrumentation is referenced by these procedures, a list will be compiled and SCEW's provided to the NRC."

### Evaluation

The Licensee states that instrumentation within the harsh environment is already reported on SCEWS. If new instrumentation is referenced in emergency procedures being rewritten for 1983 implementation, these instruments will be identified to the NRC. It is considered that the Licensee has responded to the concern identified in the SER.

At the same time, a review of the SCEWS for these instruments reveals that the specified operating times for several key instruments are too short. For example, pressurizer pressure transmitters have required operating times of 1 hour to 1 day. A further review of the SCEWS does not reveal any RCS pressure transmitter which will be available for long-term monitoring of reactor coolant system pressure. Additionally, the Licensee states that steam generator level transmitters are required to operate for only 30 minutes. While these transmitters are not necessarily required for long-term monitoring, these operating times are not consistent with the general requirements for achieving long-term shutdown cooling modes and do not adequately reflect the potential need to remain in a hot-shutdown condition for an interim period before reaching a stable long-term cooling condition.

In order to ensure that environmental qualification has been satisfactorily addressed with regard to safety-related display instruments, the Licensee should (1) ensure that RCS pressure indication is provided which is qualified for long-term monitoring and (2) ensure that steam generator wide-range and pressurizer level monitoring instruments are provided which will adequately perform their functions throughout the period when they would reasonably be expected to operate.

APPENDIX D - REVIEW OF LICENSEE'S RESPONSE TO NRC EEQ  
SER CONCERNING JUSTIFICATION FOR INTERIM OPERATION

## 1. BACKGROUND

The NRC Safety Evaluation Report (SER) concerning equipment environmental qualification (EEQ) states [16]:

"Subsection 4.2 identified deficiencies that must be resolved to establish the qualification of the equipment; the staff requires that the information lacking in this category be provided within 90 days of receipt of this SER. Within this period, the licensee should either provide documentation of the missing qualification information which demonstrates that such equipment meets the DOR guidelines or NUREG-0588 or commit to a corrective action (requalification, replacement, relocation, and so forth) consistent with the requirements to establish qualification by June 30, 1982. If the latter option is chosen, the licensee must provide justification for operation until such corrective action is complete."

On January 19, 1982, FRC representatives met with NRC Division of Licensing personnel at NRC offices to discuss the potential for FRC to assist the staff in the technical review of licensees' statements regarding justification for interim plant operation submitted in response to outstanding qualification deficiencies in the NRC EEQ SERs. The results of the meeting were as follows: (1) FRC was requested to proceed immediately with the technical review of licensees' justification for interim operation, (2) the format was established, and (3) the criteria for the review were established. These criteria are presented in Section 2 of this appendix.

On January 21, 1982, the NRC provided the following modification to Final Assignment 13 concerning this subject:

"The FRC review will consist of:

- o Review the licensee's justification of interim operation and provide FRC independent analysis which shows whether or not licensee provided technically sound rationale as a basis for justification for continued plant operation.

- o On January 27, 1982, FRC shall provide a list of those power reactors that have provided technically sound justification for continued operation. FRC shall also provide a list of those power reactors which have not provided technically sound justification for continued operation. In addition to the lists, FRC may provide any additional information which in FRC's judgment is necessary to support the conclusions regarding justification for continued operation."

On January 25, 1982, the NRC was provided with the completed review of the licensees' statements presented as a basis for justification for interim operation in response to the NRC EEQ SER.\* On February 5, 1982, at the NRC's request, the NRC was provided with actual examples of licensees' responses to the NRC EEQ SER that provide adequate rationale as a basis for justification for interim operation.\*\*

## 2. GENERAL DISCUSSION

In general, licensee-submitted justifications for interim operation are based on systems considerations, equipment operability evaluations, or failure-modes-and-effects analyses.

Systems considerations often involve the availability of backup equipment capable of performing the particular safety function of concern. The backup equipment is either environmentally qualified, unqualified but not exposed to a harsh environment at the same time as the primary equipment, or located so that it is unlikely that both the primary and backup equipment would be simultaneously exposed to a severe environment. In general, these systems discussions should consider (1) the possibility of a single-active failure

---

\* C. J. Crane

Letter to R. A. Clark, NRC. Subject: Transmittal of FRC Review of Licensees' Responses to NRC EEQ SER Concerning Justification for Interim Operation  
FRC, 25-Jan-82

\*\* C. J. Crane

Letter to R. A. Clark, NRC. Subject: Transmittal of Actual Examples of Licensees' Responses to NRC EEQ SER Which Provide Adequate Rationale as a Basis for Justification of Interim Operation  
FRC, 5-Feb-82

disabling the backup equipment, (2) any major differences in the characteristics of the primary and backup equipment (unless it is obvious that the equipment is essentially identical), (3) the possibility of electrical failure of the primary equipment causing an adverse effect on other safety-related equipment or power supplies, and (4) in the case of display instrumentation, the possibility of an operator being misled by the failed primary equipment. Where equipment has not been demonstrated to be qualified, some justifications discuss administrative procedures or revised operating procedures in effect. Depending upon the specific equipment involved, each of the above considerations need not be discussed in every instance, but, in general, a complete systems discussion would consider the above points.

Where equipment qualification evaluations were used, licensees generally (1) received additional information from manufacturers, (2) applied engineering judgment, (3) performed material analysis, and/or (4) used partial test data in support of the original qualification documentation. Where these evaluations were performed, the licensees determined that, although full qualification was not documented, there was sufficient evidence to suggest that the equipment would perform its intended safety function, thereby justifying interim operation until qualified equipment is installed.

Some licensees provided detailed failure-modes-and-effects analyses of electrical circuitry to demonstrate that, under all identified failure modes, the safety function of the equipment could still be accomplished.

Other justifications involved a combination of qualification information and systems information. For example, if a licensee has qualification information (such as a generic test report or other partial qualification documentation) that tends to confirm the ability of the equipment to remain operable for a specified period of time, justification for interim operation often was based upon a discussion of the required safety function being performed prior to the potential failure. This type of discussion often applies to equipment which performs a short-term trip or isolation function in the early stages of an accident.

3. PLANT-SPECIFIC REVIEW

As a result of the review, this plant was evaluated and the results documented on the "Summary of Review of Licensee's 90-Day Response" form reproduced below:

"EQUIPMENT ENVIRONMENTAL QUALIFICATION (EEQ)  
Review of Licensees' Resolution of Outstanding Issues  
From NRC Equipment Environmental Qualification  
Safety Evaluation Reports

SUMMARY OF REVIEW  
OF LICENSEE 90-DAY RESPONSE

Utility: Carolina Power & Light Co.  
Plant Name: H. B. Robinson Unit 2  
NRC Docket No. 50-261  
NRC TAC No. 42466  
NRC Contract No. NRC-03-79-118  
FRC Project No. C5257  
FRC Assignment No. 13  
FRC Task No. 511

References:

- a. E. E. Utley and M. A. McDuffie  
Letter to S. A. Varga, NRC. Subject: H. B. Robinson Steam Electric  
Plant, Unit No. 2 - Response to May 21, 1981 letter and  
Safety Evaluation Report  
Carolina Power & Light Co., 31-Aug-81  
NO-81-1432
- b. Office of Nuclear Reactor Regulation  
Safety Evaluation Report for H. B. Robinson Unit No. 2  
Environmental Qualification of Safety-Related  
Electrical Equipment  
NRC, 21-May-81



The Licensee has submitted technical information in Reference a in response to the NRC SER [b] on environmental qualification. FRC has reviewed these documents [a, b]. As a result of this review, FRC concludes that the Licensee has stated that the equipment items are environmentally qualified; or has provided a technically sound rationale as a basis for justification for continued plant operation; or has provided a technically sound rationale or other additional information which in FRC's judgment provides a basis for justification for continued operation; with the following exceptions:

<u>Equipment Item</u>	<u>Equipment Description/ Function</u>	<u>SCEW Sheet No.</u>	<u>Status Code</u>	<u>Basis for Deficiency</u>
-----------------------	--	-----------------------	--------------------	-----------------------------

None

The Licensee's response to the SER addressed and provided resolution of deficiencies identified in the SER and provided adequate rationale as a basis for justification for interim operation."

APPENDIX E - REQUEST FOR ADDITIONAL INFORMATION

This appendix contains the Request for Additional Information (RAI) that was developed during the course of the review and issued to the NRC for forwarding to the Licensee. The RAI was revised throughout the review to reflect the Licensee's response(s) to the initial RAI.

The reader is cautioned that the numbers in brackets refer to citations found in the list of references at the end of this appendix and not to the citations listed in Section 6, References, of the TER.

TER-C5257-511

REQUEST FOR ADDITIONAL INFORMATION

EQUIPMENT ENVIRONMENTAL QUALIFICATION (EEQ)  
REVIEW OF LICENSEES' RESOLUTION OF OUTSTANDING ISSUES  
FROM NRC EQUIPMENT ENVIRONMENTAL QUALIFICATION SAFETY  
EVALUATION REPORTS (SER) AND TMI ACTION PLAN INSTALLED EQUIPMENT

Carolina Power & Light Company

H. B. Robinson Steam Electric Plant Unit No. 2

NRC Docket No. 50-261

November 24, 1981

NRC TAC No. 42466

Rev. 1, February 1, 1982

Rev. 2, April 7, 1982

## BACKGROUND

Franklin Research Center (FRC) of Philadelphia, Pa. is providing assistance to the U.S. Nuclear Regulatory Commission (NRC) for the equipment environmental qualification (EEQ) review of operating reactors. FRC will perform an EEQ review of the Licensee's 90-day response to outstanding issues from the NRC Equipment Environmental Qualification Safety Evaluation Report (SER) and the installed TMI Action Plan equipment. The review will be limited to safety-related equipment potentially exposed to a harsh environment. The results will be presented in the form of a technical evaluation report for each plant.

This request for additional information (RAI) is the result of an evaluation of the information provided by letters dated August 31, 1981 [1] and January 30, 1981 [2].\* FRC previously requested TMI Action Plan information by telephone memoranda dated July 14, July 31, and September 9, 1981 [3,4,5].

In response, CP&L transmitted the following information on July 31, 1981 [6] and September 15, 1981 [7].

- a. Normal Environments Inside Containment
- b. Normal Environments Outside Containment
- c. Analyses of High Energy Line Break Outside Containment
- d. 45-day Response to IE Bulletin 79-01B
- e. General Plant Procedure No. 6 (Edited)
- f. Nuclear Qualification Test Procedure 548-8955 Revision A, January 7, 1981
- g. Qualification Test Report AMP-110-11002, for Cable Splices.

On January 25, 1982, the NRC transmitted two reports concerning information on environmental qualification [10, 10.1].<sup>(1)\*\*</sup>

\*Numbers in brackets refer to citations found in the list of references.

\*\*Throughout the text, superscript numbers in parentheses indicate the revision in which the underlined material preceding the superscript was added.

In a letter dated March 1, 1982, CP&L stated the following with regard to its RAI response:<sup>(2)</sup>

"For the reasons listed below, CP&L believes that a more cost effective review could be conducted by the NRC and FRC at CP&L's General Office in Raleigh, N.C.

1. The Technical Specifications imposed by NRC's Order of October 24 1980 require that CP&L maintain control of the Robinson central file. Sending the central file to FRC would violate that NRC Order.
2. The material requested is available for audit and review in CP&L's central file located at the Company's General Office in Raleigh, N.C. Additionally, the central file contains supporting information used by CP&L in determining the qualification of individual pieces of equipment. The test reports are only a part of the processes involved, and a review of only the test reports by FRC would provide an incomplete and out-of-context picture.
3. There appears to have been no attempt by FRC to consolidate the requested information. It is quite possible that they have requested the same document from several licensees. In the NRC's request of December 11, 1981, FRC acknowledges receipt of "Analyses of High Energy Line Break Outside Containment" from Robinson, yet requests a Postulated Pipe Failure Analysis Outside of Containment. The two analyses are one in the same. By not consolidating and comparing the requests, a needless duplication of effort and waste of resources would occur."<sup>(2)</sup>

A. FRC REVIEW OF THE LICENSEE'S 90-DAY RESPONSE TO THE NRC EEQ SER

INFORMATION REQUESTED

DATE RECEIVED BY FRC\*\*\*

1. In reference to the Licensee's 90-day response [1] to the NRC SER [8], a legible single copy of each of the following qualification documents is requested in order that the FRC evaluation may proceed:
  - a. Westinghouse Letter CPL-77-550 (CP&L Reference 2, Section 3.1 [1])
  - b. Crouse Hinds Connector Data, Electrical Penetrations (CP&L Reference 13, Section 3.1 [1])

\*\*\*This column will be completed by FRC as requested information is received.

DATE RECEIVED BY FRC\*\*\*

- c. WCAP-8587, Environmental Qualification of Westinghouse NSSS Class IE Equipment (CP&L Reference 19, Section 3.1 [1]) 1-25-82 [10.1]<sup>(1)</sup>
- d. Postulated Pipe Failure Analysis Outside of Containment (CP&L Reference 21, Section 3.1 [1]) 7-31-81 [6]
- e. Rosemount Test Report 97215A, Model 1151 Transmitter (CP&L Reference 25, Section 3.1 [1]) Received 2/12/82 on Task 495<sup>(2)</sup>
- f. Rosemount Test Report 127227 Rev. A, Model 1151 Transmitter (CP&L Reference 26, Section 3.1 [1])
- g. Rosemount Report 37821, Model 1153 Transmitter (CP&L Reference 41, Section 3.1 [1]) Received 4/1/82 for Task 452<sup>(2)</sup>
- h. Limitorque Test Report FP-3271 (CP&L Reference 42, Section 3.1 [1]) 1-25-82 [10]<sup>(1)</sup>
- i. Kerite Company - Letter dated August 5, 1980 enclosures: LOCA Qualification of Kerite 1000 Volt FR/FR Control Cable  
LOCA Qualification of Kerite 1000 Volt HTK/FR Power Cable (CP&L Reference 49, Section 3.1 [1])
- j. Kerite Company - Letter dated October 21, 1980 in response to CP&L letter, CO-02726, dated October 13, 1980 requesting qualification data on use of Scotch 70 Silicone Rubber Tape (CP&L Reference 50, Section 3.1 [1])
- k. H. B. Robinson Steam Electric Plant Unit 2 TMI Project Modification Design Criteria (CP&L June 1, 1980) (CP&L Reference 53, Section 3.1 [1])

## B. FRC REVIEW OF INSTALLED TMI ACTION PLAN ITEMS

## INFORMATION REQUESTED

DATE RECEIVED BY FRC\*\*\*

1. Reference 1 does not provide adequate detail with respect to identification of TMI Action Plan equipment installed after 1/1/81. Identification of TMI Action Plan items installed after 1/1/81 is requested.
2. The qualification documents, e.g., the actual test reports and associated correspondence cited as evidence of qualification listed on the SCEW sheets, for identified TMI Action Plan equipment installed after 1/1/81 are requested. [The identification of those reports considered to be proprietary is requested so that proper control of documents can be maintained.]
3. A legible single copy of Wyle test report on AMP splices built per CP&L installation procedure M-521 is requested in order that the FRC evaluation may proceed.
4. Where the Licensee has a standard Owners' Group position with respect to a NUREG-0737 technical area or has requested extensions of implementation dates, this information is requested in order to incorporate it into the review.

## C. INSTRUCTIONS FOR TRANSMITTING INFORMATION REQUESTED

1. The schedule for completion of the FRC assignment requires that the Licensee provide the requested information within 3 weeks of the date of the RAI.
2. The Licensee may transmit the requested information as follows:
  - o complete package directly to the NRC project manager
  - or
  - o copy of cover letter to NRC project manager and complete package to FRC.

## REFERENCES

1. E. E. Utley and M. A. McDuffie  
Letter to S. A. Varga, NRC. Subject: H. B. Robinson Steam Electric Plant, Unit No. 2 - Response to May 21, 1981 letter and Safety Evaluation Report  
Carolina Power & Light Co., 31-Aug-81  
NO-81-1432
2. B. J. Furr  
Letter to J. P. O'Reilly, NRC. Subject: H. B. Robinson Steam Electric Plant, Unit No. 2 Revision 3 to IE Bulletin 79-01B Ninety-Day Report.  
Carolina Power & Light, 30-Jan-81  
Serial: NO-81-12
3. Telephone memorandum dated 7/14/81  
C. J. Crane, J. A. Murphy (FRC) conversation with J. Sheppard, R. Schwager (CP&L)  
Subject: Request for additional information; Robinson 2
4. Telephone memorandum dated 7/31/81  
C. J. Crane (FRC) conversation with J. J. Sheppard (CP&L) and J. Van Vliet (USNRC PM)  
Subject: Request for additional information, Brunswick 1 & 2, Robinson Unit 2
5. Telephone memorandum dated 9/9/81  
D. J. Schmitz (FRC) conversation with R. A. Schwager (CP&L)  
Subject: Cable splices made per CP&L procedure M-521
6. E. E. Utley  
Letter to C. J. Crane, FRC. Subject: H. B. Robinson Steam Electric Plant Unit 2, Transmittal of TMI Action Plan Information  
Carolina Power and Light, July 31, 1981
7. E. E. Utley  
Letter to C. J. Crane, FRC. Subject: H. B. Robinson Steam Electric Plant Unit 2, Transmittal of TMI Action Plan Information  
Carolina Power and Light, September 15, 1981
8. Office of Nuclear Reactor Regulation  
Safety Evaluation Report for H. B. Robinson Unit No. 2  
Environmental Qualification of Safety-Related  
Electrical Equipment  
NRC, 21-May-81
9. NUREG-0737, "Clarification of TMI Action Plan Requirements"  
NRC, November 1980



10. S. A. Varga  
Letter to C. J. Crane, FRC. Subject: Transmittal of WCAP-8587, and  
Correction of Limitorque Test Report Number from Robinson 2 RFI  
USNRC, 25-Jan-82<sup>(1)</sup>
- 10.1 G. Butterworth and R. B. Miller  
Methodology for Qualifying Westinghouse WRD Supplied NSSS  
Safety Related Electrical Equipment  
Westinghouse, Feb-79  
WCAP-8587, Rev. 2<sup>(1)</sup>
11. E. E. Utley  
Letter to D. G. Eisenhut, NRC. Subject: H. B. Robinson  
Steam Electric Plant, Unit No. 2 Request for Additional  
Information - Environmental Qualification  
Carolina Power & Light Co., 01 Mar. 1982<sup>(2)</sup>

## APPENDIX F - EQUIPMENT WHICH IS EXEMPT OR NOT IN SCOPE OF THE REVIEW

EQUIPMENT ITEM NO. 33  
SOLENOID VALVE LOCATED IN THE CONTAINMENT  
ASCO MODEL NP831655E  
REQUIRED OPERATING TIME: NOT STATED  
TER CHECKSHEET NO. 1  
LICENSEE REFERENCE(S): 649  
FUNCTION (PLANT ID): CHARGING LINE LOOP A, COLD LEG (V-310A,B)  
LICENSEE SUBMITTAL: SCEW(S): 9-11  
FUNCTION (PLANT ID): AUXILIARY PRESSURIZER SPRAY (V-311)  
LICENSEE SUBMITTAL: SCEW(S): 10-11  
FUNCTION (PLANT ID): REACTOR COOLANT LETDOWN (LCV-460A,B)  
LICENSEE SUBMITTAL: SCEW(S): 11 OF 11 [20]

EQUIPMENT ITEM NO. 34  
SOLENOID VALVE LOCATED IN THE REACTOR AUXILIARY BLDG.  
ASCO MODEL LBX831614  
REQUIRED OPERATING TIME: NOT STATED  
TER CHECKSHEET NO. 2  
LICENSEE REFERENCE(S): 2850  
FUNCTION (PLANT ID): REACTOR COOLANT LETDOWN ISOLATION (V-204A,B)  
LICENSEE SUBMITTAL: SCEW(S): 7 OF 11 [20]

EQUIPMENT ITEM NO. 35  
SOLENOID VALVE LOCATED IN THE CONTAINMENT  
ASCO MODEL LBX831614  
REQUIRED OPERATING TIME: NOT STATED  
TER CHECKSHEET NO. 3  
LICENSEE REFERENCE(S): 2850  
FUNCTION (PLANT ID): SEAL WATER BYPASS HEADER (V-307)  
LICENSEE SUBMITTAL: SCEW(S): 8 OF 11 [20]

EQUIPMENT ITEM NO. 36  
MOTORIZED VALVE ACTUATOR LOCATED IN THE CONTAINMENT  
LIMITORQUE MODEL SMB2  
REQUIRED OPERATING TIME: NOT STATED  
TER CHECKSHEET NO. 9  
LICENSEE REFERENCE(S): 637, 639  
FUNCTION (PLANT ID): ACCUMULATOR ISOLATION LOOP 1 RCS COLD LEG (V-865A, B, C)  
LICENSEE SUBMITTAL: SCEW(S): 6 OF 11 [20]

EQUIPMENT ITEM NO. 37  
MOTORIZED VALVE ACTUATOR LOCATED IN THE CONTAINMENT  
LIMITORQUE MODEL SMB1  
REQUIRED OPERATING TIME: NOT STATED  
TER CHECKSHEET NO. 11  
LICENSEE REFERENCE(S): 637, 639  
FUNCTION (PLANT ID): RC LOOP 2 HOT LEG SUPPLY ISOLATION (V-750)  
LICENSEE SUBMITTAL: SCEW(S): 2 OF 11 [20]  
FUNCTION (PLANT ID): RC LOOP 2 HOT LEG SUPPLY ISOLATION (V-751)  
LICENSEE SUBMITTAL: SCEW(S): 3 OF 11 [20]

EQUIPMENT ITEM NO. 38  
MOTORIZED VALVE ACTUATOR LOCATED IN THE REACTOR AUXILIARY BLDG.  
LIMITORQUE MODEL SMBO  
REQUIRED OPERATING TIME: NOT STATED  
TER CHECKSHEET NO. 12  
LICENSEE REFERENCE(S): 662  
FUNCTION (PLANT ID): RHR HEAT EXCHANGERS COOLING WATER (V-749A, B)  
LICENSEE SUBMITTAL: SCEW(S): 1 OF 11 [20]  
FUNCTION (PLANT ID): RWST/RHR PUMP SUCTION (V-862A, B)  
LICENSEE SUBMITTAL: SCEW(S): 4 OF 11 [20]  
FUNCTION (PLANT ID): RWST OUTLET (V-864A, B)  
LICENSEE SUBMITTAL: SCEW(S): 5 OF 11 [20]

EQUIPMENT ITEM NO. 39 (TMI ACTION PLAN ITEM II.E.3.1)  
CONTROL SWITCH LOCATED IN THE REACTOR AUXILIARY BLDG.  
GEMCO MODEL 404S2X4111  
REQUIRED OPERATING TIME: NOT STATED  
TER CHECKSHEET NO. 26  
LICENSEE REFERENCE(S): 2850  
FUNCTION (PLANT ID): PRESSURIZER HEATER BREAKER TRIP (PLANT ID NOT STATED)  
LICENSEE SUBMITTAL: SCEW(S): 1 OF 15 [20]

EQUIPMENT ITEM NO. 40 (TMI ACTION PLAN ITEM II.E.4.2)  
RESET SWITCH LOCATED IN THE REACTOR AUXILIARY BLDG.  
GEMCO MODEL 404PI331PPI  
REQUIRED OPERATING TIME: NOT STATED  
TER CHECKSHEET NO. 27  
LICENSEE REFERENCE(S): 2850  
FUNCTION (PLANT ID): FUNCTION AND PLANT ID NOT STATED  
LICENSEE SUBMITTAL: SCEW(S): 5 OF 15 [20]

EQUIPMENT ITEM NO. 41 (TMI ACTION PLAN ITEM II.E.4.2)  
SELECTOR SWITCH LOCATED IN THE REACTOR AUXILIARY BLDG.  
GEMCO MODEL 404S34122EE8  
REQUIRED OPERATING TIME: NOT STATED  
TER CHECKSHEET NO. 28  
LICENSEE REFERENCE(S): 2850  
FUNCTION (PLANT ID): FUNCTION AND PLANT ID NOT STATED  
LICENSEE SUBMITTAL: SCEW(S): 7 OF 15 [20]

EQUIPMENT ITEM NO. 42 (TMI ACTION PLAN ITEM II.E.1.2)  
TRANSDUCER LOCATED ON THE TURBINE DECK  
CONTROLOTRON MODEL 24ON4CS8OHT  
REQUIRED OPERATING TIME: NOT STATED  
TER CHECKSHEET NO. 29  
LICENSEE REFERENCE(S): 2850  
FUNCTION (PLANT ID): NOT STATED (FT-425A, B, C)  
LICENSEE SUBMITTAL: SCEW(S): 9 OF 15 [20]

EQUIPMENT ITEM NO. 43 (TMI ACTION PLAN ITEM II.E.1.2)  
TRANSDUCER LOCATED IN THE REACTOR AUXILIARY BLDG.  
CONTROLOTRON MODEL 24ON4CS8OHT  
REQUIRED OPERATING TIME: NOT STATED  
TER CHECKSHEET NO. 30  
LICENSEE REFERENCE(S): 2850  
FUNCTION (PLANT ID): NOT STATED (FT-426A, B, C)  
LICENSEE SUBMITTAL: SCEW(S): 10 OF 15 [20]

EQUIPMENT ITEM NO. 44 (TMI ACTION PLAN ITEM II.E.1.2)  
FLOW COMPUTER LOCATED ON THE TURBINE DECK  
CONTROLOTRON MODEL 241N  
REQUIRED OPERATING TIME: NOT STATED  
TER CHECKSHEET NO. 31  
LICENSEE REFERENCE(S): 2850  
FUNCTION (PLANT ID): FUNCTION AND PLANT ID NOT STATED  
LICENSEE SUBMITTAL: SCEW(S): 11 OF 15 [20]

EQUIPMENT ITEM NO. 45 (TMI ACTION PLAN ITEM II.D.3)  
RELAY LOCATED IN THE REACTOR AUXILIARY BLDG.  
WESTINGHOUSE MODEL Nbfd22S  
REQUIRED OPERATING TIME: NOT STATED  
TER CHECKSHEET NO. 34  
LICENSEE REFERENCE(S): 2850  
FUNCTION (PLANT ID): FUNCTION AND PLANT ID NOT STATED  
LICENSEE SUBMITTAL: SCEW(S): 4 OF 15 [20]