June 1, 1981

Docket No. 50-244
LS05-81-06-002

Mr. John E. Maier
Vice President
Electric and Steam Production
Rochester Gas and Electric Corporation
89 East Avenue
Rochester, New York 14649

SEE Rqsts. # 8103240212

SUBJECT: ENVIRONMENTAL QUALIFICATION OF SAFETY-RELATED ELECTRICAL EQUIPMENT

RE: R. E. GINNA NUCLEAR POWER PLANT

Reference (a) - Order for Modification of License Concerning the Environmental Qualification of Safety-Related Electrical Equipment dated October 24, 1980

Dear Mr. Maier:

This letter transmits the Safety Evaluation for the Environmental Qualification of Safety-Related Electrical Equipment at your facility. This evaluation was based on your submittals dated April 25, 1980, May 22, 1980, May 29, 1980, and October 31, 1980. Our letter of February 11, 1981, which forwarded our preliminary results, indicated that an item-by-item re-evaluation would be required at a later date. This safety evaluation identifies the specific information required by the staff and the actions, on your part, necessary to comply with Reference (a). We request that you provide the information identified in Sections 3 and 4 of this Safety Evaluation to us within 30 day.

This Safety Evaluation addresses only the safety-related electrical equipment exposed to a harsh environment resulting from an accident (i.e., the IEB 79-01B review). Reference (a) requires that all safety-related electrical equipment be qualified by June 30, 1982. The NRC review effort for the equipment in mild environments will be addressed by separate correspondence.

Your response may present alternatives to the staff positions in the evaluation. The staff will consider alternative approaches if these methods are within the DOR Guidelines or NUREG-0588, as appropriate. For example, an acceptable alternative to the NRC staff's temperature criterion used for the service conditions (i.e. Section 3.3) must base that service condition on the FSAR analysis or other NRC approved analysis, provided that the specific analysis, together with reference to the previous NRC acceptance of that analysis, accompanies the 90 day response. In addition, some of the information in the Safety Evaluation may require clarification. Contact your project manager for assistance in these matters.

AUG 5 1981

OFFICE ▷							
SURNAME ▷							
DATE ▷							

It remains your responsibility to assure that the qualification deadline is met for all safety-related electrical equipment. The staff's review of your response to this letter should not delay any action which is required in order to meet the deadline.

Sincerely,

Original signed by
Dennis M. Crutchfield

Dennis M. Crutchfield, Chief
Operating Reactors Branch #5
Division of Licensing

Enclosures:
1. Safety Evaluation Report
2. TER (Proprietary Information - Withheld from Public Disclosure) dated March 18, 1981

cc w/o TER:
See next page

~~*SEE ATTACHED YELLOW FOR PREVIOUS CONCURRENCES~~

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TECHNICAL EVALUATION REPORT

EQUIPMENT ENVIRONMENTAL QUALIFICATION

ROCHESTER GAS AND ELECTRIC CORPORATION
R. E. GINNA STATION

NRC DOCKET NO. 50-244

NRC TAC NO. 42520

FRC PROJECT C5257

NRC CONTRACT NO. NRC-03-79-118

FRC TASK 178

Prepared by

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March 20, 1981

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ACKNOWLEDGMENTS

The engineering, administrative, and editorial staff who produced this Technical Evaluation Report labored long hours giving the required intense attention to complex details. Without their extraordinary effort and devotion to this work, these reports could not have been produced in the short time that was available. The following are all to be thanked.

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Many others, too numerous to list also aided in this effort and are to be thanked.

Subcontractors

ECI = Energy Consultants, Inc.

SRC = Synergic Resources Corporation

W = WESTEC Services, Inc.

IDENTIFICATION OF PROPRIETARY INFORMATION

Some of the information in this technical evaluation report was obtained from manufacturers' proprietary test reports. All proprietary information is designated by underlining.

1. INTRODUCTION

1.1 PURPOSE OF THE EVALUATION

The purpose of this report is to evaluate qualification documentation of nuclear power plant safety-related electrical equipment 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. Where practical, this report presents recommendations for actions to remedy deficiencies.

1.2 GENERIC ISSUE BACKGROUND

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 design basis events (DBEs).

Qualification criteria applied during the licensing of 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, 334-74, 381-77, 382-80, and 627-80. NRC NUREG documents 0413 and 0588 have been developed to address this topic. In particular, NUREG-0588 (published for comment in December 1979) 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 1E 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."

In 1977, 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 program) 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 licensee responses indicated deficiencies in the scope of equipment addressed, definition of harsh environments, and adequacy of qualification documentation. It became apparent that generic criteria were needed to evaluate 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" [16].* (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 (FRC) 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. FRC 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).

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

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 high energy line breaks (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; problems arising from this review would be resolved using NUREG-0588 as a guide.

In early February 1980, the NRC decided that Indian Point Units 2 and 3 and Zion 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 screening 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" [16], 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.

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 27, 1980, the NRC issued Memorandum and Order CLI-80-21 [19], 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 Safety Evaluation Reports 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.

1.3 SPECIFIC ISSUE BACKGROUND

By a letter dated December 15, 1977, Rochester Gas and Electric Corporation (RG&E) was requested by the NRC to address the environmental qualification of safety-related electrical equipment installed in the R.E. Ginna Station. Information requested included identification of electrical equipment required to perform safety functions while subjected to design basis accident environments, definitions of environmental service conditions at equipment locations, and the status of environmental qualification documentation. In response to this request, RG&E provided information via submittal letters dated February 24 and December 1, 1978 (Revision 1) [5,6].

On February 15, 1980, NRC qualification guidelines for identification and evaluation of safety-related equipment were transmitted to RG&E. By letters dated March 6 and 28, 1980, NRC provided further guidance and a schedule to RG&E concerning submittal of qualification information.

On April 25, 1980, RG&E transmitted Revision 2 of its equipment qualification submittal to the NRC [14].

During the week of May 5, 1980, NRC and FRC representatives visited the Ginna plant site, conducted a general overview of the April 25, 1980 submittal, and inspected safety-related systems and equipment.

On May 22 and May 29, 1980, RG&E submitted additional information which supplemented the April 25, 1980 submittal.

On August 20, 1980, FRC issued a Draft Interim Technical Evaluation Report (DITER) for equipment environmental qualification on the R.E. Ginna Station [20].

On October 7, 1980, representatives of the NRC, RG&E, and FRC held a meeting in Bethesda, Maryland, to discuss the FRC DITER.

On October 31, 1980, RG&E provided Revision 3 to the previous submittals concerning environmental qualification of safety-related electrical equipment [1].

1.4 SCOPE OF THE EVALUATION

Environmental qualification of safety-related electrical equipment was selected by the NRC for accelerated review. Therefore, the scope of this report is limited to equipment that must function to mitigate the consequences of a loss-of-coolant accident (LOCA) or high energy line break (HELB) and equipment whose environment is adversely affected by those events. Qualification aspects not included within the scope of this evaluation are:

- seismic qualification
- equipment protection against natural phenomena
- equipment operational service conditions (e.g., vibration, voltage, and frequency deviations)
- equipment located where it is subject to outdoor environments
- equipment protection against fire hazards
- equipment protection against missiles.

2. NRC CRITERIA FOR ENVIRONMENTAL QUALIFICATION

2.1 CRITERIA PROVIDED BY THE NRC

The DOR screening guidelines used by FRC to evaluate the electrical equipment environmental qualification programs were:

- "Guidelines for Evaluating Environmental Qualification of Class IE Electrical Equipment in Operating Reactors" [16]
- "Guidelines for Identification of That Safety Equipment of SEP Operating Reactors for Which Environmental Qualification Is To Be Addressed" [16].

These guidelines were issued for implementation to all licensees by the NRC in February 1980.

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 DOR screening guidelines.

2.2.1 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 [17], "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 whether the calculated plant-specific temperature/pressure profiles encompass the LOCA and HELB accidents inside containment.

2.2.2 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 [17] 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.

2.2.3 EQUIPMENT LOCATED IN AREAS NORMALLY MAINTAINED AT ROOM CONDITIONS
(DOR Guidelines Section 4.3.3)

Supplement 2 of IE Bulletin 79-01B [17] 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 HELB or to nuclear radiation emanating from circulation of fluids containing radioactive substances. At the licensee's option, the review may be deferred until after February 1, 1981.

By June 30, 1982, all safety-related electrical equipment potentially exposed to a harsh environment in nuclear generating stations licensed to operate on or before June 30, 1982 shall be qualified to either the DOR Guidelines or NUREG-0588 (as applicable). Safety-related electrical equipment is that required to bring the plant to a cold shutdown condition and to mitigate the consequences of the accident. It is the responsibility of the licensee to evaluate the qualification of safety-related electrical equipment to function in environmental extremes not associated with accident conditions and to document it in a form that will be available for the NRC to audit. Qualification to assure functioning in mild environments must be completed by June 30, 1982.

2.2.4 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 [17] 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."

2.2.5 DEFERMENT OF QUALIFICATION REVIEW

Supplement 3 to IE Bulletin 79-01B [18] permits the submittal of qualification documentation regarding the TMI Action Plan equipment and the equipment required to achieve and maintain a cold shutdown condition to be delayed as follows:

- o "Qualification information for installed TMI Action Plan equipment must be submitted by February 1, 1981.
- o 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.
- o Qualification information for TMI Action Plan equipment currently under NRC review should be submitted as soon as possible.
- o 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.
- o The qualification information for equipment required to achieve and maintain a Cold Shutdown condition ... will be submitted not later than February 1, 1981."

2.2.6 TEST SEQUENCE
(DOR Guidelines Section 5.2.3)

Supplement 2 to IE Bulletin 79-01B [17] 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 would then fall in the first or second category."

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

Supplement 2 to IE Bulletin 79-01B [17] 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:

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

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."

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

3. METHODOLOGY USED BY FRC

The Licensee, Rochester Gas and Electric Corp., identified 69 safety-related electrical equipment items in various locations of the R.E. Ginna Station in its final submittal [1] to the NRC. 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). Appendix A contains the environmental service conditions for each location, Appendix B contains the Licensee's tabulation of the equipment items and locations (the tabulation does not include equipment covered by the evaluation deferment described in Section 2.2.3 of this report), and Appendix C lists the plant systems identified by the Licensee and the NRC as being essential to safety.

Using the listing of safety-related electrical equipment items,* each equipment item was reviewed by FRC in relation to:

- NRC DOR Guidelines, as modified by NRC staff interpretations
- Licensee definition of harsh service environments (Appendix A)
- results of plant visit and equipment inspection
- qualification documentation
- analysis and/or justification of qualification
- Licensee-proposed remedies for qualification deficiencies
- Licensee-stated position concerning system or component function.

Topics not within the scope of FRC evaluation are:

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

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

The initial results of FRC's review of the equipment environmental documentation were issued to the NRC as a Draft Interim Technical Evaluation Report (DITER) on August 20, 1980 [20]. Qualification data summary forms used to summarize salient data compiled from the various information sources were included in the DITER.

In developing the present final Technical Evaluation Report (TER), FRC used the DITER and the Licensee submittals [1,2,5,6,7,10,14,21]. This information was analyzed by FRC to determine:

- o what specific response was made to the FRC DITER
- o whether the Licensee made any changes to the initial submittal
- o what additional information was supplied (e.g., analysis, test report, or justification for qualification)
- o whether any changes were made in the environmental conditions
- o whether any equipment was added or deleted.

All information was reviewed by FRC for conformance to the NRC criteria referenced in Section 2 of this report. As requested by the NRC, all qualification information developed in the Equipment Environmental Qualification (EEQ) program was used by the FRC reviewers, whether referenced by the Licensee or not. The qualification data summary forms were updated as appropriate and were then used to identify deviations from NRC criteria and the Licensee's qualification program. The final TER text was written primarily to address these deviations from the criteria. Items or test results not specifically cited by FRC implicitly satisfy the qualification criteria.

Upon completion of the final review for each equipment item, FRC developed an overall evaluation of the component and a specific conclusion with respect to its qualification. At the NRC's request, suggested recommendations were made to resolve questions of deficient qualification. Based on the FRC conclusion, each equipment item was assigned to one of the generic qualification categories provided by the NRC. The NRC category descriptions follow.

NRC CATEGORIES AND DEFINITIONS

- NRC Category I.a
  EQUIPMENT THAT FULLY SATISFIES ALL APPLICABLE REQUIREMENTS OF THE DOR GUIDELINES

This category includes equipment items which are fully acceptable on the basis that all applicable criteria defined in the DOR Guidelines are satisfied and the equipment has been found to be qualified for the life of the plant.

- NRC Category I.b
  EQUIPMENT WITH ACCEPTABLE DEVIATIONS FROM THE DOR GUIDELINES

This category includes equipment items which do not satisfy one or more of the applicable criteria defined in the DOR Guidelines; however, sufficient information has been presented to determine that the specific deviations are acceptable and the equipment has been found to be qualified for the life of the plant.

- NRC Category II.a
  EQUIPMENT THAT SATISFIES ALL APPLICABLE REQUIREMENTS OF THE DOR GUIDELINES 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 are satisfied with the exception of the qualified life criterion. With respect to qualified life, the equipment items have been found to have a qualified life which (1) is limited to a time interval less than plant life, (2) has not been adequately established in terms of calendar time, or (3) has not been evaluated by the licensee.

- NRC Category II.b
  EQUIPMENT THAT SATISFIES ALL APPLICABLE REQUIREMENTS OF THE DOR GUIDELINES WITH THE EXCEPTION OF QUALIFIED LIFE PROVIDED THAT SPECIFIC MODIFICATIONS ARE MADE

This category includes equipment items which will be acceptable and will satisfy all applicable criteria defined in the DOR Guidelines with the exception of qualified life provided that specific modifications are made on or before the designated date. When the modifications are complete, the equipment can be considered qualified with the exception of the qualified life criterion. With respect to qualified life, the equipment items have been found to have a qualified life which (1) is limited to a time interval less than plant life, (2) has not been adequately established in terms of calendar time, or (3) has not been evaluated by the licensee.

- NRC Category II.c
  EQUIPMENT FOR WHICH DEVIATIONS FROM THE DOR GUIDELINES ARE JUDGED ACCEPTABLE WITH THE EXCEPTION OF QUALIFIED LIFE

This category includes equipment items which do not satisfy one or more of the applicable criteria defined in the DOR Guidelines; however, either (1) sufficient bases have been presented to allow a determination that the specific deviations are judged to be acceptable with the exception of the qualified life criterion, or (2) the specific deviations are judged to be acceptable with the exception of the qualified life criterion based on review of the applicable qualification documentation associated with the overall equipment environmental qualification program. With respect to qualified life, the equipment items have been found to have a qualified life which (1) is limited to a time interval less than plant life, (2) has not been adequately established in terms of calendar time, or (3) has not been evaluated by the licensee.

- NRC Category III
  EQUIPMENT THAT IS EXEMPT FROM QUALIFICATION

This category includes equipment items which 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. In addition, any failure of the exempt equipment must not degrade the ability of qualified equipment to perform its required safety-related function.

- NRC Category IV.a
  EQUIPMENT WHICH HAS QUALIFICATION TESTING SCHEDULED BUT NOT COMPLETED

The qualification of equipment items in this category has been judged deficient or inadequate based upon review of the documentation provided by the licensee. However, the licensee has stated that the equipment item is scheduled to be tested by a designated date. The results of the testing will dictate the specific qualification category of the equipment item.

- NRC Category IV.b
  EQUIPMENT FOR WHICH QUALIFICATION DOCUMENTATION IN ACCORDANCE WITH THE GUIDELINES HAS NOT BEEN ESTABLISHED

The qualification of equipment items in this category is deficient or inconclusive based upon review of the documentation provided by the licensee. This equipment is judged to have a high likelihood of operability for the specified environmental service conditions; however, complete and auditable records reflecting comprehensive qualification documentation have not been made available for review.

- NRC Category V
  EQUIPMENT WHICH IS UNQUALIFIED

The DOR Guidelines require that complete and auditable records reflecting a comprehensive qualification methodology and program be referenced and made available for review of all Class 1E equipment.

The qualification of equipment items in this category has been judged to be deficient or inadequate, based upon review of the documentation provided by the licensee. The extent to which the equipment items fail to satisfy the criteria of the DOR Guidelines can be categorized as follows: (1) documentation reflecting qualification as specified in the DOR Guidelines has not been made available for review, (2) the documentation is inadequate, or (3) the documentation indicates that the equipment item has not successfully passed required tests.

- NRC Category VI
  EQUIPMENT FOR WHICH QUALIFICATION IS DEFERRED

This category includes equipment items which have been addressed by the licensee in the equipment environmental qualification submittals; however, the qualification review of this equipment has been deferred by the NRC in accordance with criteria presented in Sections 2.2.3 and 2.2.5 of this report.

4. TECHNICAL EVALUATION

General observations concerning the Licensee's approach to qualification are included in Section 4.1. Sections 4.2 through 4.7 identify the equipment items placed in each of the major NRC qualification categories in accordance with FRC's technical evaluation of the Licensee's documentation. The results of the evaluation are summarized in Section 4.8.

The technical evaluation of each equipment item is documented in the following format:

- Original Text Taken From Draft Interim Technical Evaluation Report
- Licensee Response
- FRC Evaluation
- FRC Conclusion.

All equipment item* numbers are associated with Reference 1.

4.1 METHODOLOGY USED BY THE LICENSEE

This section includes observations concerning the Licensee's methodology, which was described in a general introductory section of the final submittal of qualification documentation from the Licensee [1].

4.1.1 COMPLETENESS OF EQUIPMENT LIST

The Licensee discussed the approach used in selecting the equipment for which qualification must be demonstrated. From this discussion, it is not

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* 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).

clear that the criteria used by the Licensee are in full accord with the DOR Guidelines. For example, the Licensee states:

> The electrical equipment described in this report is that safety-related equipment required to mitigate the effects of high or moderate energy line breaks (HELB) inside or outside containment, and to effect eventual cold shutdown of the reactor. The environmental qualification requirements are described in the "DOR Guidelines," transmitted to RG&E on February 15, 1980. Although the DOR Guidelines address all electrical equipment, the emphasis in this report will be on that equipment exposed to an adverse HELB environment. This is defined as that equipment located in the containment, Intermediate Building, Turbine Building, and Auxiliary Building basement (radiation only). This revised scope is consistent with the Commission Order of September 19, 1980. Equipment in other "mild" environments will be addressed at a later time. Supplement No. 3 to IE Bulletin 79-01B provides the timing for submittal of qualification information for equipment installed to meet the TMI Short Term Lessons Learned. RG&E intends to follow the guidance given in this supplement. In a number of cases, it is possible that additional documentation or testing results may become available after November 1, 1980. Since this additional information will be of use in documenting the status of the Ginna environmental qualification, it will be submitted when received. Every effort has been made to ensure that all documentation was obtained for use with this submittal.

The uncertainty arises because the Licensee has not explicitly stated that all equipment subject to a HELB environment is included. As another example, the Licensee discusses the concept that not all equipment mentioned in the Emergency Procedures needs to be qualified, but it is not clear how the Licensee determined (a) which items of instrumentation and control to include and (b) how the operator will know which instruments are likely to be giving reliable information.

In addition to the foregoing general items, the Licensee identifies the following equipment items as providing important safety functions, but does not include them in the list of equipment that must be qualified:

- solenoids controlling air-operated containment isolation valves (tag numbers not given)
- solenoids controlling air-operated valves 4561 and 4562
- motorized valve actuators for valves 313, 813, and 814
- other motorized valve actuators for other containment isolation valves
- motorized valve actuators for valves 704A and 704B.

No justification for the omission of these equipment items was presented.

In Section 4 of the DITER, FRC identified the following additional equipment items that the Licensee should have addressed within the scope of this program, either by including them in Table 3 of Reference 1 or stating why the equipment is not included (e.g., not present in the plant; not needed; not exposed to "harsh" environment):

- o junction boxes and terminal boards located outside containment
- o control stations
- o Class 1E medium voltage switchgear
- o Class 1E motor control centers
- o invertors
- o battery chargers
- o hydrogen monitors
- o charcoal filter deluge valves.

To this list should be added the actuators for the steam-dump-to-atmosphere valves, the actuators for the valves in the hot leg injection path, the I/P convertors on the RHR heat exchanger discharge valves, limit switches, and connectors.

4.1.2 ENVIRONMENTAL SERVICE CONDITIONS

QUALIFICATION TIME REQUIREMENT

The Licensee states:

> It is important to note that the arbitrary requirement of the DOR Guidelines to qualify equipment to function for at least one hour, even if its only function is completed within seconds, is not well reasoned. In many cases, the environment would not exist unless the equipment safety function had been completed (e.g., flooding to a seven foot level in containment by necessity means that SI was initiated). RG&E does not agree with this one-hour requirement, and it is therefore not applied as an environmental qualification requirement.

FRC's comments relative to this statement are:

1. The Licensee has not provided acceptable justification for ignoring this requirement of the Guidelines. The NRC's rationale for this requirement is presented in Section 2.2.4 of this report.

2. Supplement 2 to IE Bulletin 79-01B exempts equipment subject to submergence after its safety function has been accomplished from this

specific service condition, provided that such submergence does not adversely affect any safety-related function or mislead the operator. (Refer to Section 2.2.2.)

HIGH ENERGY LINE BREAKS

As is noted in Section 4.1.1, it is not clear that the Licensee has included all HELB environments that should be considered, including water sprays. Supplement 2 to IE Bulletin 79-01B states that the Licensee should apply the guidance presented in Regulatory Guide 1.46 and Standard Review Plans 3.6.1 and 3.6.2. The Licensee states:

> The failure of steam heating lines in the Auxiliary Building was identified and discussed in Reference (HELB-1). It has been determined that steam heating lines also traverse other areas in the vicinity of safety related equipment (Reference HELB-15). Modifications are planned which will isolate the steam heating line to the affected areas in the event of a failure and therefore preclude an adverse environment. The commitment to perform analyses/modifications for those pipe breaks outside containment are given in Reference (HELB-13). Prior to its installation, regular inspections are being performed to reduce the likelihood of a failure creating an adverse environment.

This statement suggests that there may be additional equipment subject to a harsh environment beyond that listed in Appendix B or that the environmental service conditions may be more severe for some of the listed equipment than has been assumed in the analyses provided to date.

NUCLEAR RADIATION DOSE

The Licensee has used an integrated nuclear radiation dose of 160 Mrd for equipment within containment. FRC has assumed that this value includes both beta and gamma radiations. The Guidelines permit a lower integrated dose value for equipment which would not be affected by beta radiations. In the case of electric cables, protection against beta radiation would be desirable. A more detailed discussion is presented in Appendix H. In addition, the Guidelines require consideration of radiation exposure to equipment outside containment due to recirculating radioactive fluid. This was not consistently done by the Licensee.

4.1.3 AGING AND QUALIFIED LIFE

The Licensee has not adequately addressed the related topics of aging and qualified life. The DOR Guidelines require that the Licensee:

- establish (numerically) the qualified life for all equipment items containing components susceptible to degradation produced by heat and nuclear radiations
- implement programs to review detailed surveillance and maintenance records to assure that equipment that exhibits age-related degradation is identified and replaced (or modified) as necessary.

Qualified life is the maximum period of normal service, under specified conditions, for which it can be demonstrated that the functional capability of the equipment at the end of the period is still adequate for it to perform its specified safety function(s) for applicable design basis events. The qualified life may be contingent on implementation of a specified maintenance program. It is acceptable for the qualified life of some subcomponents of an equipment item to be less than the qualified life of the item itself, provided a program for replacement of such components at intervals not exceeding their qualified lifetimes is specified and fulfilled. The qualified life of an equipment item may be changed during its installed life when justified by new information that permits a reanalysis of the qualification program.

Establishing the qualified life for equipment is a technically challenging task because of the paucity of information concerning the degradation of materials and components under long-term exposure to the environmental service conditions in a nuclear power generating station. As is discussed more fully in Reference 22, with the possible exception of certain simple materials, there is no rigorous basis for establishing equipment qualified lifetimes for periods approaching an installed lifetime of 40 years. Furthermore, applicable information regarding possible long-term synergistic effects of temperature, humidity, nuclear radiations, etc., is extremely limited.

In accordance with the Guidelines in this program, the licensees are required to establish a qualified life for equipment subject to thermal and radiation aging. In addition, surveillance, maintenance, and replacement programs should be established for equipment that may be subject to age-related degradation. The licensees should review the qualified life values and the present installed life of the equipment to determine a replacement schedule for each equipment item (or subcomponents thereof). As noted above, these schedules may be revised as new information becomes available.

4.2 EQUIPMENT QUALIFIED FOR PLANT LIFE

This section includes equipment items which are fully acceptable on the basis that (1) all qualification criteria defined in Section 2 of the report are satisfied or (2) sufficient data exist to determine that specific deviations are acceptable.

4.2.1 NRC Category I.a EQUIPMENT THAT FULLY SATISFIES ALL APPLICABLE REQUIREMENTS OF THE DOR GUIDELINES

The equipment items in this section are fully acceptable on the basis that all applicable criteria defined in the DOR Guidelines are satisfied and the equipment has been found to be qualified for the life of the plant.

4.2.1.1 Equipment Item No. 13A
Electrical Penetrations Located Within and Outside Containment
Crouse-Hinds Company (Various Conductor Configurations; Models Not Stated)
(Original Licensee References 2.1, 2.27, and 2.28;
Final Licensee References 2.45, 2.54, 2.58, and 2.64)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.2.4):

In general, electrical penetrations perform two safety-related functions: (i) provide a leaktight barrier as part of the overall plant containment system, minimizing release of radioactive materials, and (ii) carry electric power and control and instrumentation signals across the containment boundary. With regard to the first function, the design of this equipment item has three implicit failure modes that must be addressed:

- Distortion of the penetration structural members
- Failure of the O-ring elastomeric seals on the mounting flange
- Failure of the seals and electrical insulation around individual conductors.

With regard to the second function, two failure modes are relevant:

- Breakdown of the electrical insulation, causing a short-circuit to ground or between conductors
- Breakage of the conductor, causing an open circuit.

It is important to note that the two functions are related in at least two ways. First, two of the failure modes for the first function are likely to also cause one or both of the possible failure modes associated with the second function (i.e., an insulation or seal failure around a conductor may both impair containment integrity and cause electric failures). Second, the fact that the conductors carry electric current results in higher than ambient temperatures in the seals and insulation, and in electromagnetic and thermal-induced forces being imposed on these materials and the conductors. These effects help to induce failure modes, leading to impairment of both basic functions.

FRC understands that an independent, ongoing program is currently being conducted by the NRC to determine the capability of the Ginna penetrations to perform under elevated temperature and short-circuit electrical loading conditions.

The environmental service conditions inside containment are more s[redacted]re than those outside, considering both normal operation and possible acci[redacted]s. Hence, these are the conditions for which qualification must be established. FRC has reviewed the documentation submitted by the Licensee and has found it to be deficient in several aspects:

a. Licensee Reference 2.1 describes an environmental test conducted on a sample penetration.

No preaging was done, nor was the possibility of [redacted]ing degradation produced by ambient temperature, humidity, or nu[redacted]

radiation discussed. Also, no consideration was given to the possible effects of nuclear radiation that are postulated to be present under accident conditions.

b. Licensee Reference 2.27 discusses the effects of chemical sprays on various metallic samples, as discussed in Appendix D. Because the effects of containment sprays are not expected to be a problem, as noted above, and because the reference does not treat the effect of spray solutions on cables (which are an integral part of the design of these penetrations), this reference does not appear to be relevant.

c. Licensee Reference 2.28 is a letter dated March 21, 1978, in which the Licensee informed the NRC that Westinghouse has tested the materials used in the electrical penetrations mentioned by Westinghouse and in the electrical penetrations at the Brunswick Station and has informed the Licensee (RG&E) that the results of these tests "are applicable to all penetrations at Ginna."

Because these statements by Westinghouse have not been substantiated with a description of what was tested, how the tests were conducted, or what analyses were performed to supplement the testing, FRC has no basis for judgment as to their acceptability. (The Guidelines require that "complete and auditable records must be available for qualification...to be considered valid.")

Based upon the preceding discussion, FRC concludes that the documentation submitted for this equipment item is deficient for establishing qualification. The Licensee should provide the following as additional evidence:

a. An analysis of the aging degradation produced by temperature, humidity, and nuclear radiation during normal operation.

b. A determination of the peak temperature, pressure, humidity, and radiation levels that the insulation and seals would experience during a LOCA, simultaneous with maximum normal and short-circuit load conditions that could occur in each conductor. This will require an analysis that relates testing performed on one penetration under one set of conditions to the other penetrations that have other conductor sizes and configurations and other electrical loads imposed upon them. The information in Reference 9 should be used in this analysis.

c. A determination of the long-term temperature, humidity, and radiation levels to which the insulation and seals could be subjected following a postulated LOCA, again considering the electrical and mechanical loads imposed by active circuits.

d. The foregoing items should be used to explicitly determine a period of qualified life, a replacement schedule if the qualified life is less than the period for which the plant is licensed to operate, and a degradation monitoring program.

LICENSEE RESPONSE:

TER C5257 notes that the Brunswick tests could not be substantiated, since no test description was provided. Reference 2.45 provides this description. Reference 2.58 is a letter from Westinghouse stating that the Brunswick data is applicable to qualify the seal, canister, and internal connections. Reference 2.54 is an evaluation of the capability of the Ginna penetrations to perform their function under elevated and short-circuit electrical loading conditions.

Further, an evaluation [2.59] of the functions of the various materials in the penetrations disclosed that the organic compounds, which are possibly subject to aging or radiation effects, do not perform any critical insulating or sealing functions. These functions are performed by ceramic and metallic components. This evaluation augments the qualification testing performed on these penetrations, confirming that they are qualified to perform their safety function.

FRC EVALUATION:

FRC has reviewed the information mentioned in References 2.54, 2.58, and 2.59 (in particular, the drawings attached to Reference 2.59). FRC has also reevaluated the information contained in References 2.1 and 2.45 based on the drawings provided in 2.59. The Licensee response and references resolve the DITER comments.

FRC agrees that the penetration components are not subject to degradation from aging or irradiation as defined in the Guidelines because they are ceramic or metallic. Containment leakage testing and integrated leak rate testing should detect any random failures. The testing for pressure and temperature (LOCA) reported in Reference 2.45 envelopes the R. E. Ginna Plant conditions of Appendix A.

FRC CONCLUSION:

The Crouse-Hinds penetration is assigned to NRC Category I.a. Qualification has been demonstrated for the life of the plant because the equipment does not contain materials subject to aging degradation. This category applies to the penetration only. Connected cables, splices, and terminations are addressed in appropriate sections of this report.

4.2.2 NRC Category I.b
EQUIPMENT WITH ACCEPTABLE DEVIATIONS FROM THE DOR GUIDELINES

The equipment items in this section do not satisfy one or more of the applicable criteria defined in the DOR Guidelines; however, sufficient information has been presented to determine that the specific deviations are acceptable and the equipment has been found to be qualified for the life of the plant.

For the R.E. Ginna Station, no equipment falls within this category.

4.3 EQUIPMENT QUALIFIED WITH RESTRICTIONS

This section includes equipment items that are acceptable on the basis that (1) all applicable criteria defined in Section 2 of this report are satisfied with the exception of the qualified life criterion; (2) the equipment requires specific modification which, when completed, will establish qualification with the exception of satisfying the qualified life criterion; or (3) with the exception of satisfying the qualified life criterion, deviations from the criteria presented in Section 2 have been found to be acceptable.

4.3.1 NRC Category II.a
EQUIPMENT THAT SATISFIES ALL APPLICABLE REQUIREMENTS OF THE DOR GUIDELINES WITH THE EXCEPTION OF QUALIFIED LIFE

The following equipment items in this section are fully acceptable on the basis that all applicable criteria defined in the DOR Guidelines are satisfied with the exception of the qualified life criterion. With respect to qualified life, the equipment items have been found to have a qualified life which (1) is limited to a time interval less than plant life, (2) has not been adequately established in terms of calendar time, or (3) has not been evaluated by the Licensee.

4.3.1.1 Equipment Item No. 23
Pressure Transmitters Located in the Intermediate Building
Foxboro Model 611 GM-DSI
Steam Line Pressure (PT-468, 469, 478, 479, 482, 483)
(Original Licensee References 2.18, 2.19, 2.27, and 2.31;
Final Licensee References 2.18, 2.19, and 2.31)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.2.1):

The Foxboro Model GM-DSI transmitter is located in the intermediate building and could be exposed to a HELB environment. The manufacturer has suggested that certain modifications are required on these units in order to preclude early steam entry into the electronics of the transmitter. Westinghouse stated that modifications to the Licensee's transmitter were made in the field.

The Licensee has stated that these transmitters provide post-accident monitoring information to the operator. In addition, for HELBs in the

intermediate building, steam generator level instrumentation located within the containment could be used to provide alternate information if this instrumentation failed due to a hostile environment. The Licensee has stated that the transmitter experiences failure at radiation exposure levels greater than 0.03 Mrd.

FRC has reviewed the documentation referenced by the Licensee. With respect to test results and qualification programs, FRC has described and made general comments to the referenced test programs under Equipment Item No. 22. After review of all referenced documentation, FRC notes the following:

a. The relationship between the installed transmitter and the test specimen has not been established in Reference 2.18; however, Reference 2.31 clearly establishes this relationship. FRC finds this acceptable.

b. From Reference 2.18, FRC concludes that the transmitter is deficient with respect to adequate stability and accuracy; however, Reference 31 establishes satisfactory performance for the transmitter for at least a half-hour under severe environmental conditions. Since these transmitters are located outside containment in an area where peak temperature is not predicted to exceed 215°F, it can be concluded that the transmitters would operate successfully for a longer period of time.

c. All test conditions satisfactorily enveloped the postulated accident environment.

d. Due to the location of the transmitter, qualification for submergence, spray, and radiation is not required.

Based on this review, FRC finds that this equipment satisfies the requirements of the DOR Guidelines.

LICENSEE RESPONSE:

TER C5257 noted that this instrumentation meets the DOR Guidelines. In order to provide instrumentation with all of the proper qualification documentation, there are plans to replace these transmitters by June 1982. Qualification documentation will be made available when received.

FRC EVALUATION:

As previously stated, these transmitters met the requirements of the DOR Guidelines; however, aging degradation has not been evaluated by the Licensee, nor has qualified life been addressed.

FRC CONCLUSION:

This equipment is assigned to NRC Category II.a. Based on review of all documentation, FRC concludes that these transmitters are qualified with the limiting condition that qualified life has not been addressed. The Licensee states that these transmitters will be replaced with qualified units by June 1982.

4.3.1.2 Equipment Item No. 25
Level Transmitters Located in the Auxiliary Building
Foxboro Model 613 DM-MSI
BAST Level (LT-102, 106, 171, 172)
(Original Licensee References 2.18, 2.19, 2.27, 2.31, and 2.33; Final Licensee references not cited)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.2.4):

The Foxboro Model 613 DM-MSI BAST level transmitters are located within the auxiliary building. The Licensee has stated that these transmitters are not anticipated to be exposed to a design basis accident. However, Reference 4 states that an adverse environmental condition could occur due to a postulate heating steam or chemical and volume control system (CVCS) letdown line break.

FRC has reviewed the documentation referenced by the Licensee. With respect to test results and qualification programs, FRC has described and made general comments to the referenced test programs under Equipment Item No. 24. After review of all referenced documentation, FRC notes the following:

a. The relationship between the installed transmitter and the test specimen has not been established in Reference 2.18; however, Reference 2.31 clearly establishes this relationship. FRC finds this acceptable.

b. The test chamber time-dependent temperature/pressure profile, as stated in the referenced test report,

All zero and span shifts were in the conservative (negative) direction. Reference 2.31 establishes satisfactory performance under severe environmental conditions, for at least a half-hour.

c. The Guidelines state that a vendor Certificate of Compliance (COC) with design specifications is not considered sufficient evidence for qualification. For equipment located within containment, a complete and detailed test report is required, supplemented by analyses that demonstrate the validity and applicability of any testing performed

for similar units. FRC notes that the referenced report includes a Foxboro letter dated July 14, 1969, which summarized preliminary test information for the 613 DM transmitter. Although FRC considers this type of documentation more acceptable than a COC, it is clearly less acceptable than an actual test report. However, there is sufficient detail in this document to allow adequate judgment to be made. On this basis, FRC finds the letter acceptable.

Based on the review, FRC concludes that this equipment satisfies the intent of the Guidelines.

LICENSEE RESPONSE:

TER C5257 found that these transmitters met the intent of the DOR Guidelines. It is important to note that this instrumentation performs its safety function following a LOCA or steam line break prior to the time any accident environment is encountered in the Auxiliary Building. For a HELB in the Auxiliary Building, there is no need for the BAST level transmitters to function. No additional information is required for this equipment.

FRC EVALUATION:

FRC agrees with the Licensee's position that the safety-related function of this equipment item is performed following a LOCA or HELB inside containment prior to being subject to a hostile radiation environment as a result of recirculation of fluid from containment to the RHR heat exchanger. FRC also agrees with the Licensee's position that this item is not required to function after a HELB in the auxiliary building. As previously stated in the DITER, these transmitters meet the requirements of the DOR Guidelines. However, aging degradation and qualified life have not been evaluated by the Licensee.

FRC CONCLUSION:

This equipment is assigned to NRC Category II.a. Based on a review of all documentation, these transmitters are qualified with the limiting condition that qualified life has not been addressed.

4.3.1.3 Equipment Item No. 18
Level Transmitter Located in the Auxiliary Building
Foxboro Model 611 GM-ASI
RWST Level (LT-920)
(Original Licensee References 2.18, 2.19, 2.27, and 2.31;
Final Licensee references not cited)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.2.5):

The Foxboro Model 611 GM-ASI transmitter is located in the basement of the auxiliary building. The Licensee claims that the transmitter is not exposed to accident environmental conditions due to HELBs. The manufacturer has suggested that certain modifications are required on these units in order to preclude early steam entry into the electronics of the transmitter. Westinghouse stated that modifications to the Licensee's transmitter were made in the field.

FRC has reviewed the documentation referenced by the Licensee. With respect to test results and qualification programs, FRC has described and made general comments to the referenced test programs under Equipment Item No. 22 (Section 3.3.2.8). After review of all reference documentation, FRC notes the following:

a. The relationship between the installed transmitter and the test specimen has not been established in Reference 2.18; however, Reference 2.31 clearly establishes this relationship. FRC finds this acceptable.

b. For Reference 2.18, FRC concludes that the transmitter is deficient with respect to adequate stability and accuracy; however, Reference 2.31 establishes satisfactory performance for the transmitter for at least a half-hour under severe environmental conditions. Since these transmitters are located outside containment in an area where peak temperatures are not predicted to exceed 215°F, it can be concluded that the transmitter would operate successfully for a longer period of time.

c. The test condition stated in Reference 2.31 satisfactorily envelops the postulated accident environment.

d. Due to the location and required function of the transmitter, qualification for spray, radiation, and submergence is not required.

FRC concludes that this item is not required to function to mitigate the consequences of a HELB accident. In addition, after review of all referenced documentation, FRC notes that this item meets the intent and satisfies the requirements of the DOR Guidelines.

LICENSEE RESPONSE:

> TER C5257 notes that this item satisfies the intent of the DOR Guidelines. For further assurance, this transmitter will be replaced by June 1982 with a fully qualified transmitter. Qualification documentation will be made available when received.

FRC EVALUATION:

The Licensee has stated that this equipment item's safety function is performed prior to its being subject to a hostile radiation environment as a result of recirculation of fluid from containment to the RHR heat exchanger. In addition, the Licensee has stated this equipment item is not required to function after a HELB in the auxiliary building. FRC agrees with the Licensee's position. As previously stated in the DITER, these transmitters meet the requirements of the DOR Guidelines. However, aging degradation and qualified life have not been evaluated by the Licensee.

FRC CONCLUSION:

This equipment is assigned to NRC Category II.a. Based on a review of all documentation, these transmitters are qualified with the limiting condition that qualified life has not been addressed. The Licensee will replace these transmitters with fully qualified units by June 1982, for further assurance of performance.

4.3.1.4 Equipment Item No. 8E
Motorized Valve Actuators Located in the Auxiliary Building
Limitorque Model SMB-00 with Reliance Electric Co. Motor
Actuates Sump Valves (MOV 850 A,B); RHR to SI Valves (MOV-857 A,B,C); RWST to RHR Valves (MOV-856); and CS Valves (MOV-860 A,B,C,D)
(Original Licensee References 2.18, 2.19, and 2.27; Final Licensee References 2.18, 2.19, and 2.53)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.1.4):

The actuators installed at the plant were not identified in the referenced documentation in enough detail to correlate the results of a test report or analysis with their expected performance. It should be possible, however, for the Licensee to demonstrate qualification by similarity or by obtaining more recent qualification reports from the manufacturer. After review of all referenced documentation, FRC notes the following:

a. The referenced test reports are for an

The Guidelines require that the test specimen be the same as the equipment being qualified.

The Licensee did not present an analysis comparing the impact of deviations between the test specimen's specific design features, materials, and production procedure and those of the installed equipment. Therefore, an independent conclusion cannot be reached regarding the extent to which the two units were similar.

b. The thermally aged and tested specimen was not the same as the one exposed to 200 Mrd; therefore, the conducted tests do not combine the effects of aging and irradiation on a single specimen.

c. Assuming that the DBE radiation exposure is low, and since the other DBE environment is not as severe as that used for the tests of similar equipment, it is probable that this item will perform its safety function without the occurrence of a common-mode failure.

Documentation that provides proper evidence that this item is sufficiently similiar to that qualified should be submitted for review.

LICENSEE RESPONSE:

Documentation Reference 2.53, submitted to the NRC on September 24, 1980, provides a reference to Limitorque Report B0003. This reference provides assurance that these valves will perform their safety function. Additional information from Limitorque Report B0058 has been added to

Reference 2.53, documenting Limitorque's use of generic qualification to qualify multiple size actuators by one type test.

FRC EVALUATION:

1. FRC has reviewed Reference 2.53 and notes the following:

   a. Limitorque Report B0003 describes a qualification test program conducted on a SMB-0 MVA (motorized valve actuator) having a Reliance motor with Class B insulation, plus two additional motors: one that is identical to the motor in the MVA (1.6 hp) and the other a 2.6-hp unit manufactured by Electric Apparatus, also with Class B insulation.

      The MVA and motors were thermally aged and simultaneously operated (200 hours at 165°F; operation for 30 seconds in each direction once per hour for 176 hours, and then the MVA was operated for an additional 15 minutes in each direction). The MVA was operated under simulated load, while the motors were unloaded. The MVA then received a nuclear radiation dose of 20 Mrd, and the motors 204 Mrd. Subsequently, the MVA and motors were seismically tested and subjected to a 16-day steam exposure test. Functional operation was demonstrated prior to and at five times during the latter exposure, the last being immediately prior to the end of the test. Insulation resistance (IR) to ground was measured at each of these times also. The MVA malfunctioned once (at 5.8 hours, just after the ambient temperature had been reduced from 250°F to 200°F). This malfunction was attributed to a "a momentary electrical short due to localized condensate buildup, a malfunction of the reversing contactor, or a combination of both." The IR readings decreased with time at each of the two temperature plateaus of the steam exposure, but ac current draw was not affected significantly.

      The manufacturer concluded that "this test generically qualifies Limitorque Valve Actuators type SMB/SB for Class 1E Service outside primary containment for conditions as defined in this report."

   b. Limitorque Report B0058 provides a generic discussion of Limitorque's approach to qualification of its equipment. This report states: "The qualification of the Limitorque Size SMB-0, as reported in the documentation of each of the four tests, was used to generically qualify all sizes of Limitorque operators for the environmental test conditions in accordance with IEEE 382-1972. The Size SMB-0 actuator is an average mid-size unit, and all other sizes of the type SMB, SB, SBD and SMB/HBC are also deemed qualified. All sizes are constructed of the same materials with components designed to equivalent stress levels,

same clearances and tolerances with the only difference being in physical size which varies corresponding to the differences in unit rating."

2. For this equipment, FRC accepts the validity of the approach by Limitorque of qualifying a generic "family" of different size units based upon tests of the mid-range size.

3. The Licensee has not made an assessment of aging degradation, as required by the Guidelines. The qualified life should be determined on a conservative basis. (see Section 4.1.3 for additional information). FRC expects that a proper analysis will show that the qualified life is substantial, but less than plant life.

FRC CONCLUSION:

This equipment is assigned to NRC Category II.a because qualification has been established except for the requirements related to aging and qualified life.

4.3.2 NRC Category II.b
EQUIPMENT THAT SATISFIES ALL APPLICABLE REQUIREMENTS OF THE DOR GUIDELINES WITH THE EXCEPTION OF QUALIFIED LIFE PROVIDED THAT SPECIFIC MODIFICATIONS ARE MADE

The equipment items in this section will be fully acceptable and will satisfy all applicable criteria defined in the DOR Guidelines with the exception of qualifed life provided that specific modifications are made on or before the designated date. When the modifications are complete, the equipment can be considered qualified with the exception of the qualified life criterion. With respect to qualified life, the equipment items have been found to have a qualified life which (1) is limited to a time interval less than plant life, (2) has not been adequately established in terms of calendar time, or (3) has not been evaluated by the Licensee.

For the R.E. Ginna Station, no equipment falls within this category.

4.3.3 NRC Category II.c
EQUIPMENT FOR WHICH DEVIATIONS FROM THE DOR GUIDELINES ARE JUDGED ACCEPTABLE WITH THE EXCEPTION OF QUALIFIED LIFE

The equipment items in this section do not satisfy one or more of the applicable criteria defined in the DOR Guidelines; however, either (1) sufficient bases have been presented to allow a determination that the

specific deviations are judged to be acceptable with the exception of the qualified life criterion, or (2) the specific deviations are judged to be acceptable with the exception of the qualified life criterion based on review of the applicable qualification documentation associated with the overall equipment environmental qualification program. With respect to qualified life, the equipment items have been found to have a qualified life which (1) is limited to a time interval less than plant life, (2) has not been adequately established in terms of calendar time, or (3) has not been evaluated by the Licensee.

4.3.3.1 Equipment Item No. 8D
Motorized Valve Actuators Located in the Intermediate Building
Limitorque Model SMB-00 with Reliance Electric Co. Motor
Actuates AFW Discharge Valves (MOV-4007, 4008); AFW Suction Valves (MOV-4027, 4028); and AFW Cross-Connect Valves (MOV-4000 A,B)
(Original Licensee References 2.18, 2.19, and 2.27; Final Licensee reference not cited)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.1.4):

The actuators (MOV-4027 and 4028, AFW suction; MOV-4007 and MOV-4008, AFW discharge; and MOV-4000A,B, AFW cross-connect) installed at the plant were not identified in the referenced documentation in sufficient detail to correlate the results of a test report or analysis with their expected performance. It should be possible, however, for the Licensee to demonstrate qualification by similarity or by obtaining more recent qualification reports from the manufacturer. After review of all referenced documentation, FRC notes the following:

a. The referenced test reports are for an

The Guidelines require that the test specimen must be the same as the equipment being qualified. The Licensee did not present an analysis comparing the impact of deviations between the test specimen's specific design features, materials, and production procedure and those of the installed equipment. Therefore, an independent conclusion cannot be reached regarding the extent to which the two units are similar.

b. The DBE environment is not as severe as that used in tests of similar equipment. Therefore, it is probable that this item will perform its safety function without the occurrence of a common-mode failure.

It is recommended that documentation demonstrating that this item is sufficiently similiar to the one qualified be obtained by the Licensee and submitted for review.

However, the Licensee has noted that the hostile environment in the intermediate building due to a HELB accident can be more severe than the auxiliary feedwater (AFW) system electrical equipment can withstand. For this reason, an additional set of AFW pumps was installed in a new addition to the building so that failure of this equipment item can be tolerated without incurring a significant decrease in the safety of the plant. The Licensee has stated that any portion of the standby AFW system required to operate in an emergency is not subject to adverse environment. FRC concludes, therefore, that the lack of complete qualification documentation is a moot point for these devices since other AFW system components also lack documentation. FRC agrees that explicit qualification for service under accident conditions is not required provided that NRC concurs with the Licensee's position that the "remote-manual" controlled standby AFW system's safety function eliminates the need for a qualified AFW system.

LICENSEE RESPONSE:

> As noted in TER C5257, these valves would not be used in the event of a HELB in the Intermediate Building. RG&E Emergency Procedures specifically call for actuating the Standby Auxiliary Feedwater System in the event the AFW system is inoperable. Since none of the Standby AFW System components will be exposed to a HELB, it is concluded that this system will be sufficient to provide the needed safety function. No "harsh" environmental qualification for the AFW valves is needed.

FRC EVALUATION:

1. A thorough review of the AFW system(s) at this plant (see Item E.1 in Appendix E) has led to the conclusion that the present configuration, with remote-manual initiation of the standby AFW system, is not satisfactory. FRC finds that exempting this equipment from qualification is justified only if the standby AFW pumps are automatically initiated (e.g., the standby AFW pumps are aligned to a

reliable source of quality water with the main AFW pumps placed in a backup role).

2. Qualification for the postulated conditions has been established based upon the references originally cited, and the information contained in Reference 2.53 cited for the similar Equipment Item No. 8E. The Licensee has not assessed aging degradation, as required by the Guidelines. The qualified life should be determined on a conservative basis, recognizing the uncertainties in the determination of long-term aging effects related to long-term exposure to humidity and temperature (see Section 4.1.3 for additional information). It is expected that this will indicate the qualified life is substantial, but less than the licensed plant life.

FRC CONCLUSION:

This equipment is assigned to NRC Category II.c because qualification (except for evaluating aging degradation and establishing the qualified life) is established by the references previously cited as well as those cited for similar equipment.

4.3.3.2 Equipment Item No. 8H
Motorized Valve Actuators Located Within Containment
Limitorque Model SMB-1 with Reliance Electric Co. Motor
Actuates Core Deluge Valves (MOV-852 A,B)
(Original Licensee References 2.18, 2.19, 2.27, and 2.37;
Final Licensee References 2.18, 2.19, and 2.37)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.2.2):

Licensee References 2.18 and 2.19 contain basically the same information. The more complete is Reference 2.18, Westinghouse Report WCAP-7710-L, Vol. II, which describes a test program in which a actuator was subjected to a qualification test program. Reference 2.19 is a nonproprietary version of 2.18, and thus contains less information. Reference 2.27 describes the effects of different spray solutions on metal sample coupons, and Reference 2.37 is a letter discussing the matter of submergence. FRC has reviewed these references and has noted the following:

a. The Guidelines require that the test specimen be the same as the equipment being qualified. The Licensee did not present an analysis comparing the impact of deviations between the test specimen's specific design features, materials, and production procedure and those of the installed equipment. Therefore, an independent conclusion cannot be reached regarding the extent to which the two units are similar.

b. The Licensee's submittal of February 24, 1978 listed the motor for this item as having Class B insulation.

The referenced test report states that this motor actuator with Class B insulation should be considered unsatisfactory for long-term operation. The Licensee's submittal states that the valve completes its safety function (to open) early into the accident. The judgment with regard to the acceptability of this statement, and hence the justification for only a relatively brief period of demonstrated performance, is the responsibility of the NRC.

c. The Guidelines require that radiation exposure should be applied during the test sequence concurrent with, or prior to, the temperature and pressure/steam environment, if it is known that the device contains materials degraded by irradiation. FRC notes that the specimen thermally aged and subjected to a LOCA simulation was not the same as the one exposed to 200 Mrd. The conducted tests do not combine the effects of aging, radiation, and steam environment on a single specimen. However, the Guidelines also state that equipment exposed to a radiation environment must be qualified for that environment by either test or analysis. Since there is no evidence of material degradation due to irradiation, FRC concludes that this methodology is acceptable.

d. The referenced test report did not consider simulation of submergence, which is a DBE environmental condition. Licensee Reference 2.37 is a letter stating that some action was taken to address the possibility of flooding; the details were not made available to FRC, and a conclusion cannot be reached concerning the effect of flooding.

The actuators installed at the plant were not identified in sufficient detail to correlate the results of a test report or analysis with their expected performance. It may be necessary in this case to specify a motor with both high-temperature rating and radiation resistance if long-term active

service is required based on NRC review. The deficiencies cited in the documentation should be addressed by the Licensee.

LICENSEE RESPONSE:

TER C5257 notes that these valve actuators are not acceptable for long-term service in an accident environment and are not qualified for submerged operation. Qualification for short-term post-LOCA operation is shown in Reference 2.18, however. The function of these valves is to open upon receipt of an SI signal and then to remain open. Qualification for submerged operation is not required. Submergence could not occur unless the safety function of the valves has already occurred. Specifically, to submerge these valve operators, the entire contents of the primary system, the entire contents of both accumulators, and a portion of the water in the refueling water storage tank must be discharged to the containment. For this to occur, however, a safety injection signal must have occurred, and the valves must have opened.

RG&E has incorporated modifications to these valve operators to prevent undesired operation in the event of submergence. The details of these modifications were provided in References [FLOOD-2, FLOOD-3] transmitted to FRC on May 29, 1980. It is thus considered that these valves [sic] are qualified to perform their required safety function.

FRC EVALUATION:

1. FRC has reviewed and accepts the Licensee's analysis concerning the function of this equipment (i.e., its active function exists only early in the accident, and its long-term, passive function is to remain in position and not degrade other circuits).

2. In connection with Equipment Item No. 8E, the Licensee has cited Reference 2.53, a Limitorque Report B0058. This report provides a generic discussion of Limitorque's approach to qualification of its equipment, stating:

> "The qualification of the Limitorque Size SMB-0, as reported in the documentation of each of the four tests, was used to generically qualify all sizes of Limitorque operators for the environmental test conditions in accordance with IEEE 382-1972. The Size SMB-0 actuator is an average mid-size unit, and all other sizes of the type SMB, SB, SBD, and SMB/HBC are also deemed qualified. All sizes are constructed of the same materials with components designed to equivalent stress levels, same clearances and tolerances with the only difference being in physical size which varies corresponding to the differences in unit rating."

The approach used by Limitorque for qualifying a generic family of different sized actuators based on tests of a mid-size unit is acceptable.

3. Reference 2.18, which was originally cited, therefore adequately establishes the qualification of the installed equipment for a period of at least an hour, which is sufficient. With regard to the long-term, passive function while the units are submerged, the steps taken by the Licensee provide sufficient assurance that inadvertent operation will not occur. Further assurance is provided by the fact that in another test known to FRC, a Limitorque MVA of similar design was subjected to a steam/spray exposure during which a drum in the test vessel became clogged and as a result the MVA was submerged. No inadvertent operation occurred.

4. The Licensee has not evaluated aging degradation, nor determined the qualified life on a conservative basis (see Section 4.1.3 for additional information). FRC expects that such an evaluation would show that the qualified life is substantial, but less than plant life.

FRC CONCLUSION:

This equipment is assigned to NRC Category II.c. The Licensee has provided sufficient documentation, both initially and in connection with similar equipment, to establish qualification. The qualified life is not established but is expected to be substantial, but less than the plant life.

4.3.3.3 Equipment Item No. 15C
Electric Power Cables Located Outside Containment
Kerite Co., Cable Type HT
(Original Licensee References 2.11, 2.18, 2.19, and 2.27;
Final Licensee References 2.11 and 2.51)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.2.7):

The cable installed at the plant bore no identification concerning either manufacturer or type; therefore, it was not possible to verify this information during the plant inspection. Documentation concerning this aspect (purchase orders, cable schedules, etc.) should be provided by the Licensee for review. The environmental service conditions within containment are more severe and

are therefore controlling. FRC has reviewed the qualification references cited by the Licensee and has noted the following:

a. None of the numerical values for qualification exposure parameters tabulated in the Licensee's submittal [1] can be authoritatively verified.

b. Licensee References 2.18 and 2.19 contain basically the same information. The more complete is Reference 2.18, Westinghouse report WCAP-7710-L, Vol. II, which describes a test program in which

were spliced and then exposed to various combinations of thermal aging (40-year equivalent), gamma irradiation, and steam/chemical spray. The Licensee has not provided information to verify that the tested cable is the same as that installed in the plant, as the Guidelines require. The same reference also mentions another steam/chemical spray exposure test, involving power cables, but does not identify the manufacturer, size, materials, construction, etc.

c. In the test program described in Reference 2.18, the temperature/pressure parameters essentially envelop those specified by the Licensee, except that the pressure decreases somewhat more rapidly. This deviation is not regarded as significant. The chemical spray composition in the test was slightly different and the spray density was not stated. These deviations are judged to be acceptable, since other tests in the same series, reported in the same reference, did use the proper density. A more serious deviation is the fact that the spray was present for

d. With regard to nuclear radiation exposure, the Licensee has specified a value many times larger then the value stated in the Guidelines as being acceptable for gamma exposure (160 Mrd vs. 20 Mrd). The exposure in the test program was 50 Mrd, but the Licensee has not specifically evaluated the contribution to the total dose experienced by the cable that results from beta radiation, as is required by the Guidelines. (Presumably, the difference between the 160-Mrd and 20-Mrd values is, in large part, due to beta radiation.) Also, the Licensee has not stated the dose that the cable will accumulate during its installed life under normal plant operation. FRC therefore has no basis for determining whether the total exposure of 50 Mrd in the test program is adequate.

e. Licensee Reference 2.18 states that the cable samples were electrically loaded during the steam/chemical spray exposure by

Because of a failure in another cable sample included in the test (one for which the manufacturer was not stated),

The Licensee has not provided information concerning the actual operational service conditions for the installed cables (specifically, the current load), so FRC is unable to judge the adequacy of the current load applied during the test in producing insulation overheating representative of actual conditions.

f. Licensee Reference 2.11 is an internal memorandum of the Kerite Co., signed by the Chief Engineer, containing (i) statements concerning the capabilities of the cables supplied for the Ginna plant and (ii) a description of an 18-day, 214°F steam test exposure conducted on cable samples.

This document is too general and vague to serve as definitive evidence for qualification. In particular, the environmental parameter values (Appendix A) are not considered.

g. Licensee Reference 2.27 describes the effects of several chemical spray solutions on metal sample coupons and has no relevance to electrical cables (see Appendix D).

On the basis of the foregoing review, FRC concludes that:

1. The Licensee should provide evidence that the tested cable of Reference 2.18 is the same as that installed in the plant.

2. The Licensee should justify by analysis or additional test data that a continuous chemical spray would not lead to failure.

3. The Licensee should describe the actual service load for the installed cable, so that the deficiencies in current loading as applied during the temperature/steam pressure tests can be assessed.

4. The Licensee should state the radiation dose the cable will accumulate during normal operation over its installed life and specifically evaluate the beta doses, as required by the Guidelines.

5. The Licensee should delineate which cable types are subject to submergence and provide submergence test data for those.

LICENSEE RESPONSE:

Reference 2.51 is the "Cable Identification and Qualification Supplement." This document can be used to determine the identity of cable in use throughout the plant. It is shown that all power cable inside Containment is Kerite. The most recent and comprehensive qualification testing of Kerite cable was performed in conjunction with the testing of Raychem sleeves [2.38]. Reference 2.55 is a letter from Kerite verifying that the cable supplied for the qualification testing in Reference 2.38 is identical to that originally supplied and installed in the Ginna Containment. The preaging done for the Kerite cable during the Raychem sleeve test established a 93.3-year life at 140°F mean surface temperature. The Arrhenius data is confidential to the manufacturer, but is available at RG&E as Reference 2.63.

RG&E believes that this recent testing definitively demonstrates the adequacy of the Kerite cable for performing its required safety function.

FRC EVALUATION:

The following comments are based on a review of the Licensee's response, information appearing in Reference 2.51, and other applicable test reports examined during the EEQ program:

1. Cable Identification: Reference 2.51 describes power and control cable outside containment. The Ginna plant specifications limit power cable for safeguards applications to Kerite. Therefore, the DITER comments on cable identity have been resolved.

2. Aging: FRC does not agree that thermal aging alone [2.63] simulates all the aging conditions to which the cable would be subjected for the life of the plant and therefore disagrees with the statements of life time. See Section 4.1.3 for further discussion.

3. Environmental Service Conditions: Reference 2.51 contains a copy of FIRL Report F-C5074 (supplement) discussing tests on Kerite cables under LOCA conditions. The maximum accident conditions outside containment involve an environment of 220°F/15.8 psia/100% RH. The test conditions envelop those resulting from a HELB outside containment.

For supplemental information, see Equipment Items 15A and 15B.

FRC CONCLUSION:

This item is assigned to NRC Category II.c. The testing conducted on Kerite cables (also see Equipment Items 15A and 15B) envelops the conditions

that would be encountered in locations outside containment at the Ginna Plant. However, a conservative qualified life (see Section 4.1.3) should be determined, and a monitoring program established to determine whether degradation is occurring.

4.3.3.4 Equipment Item No. 8B
Motorized Valve Actuators Located in the Auxiliary Building
Limitorque Model SMB-00 with Peerless Electric Co. Motor
Actuates BAST to SI Pump Valves (MOV-826 A,B,C,D); and RWST to SI Pump Valves (MOV-896 A,B)
(Original and Final Licensee Reference 2.13)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.1):

Reference 2.13 is a specification, not a test report, and this type of documentation is not considered proper evidence of qualification. The actuators installed at the plant were not identified in the referenced documentation in enough detail to correlate the results of a test report or analysis with their expected performance. It should be possible, however, for the Licensee to demonstrate qualification by similarity or by obtaining more recent qualification reports from the manufacturer.

The DBE environment is not as severe as that to which similar equipment has been exposed in test programs. Therefore, it is probable that this item will perform its designed function without the occurrence of a common-mode failure. Documentation demonstrating that this item is qualified should be obtained by the Licensee and submitted for review.

LICENSEE RESPONSE:

The MOVs 826 A,B,C,D are located at the discharge of the Boric Acid Storage Tanks (BAST), and provide suction to the SI pumps in the event of a Safety Injection signal. Upon low BAST level, these valves close after the 825 A,B valves open. The valves are located in the auxiliary building, and will have completed their function prior to the presence of an adverse environment caused by sump recirculation fluid.

MOVs 896 A,B are normally locked-open valves, located at the suction of the SI and CS pumps from the RWST. The valves are closed prior to the time sump recirculation is initiated. Therefore, these valves will have completed their function prior to the time an adverse environment would occur.

In the case of all six valves, environmental qualification for an adverse environment is not required.

FRC EVALUATION:

The environmental service conditions tabulated by the Licensee for this equipment have not been established considering the requirement that qualification is required for a period of one hour plus operating time. However, even with conditions more severe than those stated by the Licensee at the installed location of this equipment, the equipment is considered qualified on the basis of qualification documentation submitted for similar equipment, but with the same concerns and comments pertaining to qualified life.

FRC CONCLUSION:

This equipment is assigned to NRC Category II.c based upon the qualification documentation provided for similar equipment. FRC considers the qualified life to be substantial but less than the period of licensed plant life.

4.3.3.5 Equipment Item No. 8C
Motorized Valve Actuators Located in the Auxiliary Building
Limitorque Model SMB-00 with Reliance Electric Co. Motor
Actuates Valves in Lines Between RWST and SI Pumps Valve (MOV-825 A,B)
(Original Licensee References 2.18 and 2.19; Final Licensee Reference 2.13)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.1.3):

The actuators (MOV-825A,B: RWST to SI Pumps) installed at the plant were not identified in the referenced documentation in sufficient detail to correlate the results of a test report or analysis with their expected performance. It should be possible, however, for the Licensee to demonstrate qualification by similarity or by obtaining more recent qualification reports from the manufacturer. After review of all referenced documentation, FRC notes the following:

a. The referenced test reports are for an

The Guidelines require that the test

specimen be the same as the equipment being qualified. The Licensee did not present an analysis comparing the impact of deviation between the test specimen's specific design features, materials, and production procedure and those of the installed equipment. Therefore, an independent conclusion cannot be reached regarding the extent to which the two units are similar.

b. The DBE environment is not as severe as that used in tests of similar equipment. Therefore, it is probable that this item will perform its safety function without the occurrence of a common-mode failure.

It is recommended that an analysis demonstrating that this item is similar to that qualified or a more recent qualification test report on the same model as used in the plant be obtained by the Licensee and submitted for review. However, the Licensee has stated that valves MOV-825A and 825B function to open automatically at approximately a half-hour into a postulated LOCA accident in order to provide suction from the refueling water storage tank to the safety injection pumps. This function occurs when the boric acid storage tank level decreases to the 10% full level. In addition, the Licensee has stated that the valves perform their safety function (and remain open) prior to exposure to a hostile environment due to the recirculation of fluid from containment to the RHR heat exchangers (see Appendix A). FRC concludes, therefore, that the lack of complete qualification documentation is a moot point, provided that NRC concurs in this safety-function assessment. Subject to NRC concurrence, FRC agrees that explicit qualification for service under accident conditions is not required.

LICENSEE RESPONSE:

As noted in TER C5257, these valves perform their safety function (open to allow RWST fluid to the suction of the SI pumps) prior to the time an adverse environment would exist in the Auxiliary Building due to sump recirculation. No harsh environmental qualification is required for these items.

FRC EVALUATION:

The environmental service conditions tabulated by the Licensee for this equipment have not been established considering the requirement that qualification is required for a period of one hour plus operating time.

However, even with conditions more severe than those stated by the Licensee at the installed location of this equipment, the equipment is considered qualified on the basis of qualification documentation submitted for similar equipment, but with the same concerns and comments pertaining to qualified life.

FRC CONCLUSION:

This equipment is assigned to NRC Category II.c based upon the qualification documentation provided for similar equipment. FRC considers the qualified life to be substantial but less than the period of licensed plant life.

4.4 NRC Category III EQUIPMENT THAT IS EXEMPT FROM QUALIFICATION

The equipment items in this section 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. In addition, any failure of the exempt equipment must not degrade the ability of qualified equipment to perform its required safety-related function.

4.4.1 Equipment Item No. 8A Motorized Valve Actuators Located Within Containment Limitorque Model SMB-2 with Reliance Electric Co. Motor Operates Accumulator Discharge Valve (MOV-841, 865) (Original Licensee References 2.18, 2.19, 2.27, and 2.37; Final Submittal Deletes Reference 2.27)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.1.1):

The most relevant source for justification documentation is Reference 2.18. Licensee Reference 2.19 is a nonproprietary version of the former reference and contains less detailed information. Reference 2.27 describes the effects of chemical spray on metal coupons (Appendix D presents FRC comments on this reference). Reference 2.37 is a letter from the Licensee to the NRC, which addresses the matter of submergence of these equipment items and others. It notes that power has been removed from these items, and they do not function during or following an accident. After review of all referenced documentation, FRC notes:

a. Licensee Reference 2.18 contains a test report for an

The Guidelines require that the test specimen be the same as the equipment being qualified. The Licensee did not present an analysis comparing the impact of deviations between the test specimen's specific design features, materials, and production procedure and those of the installed equipment. Therefore, an independent conclusion cannot be reached regarding the extent to which the two units are similar. Hence, the validity of the cited test as evidence of qualification has not been established.

b.

The Licensee's letter of February 24, 1978 lists this item as having a motor with Class B insulation. The referenced report states that motors with Class B insulation are unsatisfactory for long-term application in the LOCA and post-LOCA environment.

c. The specimen subjected to a LOCA simulation was not the same as the one exposed to 200 Mrd. Therefore, the conducted tests did not combine the effects of radiation and steam environment on a single specimen. The Guidelines require that the effect of nuclear radiation combined with other LOCA environments be assessed by test or analysis.

d. The referenced test report did not consider simulation of submergence, which is a DBE environmental condition. The Guidelines require that specifying saturated steam as a service condition during type testing of equipment that becomes flooded in service is not an acceptable alternative for actually flooding the equipment during the test.

Although the foregoing items highlight various shortcomings in the qualification documentation, the Licensee submittal and Licensee Reference 2.37 state that these valve actuators are locked in the "open" position with power removed and have no need to function. As long as this is the case, the lack of valid qualification documentation is a moot point, and no further information is required from the Licensee.

LICENSEE RESPONSE:

TER C5257 concludes that, since these valve actuators are locked in the "open" position with power removed with no need to function, lack of valid qualification documentation is a moot point. Thus, no qualification information is required for this item.

FRC EVALUATION:

This equipment is exempt from qualification because it is locked open with power removed and therefore does not have to operate.

FRC CONCLUSION:

This equipment is assigned to NRC Category III because it is locked open with power removed and is not required to operate in the event of a postulated accident.

4.4.2 Equipment Item Nos. 8F and 8G
Motorized Valve Actuators Located Within Containment
Limitorque Model SMB-00
8F: Actuates Valves for RHR Suction from Sump B (MOV-851 A,B)
8G: Actuates Valves for Safety Injection to Cold Legs (MOV-878 B,D)
(Original and Final Licensee Reference 2.13)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.1.2):

The reference cited by the Licensee is a specification, not a test report. Generally, this type of document is not considered evidence of qualification.

The actuators installed at the plant were not identified in enough detail to correlate the results of a test report or analysis with their expected performance. It may be possible, however, for the Licensee to demonstrate qualification by similarity or by obtaining more recent qualification reports from the manufacturer if necessary. It may be necessary in this case to specify a motor with a high temperature rating if long-term active service is required.

As was the case with the preceding equipment item, the Licensee submittal states that these valve actuators are normally locked in position with power removed and have no need to perform an active safety function. As long as this is the case, environmental qualification is a moot point, and no further information is required from the Licensee.

LICENSEE RESPONSE:

> TER C5257 concludes that, since these valve actuators are locked in the safety position with no need to function, lack of valid qualification documentation is a moot point. Thus, no qualification information is required for this item.

FRC EVALUATION:

The equipment is exempt from qualification because it is locked open with power removed and therefore does not have to operate.

FRC CONCLUSION:

These equipment items are assigned to NRC Category III because they are locked open with power removed and are not required to operate in the event of a postulated accident.

4.4.3 Equipment Item No. 5A
Solenoid Valves Located in Turbine Building and Auxiliary Building
Automatic Switch Co., Model Not Stated
Actuates RHR Discharge Valves (AOV-624, 625)
(Original Licensee Reference 2.23)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.2):

The Licensee has submitted documentation that is not applicable to these items or for which applicability cannot be determined. It should be possible, however, for the Licensee to demonstrate qualification by similarity or by obtaining relevant test reports from the manufacturer. If the safety function of these equipment items is to deenergize to the fail-safe position, then only the nonelectrical components of the valve are required to function. The safety functions of these items should be clarified by the Licensee.

a. The Guidelines require that the test specimen must be the same as the equipment being qualified. The Licensee did not present an analysis comparing the impact of deviations between the test specimen's specific design features, materials, and production procedures and those of the installed equipment. Therefore, an independent conclusion cannot be reached regarding the extent to which the two units are similar. Hence, the validity of the test as evidence of qualification has not been established.

b. The test specimen was exposed to saturated steam

The report did not indicate the reason for the failure.

c. Aging of the test specimen was not considered, no qualified life has been established, and there is no program to ascertain whether any in-service failures during the installed life of the equipment are the result of aging degradation.

LICENSEE RESPONSE:

This equipment controls the RHR discharge valves, which are normally open. They need only remain open in the event of an accident. The I/P controller (rather than a solenoid valve) controlling their position is

fail-open. Since no function must be performed by these valves, they have been deleted from Table 3.

FRC EVALUATION:

FRC concurs that this equipment is exempt from qualification because it does not perform a safety-related function.

FRC CONCLUSION:

This equipment is assigned to NRC Category III because it does not perform a safety-related function.

4.4.4 Equipment Item No. 7
.Control Room Dampers D-81 Through D-87
Manufacturer and Model Not Stated
(Licensee reference not cited)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.7):

The Licensee referenced no documentation in support of qualification for this item. Therefore, no conclusion can be reached regarding the adequacy of qualification. The Licensee has not considered the possibility of abnormal environments in the space where they are located (presumed to be the control room mechanical equipment room) as is discussed in Reference 4 and quantified in Appendix A.

LICENSEE RESPONSE:

This equipment item is not electrical, and therefore is not addressed in this report. The solenoid valves operating these dampers are addressed under paragraph TER 3.3.3.23 (Table 3, Item No. 40).

FRC EVALUATION:

This equipment should not have been included in the Licensee's list of safety-related electrical equipment.

FRC CONCLUSION:

This equipment is assigned to NRC Category III because it was incorrectly included in the earlier submittal [6].

4.5 EQUIPMENT FOR WHICH DOCUMENTATION CONTAINS DEVIATIONS FROM THE GUIDELINES THAT ARE JUDGED UNRESOLVED

This section includes equipment items which are deficient on the basis that all criteria defined in the DOR Guidelines are not satisfied. However, the equipment item is either scheduled to be tested or is judged to have a high likelihood of operability.

4.5.1 NRC Category IV.a
EQUIPMENT WHICH HAS QUALIFICATION TESTING SCHEDULED BUT NOT COMPLETED

The equipment items in this section have been judged deficient or inadequate based upon review of the documentation provided by the Licensee; however, the Licensee has stated that the equipment item is scheduled to be tested by a designated date. The results of the testing will dictate the specific qualification category of the equipment item.

For the R.E. Ginna Station, no equipment falls within this category.

4.5.2 NRC Category IV.b
EQUIPMENT FOR WHICH QUALIFICATION DOCUMENTATION IN ACCORDANCE WITH THE GUIDELINES HAS NOT BEEN ESTABLISHED

The qualification of the equipment items in this section is deficient or inconclusive based upon review of the documentation provided by the Licensee. This equipment is judged to have a high likelihood of operability for the specified environmental service conditions; however, complete and auditable records reflecting comprehensive qualification documentation have not been made available for review.

4.5.2.1 Equipment Item No. 21A
Pressure Transmitters Located in the Auxiliary Building
ITT-Barton Model 332
Containment Pressure
(Original and Final Licensee Reference 2.31)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.2.3):

FRC has reviewed the documentation referenced by the Licensee. With respect to test results and qualification programs, FRC has described and made general comments to the referenced test programs under Equipment Item No. 20. After review of all referenced documentation, FRC notes that this item meets the intent and satisfies the requirements of the Guidelines.

LICENSEE RESPONSE:

TER C5257 found that these transmitters satisfied the DOR Guidelines. In light of TMI Lessons Learned, five of the seven transmitters, which could see a high radiation field following a LOCA, are being replaced with new transmitters (three will have a 10- to 200-psig span and provide post-accident monitoring). These transmitters will be qualified for the post-LOCA environment and will therefore be qualified for a HELB outside containment environment. All five will be replaced by June 1982. Qualification documentation will be made available when received. The two transmitters not being replaced are not exposed to a harsh environment as the result of a LOCA. For a HELB outside containment, these two transmitters are not required to function.

FRC EVALUATION:

The Licensee has stated that the two transmitters located in the auxiliary building at the intermediate elevation are not exposed to an adverse environment when required to function during a LOCA, HELB inside containment, or recirculation of containment fluids outside containment at the equipment location.

The Licensee has not provided information (see Equipment Item No. 20) that would establish similarity between the tested Barton Model 332 MOD-I and the installed Barton Model 332 transmitter. Therefore, evidence of qualification has not been made available. In addition, the Licensee has not addressed aging degradation or qualified life. However, these transmitters are not exposed to an adverse environment and, therefore, the equipment is

judged to have a high likelihood of operability under its specified environmental service conditions.

FRC CONCLUSION:

This equipment is assigned to NRC Category IV.b. Based on review of all information, these transmitters have a high likelihood of operability because the environmental service conditions are not severe at the installed location. However, qualification documentation, aging degradation, and qualified life have not been established for this equipment.

4.5.2.2 Equipment Item No. 19
Level Switch Located in the Auxiliary Building
ITT-Barton Model 289
RWST Level (LIC-921)
(Original and Final Licensee Reference 2.34)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.2.6):

The Barton Model 289 differential pressure switch is located in the basement of the auxiliary building. The Licensee has stated that the unit provides low-level alarm functions for the RWST tank. FRC has reviewed the ITT Barton Technical Manual referenced by the Licensee as evidence of qualification and has noted that the test report and qualification program are not included in this documentation. FRC concludes, however, that this item is not required to function to mitigate the consequences of a HELB accident. In addition, the device will have served its function prior to being subject to a hostile environment as a result of recirculation of fluid from containment to the RHR heat exchangers. FRC concludes, therefore, that the lack of qualification documentation for this device is a moot point provided that NRC concurs with this assessment. With NRC concurrence, FRC agrees that explicit qualification for service under accident conditions is not required.

LICENSEE RESPONSE:

TER C5257 notes that this item does not require environmental qualification, since the safety function is performed prior to the onset of an adverse environment. This is correct; however, for added assurance of post-accident monitoring, this item is being replaced by June 1982. Qualification documentation will be made available when received.

FRC EVALUATION:

The safety function of this component is performed following a LOCA or HELB inside containment prior to being subjected to a hostile radiation environment from recirculation of coolant from containment to the RHR heat exchanger. Furthermore, this equipment is not required to function after a HELB in the auxiliary building. However, FRC notes that qualification documentation has not been provided and that the Licensee will replace the equipment.

FRC CONCLUSION:

This equipment is assigned to NRC Category IV.b because it should perform its safety function prior to exposure to an adverse environment. However, qualification documentation, qualified life, and aging degradation have not been established. The Licensee will replace this component with a qualified component by June 1982.

4.5.2.3 Equipment Item Nos. 15A and 15B
Electric Cables Located Within Containment
Kerite Co. Cable Type HT
15A: Power Cables
15B: Control Cables
(Original Licensee References 2.11, 2.18, 2.19, and 2.27;
Final References 2.11, 2.38, 2.51, 2.55, and 2.63)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.2.7):

The cable installed at the plant bore no identification concerning either manufacturer or type; therefore, it was not possible to verify this information during the plant inspection. Documentation concerning this aspect (purchase orders, cable schedules, etc.) should be provided by the Licensee for review. The environmental service conditions within containment are more severe and are therefore controlling. FRC has reviewed the qualification references cited by the Licensee and has noted the following:

a. None of the numerical values for qualification exposure parameters tabulated in the Licensee's submittal [1] can be authoritatively verified.

b. Licensee References 2.18 and 2.19 contain basically the same information. The more complete is Reference 2.18, Westinghouse Report WCAP-7710-L, Vol. II, which describes a test program in which

were spliced and then exposed to various combinations of thermal aging (40-year equivalent), gamma irradiation, and steam/chemical spray. The Licensee has not provided information to verify that the tested cable is the same as that installed in the plant, as the Guidelines require. The same reference also mentions another steam/chemical spray exposure test, involving power cables, but does not identify the manufacturer, size, materials, construction, etc.

c. In the test program described in Reference 2.18, the temperature/pressure parameters essentially envelop those specified by the Licensee, except that the pressure decreases somewhat more rapidly. This deviation is not regarded as significant. The chemical spray composition in the test was slightly different and the spray density was not stated. These deviations are judged to be acceptable, since other tests in the same series, reported in the same reference, did use the proper density. A more serious deviation is the fact that the spray was present for

d. With regard to nuclear radiation exposure, the Licensee has specified a value many times larger than the value stated in the Guidelines as being acceptable for gamma exposure (160 Mrd vs. 20 Mrd). The exposure in the test program was 50 Mrd, but the Licensee has not specifically evaluated the contribution to the total dose experienced by the cable that results from beta radiation, as is required by the Guidelines. (Presumably, the difference between the 160-Mrd and 20-Mrd values is, in large part, due to beta radiation.) Also, the Licensee has not stated the dose that the cable will accumulate during its installed life under normal plant operation. FRC therefore has no basis for determining whether the total exposure of 50 Mrd in the test program is adequate.

e. Licensee Reference 2.18 states that the cable samples were electrically loaded during the steam/chemical spray exposure by

Because of a failure in another cable sample included in the test (one of those for which the manufacturer was not stated),

The Licensee has not provided information concerning the actual operational service conditions for the installed cables (specifically, the current load thus) so FRC is

unable to judge the adequacy of the current load applied during the test in producing insulation overheating representative of actual conditions.

f. Licensee Reference 2.11 is an internal memorandum of the Kerite Co., signed by the Chief Engineer, containing (i) statements concerning the capabilities of the cables supplied for the Ginna plant and (ii) a description of an 18-day, 214°F steam test exposure conducted on cable samples. This document is too general and vague to serve as definitive evidence for qualification. In particular, the environmental parameter values (Appendix A) are not considered.

g. The Licensee's submittal claims that no cables are submerged at the time they must perform their function and does not address this subject further. However, during the plant inspection, it appeared that cables were installed within the submergence depth. The Guidelines require that equipment located within containment and subject to submergence should be qualified with actual submergence during testing.

h. Licensee Reference 2.27 describes the effects of several chemical spray solutions on metal sample coupons and has no relevance to electrical cables (see Appendix D).

On the basis of the foregoing review, FRC concludes that:

1. The Licensee should provide evidence that the tested cable of Reference 2.18 is the same as that installed in the plant.

2. The Licensee should justify by analysis or additional test data that a continuous chemical spray would not lead to failure.

3. The Licensee should describe the actual service load for the installed cable, so that the deficiencies in current loading as applied during the temperature/steam pressure tests can be assessed.

4. The Licensee should state the radiation dose the cable will accumulate during normal operation over its installed life and specifically evaluate the beta doses, as required by the Guidelines.

5. The Licensee should delineate which cable types are subject to submergence and provide submergence test data for those.

LICENSEE RESPONSE:

Reference 2.51 is the "Cable Identification and Qualification Supplement." This document can be used to determine the identity of cable in use throughout the plant. It is shown that all power cable inside containment is Kerite. The most recent and comprehensive qualification testing of Kerite cable was performed in conjunction with the testing of Raychem sleeves [2.38]. Reference 2.55 is a letter from Kerite verifying that the cable supplied for the qualification testing in Reference 2.38 is identical to that originally supplied and installed in the Ginna containment. The preaging done for the Kerite cable during the Raychem sleeve test established a 93.3-year life at 140°F mean surface temperature. The Arrhenius data is confidential to the manufacturer, but is available at RG&E as Reference 2.63.

RG&E believes that this recent testing definitively demonstrates the adequacy of the Kerite cable for performing its required safety function.

There are no safety-related cables inside containment subject to flooding that are required to perform a safety function during submergence. Qualification for submergence is, thus, not required.

FRC EVALUATION:

The following comments are based on a review of the Licensee's response, information appearing in References 2.55, 2.38, and 2.51, and other applicable test reports examined during the EEQ program:

1. Cable Identification, Reference 2.51 describes power and control cable inside containment. The Ginna specifications limit the selection to Kerite for power and control cable inside and outside containment for safeguards applications. The DITER questions concerning cable identity between installed and tested cables have been resolved by the Licensee.

2. Reference 2.51 contains a copy of FIRL Report F-C5074 (supplement) which discusses tests on Kerite cables. The test report supplied in 2.51 and the basic test Report F-C5074 [2.38] have been reviewed and any conclusions cannot be drawn on performance or qualified life of the cable. The cable discussed in the Licensee Response was laid in the bottom of the box with the main specimens. The effect of shielding of the steel plate and of the heavy cables and penetrations was not considered. Therefore, the dose received by the loose cables cannot accurately be determined. The radiation curve supplied in the test report is for the normal distance attenuation that would occur

if no sample were present. Furthermore, no measurements of cable parameters were taken during the LOCA tests to determine performance during the exposure.

3. The high dose rate radiation exposure during LOCA at Ginna would cause greater degradation than the test condition dose rate in Reference 2.5 for the cable insulation materials used (see Appendix H).

4. As a result of review of other test reports referenced by other Licensees in the EEQ program for SEP plants, FRC has also reviewed FIRL Report F-C4020-1. The cables covered are Kerite cables which are the same as those installed at Ginna Station.

   For the cables reported in FIRL Report F-C4020-1, there was a noticeable decrease in insulation resistance after thermal aging and approximately a factor of 100 reduction in insulation resistance during radiation exposure. The report identifies a further reduction (approximately a factor of) in insulation resistance after the first 1.5-hour exposure to 346°F/113 psig in the test chamber.

5. Appendix H contains a discussion of the effects of dose rate on cable performance. Although the Licensee submittal does not state whether cables are exposed or in conduit, the Licensee has indicated that cables are in uncovered cable trays and therefore would be subject to high dose rates due to beta plus gamma irradiation. The Licensee needs to analyze the effects of reduced insulation resistance which would occur during LOCA, as described in the test report.

FRC CONCLUSION:

This equipment is assigned to NRC Category IV.b. From the test reports reviewed and discussed above, the cable insulations for this equipment show substantial reduction of insulation resistance as a result of LOCA conditions and radiation dose rate. The initial safety function should be performed, but FRC considers that the exposure to beta radiation during and after LOCA would be the limiting condition for the Ginna cables in containment. Protection against beta radiation could result in substantially dose rate and the cable falling being assigned to NRC Category II.a.

4.5.2.4 Equipment Item No. 30
Reactor Containment Fan Cooler Motors Located Within Containment
Westinghouse Electric Corp., 588.5-CSP
(Original Licensee References 2.17, 2.18, 2.19, and 2.20;
Final Licensee References 2.64, 2.65, 2.67, and 2.70)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.2.10):

FRC was not able to inspect the RCFC motors because they are totally enclosed within the fan cooler cabinets. FRC has reviewed the referenced qualification documentation and notes the following:

a. Westinghouse Report WCAP-9003 [2.20] describes an extensive series of steam/chemical spray tests of a large electric motor under conditions that exceed those which might result from a LOCA at the Ginna plant. The statement is made that the tested motor is the same model as that installed at Ginna, but no nameplate data for the tested unit is provided in the test report. This omission is not regarded as serious, although a reference in the test report to model number and other data concerning the rating of the unit is highly preferred.

b. The temperature/pressure profile presented in Appendix A shows that the temperature returns to the pre-accident value (125°F) in about 8 hours, but the conservative representation of the pressure profile remains elevated for 11 days. The calculated pressure profile is presented in WCAP-7410-L, Vol. II [2.18], which also shows that the pressure returns to 0 psig at about 8 hours (the same time the temperature profile returns). The fact that the two longest simulated LOCA exposures reported in Licensee Reference 2.20 is therefore judged to be entirely adequate. This judgment, and the overall belief that qualification with regard to steam/chemical spray exposures has been established, is reinforced by the facts that:

   (1) Margins of were used as peak exposure conditions.

   (2) The duration of the exposure was long, with several tests being run.

   (3) The power loading on the motor was

c. The test program described above from Licensee Reference 2.20 states that, , the motor was aged and that this is equivalent to 7 years of service under normal conditions. No calculations are presented to substantiate this assertion or to determine whether the period is actually longer or shorter. In any event, accepting the 7-year figure would mean

that the qualified life is only 7 years. The plant has already operated longer than this period. Reference 2.18* presents the results of aging and radiation exposure tests of RCFC motor coils having the same insulation system. These tests demonstrate that, while some degradation does occur, the overall performance is satisfactory after samples were aged to the equivalent of 40 years of normal plant service and then subjected to

Although this test does not address the effects of a LOCA exposure, it does serve to support the belief that the very severe, multiple exposures in the simulated LOCA test demonstrate a qualified life of more than 7 years.

d. Licensee Reference 2.18, Westinghouse Report WCAP-7410-L (Vol. II), describes a test program conducted to verify the capabilities of the coil insulation and grease lubricant used in this motor to withstand exposure to nuclear radiation without severe degradation (severe in a sense of impairing the proper functioning of the motor). The program involved thermal aging, gamma irradiation, vibration, and high potential and voltage breakdown tests. Although (as noted above) the tests indicate that the samples performed satisfactorily, there are three gaps in the qualification picture:

   (1) No analyses, resultant values therefrom, or statements have been provided concerning the expected radiation exposure to the windings and lubricant, considering (a) the effects of radionuclide concentration on the filters following a LOCA and (b) the radiation ambient during normal operation, as required by the Guidelines. Because the Licensee has used a radiation qualification figure many times greater than the Guidelines requirement for accident dose (160 Mrd vs. 20 Mrd), this deviation from the Guidelines requirements is irrelevant in FRC's judgment. The actual integrated dose to which these components would be subjected is probably not more than 30 Mrd,+ and satisfactory service when exposed to doses in the 120- to 140-Mrd range has been demonstrated.

   (2) It has not been shown, either by test or analysis, that the combined effects of radiation and steam/chemical spray environments postulated to follow a LOCA event are unlikely to cause motor failure. The Guidelines require that the same test sample exposed to the steam environment also be irradiated (either before or during the exposure) unless it is known that the equipment item does not contain any materials susceptible to significant radiation damage at the service condition levels.

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*Licensee Reference 2.17 is an older and less complete version of 2.18, while Reference 2.19 is nonproprietary and, hence, also an incomplete version.

+This figure reflects shielding provided by the motor frame and casing.

While the test program reported in Reference 2.18 suggests that insulation and grease are not degraded by irradiation so as to produce motor failure, they are degraded to some extent. The test program did not contain a "no irradiation" case; therefore, absolute judgments cannot be made.

(3) Qualification of the motor-lead splices and lead-to-cable splices was not addressed with respect to radiation.

FRC concludes that the Licensee should prepare and submit for review an analysis that establishes the qualified life for this equipment item. If this period is less than the period for which the plant is licensed to operate, a commitment to replace it at an appropriate time should be made by the Licensee. The analysis should explicitly include the effects of combined steam/chemical spray and radiation exposure on splices and lubricants.

LICENSEE RESPONSE:

TER C5257 concluded that, in addition to the information provided in References 2.18 and 2.20, information needed for complete qualification of the fan cooler motors is (a) documentation regarding qualification of motor-lead and lead-to-cable splices and (b) determination of a qualified life for the motor. Information regarding the splices is given in Reference 2.64.

Aging information for the insulating material of these motors, as well as the bearing lubricants, is given in Reference 2.18, Section 4. Aging to demonstrate 40-year continuous operation at 120°C was performed. This is consistent with the data given in Reference 2.67 and is considered sufficient to qualify the fan cooler motors for continued operation. A program at RG&E to maintain motor bearings and lubricants is given in Reference 2.65. This program will ensure that the lubricants used are compatible with the environmental conditions which could occur during a DBE.

Additional information regarding qualification testing of the same type of motors is given in WCAP-7829, "Fan Cooler Motor Unit Test" [2.70].

FRC EVALUATION:

The DITER cited three basic concerns to be addressed by the Licensee in order to demonstrate qualification for this equipment. The following paragraphs summarize these concerns and FRC's evaluation of the Licensee's response to each.

1. The Licensee did not completely address the combined effects of steam/chemical spray/radiation on the motor's lubrication system, insulation, and other components which may be susceptible to degradation from the combined environments. The qualification of the motor's lubrication was not completely addressed by the Licensee's submittal of Reference 2.65. This reference was the Ginna "Equipment Inspection Period and Lubricant List," Procedure A-1011 which listed the different types of equipment in the plant and their respective type of lubricants. Unfortunately, there was no traceable listing available for the containment recirculation fan motor. The Licensee stated in a follow-up conversation that ARCO Rotanium Lubricant was used on these motors and that follow-up information was being forwarded to the NRC in regard to its qualification.

   Similarly, no analysis or other type of documentation was available to demonstrate that other components of this particular motor would be able to sustain the combined effects of its environment without degradation. Reference 2.70, WCAP-7829, has amplified FRC's concern regarding the combined effects on such components as motor splices, because two different types of splice materials sustained significant degradation when subjected to the combined environment of steam and radiation. These two different splice materials have since undergone design changes by Westinghouse; however, there is no evidence available which would demonstrate that the older types are not still used in the Ginna plant motors. The Licensee should confirm that Okonex tape or Elastimould No. 86 was not used for splice material in its containment recirculation fan motors. Licensee Reference 2.64 was submitted in order to demonstrate qualification for the motor cable connector insulation from the Kerite Co. as referenced by a Westinghouse drawing. However, evidence was not submitted which would clearly indicate the applicability of the Westinghouse drawing to the containment recirculation fan motor at Ginna. In addition, RG&E stated that the splice test was solely a radiation test and not a test which would demonstrate the combined effects of steam and radiation. Reference 2.64 was considered by the Licensee to be preliminary, with final analysis pending.

   In regard to Reference 2.67, the Licensee had presented a listing of several safety-related Ginna plant motors for the purpose of identifying insulation. It consisted of a letter from Westinghouse to RG&E which stated that the containment recirculation fan motor had Class B insulation. Handwritten notes on the side of the list indicated that the motor's nameplate had Thermalastic Epoxy insulation. Designated Westinghouse Report WCAP-9003 stated that the Thermalastic Epoxy had a Class F rating and that it is representative of Ginna's fan motor. Because of the additional confusion created by specific references, it is presently impossible to allow either WCAP-9003 or WCAP-7829 to qualify the insulation until final verification can be presented by the Licensee.

2. The Licensee did not provide an overall definitive qualified life statement for the entire unit including the motor bearings. The Licensee's response quoted a 40-year continuous operation assessment from Reference 2.18, Westinghouse WCAP-7410-L, Section 4. This 40-year value for qualified life is inadequate because it only considered the aging of the motor windings and did not consider other items which would be susceptible to aging degradation within the motor, such as splices, bearings, and lubrication. Reference 2.70, which is the Westinghouse Report WCAP-7829 did not provide a definitive statement on qualified life for the types of motors tested. The bearing life was simply referenced to IEEE Std 334-71 which, in turn, references the statistical data furnished by the Anti Friction Bearing Manufacturers Association. There was no specific reference made to the type, size, or manufacturer of the specific motor bearings tested; however, a 20-month bearing test using irradiated grease subjected to both steam and spray was conducted.

   In summary, the Licensee should review the various motor components and determine which of the components is the critical item that will govern the determination of qualified life. A detailed review of plant maintenance records may indicate other motor component failures which previous testing programs had not uncovered.

3. Qualification of the motor-lead splices and lead-to-cable splices was not adequately documented by the Licensee's Reference 2.64. This reference simply stated that the cable splices were made by Kerite Co. and that review of their qualification was still being performed by RG&E. The applicability of the Westinghouse drawing to the motor at the Ginna plant has not been provided.

   The Licensee has submitted additional supplemental information from Westinghouse related to the motor's splices. It is based on a Westinghouse drawing which indicates that the splices were made of Dow Corning 899 RTV with wraps of Scotch 70 tape, mica tape, and additional layers of Scotch 70. The Westinghouse drawing, however, is not an "as built" drawing of the Ginna motor but rather a standard drawing for Westinghouse motors. Because of this lack of total evidence which would completely ensure that the Ginna motors do in fact have the splice material construction mentioned above, the Licensee has committed to the disassembly of the motor at the next outage to determine what splices were used in the motor.

   Although the Licensee submitted Reference 22 as justification for this type of motor splice, qualification is not demonstrated because peak temperatures of the test were not identified and the report admits that further testing is needed on power cable splices made of Scotch 70 and glass tape material.

FRC CONCLUSION:

This equipment is assigned to NRC Category IV.b because the motor has a high likelihood of operability based on previous testing of Westinghouse containment fan motors, but complete qualification documentation is not available. In summary, items such as a qualified life statement, motor-lead and lead-to-cable splice environmental qualification, correct lubricant usage, and motor bearing/component surveillance of maintenance need to be addressed further by the Licensee in order to assure operability more adequately.

- In order to qualify this motor, the Licensee could elect to physically examine a disassembled unit in order to verify the type of splice which has been installed. If it is made by a manufacturer whose splices have successfully passed type testing according to WCAP-7829 or other qualification documentations, replacement would not be necessary. Otherwise, qualified splices should be installed.

- The type of lubricant used should be reviewed to ensure that it is qualified for its postulated combined environmental exposure to chemicals, steam, and radiation. Documentation of the lubricant's qualification should be made available.

- The type of insulation used should be verified because of the confusion created by Reference 2.67 and mentioned above in Item 1. Once this is accomplished, the insulation could possibly be qualified by previous testing documented in WCAP-9003, -7410-L, and -8754.

- The Licensee could arrive at a value for the motor's qualified life by determining which motor component has the shortest expected operating life span. For example, if this is the motor bearings, where the Licensee might determine their anticipated operational life by assessing maintenance records, motor manufacturer's information, or tabulated failure data from the bearing manufacturer.

4.5.2.5 Equipment Item No. 34
Cable Splices Located Within Containment
Raychem Co., Type WCSF-N
(Original Licensee References 2.36 and 2.38; Final Licensee References 2.51, 2.56, and 2.62)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.2.11):

The Licensee submitted two qualification test reports for this type of cable splice. The first was a generic report done for Raychem; the second was done for RG&E for a mockup of the inside-containment side of an electrical penetration with cable splices included near the boundary of the penetration.

From the Licensee's references, FRC notes:

a. The Licensee's qualification references indicate that the following cable splices were tested:

The Licensee identified the installed splices as type WCSF-N. During the site visit, FRC observed two installed splices, Models WCSF-070-250 and WCSF-1000-3000. The referenced documentation provided does not indicate that all splices or safety-related cables are identical to those installed in the plant; detailed descriptions of the installed splices were not provided. The test specimen must be the same as the equipment being qualified. The Licensee did not present an analysis comparing the impact of deviations between the test specimen's specific design features, materials, and production procedure and those of the installed equipment. Therefore, an independent conclusion cannot be reached regarding the extent to which the two units are similar.

b. An omission in both test reports is that the qualified life of the splices tested was not stated; however, accelerated aging was performed in both reported tests.

FRC concludes that the Licensee should present evidence of similarity between the tested and installed equipment and a determination of the qualified life for this equipment.

LICENSEE RESPONSE:

TER C5257 states that RG&E should present evidence of similarity between the tested and installed equipment. This is documented in the detailed evaluation and observation of the splice sleeve replacement program, given in IE Inspection Reports 78-20 and 78-21 [2.56].

It is also stated that a determination of qualified life should be made for the sleeves. The actual test in Reference 2.38 established a 12.1-year life at 60°C ambient. This pre-aging was constrained by the concurrent aging of the Kerite cable, which was pre-aged for 93.3 years at 60°C by the same test. Based on proprietary Raychem information (included in Reference 2.63 and available for audit at RG&E) a 40-year life at 91°C can be expected. Therefore, these sleeves are considered fully qualified.

FRC EVALUATION:

The Licensee Response and the test reported in Reference 2.38 has been reviewed. Further, from review of tests cited by other Licensees in the SEP plant EEQ program, it is noted that FIRL Report F-C4033-3 on Raychem splices provided information on Raychem WCSF splice sleeves that were subjected to

combined thermal and radiation preaging (and an integrated dose of) followed by simultaneous LOCA, irradiation, and spray. Comments a and b above are therefore resolved.

FRC also notes that Raychem Corp. has stated to various Licensees that the splice (WCSF-N type) is limited by cable performance and lifetime capability, i.e., the splice does not increase the cable life.

FRC CONCLUSION:

This item is assigned to NRC Category IV.b. While the splices themselves could be assigned to NRC Category II.a, the splice, as stated by Raychem, is limited by cable capability. As discussed in the Evaluation and Conclusions under Section 4.5.2.3, the cables installed in Ginna containment are considered to be limited by beta radiation dosage and therefore were assigned to NRC Category IV.b (i.e., the splice cannot be categorized higher than the cable). If protection of the cable from beta radiation is provided (see Equipment Items 15A and 15B) this item could be moved to NRC Category II.a.

4.5.2.6 Equipment Item Nos. 1A and 1B
Solenoid Valves Located in the Turbine Building
1A: Automatic Switch Co. (ASCO) Model LB8300B61U
FW Control Valves (V-4269, 4270)
1B: Automatic Switch Co. (ASCO) Model LB8300B64RU
Actuates FW Bypass Valves (V-4271, 4272)
(Original and Final Licensee Reference 2.23)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.2):

The Licensee has submitted documentation that is not applicable to these items or for which applicability cannot be determined. It should be possible, however, for the Licensee to demonstrate qualification by similarity or by obtaining relevant test reports from the manufacturer. If the safety function of these equipment items is to deenergize to the fail-safe position, then only the nonelectrical components of the valve are required to function. The safety functions of these items should be clarified by the Licensee.

a. The Guidelines require that the test specimen must be the same as the equipment being qualified. The Licensee did not present an analysis comparing the impact of deviations between the test specimen's specific design features, materials, and production procedure and those of the installed equipment. Therefore, an independent

conclusion cannot be reached regarding the extent to which the two units were similar. Hence, the validity of the test as evidence of qualification has not been established.

b. The test specimen was exposed to saturated steam at The report did not indicate the reason for the failure.

c. Aging of the test specimen was not considered. Therefore, no qualified life has been established, nor has a program to ascertain whether any in-service failures during the installed life of the equipment are the result of aging degradation.

LICENSEE RESPONSE:

The feedwater control and bypass valves (Items 1A, 1B) fail closed on loss of air. This is supported by Reference 2.23. In order to further ensure that these valves will perform their safety function when exposed to a HELB in the Turbine Building, the solenoids will be replaced with valves having proper qualification documentation. It is expected that this can be accomplished by June 1982. The fail-safe closure of the valves ensures that the required safety function can be performed until replacement can be effected.

FRC EVALUATION:

The feedwater control valves (main and bypass valves) are automatically shut by a safety-injection actuation signal. This action is necessary to isolate the feedwater line in the case of a feedwater line break accident (FWLB). While it is recognized that this function is likely to be performed early (within seconds) and also that the valves fail shut on loss of air pressure, FRC concurs with the Licensee's decision to replace these valves with qualified units in order to ensure their proper function.

FRC CONCLUSION:

This equipment is assigned to NRC Category IV.b because, although valid qualification documentation has not been provided, there is a high likelihood that their short-term trip function will be performed.

4.5.2.7 Equipment Item Nos. 16A and 16B
Electrical Cable Located Within Containment
16A: Coleman Cable Co. (Instrumentation Cables)
16B: Rome Cable Co. (Deleted; Incorporated in Equipment Item No. 17B)
(Original Licensee References 2.18, 2.19, and 2.27;
Final Licensee References 2.46 and 2.51)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.11):

FRC has reviewed the referenced documentation and notes the following:

The Licensee did not provide sufficient identification of the installed cable to correlate its expected performance with the results of a test report. The referenced test report did not list Coleman as a manufacturer of the cable tested. In addition, the cable manufacturer and type could not be identified during the plant inspection. FRC concludes that:

1. The Licensee did not present an analysis comparing the impact of deviations between the test specimen's specific design features, materials, and production procedure and those of the installed equipment. Therefore, an independent conclusion cannot be reached regarding the extent to which the two units were similar. Hence, since the test specimen must be the same as the equipment being qualified, the validity of the test as evidence of qualification has not been established.

2. Licensee Reference 2.27 describes the effects of different spray solutions on metal sample coupons and has no relevance to electrical cables (see Appendix D).

3. Aging concerns have not been addressed in accordance with the Guidelines, nor has the qualified life been established.

LICENSEE RESPONSE:

Reference 2.51 is the "Cable Identification and Qualification Supplement." This reference allows traceability of all cable used in the Ginna plant, by referencing back to the original purchase order specifications. It can be seen that, in addition to the Kerite safeguards cable, the only other cable inside containment used to perform a required post-accident safety function is the silicone-rubber insulated cable, which is used for all required safety-related instrumentation and control cable. Reference 2.46 identified this as Coleman cable. In addition to the testing stated in Reference 2.46, a section of this cable was taken from the Ginna plant and environmentally qualified with the Raychem splice sleeves (documentation of the testing is given in FRC Final Report Supplement, F-C5074 (Supplement), April 1979, which is

included in Reference 2.51). The cable is specimen number C5074-7 of Table 1 of F-C5074 Supplement.

This testing shows that the Coleman silicone-rubber insulated cable will perform its required safety functions inside containment.

Reference 2.46 states that this cable is aged at 200°C for 168 hours. Although no specific Arrhenius plot is available, the application of the "10°C rule" shows an operating life of 40 years at 60°C. This is considered a reasonable estimate of the expected life of this cable.

FRC EVALUATION:

FRC agrees with the Licensee Response above except for radiation qualification and qualified life, which is a function of total environmental conditions. As noted previously for the Kerite cables (Equipment Items 15A and 15B) identified in the Supplemental FIRL Report F-C5074, it is not possible to determine the dose to which the cables laying loosely in the crate were exposed during testing. The shielding effect of the steel plates and copper cable was not factored into the dose rate, but it is apparent that the dose does not approach the dose rate which would produce the 160 Mrd specified within containment under LOCA conditions.

FRC has noted from other testing on silicone-rubber insulation for instrument cables that insulation resistance is degraded with increasing radiation dose (see Appendix H) and that radiation and LOCA result in low insulation resistances.

FRC CONCLUSION:

This item is assigned to NRC Category IV.b because it is probable that the cables will perform their initial functions when the initial radiation dose is low. However, the Licensee must demonstrate that reliable information can be transmitted over these cables under conditions which would be experienced during LOCA (pressure, temperature, humidity, spray, and radiation exposure). If beta radiation could be eliminated from consideration, the equipment item could be upgraded to Category II.a. The qualified life could then be identified on a conservative basis (see Section 4.1.3).

4.5.2.8 Equipment Item Nos. 17A and 17B
Electrical Cables Located Outside Containment
17A: Coleman Cable Co.
17B: Rome Cable Co.
(Original Licensee References 2.5 and 2.10; Final Licensee Reference 2.46)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.12):

The Licensee has provided an equipment specification written by a contractor and a page from IPCEA S-61-402 as evidence of qualification. These may give some confidence that the cable should withstand severe service, but they are not themselves sufficient demonstration of qualification. Also, aging considerations have not been addressed.

LICENSEE RESPONSE:

Reference 2.51 is the "Cable Identification and Qualification Supplement." From this reference, the type of cable used throughout the Ginna plant can be traced by reference back to the original purchase order specification. It is shown that all of the safety-related cable outside containment which is not Kerite cable is PVC-insulated cable. The specifications included in Reference 2.51 refer to GAI Specs SP-5324 and SP-5315. Both of these specifications in turn specify the requirements of IPCEA S-61-402 for PVC-Cable. Information from this standard is provided in Reference 2.10. Additional information for Coleman and Rome cable is provided in Reference 2.46.

The IPCEA testing of this cable, including insulation aging at 121°C (250°F) for 168 hours (jacket at 212°F), oil immersion, heat shock, and cold shock, shows the ability to operate under conditions more severe than those anticipated outside containment. Although no specific qualification testing was performed, the standard testing of these cable types gives reasonable assurance that they are suitable for outside containment use.

FRC EVALUATION:

Based on the information provided by the Licensee, FRC has the following comments:

a. The pressure and temperature conditions to which the cable has been tested envelop the condition during HELB outside containment provided by the Licensee.

b. Some cables would be exposed to radiation as a result of circulating fluids outside containment and the magnitude of such radiation doses rates has not been established (see Appendix H).

FRC CONCLUSION:

This item is assigned to NRC Category IV.b. Evidence of radiation qualification has not been established. However, it is likely that the cable would be adequate for the general environment, based on production testing. The Licensee should establish the full spectrum of environmental conditions, including radiation, to which the cable is exposed outside containment and then determine whether available test data is adequate.

4.5.2.9 Equipment Item No. 17C
Electrical Cables Located Outside Containment
General Cable Co.
(Final Licensee References 2.5, 2.10, and 2.46)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT:

None

LICENSEE STATEMENT (NEW EQUIPMENT ITEM):

Reference 2.51 is the "Cable Identification and Qualification Supplement." From this reference, the type of cable used throughout the Ginna plant can be traced by reference back to the original purchase order specification. It is shown that all of the safety-related cable outside containment which is not Kerite cable is PVC-insulated cable. The specifications included in Reference 2.51 refer to GAI Specs SP-5324 and SP-5315. Both of these specifications in turn specify the requirements of IPCEA S-61-402 for PVC-Cable. Information from this standard is provided in Reference 2.10.

The IPCEA testing of this cable, including insulation aging at 121°C (250°F) for 168 hours (jacket at 212°F), oil immersion, heat shock, and cold shock, shows the ability to operate under conditions more severe than those anticipated outside containment. Although no specific qualification testing was performed, the standard testing of these cable types gives reasonable assurance that they are suitable for outside-containment use.

FRC EVALUATION:

Based on the information provided by the Licensee, FRC has the following comments:

a. The pressure and temperature conditions to which the cable has been tested envelop the conditions during HELB outside containment provided by the Licensee.

b. Some cables would be exposed to radiation as a result of circulating fluids outside containment and the magnitude of such radiation dose rates has not been established (see Appendix H).

FRC CONCLUSION:

This item is assigned to NRC Category IV.b. Evidence of radiation qualification has not been established. However, it is likely that the cables would be adequate for the general environment, based on production tests. The Licensee should establish the full spectrum of environmental conditions to which the cable is exposed outside containment and then determine whether the test data is adequate.

4.5.2.10 Equipment Item Nos. 3A and 3B
Solenoid Valves Located in the Intermediate Building
3A: Lawrence Co. Model 110114W - Supply (V-3516)
3B: Lawrence Co. Model 125434W - Vent (V-3517)
Actuates Main Steam Isolation Valves
(Original and Final Licensee Reference 2.25)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.4):

The Licensee submitted a product bulletin as evidence of qualification. The bulletin indicates that this item has a solenoid with a Class H coil and a temperature rating of 250°F, which gives some confidence that the solenoid valve will function properly during the DBE. However, this type of documentation is not sufficient as a demonstration of qualification.

LICENSEE RESPONSE:

Based on the design principle of these valves, they will perform their safety function by failing in a closed position upon loss of power. However, if proper qualification documentation is not established, RG&E will initiate a replacement for these solenoid valves. Qualification documentation will be made available when received. The fail-safe mode of operation ensures no loss of safety function in the interim.

FRC EVALUATION:

In the event of a small line break, the solenoid valves could be exposed to a prolonged high temperature environment approaching the design rating of

the coil. There is no evidence of qualification, but the Class H insulation and fail-safe (electrically) application result in the expectation that performance is likely to be satisfactory. FRC believes that this equipment should be replaced with properly qualified units. Aging degradation should be assessed and the qualified life established on a conservative basis, considering the expected operating temperature (these items are continuously energized during normal plant operation).

FRC CONCLUSION:

This equipment is assigned to NRC Category IV.b because, although evidence of qualification has not been provided, the construction and fail-safe application result in the exceptation that performance is likely to be satifactory. The Licensee will either produce evidence of qualification or replace the equipment.

4.5.2.11 Equipment Item No. 4
Solenoid Valves Located Within Containment
Versa Valve Co. Model VSG
Actuates Containment Recirculation System Dampers
(V-5871 through 5876)
(Original Licensee References 2.26 and 2.27; Final Submittal Deletes Reference 2.27)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.5):

The Licensee submitted a product bulletin and a study of the effect of chemical sprays on materials as evidence of qualification. These documents alone are not valid for this purpose (see also Appendix D). The Guidelines require that a test be performed for items located within containment and that aging degradation resulting from temperature and radiation environments in normal operation be considered. The Licensee pointed out that the safety function of this item occurs with deenergization and that this action occurs at the beginning of an accident. Because the seals and other components of the valve may be degraded by the normal service environment, and because a high temperature steam environment may exist for several minutes before functioning (i.e., change of position) is called for, a qualification test should be performed to verify proper operation. The effects of the normal service environment on the equipment should be taken into consideration and the qualified life explicitly determined.

LICENSEE RESPONSE:

The safety function of the solenoid valves controlling the containment air recirculation dampers is accomplished through fail-safe operation. This is accomplished immediately with the SI signal following an accident, before environmental conditions would become very severe. In order to have this safety function accomplished with equipment having the proper qualification testing and documentation, replacement of these solenoid valves will be initiated. It is expected that this can be accomplished by June 1982. Qualification documentation will be made available when received.

FRC EVALUATION:

The Licensee has not presented valid evidence of qualification and has decided to replace this equipment. However, the fail-safe (electrically) application and probable operation very early in the accident scenario lead to the expection that performance is likely to be satisfactory. When evaluating aging degradation and establishing the qualified life of the replacement units, the Licensee should consider the expected operating temperature.

FRC CONCLUSION:

This equipment is assigned to NRC Category IV.b because, although evidence of qualification has not been provided, proper operation is considered to be likely based on expected operating time and fail-safe application.

4.6 NRC Category V
EQUIPMENT WHICH IS UNQUALIFIED

The DOR Guidelines require that complete and auditable records reflecting a comprehensive qualification methodology and program be referenced and made available for review of all Class 1E equipment.

The qualification of the equipment items in this section has been judged to be deficient or inadequate, based upon review of the documentation provided by the Licensee. The extent to which the equipment items fail to satisfy the criteria of the DOR Guidelines can be categorized as follows: (1) documentation reflecting qualification as specified in the DOR Guidelines has not been made available for review, (2) the documentation is inadequate, or (3) the documentation indicates that the equipment item has not successfully passed required tests.

4.6.1 Equipment Item Nos. 31 and 41

31: Medium Voltage Switchgear Located in Intermediate Building
Westinghouse Electric Corporation Model DB-50A 1600-A
Controls Reactor Trip System Power

41: Medium Voltage Switchgear Located in Turbine Building (A-7)
Westinghouse Electric Corporation Model DH-350E 1200-A
Controls Power to Reactor Coolant Pump Motors

(Licensee reference not cited)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.2.2):

These equipment items serve the reactor (Equipment Item 31) and reactor coolant pumps (Equipment Item 41). The Licensee submittal states that the items function in a fail-safe mode (to trip) early in an accident.

Provided that NRC concurs in this safety-function assessment, FRC agrees that explicit qualification for service under accident conditions is not required.

LICENSEE RESPONSE:

TER C5257 found these acceptable, since the breakers are exposed only to a relatively mild (1 psig, 220°F) environment, must function within a short time (generally seconds), and fail-safe on loss of power. No

additional information is considered necessary to show proper operational capability under the required accident conditions.

FRC EVALUATION:

The Licensee has stated that Equipment Item 31 is located in a relatively mild environment and will be fail-safe on loss of power. FRC does not concur that this area (the intermediate building) is relatively mild. The intermediate building is expected to see a 220°F temperature for 30 minutes and 100% relative humidity indefinitely during a HELB occurrence. These conditions are harsh, and prolonged exposure to high humidity can cause degradation to the switchgear. In addition, the Licensee, with the NRC, is currently addressing the potential for flooding outside containment in the switchgear area.

It is not clear that a HELB outside containment will enable an automatic trip of the reactor trip switchgear to occur. Therefore, the switchgear could be exposed to a harsh environment for an unknown period until manual tripping of the switchgear occurs.

This switchgear should be provided with qualification documentation from either test or analysis to address the switchgear's operability under HELB environmental conditions. The documentation should demonstrate equipment functional capability for a time period of at least 1 hour plus the length of time it is required to operate.

The Licensee has stated that the RCP switchgear, Equipment Item 41, is located in a relatively mild environment and will be fail-safe on loss of power. FRC does not concur that this area, which involves the turbine building, is relatively mild. The turbine building would experience a temperature of 220°F for 30 minutes. These conditions are harsh, especially with the prolonged high humidity, and can cause degradation.

Switchgear for the reactor coolant pump motor (Equipment Item 41) provides an important function as outlined in Section E.2 of Appendix E. Qualification of the switchgear is needed in order to ensure its operability during the high temperature and high humidity excursions during a postulated HELB condition. In addition, it is the NRC's position that the Licensee must

show the equipment is operable for 1 hour plus its anticipated accident operational time.

No qualification has been provided by the Licensee for this equipment. The Licensee should provide either test or analysis information supported by surveillance of maintenance activity that could demonstrate this equipment's qualification and qualified life. Because this equipment will be exposed to its worst-case environment during a HELB, qualification documentation must not only address the switchgear's ability to keep the pump motor energized, but also its ability to open the circuit on command. The switchgear's qualification should investigate the possibility of any protective thermal relays which may exist in the switchgear's control circuit that could trip the switchgear when high ambient temperatures are experienced. Degradation associated with high ambient humidity also needs to be addressed.

FRC CONCLUSION:

These equipment items are assigned to NRC Category V because qualification documentation substantiating the switchgear's operability during HELB conditions has not been provided. If qualification documentation cannot be provided, then possible alternatives could be to relocate the equipment or protect it from the environment.

4.6.2 Equipment Item No. 11
Motors Located on Basement Level of Intermediate Building
Westinghouse Electric Corporation, Type ABDP, 250 hp
Drive Main Auxiliary Feedwater Pumps
(Original Licensee References 2.8 and 2.16; Final Licensee References 2.67 and 2.68)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.1.5):

The cited references are equipment specifications by the A/E and reactor vendor for the plant (Gilbert Associates and Westinghouse, respectively). As such, they provide little information that is useful as evidence of qualification. References 1 [now 14], 7, and 8 discuss the fact that the environment where this equipment is located can become more severe during a HELB accident in the building than the equipment can withstand. For this reason, an additional set of auxiliary feedwater (AFW) pumps was installed in

a new building addition so that failure of this equipment item can be tolerated without incurring a significant decrease in the safety of the plant.

FRC has therefore concluded that this equipment need not be qualified for the severe environment resulting from a pipe break, but should be qualified for the ambient temperatures that would occur if the pumps and other equipment in the space were operating under LOCA conditions (i.e., onsite power only).

However, FRC concludes that the lack of complete qualification documentation is a moot point for these items since other AFW system components also lack documentation. FRC agrees that explicit qualification for service under accident conditions is not required, provided that the NRC concurs with the Licensee's position that the "remote-manual" controlled standby AFW system's safety function eliminates the need for a qualified AFW system.

LICENSEE RESPONSE:

> As noted in TER C5257, these pumps are not required to function in the event of a HELB in the Intermediate Building. The Standby AFW System performs the required safety function. Procedures call for removing the AFW pumps from the safety-related bus, prior to connecting the standby system. Mechanical interlocks ensure that both sets of pumps cannot be powered from the diesels concurrently. No harsh environmental qualification for the auxiliary feedwater pumps is required.

FRC EVALUATION:

A thorough review of the AFW system(s) at this plant (see Item E.1 in Appendix E) has led to the conclusion that the present configuration, with remote-manual initiation of the standby AFW system and the associated manual switching of vital power sources, is not satisfactory. FRC finds that exempting this equipment from qualification is justified only if the standby AFW pumps are automatically initiated (e.g., the standby AFW pumps are aligned to a reliable source of quality water with the main AFW pumps placed in a backup role) and if the vital power source cannot be degraded because of unqualified main AFW pumps.

FRC CONCLUSION:

This equipment is assigned to NRC Category V. The Licensee should either establish qualification of the equipment for the HELB environment, isolate the equipment from the HELB environment, or modify the standby AFW system to have it automatically initiated so that the main AFW pumps are in the backup system without being in a position of possibly degrading safety-related power sources (refer to Section E.1 in Appendix E).

4.6.3 Equipment Item No. 13B
Electrical Penetration Located Both Within and Outside Containment
Westinghouse Electric Corporation, Model Not Stated
(Original Licensee References 2.29 and 2.30; Final Licensee -Reference 2.59)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.2.5):

Licensee Reference 2.29 is the specification for this item, and as such does not represent evidence of qualification. Reference 2.30 is the Technical Proposal for the item and has appended to it summaries of qualification tests performed on a prototype. These summaries fall short of the amount of detail needed for assessing the state of qualification.

The approach taken in the manufacturer's testing program was to demonstrate the adequacy of the O-ring seals through one set of tests and the adequacy of a prototype of the installed penetration in another set. FRC's assessments regarding the test program are as follows:

a. With regard to the O-ring seals on the mounting flange, the test program included

Although the same set of O-rings did not receive both irradiation and steam exposure, which would be highly desirable, this is not a Guidelines requirement. The fact that the O-rings successfully withstood a very high radiation exposure, coupled with the fact that these components are relatively well shielded by the flanges and by the protected location of the penetrations at the plant, results in the expected radiation exposure being significantly lower than the value specified in the Licensee's submittal. The matter of chemical spray resistance of the O-rings is not addressed in Licensee

Reference 2.30, but its omission is not regarded as serious because, as is noted for Equipment Item No. 13A, the penetration appears to be well-protected from spray impingement. A separate set of aging tests was performed and showed that their life exceeds that of the used in the penetration itself.

b. The test program for the prototype consisted of the following:

- o electrical resistance and overvoltage tests
- o steam exposure for a total of 45 hours (peak conditions: 6 hours at 340°F/47 psig followed by including 3 hours of chemical spray exposure
- o electrical resistance and over-voltage tests
- o thermal cycling:
- o preaging to the equivalent of 40 years at
- o gamma irradiation to Mrd
- o second steam exposure

c. One cause for concern is the fact that the aging characteristics of the epoxy resin are not firmly established. The reference contains a separate report on a set of long-term tests on a prototype using a "similar resin." These tests were still ongoing when the report was submitted and hence were extrapolated in a conservative way. However, the statistical validity has not been established, and the small number of samples and large spread in data are concerns. IEEE Std 98-72, Item 5, states: "A large number of test specimens is required to achieve an acceptable degree of reliability if there is a broad spread in failure times among the specimens exposed at each temperature." For four samples tested at 175°C, the tolerance (95% confidence level) in failure time is $\pm$33.8% of the average value of 1142 hours, which is acceptable. However, for three samples, each tested at 187.5°C and 200°C, the 95% (confidence level) tolerances computed from the Westinghouse reported data are $\pm$472% of an average 343 hours and $\pm$366% of an average 129 hours. The extrapolation of failure times to the plant ambient temperature within these large limits results in an even greater uncertainty in the explicit lifetime. The Westinghouse report states that a statistical analysis would be developed upon the conclusion of the testing program. A further serious concern is the matter of the aging of the insulation

on the cable leads, which are an integral part of the penetration; this is not addressed in the documentation.

d. Another deficiency noted in this program is the matter of electrical loadings, which were neither included in the test program nor discussed.

Based on the foregoing review, FRC concludes that:

1. Results of long-term testing of the "similar resin," including the statistical analysis, as mentioned in Reference 2.30, should be provided. The similarity of the resin tested to that actually used for the penetrations should be documented.

2. Analysis or data concerning the aging characteristics of the insulation on the cable leads should be provided.

3. The period of qualified life should be established, and a replacement scheduled if one is needed.

LICENSEE RESPONSE:

It is noted in TER C5257 that additional information concerning the "similar resin," aging characteristics of the insulation on the cable leads, and qualified life should be provided. Reference 2.61, Research Report 75-7B5-BIGAL-122, shows that the lower 95% confidence band on qualified life at 105°C is greater than 40 years. Also, the author of this report, Mr. J. F. Quirk, has stated that the word "similar" had been used only in the respect that the test results of this epoxy were close to the results of other epoxies also being tested. The epoxy in the Ginna penetrations is identical to that tested. Cable lead insulation aging data is also included in Reference 2.61. It can be concluded that these penetrations are suitable to perform their required safety functions.

FRC EVALUATION:

FRC has the following comments after reviewing the Licensee information in Reference 2.61 and reanalyzing the original submittal:

a. After review of Reference 2.61, it is noted that the data, results, and conclusions are the same as contained in 2.30 but in a different Westinghouse report format. As a result, the deficiencies cited originally remain unchanged and the comments of (c) above still apply.

b. The question of resistance heating as a result of normal current loading plus LOCA was not addressed in the Licensee Response.

c In addition to serving safety-related equipment, penetrations may serve non-safety-related electrical equipment within containment that is unqualified for LOCA conditions. In the event of a LOCA or HELB within containment, a short-circuit current through the penetrations could occur as a result of failure of unqualified or non-safety-related equipment. The qualification of the penetration by the Licensee and manufacturer has not addressed this problem.

d The test report indicates a reduction in insulation resistance of several decades without considering the effect of beta radiation (see Appendix H). The Licensee did not analyze the effects of the radiation exposure.

FRC CONCLUSION:

This equipment is assigned to NRC Category V because the reference cited has not demonstrated qualification. The Licensee should present results of tests and analysis to demonstrate that the penetrations can withstand a short circuit and maintain pressure boundary integrity. A conservative qualified life based on thorough evaluation of degradable materials should then be established. Also the effects of radiation dose rate during LOCA on penetration performance should be evaluated.

4.6.4 Equipment Item No. 14
Terminal Blocks Located Within Containment
Westinghouse Model 542247
(Original Licensee References 2.22, 2.27, and 2.50;
Final Licensee References 2.50 and 2.60)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.2.6):

The Licensee states that these terminal blocks are used in the pressurizer pressure and level signal circuits. The blocks are mounted within a vented instrument cabinet having gasketed doors, located in the basement of the containment, along with the associated transmitters (Equipment Item No. 24, Section 3.3.2.9).

As noted in the discussion of these transmitters, reliable signal information is needed for an extended period of time following a LOCA event; thus, qualification must be established for an extended period. The Licensee's submittal states that the item is required to be functional for a "long" period of time.

FRC has reviewed the reference material cited by the Licensee and notes the following:

a. Reference 2.22 is a Westinghouse memorandum that discusses the qualification of three terminal blocks with model numbers different from that of the unit installed in the plant. The memorandum states that the material used in the three blocks begins to degrade at less than The physical properties are significantly impaired at about exposure, but the electrical properties probably are not seriously affected until the exposure reaches about This reference is of little value for establishing qualification of Equipment Item 14 because:

   - o the model numbers are different, and no information has been provided by the Licensee to establish that the materials, design, and production methods are the same or closely similar, as required by the Guidelines
   - o if the materials are the same or closely similar, then the information in the reference indicates that the capabilities of the terminal block with regard to nuclear radiation exposure are uncertain.

b. Reference 2.27 describes the effects of chemical spray solutions on metal coupon samples (see Appendix D) and is irrelevant for the terminal blocks except as it may determine the corrosion resistance of the cabinet in which they are mounted. The material from which the cabinet is fabricated is not given, but is probably steel. FRC does not believe corrosion of the cabinet will lead to terminal block failure.

c. Reference 2.50 is a detailed response to NRC IE Bulletin 78-02, which requested information on terminal block qualification, and contains a summary of the results of two test programs. In one program, a terminal block identical to that installed in the plant was subjected to a test program that included a steam/chemical spray exposure that adequately enveloped the temperature/pressure profile. In the other program, the maximum pressure did not envelop the specified environment, there was no chemical spray, and the test specimen was a different model number. FRC's evaluation of this report is:

   - o The deviations from the R.E. Ginna Plant environmental parameters in the second test are inconsequential, but the absence of any documentation establishing the relevance of the tested sample requires that the second test be disregarded.
   - o The first test establishes the qualification of this equipment item for the steam exposure, with good margins. However, the qualified life is unknown because an analysis of aging degradation has not been provided.

Considering all the Licensee's submitted documentation, FRC concludes:

a. Qualification for temperature, pressure, and humidity environments are established. FRC finds them acceptable.

b. Aging degradation has not been addressed, as is required by the Guidelines. The Licensee should evaluate the susceptibility of the terminal blocks to degradation as a result of exposure to temperature and nuclear radiation during the installed life in the plant. If significant degradation is expected to occur, then aging must be treated in the test program and the qualified life must be explicitly determined.

c. The Guidelines require that equipment must be qualified to integrated nuclear radiation dose levels that (i) reflect the sum of both the normal operating dose (for the qualified life period as a minimum) and the accident dose level and (ii) consider the effects of beta radiation and the proximity of the installed equipment to the sump or other concentrated sources of radiation. A gamma dose of 20 Mrd is considered acceptable for general PWR containment areas for the contribution of the accident dose produced by gamma radiation. Because the reference cited by the Licensee does not establish that the terminal blocks installed in the plant will function properly after being exposed to high radiation dose levels, the Licensee should make a careful evaluation of what the exposure dose will be at the installed location, considering the direct and indirect (bremsstrahlung radiation) contributions of beta radiation as well as the pre- and post-accident contributions of gamma radiation. The results of this evaluation should be considered in the determination of qualified life discussed above in Item 2.

d. As is discussed more fully in Section 3.3.2.9, it appears that the safety-related function of this equipment is to ensure that the pressure and level signals produced by the transmitters associated with these terminal blocks are transmitted without significant distortion for an extended period of time following a LOCA. Based upon the submitted documentation, it appears that the protective cabinet in which the terminal blocks and transmitters are mounted is not watertight, and this equipment can therefore become directly immersed in water containing spray solution, boric acid, and radioactive substances. The Guidelines require that specifying saturated steam as a service condition during type testing of equipment that will become submerged under accident conditions is not an acceptable alternative to conducting an actual submergence test. FRC concludes that the actual submergence of the equipment cabinet as a service condition should be addressed by the Licensee.

LICENSEE RESPONSE:

TER C5257 found that, although qualification for pressure, temperature, and humidity is acceptable, additional information is needed concerning thermal aging and radiation. Reference 2.60 is a Proprietary Westinghouse R&D Report (No. 77-7B7-CBSEL-R3) dated July 13, 1977. It shows that for a criteria of failure of 50% of the original flexure strength and impact strength, the 40-year life extrapolation is approximately 120°C. This report is not yet in our possession, but may be audited at the Westinghouse facility.

Additional information concerning radiation susceptibility of the terminal blocks is also provided in Reference 2.60. It is shown that the qualification level is 20 Mrads. Although not meeting the long-term conservatively calculated radiation dose for Ginna of 160 Mrads, the DOR Guidelines values are met. Based on the protected location of these terminal blocks, 20 Mrads is considered adequate. A detailed evaluation of this post-LOCA radiation dose will be made. If the required dose for the long-term monitoring function is greater, replacement or additional protection will be provided.

NRC EVALUATION:

Comments are provided on the terminal blocks installed inside the Ginna containment building. These comments are based on a review of the Licensee Response and Reference 2.6. In addition, supplementary information obtained in the review of other SEP plants has been used.

1. Submergence: The Licensee has not addressed the questions raised in TER-C5257/178 regarding submergence. Section 3.4 of Reference 2.50 discusses short-term performance of pressurizer pressure and pressurizer level instruments and the associated terminal blocks, specifically stating that trip would occur before flooding and implying that no function of the instruments is needed thereafter. NRC has concluded that pressurizer pressure and level are required long term. Reference 2.50 indicates that the terminal blocks are more than 23 inches above the floor (see Equipment Item Nos. 22 and 24). The environmental conditions in Table 4 of the Licensee submittal indicate a flooding level of 7 feet. Based on the location of the transmitters, it must be concluded that the terminal blocks would be submerged after a LOCA. There is no evidence from test or analysis to demonstrate that the terminal blocks would function and not short out. On the contrary, the tests indicate that submergence may very well short out or ground the terminals. The Licensee did not address causes for flooding other than a LOCA, such as has recently occurred at Indian Point 2. Circuit analysis of the effects of flooding that is not the result of a LOCA must be evaluated.

2. Spray: The report contained in Reference 2.50 (PEW-TR-83) indicates that chemical spray of borated water was applied for 1 hour during the LOCA simulation test. The chemical composition was not stated and therefore cannot be compared to the Ginna environmental service conditions. The spray duration of 1 hour does not envelop the 24 hours or more of spray that would occur in the plant. FRC has reviewed 24-hour tests in which deposits accumulated along mold lines caused grounding of terminals. Examination of various terminal blocks after a simulated LOCA with chemical spray has indicated conductive deposits on all surfaces, resulting in reduced insulation resistance. The Licensee has not analyzed the effect of high conductivity on pressurizer pressure and pressurizer level signals. Merely maintaining voltage as described in Reference 2.50 does not assure reliable transmission of level/pressure information.

3. Aging: Reference 2.60 provides statements concerning aging and irradiation effects on the materials used in terminal blocks. It is stated that the material
of withstanding continuous service It also states that the extrapolated 40-year life temperature is The report indicates that mechanical properties begin

The mechanical and thermal properties of wood-flour-filled phenolics are highly variable, as shown in Appendix G. The data presented in Reference 2.60 are within the range of data reviewed for the EEQ program, but the data scatter on thermal aging is wide (e.g., 171 hours at 150°C = 40 years, 160 hours at 136°C = 40 years, 100 hours at 126°C = 11.4 years). FRC considers that meaningful forecasts of lifetime and uniform standards for aging damage have not been established for the wood-flour-filled phenolics.

FRC has also reviewed a Sandia Report (Number SAND80-2447A) presented at the Eighth Water Reactor Safety Research Information meeting held at the National Bureau of Standards from October 27 to 31, 1980. The following statement is presented verbatim from page 1 of the report:

Otmar M. Steutzer
Sandia National Laboratories
Albuquerque, New Mexico 87185

Wire connections in reactor systems are generally made by means of Terminal Blocks (TBs), small insulating boards, each accommodating from 6 to 12 screwdown metal terminals. Figure 1 shows the three models of TBs used in the containment of Three Mile Island, Unit 2 (TMI-2). The blocks are shielded from dirt, or direct steam impingement, by protective enclosures or circuit boxes, many of them similar to the standard fuse boxes. The enclosures are not hermetically sealed and are equipped with

breathers or "weep-holes," which at TMI-2 are 6 mm in diameter, but in some other reactors are 25 mm wide. During a steam outbreak, steam can therefore reach the TBs by diffusing through these openings. This makes the insulator surface more conductive. Figure 2 indicates what happens: increased leakage currents (from terminal-to-ground or to another terminal), noise in the circuits, and potentially total electrical breakdown.

TBs have been suspect for a long time. At the urging of the NRC, TBs in safety related (1E) circuits were replaced in most reactors by splices. At TMI, 620 terminals were eliminated, but there are still 2700 in the containment. And in the case of an accident even non-safety circuits may be important.

The report presents data and statistical evaluation of results for probability of failure as a function of time and voltage.

FRC CONCLUSION:

This equipment item is assigned to NRC Category V. There is no evidence that the terminal blocks would either (a) perform any reliable function under submergence resulting from a flooding incident or (b) allow reliable long-term monitoring of pressurizer level and pressure after a LOCA as required by the NRC (and reiterated during the meeting among NRC, Licensee, and FRC representatives in Bethesda on October 7, 1980). Based upon these considerations, the terminal blocks should be replaced with fully qualified splices.

4.6.5 Equipment Item No. 22
Pressure Transmitters Located Within Containment
Foxboro Model 611 GM-DSI
Pressurizer Pressure (PT-429, 430, 431, 449)
(Original Licensee References 2.18, 2.19, 2.27, and 2.31;
Final Licensee References 2.18, 2.19, and 2.33)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.2.8):

The Foxboro Model 611 GM-DSI transmitter is located within the pressurizer level and pressure control cabinets. FRC assumes that these sealed cabinets are designed to provide environmental and physical protection for terminal blocks and instrumentation. The manufacturer has suggested that certain modifications are required on these units in order to preclude early steam entry into the electronics of the transmitter. Westinghouse stated that their modifications to the Licensee's transmitter were made in the field.

The Licensee stated that pressurizer pressure signals initiate the safety injection system. In addition, these transmitters provide post-accident monitoring information to the operator. The Licensee stated that under accident conditions, when flooding or radiation could damage this equipment, backup instrumentation (safety injection flow) provides alternate information for the operator. Furthermore, the Licensee states that emergency procedures dictate that safety injection flow will be maintained to the reactor if the pressurizer indicator does not read stable or increasing pressurizer pressure.

The Licensee has stated that the transmitter experiences failure at radiation exposure levels of greater than 0.03 Mrd; however, LOCA analysis demonstrates that fuel failures do not occur until well after the pressurizer pressure has decreased below the safety injection signal set point. The Licensee concludes that these transmitters will perform their function before failure due to incident radiation.

FRC has reviewed the documentation referenced by the Licensee. With respect to test results and qualification programs, FRC has described the testing and made general comments on the referenced test programs under Equipment Item No. 24 (Section 3.3.2.9). After review of all referenced documentation, FRC notes the following:

a. With respect to model numbers, the relationship between the installed transmitter and the test specimen has not been established in Reference 2.18; however, Reference 2.31 clearly establishes this relationship. This is acceptable.

b. For Reference 2.18, FRC concludes that the transmitter is deficient with respect to radiation exposure. Radiation exposure was not included in the test program for Reference 2.31 (see Equipment Item No. 24, Section 3.3.2.9).

c. Submergence is not included in the test program for References 2.18 or 2.31 (see Equipment Item No. 24, Section 3.3.2.9).

d. Chemical spray analysis is included in the test program (Reference 2.27); however, the potential for in-leakage due to seal failure has not been established (see Equipment Item No. 24, Section 3.3.2.9).

e. For Reference 2.18, FRC concludes that the transmitter is deficient with respect to adequate stability and accuracy; however, Reference 2.31 establishes more adequate stability results. Westinghouse

claimed that the test results indicate instrument availability for at least In addition, Westinghouse stated that the summarized test results show transmitter zero shifts ranging between of span and and that the zero shifts would result in trip points varying in the conservative direction. Although summarized data varies slightly with the Westinghouse statement, sufficient data exists to allow adequate judgment to be made. On this basis, FRC finds the data acceptable.

On the basis of the foregoing review, FRC concludes that:

1. The transmitter is deficient with respect to radiation exposure. Radiation was not included in the test program for Reference 2.31 and was applied after LOCA temperature/pressure exposure for Reference 2.18. Reference 2.18 suggests that the transmitter is degraded by radiation. The Licensee should provide evidence of radiation testing combined with LOCA temperature/pressure exposure.

2. Submergence was not included in the test programs for References 2.18 and 2.31. The Licensee should provide evidence of submergence testing or analytical justification that submergence will not impair accuracy or functioning.

3. Chemical spray is included in the test program [2.27]; however, potential for in-leakage due to seal failure has not been established. The Licensee should provide evidence of further testing or appropriate analysis.

The Licensee stated that this instrumentation is used for post-accident monitoring; however, in the event of failure due to irradiation or submergence, emergency procedures require plant operation to continue safety injection flow if there is no indication of stable or increasing pressurizer pressure. FRC concludes that, on the basis of the foregoing findings, the Licensee's evidence for qualification does not preclude the possibility that the transmitters will provide erroneous readings or ultimate failure.

LICENSEE RESPONSE:

The deficiencies noted in TER C5257 included lack of radiation and submergence qualification. RG&E does not claim credit for the use of this instrumentation at the time it would receive excessive radiation exposure or become submerged. Ginna Emergency Procedures specify that, unless pressurizer pressure, level, and other parameters appear stable and are returning to prescribed levels, safety injection flow is not to

be terminated. Failure to terminate safety injection is not a safety concern. Therefore, lack of qualification for this instrumentation is not considered of immediate safety significance.

It is recognized, however, that accurate primary system information would be extremely useful to the operator for diagnosing the status of the plant during accident conditions. RG&E, therefore, plans to replace the present instrumentation by June 1982 with fully qualified transmitters located above any possible submergence level. Qualification documentation will be made available when received.

FRC EVALUATION:

In response to the DITER, the Licensee has not cited additional references as evidence of qualification for this transmitter; therefore, the specified deficiencies remain unchanged. FRC agrees with the Licensee's position that qualification of this transmitter is needed for long-term post-accident monitoring.

FRC CONCLUSION:

This equipment is assigned to NRC Category V. Based on a review of all documentation, FRC concludes that these transmitters are not qualified. The Licensee has stated that these transmitters will be replaced with fully qualified transmitters by June 1982. In addition, the replacement transmitters will be located above any possible submergence level (see discussion for Equipment Item No. 14). FRC concludes that short-term trip functions can be performed by these transmitters. However, until these transmitters are replaced, the Licensee should ensure that emergency procedures take into account the possibility that this instrumentation could provide erroneous information (see Section E.3 in Appendix E).

4.6.6 Equipment Item No. 24
Level Transmitters Located Within Containment
Foxboro Model 613 M-MDL, Modified
Pressurizer Level (LT-426, 427, 428, and 433)
(Original Licensee References 2.18, 2.19, 2.27, 2.31, and 2.33)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.2.9):

The Foxboro Model 613M-MDL transmitters are located within the pressurizer level and pressure control cabinets. FRC assumes that these sealed cabinets are designed to provide environmental and physical protection for terminal blocks and instrumentation. The manufacturer has suggested that

certain modifications are required on these units in order to preclude early steam entry into the electronics of the transmitter. Westinghouse stated that these modifications to the Licensee's transmitters were made in the field. The Licensee stated that the pressurizer level is no longer used to generate a safeguards actuation signal; however, this instrumentation provides post-accident information to the operator. In addition, the Licensee stated that under accident conditions, when flooding or radiation could damage this equipment, the existing emergency procedures for the plant provide for continued addition of safety injection if the pressurizer level indication does not reflect returning pressurizer level.

FRC has reviewed the documentation referenced by the Licensee. With respect to test results and qualification programs, FRC has noted the following:

a. The Licensee cited References 2.18 and 2.19 as evidence of qualification. FRC notes that Reference 2.19 is a nonproprietary and condensed version of Reference 2.18. With respect to Reference 2.18, FRC notes that the information base is not easily ascertained. Reference 2.18 (WCAP-7410-L, Vol. I of II, Section 4) describes environmental testing programs performed on process instrumentation such as pressure and differential pressure transmitters manufactured by ITT-Barton, Fischer & Porter, and Foxboro. FIRL Reports F-C2639 and F-C2667 are cited by Reference 2.18 as evidence of qualification for pressure and temperature steam environmental accident conditions. FIRL Report F-C2639 describes results of three tests conducted on various Foxboro and Fisher & Porter transmitters. Test No. 1 was conducted using four pressure transmitters as test specimens, Test No. 2 was conducted using four differential pressure transmitters, and Test No. 3 was conducted using two specimens previously tested in Test No. 2 plus two new pressure transmitters. A Foxboro differential pressure transmitter, Serial No. was used as a test specimen in Test No. 2.

F-C2639 did not specifically state the test temperature/pressure profile utilized in Test No. 3; however, the report implied that the same generic environmental profile was reasonably duplicated in all three tests. Following the environmental tests, Foxboro unit Serial No. was seismically tested and subsequently radiation tested.

With respect to Reference 2.18, FRC notes that:

(1) The referenced test stated that a Foxboro differential pressure transmitter, Serial No. , was used as a test specimen.

The model number of this transmitter was not stated in the referenced report.

The Guidelines require that the test specimen must be the same as the equipment being qualified. The Licensee did not present evidence that the test specimen is identical to the installed equipment. In addition, the Licensee did not present an analysis comparing the impact of deviations between the test specimen's specific design features, materials, and production procedures and those of the installed equipment. Therefore, an independent conclusion cannot be reached regarding the extent to which the two units are similar.

(2) The Guidelines require that equipment exposed to radiation as an environmental service condition must be qualified to integrated dose levels which are a combination of the normal operating dose level plus the accident dose level. A gamma dose of 20 Mrd is considered acceptable for general PWR containment areas. The Licensee stated that the total integrated radiation level after a DBE is 160 Mrd. FRC presumes that the difference between 160-Mrd and 20-Mrd values is in part due to beta radiation contribution. The referenced test stated that the

Westinghouse stated that the unit would be examined to establish the cause of failure. If the cause of failure could not be corrected, Westinghouse suggested shielding the units, which are required to operate long-term post-accident, so that total dosage would be less than FRC concludes that beta radiation doses are not significant for qualification of this equipment. In addition, FRC concludes that sufficient evidence of test specimen transmitter's performance (accuracy and stability), prior to failure during the test, does not exist to warrant a determination of satisfactory operation up to a level of Therefore, the transmitter qualification to the anticipated radiation environment is deficient due to evidence of failure during the type test.

(3) The 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. Although these transmitters are located in a protective cabinet, the cabinet can be submerged, and no evidence exists to justify that leakage of water into the cabinet and subsequent flooding of the transmitter will not occur. FRC notes that Reference 2.50 states that vent areas exist so that the cabinet will not collapse due to external pressure. The Licensee has implied that the transmitter could become submerged. FRC concludes, therefore, that actual submergence of the equipment as a service condition should be

addressed in the test program, unless it can be justified by analysis that submergence of these transmitters will not degrade circuitry, control functions, or impair information channels necessary to provide safe operation of the facility.

(4) The Guidelines require that equipment exposed to chemical sprays must be qualified for the most severe chemical environment by either test or analysis. In addition, the effects of enclosure pressure boundary integrity and fluid in-leakage must be considered. As discussed previously, these transmitters could become submerged in the chemical solution. The test program [2.27] has not addressed the potential for chemical attack on elastomer seals and gaskets (see Appendix D). Documentation providing evidence (in the form of either testing or analysis) that the performance of this equipment is not degraded due to containment spray solution should be provided.

(5) The Guidelines require that equipment operational modes during testing should be representative of the actual plant application requirements. In addition, failure criteria should include instrument accuracy requirements. The referenced test stated that the maximum error of the

FRC concludes that this is presumably unacceptable and reflects failure of the transmitter to perform
Unless the Licensee provides justification for acceptability of FRC concludes that the unit has failed to qualify under environmental testing.

(6) The Guidelines require that the test chamber temperature/pressure profile envelop the service conditions for a time equivalent to the period from the initiation of the accident until the service conditions return to normal values. As stated in the referenced test report, the test chamber time-dependent temperature/pressure profile exceeded the postulated accident profile for but did not totally envelop the required environmental service conditions. The referenced test time duration, did not envelop the required accident profile 8.3-hour interval. The required environmental service conditions are such that the temperature returns to normal (125°F) and the calculated worst-case pressure returns to normal (0 psig) in 8.3 hours after the initiation of the accident.

(7) The Guidelines require that radiation exposure should be applied during the test sequence concurrent with or prior to the temperature and pressure/steam environment if it is known that the device contains materials which can be degraded by irradiation. FRC notes that the unit was

It has been established that the transmitter is susceptible to radiation exposure as a result of testing. In light of this, FRC concludes that the test sequence for this device should have included irradiation exposure prior to or concurrent with the temperature/pressure testing.

b. In addition to References 2.18 and 2.19, the Licensee cited Reference 2.31 (WCAP-7354-L) as evidence of qualification. WCAP-7354-L describes additional environmental testing programs performed on process instrumentation such as differential pressure transmitters manufactured by Foxboro and ITT-Barton. Specific modifications to the Foxboro transmitter are discussed. Each supplier has summarized test results, and backup test data is on file at Foxboro.

Westinghouse stated that the limit for acceptable transmitter operation has been set at a half-hour minimum, which was based on the approximate time required to flood the instrument cabinets after safeguards initiation. This is stated to be well beyond the time for emptying the pressurizer under accident conditions.

With respect to Reference 2.31, FRC notes that:

(1) The Guidelines state that a vendor Certificate of Compliance (COC) with design specifications is not considered sufficient evidence for qualification. For equipment located within containment, a complete and detailed test report is required, supplemented by analyses that demonstrate the validity and applicability of any testing performed for similar units. FRC notes the referenced report includes a Foxboro letter dated July 14, 1969, which summarizes preliminary test information for the 613 DM transmitter. Although FRC considers this type of document more acceptable than a COC, it is less acceptable than an actual test report. However, there is sufficient detail in the case to allow adequate judgment to be made. On this basis, FRC finds the letter acceptable.

(2) The test chamber time-dependent temperature/pressure profile, as stated in the referenced test report, enveloped the postulated accident profile for a stated test duration time of

After review of all referenced documentation, FRC concludes the following:

1. The transmitter is deficient with respect to radiation exposure. Radiation was not included in the test program for Reference 2.31 and

was applied after LOCA temperature/pressure exposure for Reference 2.18. Reference 2.18 suggests that the transmitter is degraded by radiation. The Licensee should provide evidence of radiation testing combined with LOCA temperature/pressure exposure.

2. Submergence was not included in the test programs for References 2.18 and 2.31. The Licensee should provide evidence of submergence testing or analytical justification that submergence will not impair accuracy or functioning.

3. Chemical spray is included in the [2.27] test program; however, potential for in-leakage due to seal failure has not been established. The Licensee should provide evidence of further testing or appropriate analysis.

4. The relationship between the installed transmitter and the test specimen has not been established in Reference 2.18; however, Reference 2.31 clearly establishes this relationship. FRC finds this acceptable.

5. From Reference 2.18, FRC concludes that the transmitter is deficient with respect to ; however, Reference 2.31 establishes satisfactory performance for the transmitter for at least a half-hour.

6. From Reference 2.18, FRC concludes that the duration of steam exposure in the test was not sufficient; however, Reference 2.31 establishes a test duration which satisfies the accident profile duration.

The Licensee stated that this instrumentation is used for post-accident monitoring; however, in the event of failure due to irradiation or submergence, emergency procedures require plant operators to continue safety injection flow if there is no indication of returning pressurizer level. FRC concludes that, on the basis of the foregoing findings, the Licensee's evidence for qualification does not preclude the possibility that the transmitters will provide erroneous readings or ultimate failure.

LICENSEE RESPONSE:

The deficiencies noted in TER C5257 included lack of radiation and submergence qualification. RG&E does not claim credit for the use of this instrumentation at the time it would receive excessive radiation exposure or become submerged. Ginna Emergency Procedures specify that, unless pressurizer pressure, level, and other parameters appear stable and are returning to prescribed levels, safety injection flow is not to

be terminated. Failure to terminate safety injection is not a safety concern. Therefore, lack of qualification for this instrumentation is not considered of immediate safety significance. It is recognized, however, that accurate primary system information would be extremely useful to the operator for diagnosing the status of the plant during accident conditions. RG&E, therefore, plans to replace the present instrumentation by June 1982 with fully qualified transmitters located above any possible submergence level. Qualification documentation will be made available when received.

FRC EVALUATION:

In response to the DITER, the Licensee has not cited additional references as evidence of qualification for this transmitter and has withdrawn the references originally cited. Therefore, the specific deficiencies remain. Furthermore, qualification of this transmitter is needed for long-term post-accident monitoring. The Licensee has stated in the submittal that this transmitter is no longer used to generate a safeguards actuation signal.

FRC CONCLUSION:

This equipment is assigned to NRC Category V. After reviewing all documentation, FRC concludes that these transmitters are not qualified. The Licensee has stated that these transmitters will be replaced with fully qualified transmitters by June 1982. In addition, the replacement transmitters will be located above any possible submergence level (see discussion for Equipment Item No. 14). Short-term monitoring functions can be performed by these transmitters. However, until these transmitters are replaced, the Licensee should ensure that emergency procedures take into account the possibility that this instrumentation could provide erroneous information (see Section E.3 in Appendix E).

4.6.7 Equipment Item No. 20
Flow Transmitters Located Within Containment
Barton Model 332
Steam Line Flow Transmitters (FT-464, 465, 474, and 475)
(Original Licensee References 2.27 and 2.31, Final Licensee Reference 2.31)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.2.12):

The Barton Model 332 transmitters are located within containment at the operating floor elevation. The transmitters are used to measure steam flow

and provide signals for steam line isolation. The Licensee has stated that the transmitter is housed in a NEMA type 4 enclosure for protection against water in-leakage. In addition, the Licensee claims that these transmitters do not need to function for any steam line break where they would be exposed to elevated temperatures. A signal for main steam line isolation is also provided by high containment pressure instrumentation located outside containment.

FRC has reviewed the referenced documentation cited by the Licensee. WCAP-7354-L describes additional environmental testing programs performed on process instrumentation such as differential pressure transmitters manufactured by Foxboro and ITT-Barton. Each supplier has summarized test results, and backup test data is on file at Barton. Westinghouse maintains that the most sensitive parameter for these devices is

Westinghouse stated that the limit for acceptable transmitter operation has been set at a half-hour minimum. Westinghouse has stated that

With respect to Reference 2.31, FRC has noted the following:

a. The Guidelines state that a vendor Certificate of Compliance (COC) with design specifications is not considered sufficient evidence for qualification. For equipment located within containment, a complete and detailed test report is required, supplemented by analyses that demonstrate the validity and applicability of any testing performed for similar units. FRC notes the referenced report includes a Barton letter dated June 27, 1969, which summarizes test information for the 332 transmitter. Although FRC considers this type of document more acceptable than a COC, it is less acceptable than an actual test report. However this is sufficient detail to allow adequate judgment to be made. On this basis, FRC finds the letter acceptable.

b. The Guidelines require that the test chamber temperature/pressure profile envelop the service conditions for a time equivalent to the period from the initiation of the accident until the service conditions return to normal values. As stated in the referenced test, the test consisted of

c. The Guidelines require that equipment exposed to radiation as an environmental service condition must be qualified to integrated dose levels that are the sum of the normal operating dose and integrated accident dose. The referenced test report did not include radiation testing. FRC notes, however, that WCAP-7410-L reports on a successfully tested Barton model FRC finds this data acceptable as evidence of qualification for a radiation environment.

d. The Guidelines require that equipment exposed to chemical sprays must be qualified for the most severe chemical environment by either test or analysis. In addition, the effects of enclosure pressure boundary integrity and fluid in-leakage must be considered. These transmitters will become subject to chemical spray. The test program (Reference 2.27) has not addressed the potential for chemical attack on elastomer seals and gaskets (see Appendix D). FRC concludes that the potential for in-leakage due to seal failure has not been established. The Licensee should provide evidence of further testing or appropriate analysis.

LICENSEE RESPONSE:

RG&E has stated that these transmitters are not required to perform a safety function at a time when they could be exposed to a HELB environment. Thus, the lack of complete qualification documentation is a moot point for these transmitters. For a steam line break inside containment, the steam line nonreturn check valves will assure that the intact steam generator will not blow down. Steam line isolation would be provided by the high-containment pressure signal.

For added assurance of steam line isolation in the event of a steam break inside containment, these transmitters will be replaced by June 1982 with fully qualified equipment. Qualification documentation will be made available when received.

FRC EVALUATION:

In response to the DITER, the Licensee has not cited additional references as evidence of qualification or provided evidence of any similarity between the installed Barton Model 332 transmitters and the Barton MOD 1 transmitters which have been tested. Thus, acceptable evidence of qualification has not been provided for these transmitters.

The Licensee has stated that these transmitters are not required to perform a safety function under an adverse HELB environment because steam line nonreturn check valves will isolate the intact steam generator. Although the nonreturn check valves provide backup for MSIV failure to close due to failure of the steam line flow transmitter, these transmitters are required to perform a safety function since the fastest possible termination of steam generator(s) blowdown is needed to mitigate the consequences of a HELB. FRC concludes that these transmitters are required to perform the safety function of MSIV closure under HELB conditions. The systems justification for qualification has been reviewed in Section E.5 of Appendix E.

FRC CONCLUSION:

This equipment is assigned to NRC Category V because acceptable evidence of qualification has not been made available. The discussion of the Licensee's position concerning steam line nonreturn check valves is presented in Section E.5 of Appendix E. The Licensee will replace these transmitters with qualified units by June 1982.

4.6.8 Equipment Item No. 21B
Pressure Transmitters Located in the Intermediate Building
ITT-Barton Model 332
Containment Pressure Transmitters (PT-945, 946, 947, 948, and 949)
(Original and Final Licensee Reference 2.31)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.2.13):

FRC has reviewed the documentation referenced by the Licensee. With respect to test results and qualification programs, FRC has previously described and made general comments to the referenced test programs (see Equipment Item No. 20). After reviewing all referenced documentation, FRC notes the following:

a. The Guidelines require that the test chamber temperature/pressure profile envelop the service conditions for a time equivalent to the period from the initiation of the accident until the service conditions return to normal values. As stated in the referenced test, the test consisted of

FRC concludes that it would be advisable for the Licensee to establish the relationship between the Ginna Barton transmitters and the tested Model 332-MOD I Barton transmitter. In addition, the Licensee should establish that steam at low pressure would have a negligible effect on the performance of this item during accident conditions.

LICENSEE RESPONSE:

As noted in Section IV.3 of this report, five of the seven containment pressure transmitters, which could be exposed to high post-LOCA radiation levels, are being replaced with LOCA-qualified units by June 1982, in response to TMI Lessons Learned. Qualification documentation will be made available when received.

FRC EVALUATION:

In response to the DITER, the Licensee has not cited additional references as evidence of qualification for this transmitter or provided information which would establish similarity between the Barton Model 332 MOD I, which was tested, and the installed Barton Model 332. Therefore, comprehensive evidence of qualification has not been established for this equipment.

The Licensee Response is contradictory (See Equipment Item 21A) because the environmental service conditions for the intermediate building (See Appendix A) specify that the adverse environment is due to a steam line break with negligible radiation conditions. However, the Licensee states in response to this specific equipment item that radiation is the only adverse environmental parameter.

FRC notes that, in light of TMI Lessons Learned, these five transmitters will be replaced with new transmitters qualified for HELB conditions outside containment and a post-LOCA radiation environment.

FRC CONCLUSION:

This equipment is assigned to NRC Category V because acceptable evidence of qualification has not been made available. The Licensee will replace all five transmitters with qualified units by June 1982. FRC assumes that the Ginna design incorporates two containment pressure transmitters located in an area (auxiliary building) that is not exposed to a harsh environment, with the exception of radiation, and five containment pressure transmitters located in a HELB area (intermediate building). The Licensee presumes that for the LOCA condition the physical separation of these transmitters provides some assurance that the overall safety function will be accomplished. FRC concludes that this rationale appears to have some justification; however, the specific details of the electrical circuit logic have not been presented.

4.6.9 Equipment Item Nos. 6A and 6B
Solenoid Valves Located Outside and Inside Containment
Versa Valve Co.
6A: Model VSG-3731, Actuates Containment Purge Valves
6B: Model VSG-3421, Actuates Containment Depressurization Valves
(Original Licensee References 2.39, 2.40, 2.41, and 2.42; Final Licensee Submittal Substitutes Reference 2.26)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.6):

The cited references describe in general terms a qualification program that the Licensee is currently pursuing for the pneumatic-actuated containment isolation valves controlled by these equipment items. The solenoid valves themselves are not discussed, so it is not known whether they (i.e., the same models as those installed in the plant) will be tested in this program. The containment isolation valves are mechanical equipment and therefore not within the scope of FRC's review. Based on the documents submitted, which do not provide details concerning the environmental service conditions to be represented in the planned test program, the adequacy of the solenoid valves to function under LOCA conditions cannot be ascertained. The Licensee must provide documentation giving evidence of qualification for this equipment item, addressing the possibility of aging degradation, and explicitly establishing qualified life.

LICENSEE RESPONSE:

The safety function of these containment purge and depressurization valves immediately following an accident is to close for containment isolation. This is accomplished by the fail-close design of these valves. In order to have this safety function accomplished with equipment having the proper qualification testing and documentation, replacement of these solenoid valves will be initiated. It is expected that this can be accomplished by June 1982. Qualification documentation will be made available when it is received.

FRC EVALUATION:

Reference 2.26 is a product bulletin that states that these units have Buna-N "O" rings, which are satisfactory for ambient temperatures of -10°F to +200°F. This equipment is likely to function in a satisfactory manner in the short term; however, long-term functioning is also required. There is no evidence of qualification. The Licensee has committed to replace these equipment items.

FRC CONCLUSION:

This equipment is assigned to NRC Category V because no evidence of qualification has been provided. The Licensee is committed to replacing this equipment prior to June 1982.

4.6.10 Equipment Item No. 27
Resistance Temperature Detectors Located Within Containment
Rosemount Model 176JA
Reactor Coolant System Temperature
(Original Licensee References 2.27 and 2.35;
Final Submittal Deletes Reference 2.27)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.13):

The Licensee has referenced a Rosemount qualification test report for an equipment model which is different from that installed in the plant. In addition, the Licensee states that the equipment is not exposed to a hostile DBE environment when its safety function is to be performed and, therefore, is not required to be qualified. FRC's conclusions relative to the referenced documentation are:

1. The test specimen must be the same as the equipment being qualified. The Licensee did not present an analysis comparing the impact of deviation between the test specimen's specific design feature, materials, and production procedure and those of the installed equipment. Therefore, an independent conclusion cannot be reached regarding the extent to which the two units are similar. Hence, the validity of the test, as evidence for qualification, has not been established.

2. The Guidelines state that aging of test specimens is not required if the component does not contain materials known to be susceptible to significant degradation due to thermal and radiation aging. The Licensee has not identified insulation materials used in the sensor sheath, leadwire, or terminal block. It would be necessary to perform a test on an aged specimen if any materials in the RTD assembly are susceptible to aging degradation in order to prove that this equipment is qualified for the expected service.

LICENSEE RESPONSE:

Reference 2.35 is a specification sheet and drawing of the Ginna RTD (Rosemount 176JA model). The reactor coolant system temperature detectors (RTD) are not required for a LOCA. In a steam line break accident, low Tavg plus high steam flow plus a safety injection signal will close the main steam line isolation valves. Also, high-high steam flow will perform this function. As described in Section II.B above, for a break upstream of the nonreturn check valves, which includes all breaks inside containment, closure of the main steam isolation valves is not required.

For breaks downstream of the check valves, closure of the main steam isolation valves is desirable; however, in this case the RTDs are not subjected to an adverse environment. Therefore, the RTDs do not require environmental qualification to provide their required safety function. However, the RTDs would be useful for post-accident monitoring. Since the RTDs are not qualified for post-accident use, the present Ginna Emergency Procedures specify that, if a 50°F subcooling margin cannot be established or maintained, safety injection flow shall not be terminated. Failure of the RTDs would require that SI flow be maintained. Since the Ginna high-head safety injection pumps do not have a high enough shutoff head to open the pressurizer PORVs, continued SI pump operation is not a safety concern. However, to avoid the possibility of operator confusion, RG&E will initiate a program to provide qualified RTDs for post-accident monitoring. These will be procured and installed by June 1982, subject to equipment availability and procurement/delivery schedules.

FRC EVALUATION:

FRC concludes that these RTDs should be qualified. The Licensee has not cited additional references as evidence of qualification for this equipment item. The specified deficiency (lack of qualification documentation) remains unchanged. The Licensee has stated that this equipment is not required during a LOCA. FRC does not agree with this assessment (see discussion in Section E.5 of Appendix E). FRC concurs with the operating procedure of leaving the SI pumps in operation unless there is no doubt that they are no longer needed.

With regard to establishing the qualification of the replacement units, FRC points out that the environmental service conditions must be carefully established. The RTDs are located partly within the primary system and partly within the open space of the containment. Hence, both sets of service conditions must be defined and applied to the respective portions of the equipment in the qualification program. In particular, the maximum nuclear radiation dose rate and integrated dose, and the maximum temperature, will have to be defined based upon the most severe accident conditions.

FRC CONCLUSION:

This equipment is assigned to NRC Category V because valid qualification documentation has not been provided.

4.6.11 Equipment Item No. 26
Level Transmitters Located Within Containment
Foxboro Model 613 HM-HSI
Steam Generator Level (LT-470, 471, 472, 473, 460, 461, 462, 463)
(Licensee reference not cited)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.15):

The Foxboro Model 613HM-HSI transmitter is located at the operating floor elevation within containment. The transmitter is used to measure the steam generator level. The Licensee cited no evidence of qualification for these devices. In addition, the Licensee has stated that these components are not qualified to withstand the post-accident containment environment. The Licensee claims that alternate instrumentation is available to perform this particular monitoring function (e.g., devices that monitor the heat removal

from the steam generators). The alternate instrumentation is stated to be the main steam pressure transmitters, which indicate the steam generator status, and the auxiliary feedwater flow instrumentation, which indicates flow to each steam generator. These alternate instruments are located outside the containment.

FRC has determined that the concept of the adequacy of alternate instrumentation, which alleviates the necessity of qualification for the steam generator level instruments, must be determined by the NRC. FRC concludes that qualification documentation, in accordance with Guideline requirements, is totally lacking.

LICENSEE RESPONSE:

The steam generator level transmitters, although useful for confirming secondary system heat removal capability, are not necessary for performing this function. For an accident inside containment, which could degrade the performance of the SG level transmitters, the main steam pressure transmitters, located outside containment, provide information regarding steam generator status. Auxiliary feedwater flow instrumentation for each steam generator, also located outside containment, provides the primary indication of the steam generator heat removal capability. Based on the latest information provided at the Westinghouse Emergency Operating Instructions seminar, the Ginna Emergency Procedures will be revised to reflect AFW flow indications as being of prime value as the main indication of secondary heat removal capability.

Nevertheless, in order to remove the possibility of operator confusion due to misleading instrument indications, the steam generator level transmitters will be replaced by June 1982. Qualification documentation will be made available when received.

FRC EVALUATION:

The Licensee has not cited additional references as evidence of qualification for this equipment item. The specified deficiency (lack of qualification documentation) remains unchanged. The Licensee has stated that alternate instrumentation located outside containment is available to provide information regarding steam generator status. FRC agrees with the Licensee that auxiliary feedwater flow instrumentation can be used to indicate secondary heat removal capability in lieu of qualified steam generator level

instruments until qualified replacement transmitters are installed. However, controlled cooldown rate would be difficult when operating in this mode (see Appendix E, Item 4).

FRC CONCLUSION:

This equipment is assigned to NRC Category V. After reviewing all information presented by the Licensee, these transmitters are not qualified because evidence of qualification has not been made available. The Licensee has stated that the Emergency Operating Procedures will be revised so that auxiliary feedwater flow will be used as primary indication of secondary heat removal capability. In addition, the Licensee will replace the steam generator level transmitters with qualified transmitters by June 1982. The Emergency Operating Procedures should be revised to ensure that the operator will not be misled by possibly erroneous steam generator level indication in the interim period prior to component replacement (see Appendix E, Item 4).

4.6.12 Equipment Item No. 35
Solenoid Valves Located Within Containment
Valcor Engineering Corp., Model V57300
Pressurizer PORVs
(Original and Final Licensee Reference 2.48)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.17):

The Licensee has submitted a product bulletin and the first two pages of a stress analysis report as evidence of qualification. The product bulletin states that this item has the option of being qualified to IEEE Std 323-74 requirements for active valves. This statement is not considered sufficient evidence of qualification.

LICENSEE RESPONSE:

Additional information has been added to Reference 2.48, consisting of the test results and testing methodology. This was provided to the NRC and FRC on September 24, 1980. The entire test report is also available for audit and review at RG&E.

These valves are fully qualified to IEEE-323-1974 to perform their post-accident safety function.

FRC EVALUATION:

The information provided by the Licensee in Reference 2.48 has been reviewed. The information consisted of parts of a test report for a valve with a different model number than the unit installed in the plant. Therefore, applicability of the information to the Ginna Station equipment has not been established.

A recent NRC-IE Bulletin (80-20 dated November 14, 1980) noted that Valcor had changed the combination of varnish and wire insulation in the design of environmentally tested solenoid valves. The combination of materials is incompatible causing gradual failure until the coil is shorted out. The Licensee should establish whether installed valves have compatible and qualified insulation varnish systems.

FRC CONCLUSION:

This equipment is assigned to NRC Category V. The Licensee should provide an analysis comparing the installed equipment with that tested, and determine from this whether the test results can be applied. The complete report should be submitted for review.

4.7 NRC Category VI
EQUIPMENT FOR WHICH QUALIFICATION IS DEFERRED

The equipment items in this section have been addressed by the Licensee in the equipment environmental qualification submittals; however, the qualification review has been deferred by the NRC in accordance with criteria presented in Sections 2.2.3 and 2.2.5 of this report.

4.7.1 Equipment Item No. 1C
Solenoid Valve Located in the Auxiliary Building
Automatic Switch Co. (ASCO) Model LBX831616
Actuates Valve for Charging from RWST (LCV-112B)
(Original Licensee Reference 2.23)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.2):

The Licensee has submitted documentation that is not applicable to these items or for which applicability cannot be determined. It should be possible, however, for the Licensee to demonstrate qualification by similarity or by obtaining relevant test reports from the manufacturer. If the safety function of these equipment items is to deenergize to the fail-safe position, then only the nonelectrical components of the valve are required to function. The safety functions of these items should be clarified by the Licensee.

a. The Guidelines require that the test specimen must be the same as the equipment being qualified. The Licensee did not present an analysis comparing the impact of deviations between the test specimen's specific design features, materials, and production procedure and those of the installed equipment. Therefore, an independent conclusion cannot be reached regarding the extent to which the two units were similar. Hence, the validity of the test as evidence of qualification has not been established.

b. The test specimen was exposed to saturated steam at

The report did not indicate the reason for the failure.

c. Aging of the test specimen was not considered. Therefore, no qualified life has been established, nor has a program to ascertain whether any in-service failures during the installed life of the equipment are the result of aging degradation.

LICENSEE RESPONSE:

Item 1C, the solenoid controlling LCV-112B, will not experience an adverse environment during an accident. Further, an accessible manual bypass valve, Valve 358, is used to provide alternative suction for the charging pumps from the RWST. Since this function would not be required for many hours following an event requiring the maintenance of a safe shutdown condition, the use of this manual valve is considered acceptable. Item 1C will thus be deleted from Table 3.

FRC EVALUATION:

Because the valve is located in a nonharsh area, its environmental qualification review is deferred until after February 1, 1981, as stated in Section 2.2.3.

FRC CONCLUSION:

This equipment is assigned to NRC Category VI because of qualification deferment in accordance with Section 2.2.3.

4.7.2 Equipment Item No. 8I
Motorized Valve Actuators Located in the Auxiliary Building Addition
Limitorque Model SMB-00 with Reliance Electric Co. Motor
Actuates Standby AFW Valves (MOV-9703 A,B; 9704 A,B; 9710 A,B)
(Original Licensee Reference 2.43; Final Licensee
References 2.47 and 2.54)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.2.3):

The reference the Licensee has provided is a design specification for the standby auxiliary feedwater system. This is not valid evidence as proof of qualification. The actuators installed at the plant were not identified in the referenced documentation in enough detail to correlate the results of a test report or analysis with their expected performance. It should be possible, however, for the Licensee to demonstrate qualification by similarity and analysis or by obtaining more recent qualification reports from the manufacturer.

Assuming that the DBE radiation exposure is low, and since the other DBE environment is not as severe as tests to similar equipment, it is probable that this item will perform its safety functions without the occurrence of a

common-mode system failure. Documentation demonstrating that this equipment item is qualified for the expected environments should be provided for review.

However, the Licensee has provided supplemental information. The Licensee has pointed out that actuators MOV-4000A and B (AFW cross-connect) are located in the Intermediate Building and therefore should have been grouped with Equipment Item No. 8D. In addition, the Licensee has pointed out that actuators MOV-9710A and B (standby auxiliary feedwater system) are located in the Auxiliary Building Addition and therefore are not exposed to a severe accident environment.

With respect to actuators associated with the AFW system located in the Intermediate Building, FRC concludes that qualification is a moot point for these devices since other auxiliary feedwater system components also lack documentation. As stated in Section 3.3.1.4, FRC agrees that explicit qualification for service under accident conditions is not required, provided that NRC concurs with the Licensee's position that the "remote-manual" controlled standby auxiliary feedwater system's safety function eliminates the need for a qualified auxiliary feedwater system. With respect to operators located in the Auxiliary Building Addition, FRC concludes that the actuators need only be qualified for the expected 120°F operating environment (see Appendix A). Qualification for this environment should therefore be provided by the Licensee.

LICENSEE RESPONSE:

> All of these valve operators are located in the Auxiliary Building Addition, which is a mild environment. Environmental qualification is provided under paragraph 4.3.3 of the DOR Guidelines, "Areas Normally Maintained at Room Conditions." The Auxiliary Building Addition is maintained at room conditions by redundant air conditioning systems served by the onsite emergency electrical power system. The room conditions specified in Reference 2.43 are 60° to 120°F. The valve specifiation [2.52] states that "the valve actuator shall be designed for a 40-year plant life under ambient conditions of 40°F to 120°F...." Since there is no change in the environmental conditions between normal and accident conditions, "...no special consideration need be given to the environmental qualification of Class 1E equipment in these areas provided the aging requirements discussed in Section 7.0 are satisfied and the areas are maintained at room conditions by redundant air

conditioning or ventilation systems served by the onsite emergency electrical power system." Reference 2.47 describes the program developed at R. E. Ginna for detecting age-related failures. This program was developed to conform to the provisions of Section 7.0 of the "DOR Guidelines" for the "on-going programs...to review surveillance and maintenance records to assure that equipment which is exhibiting age-related degradation will be identified and replaced as necessary."

FRC EVALUATION:

FRC concurs that this equipment is located in a mild or "normal" environment and that the equipment qualification review can be deferred until after February 1, 1981, in accordance with Section 2.2.3.

FRC CONCLUSION:

This equipment is assigned to NRC Category VI because it is not subjected to a harsh environment and thus is deferred in accordance with Section 2.2.3.

4.7.3 Equipment Item No. 38
Hydrogen Recombiner Blower Motors Located Within Containment
Westinghouse 2-hp, 3-phase, 60-Hz, 230/460-V
(Original Licensee References 2.18, 2.19, and 2.49)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.2.15):

Licensee Reference 2.49 (WCAP-9001) describes the hydrogen recombiner system. Reference 2.19 is a nonproprietary version of 2.18 and contains less information. FRC has reviewed Licensee Reference 2.18 and notes the following:

a. The report indicates that a scaled version of the installed motor was used as a test specimen. No model number was stated. The Guidelines require that the test specimen must be the same as the equipment being qualified. The Licensee did not present an analysis comparing the impact of deviations between the test specimen's specific design feature, materials, and production procedure and those of the installed equipment. Therefore, an independent conclusion cannot be reached regarding the extent to which the two units are similar. Hence, the validity of the test as evidence of qualification has not been established.

b. The thermal aging, nuclear radiation, and chemical spray exposure tests demonstrate satisfactory performance of the motor.

c. The temperature component of the steam exposure had little (if any) margin, but the deficiency is judged to be unimportant.

LICENSEE RESPONSE:

The only deficiency noted in TER C5257 is that no analysis exists comparing the impact of deviations between the test specimen's specific design features, materials, and production procedure and those of the installed equipment. The only evidence at this time is contained in Section 5.2 of Reference 2.18, WCAP-7410-L, Vol. II. It is stated that "the 2 hp motor used in the test program is constructed in the same manner as is the actual 15 hp motor used in the recombiner." Further, it has been verified that the Ginna 15-hp motor has Class H insulation, the same as the 2-hp motor tested.

Based on the available information, RG&E believes that there is reasonable assurance that the Ginna recombiner motor will perform its safety function. Further, as stated in Item No. 37 above, the hydrogen recombiner is not required by the present Ginna design basis. Based on the TMI Lessons Learned, however, RG&E will commit to replace the motor if proper environmental qualification documentation is not established.

FRC EVALUATION:

The Licensee has stated that the 15-hp Ginna recombiner motor has, according to its nameplate, Class H insulation and is of the same construction as the 2-hp motor tested by Westinghouse. Evidence of similarity needs to be presented by demonstrating the following:

1. The bearing system for the Ginna Station is equivalent to or better than the 2-hp test motor's bearings.
2. The splices for the motor-lead and lead-to-cables of the Ginna plant motor are identical to or superior to those of the tested unit.
3. The lubrication used in the Ginna Station motor can withstand the radiation and steam environment of the Ginna containment.

The Licensee Reference WCAP-7410-L, Vol. II, stated that the test motor's insulation expected life is 7 years of continuous operation or 40 years of noncontinuous operation, which is expected to be the case for the Ginna recombiner motor. The Licensee should establish the motor's overall qualified life, with attention paid to that component with the limiting life span, such as the bearing system (see Section 4.1.3).

The Licensee notes that this is a TMI Action Plan item. Qualification review can be deferred in accordance with criteria presented in Section 2.2.5.

FRC CONCLUSION:

This equipment is assigned to NRC Category VI because it is a TMI-related item for this plant and thus is deferred in accordance with Section 2.2.5. When the Licensee (i) demonstrates that similarity of the specific items mentioned above exists and (ii) provides a statement on the recombiner blower motor's qualified life, qualification of the motor will be established.

4.7.4 Equipment Item No. 5B
Solenoid Valves Located in the Auxiliary Building
Automatic Switch Co., Model Not Stated
Actuates SI Recirculation Valves (AOV-897, 898)
(Original Licensee Reference 2.23)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.2):

The Licensee has submitted documentation that is not applicable to these items or for which applicability cannot be determined. It should be possible, however, for the Licensee to demonstrate qualification by similarity or by obtaining relevant test reports from the manufacturer. If the safety function of these equipment items is to deenergize to the fail-safe position, then only the nonelectrical components of the valve are required to function. The safety functions of these items should be clarified by the Licensee.

a. The Guidelines require that the test specimen must be the same as the equipment being qualified. The Licensee did not present an analysis comparing the impact of deviations between the test specimen's specific design features, materials, and production procedures and those of the installed equipment. Therefore, an independent conclusion cannot be reached regarding the extent to which the two units are similar. Hence, the validity of the test as evidence of qualification has not been established.

b. The test specimen was exposed to saturated steam at about 300°F for 7 hours, at which time the valve would not function properly. The report did not indicate the reason for the failure.

c. Aging of the test specimen was not considered. Therefore, no qualified life has been established, nor has a program to ascertain whether any in-service failures during the installed life of the equipment are the result of aging degradation.

LICENSEE RESPONSE:

This equipment controls AOV-897 and 898, which are required to close prior to sump recirculation. They will not experience an adverse environment prior to the time they must perform their safety function. Environmental qualification of these valves will be addressed in a later submittal, concerning electrical equipment located in a mild environment.

FRC EVALUATION:

FRC concurs that the review of this equipment can be deferred until after February 1, 1981 in accordance with Section 2.2.3.

FRC CONCLUSION:

This equipment is assigned to NRC Category VI because the Licensee has stated that it is located in a mild area and thus is deferred in accordance with Section 2.2.3.

4.7.5 Equipment Item No. 2
Solenoid Valves Located in the Auxiliary Building
Copes Vulcan Co. Model D-100-60
Actuates NaOH to CS Valves (ADV-836 A,B)
(Original Licensee Reference 2.23)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.3):

The Licensee has not submitted the referenced documentation. Therefore, no conclusion can be made concerning the qualification of this item.

LICENSEE RESPONSE:

The valves were purchased from ASCO (Series 8200). Therefore, all information from Reference 2.23 applies to the valves. Further, since these valves are located in a mild environment, qualification of these valves will be discussed at a later time.

FRC EVALUATION:

The review of this equipment can be deferred until after February 1, 1981. The Licensee should correct the manufacturer and model number on its equipment list and identify the specific model.

FRC CONCLUSION:

This equipment is assigned to NRC Category VI because it is not exposed to a harsh environment and thus is deferred in accordance with Section 2.2.3.

4.7.6 Equipment Item No. 9
Motors Located in Auxiliary Building Addition
General Electric Company, Type K, 250 hp
Drive Standby Auxiliary Feedwater Pumps
(Original Licensee Reference 2.43)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.8):

The cited reference presents only the design specification for the standby auxiliary feedwater (SAFW) system. As such, it does not provide evidence of qualification. This reference states that the ambient temperature is not expected to exceed 120°F. Since the auxiliary building addition is isolated from the auxiliary building, steam formed in either space as a result of a pipe break cannot affect equipment in the other space. Therefore, the SAFW pump motors need not be qualified for a steam environment but only for a 120°F operating environment. Qualification documentation for this environment should therefore be provided by the Licensee. This documentation should include an evaluation of the extent to which aging may degrade vital components of the motor, and the qualified life should be explicitly determined.

LICENSEE RESPONSE:

Although this item is not located in a harsh environment, and therefore does not need to be addressed at this time, RG&E considers the environmental qualification of this item to be complete and acceptable. As stated in Section 4.3.3 of the DOR Guidelines, "No special consideration need be given to the environmental qualification of Class 1E equipment in these [non-harsh] areas provided the aging requirements discussed in Section 7.0 are satisfied and the areas are maintained at room conditions by redundant air conditioning or ventilation systems served by the onsite emergency electrical power system." This is the case with these motors. The equipment specification for these motors [2.3] states "Motors shall be rated for operation in an of 50°C [122°F]." This is consistent with the ambient operating conditions for the Auxiliary Building Addition of 60° to 120°F [2.43]. Furthermore, the ongoing program described in Reference 2.47 to detect age-related failures includes these motors. RG&E therefore considers these motors to have met all necessary environmental requirements.

FRC EVALUATION:

The Licensee's Reference 2.47 is only a general description of a maintenance surveillance program designed to monitor changes in plant since the equipment is located in a non-harsh environment, equipment failure rates. No specifics of this program have been provided which would allow qualified life to be assessed. Since the equipment is located in a non-harsh environment, equipment qualification and qualified life determination can be deferred until after February 1, 1981, in accordance with Section 2.2.3.

FRC CONCLUSION:

This equipment is assigned to NRC Category VI, in accordance with Section 2.2.3. The qualified life of these motors should be addressed by the Licensee.

4.7.7 Equipment Item Nos. 10A, 10B, 10C, and 12A
Motors Located in the Auxiliary Building
10A: Westinghouse 444 TS TBDP 200 hp (Containment Spray Pump Motors)
10B: Westinghouse 444 TS TBDP 150 hp (Component Cooling Water Pump Motors)
10C: Westinghouse 445 TS TBDP 200 hp (RHR Pump Motors)
12A: Westinghouse 509 US AFDP 350 hp (Safety Injection Pump Motors)
(Original Licensee References 2.15 and 2.16; Final Licensee References 2.67, 2.68, and 2.69)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.9):

The cited references are equipment specifications and do not provide any evidence of qualification. They state that the motors shall have Class B insulation, shall have drip-proof enclosures (per NEMA Standard MG1-1.20), and shall have a temperature rise that does not exceed 60°C (140°F) when operating continuously at rated load in a 40°C (104°F) ambient temperature. Equipment Item 10C is exposed to moderately high (or at least not insignificant) levels of gamma radiation and somewhat elevated temperatures during normal plant operation, and this item and both 10A and 12A are exposed to moderately high temperatures (not as yet quantified by the Licensee) and high radiation levels following a LOCA.

Equipment Item 10B is in a somewhat more protected location, but still may be subjected to age-induced degradation and to environments (such as water spray or steam) that could cause the simultaneous failure of both CCW pump motors.

The Licensee must define the DBE environments and provide proper documentation giving evidence of qualification, considering whether important material properties are significantly affected by environment during the installed life. Finally, the qualified life should be explicitly determined.

LICENSEE RESPONSE:

The first three of these Ginna motors have Class B insulation made of "Thermalastic Epoxy." The SI pump motor insulation is "PMR" (Premium Moisture Resistant). This is shown in Reference 2.67. Qualification of these systems is given in WCAP-8754 [2.68] for the "Thermalastic Epoxy" motors, and the Westinghouse Research Report 71-1C2-RADMC-R1, "The Effect of Radiation on Insulating Materials Used in Westinghouse Medium Motors," December 31, 1970 (Revised April 10, 1971) [2.69] for the "PMR" motors. These reports are proprietary, but are available for audit at RG&E and at Westinghouse. Testing does indicate that these motors can withstand an accumulated dose of 10 Mrd during their operating life, with an operating life of 20 years. Since these motors are not used at all times (only the CCW pump is used during normal operation, and even then only one of the two pumps is normally in use), the operational capability is at least 40 years. Also, RG&E has a program of insulation inspection once per year (M45.1A, Inspection of Safeguard Motor) and replacement (if needed) every five years.

Since the only adverse environment anticipated for any of these motors is a post-LOCA radiation dose (conservatively estimated in Reference [TMI-3] as 2.8 Mrd) these motors are considered properly qualified both for "life" and radiation.

FRC EVALUATION:

Westinghouse Report WCAP-8754, "Environmental Qualification of Class 1E Motors for Nuclear Out of Containment Use" [2.68], may have applicability to one of these pump motors for insulation degradation resistance to radiation, thermal cycling, and humidity. The insulation material tested was Westinghouse Thermalastic Epoxy designed for NEMA Class B insulation system. According to Licensee Reference 2.67, the safety injection pump motor (Equipment Item 12A) does have this type of insulation and the WCAP-8754 reference is applicable to qualify the insulation material.

A review of Westinghouse Report WCAP-8754 indicated that the insulation testing was rigorous. Based on this testing, the "Life-Line D" motor with Thermalastic Epoxy, designed for a NEMA Class B temperature rise, has a projected qualified life of 44,000 running hours at 130°F. Westinghouse Research Report 71-1C2-RADMC-R1 shows an expected life of 70,000 running hours. These projected qualified lives assume that a proper maintenance and inspection program is being followed at the plant.

These motors are not subject to submergence or chemical spray. With regard to aging, the motor's steel enclosure, stator punchings, and the rotor assembly are not subject to degradation due to environmental effects.

As stated by Westinghouse, the only parts of the motor which may reasonably be expected to show some signs of environmental aging are the stator winding insulation, the motor bearings, lubrication, motor-lead splices, and lead-to-cable splices.

The report does not qualify a specific type of lubrication or bearing system. The Licensee should demonstrate that the Mobilux EP No. 2 lubricant used for the pump motor has not been shown to cause any abnormal bearing wear.

Bearing qualification and qualified life can be demonstrated through a detailed maintenance surveillance review.

The other pump motors (Equipment Items 10A, 10B, and 10C) cannot be qualified by the Licensee Reference 2.68 (WCAP-8754) because a different type of insulation was used: PMR Class B, according to Reference 2.67. The Licensee has provided additional information in Reference 21 relating to Westinghouse design information on the PMR insulation system. It concludes that the PMR is designed to provide additional protection against moisture and mild chemical fumes. Class B insulation is normally designed for 120°C maximum temperature and its employment in the nonharsh auxiliary building is satisfactory, at least for its exposure to elevated temperatures. With regard to radiation concerns, the Licensee should provide other information to support qualification. The Licensee is encouraged to make the proprietary report [2.69] available for review in order to relieve this concern.

With regard to the RHR pump motors, it is important that the Licensee address the post-accident exposure of these motors to nuclear radiation during both normal plant operation and shutdown mode. The Licensee should also review maintenance records to ensure that the bearing and lubrication systems are not experiencing abnormal wear characteristics.

FRC CONCLUSION:

These equipment items are assigned to NRC Category VI because they are located in a nonharsh area and qualification review is therefore deferred until after February 1, 1980, in accordance with Section 2.2.3.

4.7.8 Equipment Item No. 12B
Motors Located in the Screen House
Westinghouse Electric Corp. 509 UPH ABDP, 300 hp
Drive Service Water Pumps
(Original Licensee References 2.15 and 2.16; Final Submittal Substitutes Reference 2.67)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.10):

These references are discussed in Paragraph 3.3.3.9. They provide sufficient documentation with regard to the temperature environment in the absence of a HELB, but do not address the ability of these motors to function while being subjected to (a) a heavy spray of water or (b) a steam environment such as could be produced by a steam line break, as is discussed in Reference 4. The Licensee must address these environments, the extent to which the insulation is likely to be degraded by thermal aging during its installed life, and the effects of such aging on the qualified life of the equipment.

LICENSEE RESPONSE:

As stated in Reference [Flood-15], the effects of jet impingement and water spray on these motors were evaluated by the NRC during the review of SEP Topic III-5.B, "Pipe Break Outside Containment." RG&E committed to supplement the NRC recommendation in Reference [FLOOD-13]. Thus, the Service Water Pump Motors have been removed from the HELB environment considerations. Further review for operation in a "mild" environment will be conducted at a later time.

FRC EVALUATION:

FRC concurs that the equipment environmental qualification review for this equipment can be deferred until after February 1, 1981.

FRC CONCLUSION:

This equipment is assigned to NRC Category VI because it is not exposed to a harsh environment and its review can be deferred, in accordance with Section 2.2.3.

4.7.9 Equipment Item No. 28
Battery Banks Located in Battery Rooms on Basement Level of Control Building
Gould Industrial Battery Division, Model FTA-19
(Original Licensee Reference 2.32)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.14):

The Guidelines state that safety-related equipment located in plant areas maintained at room conditions prior to, during, and after the design basis accident does not require environmental qualification because equipment failure can be expected to be random. Plant areas considered to be maintained at room conditions are those areas where the environment is not subject to change due to a design basis accident and which are serviced by redundant HVAC systems powered from on-site diesel-backed power sources. Room conditions are considered to be those for which industrial grade equipment is usually designed to operate (typically 50° to 104°F).

The Licensee's submittal [1, 12] notes that at present the ventilation fans are supplied from a non-1E power source; however, at a later date, a change will be made to power these fans directly from the battery bus. FRC finds this position acceptable.

The Licensee has provided a manual of installation and operating instructions as evidence of qualification. A lead-acid battery's performance can be closely monitored, and a battery can be replaced as necessary for continued operability, since replacement criteria are well defined. However, the Licensee's submittal is not considered sufficient evidence of qualification.

Table 1 of Reference 4 of this report indicates that the battery room is susceptible to flooding. The Licensee should be required to demonstrate adequate protection from flooding.

LICENSEE RESPONSE:

As noted in TER C5257, the ventilation system is being modified, such that the battery rooms can be considered a mild environment. Reference [HELB-13] committed to a resolution of the potential flooding problem. The batteries will thus be further discussed at a later time, together with other equipment located in a mild environment.

FRC EVALUATION:

As pointed out by the Licensee, modifications to the HVAC system and the battery room are needed to provide a more protected environment for the batteries. The qualification review of this equipment can be deferred in accordance with Section 2.2.3.

FRC CONCLUSION:

This equipment is assigned to NRC Category VI, and its qualification review can be deferred in accordance with Section 2.2.3.

4.7.10 Equipment Item Nos. 29A, 29B, and 29C
Diesel-Generator Electrical Equipment
29A: ALCO Diesel Engine, Model 251F and Controls
29B: Westinghouse 1900 kW Generator and Controls
29C: Westinghouse 1 hp Model TBFC AC Motor, Drives Fuel Oil Transfer Pump
(Original Licensee reference not cited; Final Licensee Reference 2.7)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.16):

The Licensee stated that the environment within the diesel generator rooms will not deviate from the normal range when the equipment is operating, citing the following facts:

- Each room is served by two ventilation fans powered from the diesel generator unit they serve.
- Each room has a large door that could be manually opened to provide ventilation air from outdoors.

FRC's evaluation of the situation is as follows:

a. The Guidelines state that safety-related equipment located in plant areas maintained at room conditions prior to, during, and after the design basis accident does not require environmental qualification because equipment failure can be expected to be random. Plant areas considered to be maintained at room conditions are those areas where the environment is not subject to change due to a design basis accident, and the area is serviced by redundant HVAC systems powered from onsite diesel-backed power sources. Room conditions are considered to be those for which industrial grade equipment is usually designed to operate (typically 50° to 104°F).

b. The Licensee has provided neither an analysis nor test results showing the temperature levels that would be likely to occur near the engine controls, electric power equipment, and fuel transfer pump during extended, full-power operation when warm weather conditions occur.

c. The Licensee has neither identified the specific items of electrical equipment located in the diesel generator rooms (other than the generators and fuel oil transfer pump motors) that are necessary for proper operation of the diesel generator units nor provided documentation to demonstrate that sustained full-power operation can be achieved. This listing and the associated documentation should be provided for review by NRC and FRC.

Because of the vital importance of the diesel generator in providing onsite power to the various ECCS, ultimate heat sink, and other Class 1E systems, FRC believes that the Licensee should provide additional information concerning the ability of at least one diesel generator to operate properly for an extended period under the most severe environmental conditions that would exist in the room. Implicit in this conclusion is the need to quantitatively determine these conditions.

LICENSEE RESPONSE:

This equipment is located in a mild environment. Its qualification will be reviewed at a later date.

FRC EVALUATION:

Because the equipment is located in a mild area, its qualification will be reviewed after February 1, 1981.

FRC CONCLUSION:

This item is assigned to NRC Category VI, and its qualification review can be deferred in accordance with Section 2.2.3.

4.7.11 Equipment Item No. 36
Level Switches Located Within Containment
Gem Corporation, Special Model, Similar to LS-1900
Containment Sump "B" Level
(Original Licensee References 2.18 and 2.19; Added Licensee Reference 2.52)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.18):

The Licensee has referenced two Westinghouse qualification reports. FRC has reviewed these reports and finds that they are not applicable to Gem Corporation level switches.

LICENSEE RESPONSE:

Reference 2.52, the specification sheet for this item, was provided to the NRC and FRC on September 24, 1980. There is evidence that these level switches can perform their function in a containment post-accident environment. However, not all of the requirements of the DOR Guidelines are met for this instrumentation. It is important to note, however, that these instruments are not used to perform any post-accident safety-related functions and are not specified for use in the Ginna Emergency Procedures except as confirmatory information. The safety-related function of determining the timing of the "sump switchover" procedure is performed by the RWST level instrumentation, located outside containment.

The TMI Lessons Learned determined that a wide-range sump level indication was to be provided for operator information. Fully qualified equipment will be purchased to meet this requirement. The qualification documentation for this instrumentation will be made available when received.

FRC EVALUATION:

The equipment environmental qualification review for this equipment can be deferred until after February 1, 1981 under the terms of Section 2.2.5.

FRC CONCLUSION:

This equipment is assigned to NRC Category VI, and its qualification review can be deferred in accordance with Section 2.2.5.

4.7.12 Equipment Item Nos. 42 and 43
Motors Located in Auxiliary Building
Westinghouse Model SBDP
Drive Cooling Fans for RHR, CS, and SI Pump Motors
42: 2 hp (for RHR Pump Motors)
43: 3 hp (for CS and SI Pump Motors)
(Original Licensee reference not cited;
Final Licensee Reference 2.69)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.19):

These motors and fans are located in the basement of the auxiliary building and circulate air through a cooling coil to pump motors that provide essential engineered safeguards functions. It appears that during accident conditions these motors could be exposed to temperature and nuclear radiation levels beyond the normal range of values for these parameters. The Licensee should more thoroughly define the accident-produced environmental conditions to which they may be exposed and provide evidence that the motors and their field connections will continue to operate satisfactorily under these conditions.

LICENSEE RESPONSE:

Reference 2.69 provides information concerning the life and radiation characteristics of these motors. These motors are capable of operation after a radiation exposure of 10 Mrd and 20 years. Since these motors are run only intermittently, operational capability for 40 years is shown. Since the only harsh environment experienced by these motors is post-LOCA radiation (estimated at 2.8 Mrd), operation under required accident conditions is shown.

FRC EVALUATION:

Licensee Reference 2.69, entitled "The Effect of Radiation on Insulating Materials used in Westinghouse Medium Motors," addressed the thermal and radiation aging phenomena associated with various materials in nuclear plant motors. Materials were conditioned for a total integrated dose of 120 Mrd and

thermal accelerated aging to simulate 20 years of continuous operational equivalent life. It concluded that Teflon was the only material not recommended for use in a radiation environment. Unfortunately, the reference report, being of a proprietary nature, lacked several pages (middle section); therefore, FRC could not verify the motor's traceability, material composition, or points where degradation may be initiated.

The Licensee should provide the necessary sections of the referenced report and address the motor's overall qualified life by examining plant maintenance records.

The equipment is located in a nonharsh environment and its qualification can be deferred until February 1, 1981 in accordance with Section 2.2.3.

FRC CONCLUSION:

This equipment is assigned to NRC Category VI, and its qualification review can be deferred in accordance with Section 2.2.3.

4.7.13 Equipment Item Nos. 32 and 44
I&C Cabinets and Various Relay Racks Located in the Relay Room on Intermediate Level of Control Building
32: I&C Cabinets, Foxboro Co.
44: Various Relay and Logic Racks, Westinghouse Electric Corporation
(Licensee reference not cited)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.20):

The Guidelines state that safety-related equipment located in plant areas maintained at room conditions prior to, during, and after the design basis accident does not require environmental qualification because equipment failure can be expected to be random. Plant areas considered to be maintained at room conditions are those areas where the environment is not subject to change due to a design basis accident and which are serviced by redundant HVAC systems powered from onsite diesel-backed power sources. Room conditions are considered to be those for which industrial grade equipment is usually designed to operate (typically 50° to 104°F).

FRC notes that References 1 and 12 indicate that the relay room is served by two self-contained HVAC units. The Licensee has stated that these units can be manually aligned to the emergency electrical buses in the event of loss of offsite power. FRC notes that the units are supplied with low-pressure heating steam and that Reference 2.4 points out that fire protection system temperature detectors would alert the control room operator to a hostile environment produced by a steam heating line break. In addition, FRC notes that the electrical power supply appears to be fed from non-1E electrical buses. FRC concludes that there is insufficient information to verify that these units can be switched to emergency power sources before an adverse environment is created. In addition, it is unclear whether the two air conditioning units are redundant or whether both are required to maintain a normal environment. FRC concludes, therefore, that the Licensee should provide additional information to support the contention that this area is maintained in the normal range or else provide documentation to demonstrate qualification for a more severe environment.

LICENSEE RESPONSE:

This equipment is located in a mild environment. Its qualification is deferred until after February 1981.

FRC EVALUATION:

The review of this equipment can be deferred until after February 1, 1981, in accordance with Section 2.2.3.

FRC CONCLUSION:

This equipment is assigned to NRC Category VI, and its qualification review can be deferred in accordance with Section 2.2.3.

4.7.14 Equipment Item No. 33A
HVAC System Located Outside Containment
Westinghouse System Z162
(Original Licensee References 2.4 and 2.6)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.21):

The Licensee has submitted specification documents as evidence of qualification for this equipment. The Guidelines require that complete and auditable records, reflecting a comprehensive qualification methodology and program, be referenced and made available for review for all Class 1E equipment. Specification documents are not acceptable as evidence of qualification.

LICENSEE RESPONSE:

This equipment is located in a mild environment. Its qualification will be considered at a later time.

FRC EVALUATION:

FRC concurs that the review of this equipment can be deferred until after February 1, 1981, in accordance with Section 2.2.3.

FRC CONCLUSION:

This equipment is assigned to NRC Category VI because of qualification deferment in accordance with Section 2.2.3.

4.7.15 Equipment Item No. 33B
HVAC System Located Outside Containment
Sturtevant System 8015
(Original Licensee References 2.4 and 2.6)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.22):

The Licensee has submitted specification documents as evidence of qualification for this equipment. The Guidelines require that complete and auditable records, reflecting a comprehensive qualification methodology and program, be referenced and made available for review for all Class 1E

equipment. Specification documents are not acceptable as evidence of qualification.

LICENSEE RESPONSE:

This item is not an electrical piece of equipment. It has thus been deleted from Table 3 and from consideration in this report.

FRC EVALUATION:

Pending receipt of more detailed information, review of this equipment is deferred until February 1, 1981.

FRC CONCLUSION:

This equipment is assigned to NRC Category VI. Review of this equipment is deferred until after February 1, 1981 in accordance with Section 2.2.3.

4.7.16 Equipment Item No. 39
Motors Located in the Auxiliary Building
U.S. Electrical Motors Model VEU, 100 hp Frame 84-445U, Class B Insulation
Drive Charging Pumps
(Licensee reference not cited)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.23):

Documentation reflecting qualification has not been made available for review for this equipment. The Guidelines require that complete and auditable records, reflecting a comprehensive qualification methodology and program, be referenced and made available for review for all Class 1E equipment. The Guidelines also require that thermal aging of the materials used in their equipment be evaluated.

LICENSEE RESPONSE:

This equipment is located in a mild environment. Its qualification will be considered at a later time.

FRC EVALUATION:

FRC concurs that the review of this equipment can be deferred until after February 1, 1981, in accordance with Section 2.2.3.

FRC CONCLUSION:

This equipment is assigned to NRC Category VI because of qualification deferment in accordance with Section 2.2.3.

4.7.17 Equipment Item No. 40
Solenoid Valves Located in Basement of Control Building
Johnson Controls Model D251
(Licensee reference not cited)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.3.24):

Documentation reflecting qualification for the environmental conditions that may exist in the mechanical equipment room has not been made available for review for this equipment, as required by the Guidelines. The Guidelines also require that a determination be made of the extent to which the materials used in the equipment are degraded as a result of aging mechanisms and that the qualified life be explicitly determined.

LICENSEE RESPONSE:

This equipment is located in a mild environment. Its qualification will be considered at a later time.

FRC EVALUATION:

The environmental qualification review of this equipment can be deferred until after February 1, 1981, in accordance with Section 2.2.3.

FRC CONCLUSION:

This equipment is assigned to NRC Category VI because of qualification deferment in accordance with Section 2.2.3.

4.7.18 Equipment Item No. 37
Hydrogen Recombiner Igniter Exciter Units Located Within Containment
Westinghouse Electric Corp., GLA Part No. 43737, Rev. A
(Original Licensee References 2.18, 2.19, and 2.49)

ORIGINAL TEXT TAKEN FROM DRAFT INTERIM TECHNICAL EVALUATION REPORT (3.3.2.14):

Licensee Reference 2.49 (WCAP-9001) describes the hydrogen recombination system. Reference 2.19 is a nonproprietary version of 2.18 and contains less information. FRC has reviewed Licensee Reference 2.18 and notes the following:

a. The Guidelines require that successful tests using test specimens not preaged may be considered acceptable provided the component does not contain materials known to be susceptible to significant degradation due to thermal and radiation aging. If the component contains such materials, a qualified life for the component should be established and a program instituted to monitor performance and analyze failures to determine whether they are random or aging-induced. No analysis of the susceptibility of the materials used to aging degradation has been provided, nor has a period of qualified life been established or documentation of an ongoing failure monitoring/analysis program been submitted.

b. The information presented with regard to the test environment used in the steam exposure indicates that there was little or no margin for temperature at the beginning of the test. The reported average temperature for of the simulation is less than the temperature of the required profile. FRC concludes that this deviation is not significant. Other aspects of the test, including its duration, exceeded the expected temperature/pressure profile.

c. The Guidelines require that equipment exposed to chemical sprays must be qualified for the most severe chemical environment by either test or analysis. Chemical spray exposure was not stated to have been included in the test program. Documentation providing evidence that the performance of this equipment is satisfactory under chemical spray conditions should be submitted.

d. Qualification for nuclear radiation is adequately demonstrated.

LICENSEE RESPONSE:

TER C5257 requested that the effects of containment spray and thermal aging be addressed. This information has not yet been received. If proper documentation is not found concerning these environmental parameters, RG&E will commit to replace the necessary equipment. It is important to note that the present licensing basis for Ginna does not include the hydrogen recombiner as a means necessary for post-LOCA

hydrogen control (see the RG&E "Technical Supplement Accompanying Application for a Full Term Operating License," August 1972, Section III.B.7).

FRC EVALUATION:

The Licensee has submitted a drawing from Westinghouse of the recombiner igniter that indicates it is constructed of materials that should not degrade as a result of exposure to the chemical/steam environment of the containment. Qualified life of the igniter does need to be addressed by the Licensee.

Review of Westinghouse Report WCAP-9001 [2.49] indicates that other components of the recombiner need to be qualified in order to allow long-term operation of the recombiner package. At a minimum, the components requiring qualification are:

1. the exhaust thermocouples, which feed back to the burner control system
2. the blower damper control solenoid
3. the blower pressure switches
4. splices
5. terminal blocks.

These components are located inside containment and will be exposed to the long-term accident environment.

As noted by the Licensee, the hydrogen recombiner components are TMI action plan items.

FRC CONCLUSION:

The overall hydrogen recombiner unit is assigned to NRC Category VI because it is a TMI action plan item, as discussed in Section 2.2.5. Documentation has been submitted for the igniter exciter showing that it will not be degraded because of the service environment at the installed location. Other components, however, will require qualification documentation to ensure that the overall recombiner will be operable for the long-term postulated accident environment.

4.8 SUMMARY OF THE EVALUATION

The following tabulations represent a summary of the results of the equipment environmental qualification evaluation conducted by FRC 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 consists of Equipment Environmental Qualification Summary Forms for each equipment item, identifying compliance with the resultant qualification requirements defined in Section 3. The following designations are used:

X = A deficiency with respect to compliance with a Guidelines requirement. Deficiencies result in equipment items categorized as unqualified or qualification not established.

L = A limiting factor with respect to qualification in that qualified life and aging have not been properly considered.

O = Assignment to an NRC qualification category.

R = Replacement of the equipment by the Licensee is planned.

Table 4-1

NUMBER OF EQUIPMENT ITEMS IN EACH QUALIFICATION CATEGORY

NRC Category No.	Category Definition	Number of Equipment Items
I.a	Equipment Fully Satisfies All Applicable Requirements for the Life of the Plant	1
I.b	Equipment Does Not Meet All Applicable Requirements for Life of the Plant; However, Deviations are Judged Acceptable for the Life of the Plant	0
II.a	Equipment Satisfies All Applicable Requirements With the Exception of Qualified Life	4
II.b	Equipment Satisfies All Applicable Requirements With the Exception of Qualified Life Provided That Specific Modifications are Made	0
II.c	Equipment Does Not Meet All Applicable Requirements; However, Deviations Are Judged Acceptable With the Exception of Qualified Life	5
III	Equipment is Exempt from Qualification Requirements	5
IV.a	Equipment has Qualification Testing Scheduled	0
IV.b	Equipment has High Likelihood of Operability; However, Proper Qualification Documentation Has Not Been Made Available for Review	15
V	Equipment is Unqualified	14
VI	Equipment Qualification is Deferred	25
		69

Table 4-2

Franklin Research Center, A Division of The Franklin Institute	FRC TASK 02.178F	REACTOR TYPE PWR	PLANT NAME R.E. Ginna Station	PAGE 1
EQUIPMENT ENVIRONMENTAL QUALIFICATION	PROJECT 02G-C5257-01		UTILITY Rochester Gas and Electric Company	
SEP PLANTS	DOCKET 50-244	NRC TAC 12381	DATE/ENGINEER	

SUMMARY REVIEW	EQUIPMENT ITEM NUMBER																					
	1A	1B	1C	2	3A	3B	4	5A	5B	6A	6B	7	8A	8B	8C	8D	8E	8F	8G	8H		
GUIDELINE REQUIREMENTS,	(DESIGNATIONS: X — DEFICIENCY, L — LIMITING CONDITION)																					
EVIDENCE OF QUALIFICATION	X	X	X		X	X	X			X	X			L	L	L	L			L		
RELATIONSHIP TO TEST SPECIMEN	X	X	X		X	X	X								L							
AGING DEGRADATION EVALUATED	X	X	X		X	X	X			X	X			L	L	L	L			L		
QUALIFIED LIFE ESTABLISHED	X	X	X		X	X	X			X	X			L	L	L	L			L		
PROGRAM TO IDENTIFY AGING	X	X	X		X	X	X															
QUAL. FOR STEAM EXPOSURE	X	X	X		X	X	X			X	X											
PEAK TEMPERATURE ADEQUATE	X	X	X		X	X	X			X	X											
PEAK PRESSURE ADEQUATE	X	X			X	X	X			X	X											
TEST DURATION ADEQUATE	X	X	X		X	X	X			X	X											
REQUIRED PROFILE ENVELOPED	X	X	X		X	X	X			X	X											
QUAL. FOR SUBMERGENCE																						
QUAL. FOR CHEMICAL SPRAY										X	X											
QUAL. FOR RADIATION										X	X											
BETA RADIATION CONSIDERED										X	X											
TEST SEQUENCE																						
TEST DURATION (1 HOUR - FUNCTION)																						
QUANTITY OF EQUIPMENT																						
EQUIPMENT INSPECTED AT SITE																						
QUALIFICATION CATEGORY,	(O — CATEGORY DESIGNATION)																					
I-A. QUAL. FOR PLANT LIFE																						
I-B. QUAL. BY JUDGEMENT																						
II-A. QUAL. FOR < PLANT LIFE																	O					
II-B. QUAL. PENDING MODIFICATION																						
II-C. QUAL. < PLANT LIFE/FRC REVIEW															O	O	O					O
III. EXEMPT FROM QUAL.								O				O	O						O	O		
IV-A. QUAL. TEST SCHEDULE																						
IV-B. QUAL. NOT ESTABLISHED	O	O			O	O	O															
V. EQUIP. NOT QUALIFIED										O	O											
VI. QUAL. IS DEFERRED			O	O					O													
REPLACEMENT SCHEDULE	R	R					R			R	R											
	SV	SV	SV Δ	SV	SV Δ	SV Δ	SV Δ	SV	SV	SV	SV	O	MVA	MVA	MVA Δ	MVA	CAE	MVE	MVE	MVE		

Table 4-2 (Cont.)

Franklin Research Center, A Division of The Franklin Institute	FRC TASK 02.178F	REACTOR TYPE PWR	PLANT NAME R.E. Ginna Station	PAGE 2
	PROJECT 02G-C5257-01		UTILITY Rochester Gas and Electric Company	
EQUIPMENT ENVIRONMENTAL QUALIFICATION	DOCKET	NRC TAC	DATE/ENGINEER	
SEP PLANTS	50-244	12381		

SUMMARY REVIEW	EQUIPMENT ITEM NUMBER																				
	8I	9	10A	10B	10C	11	12A	12B	13A	13B	14	15A	15B	15C	16A	16B	17A	17B	17C		
GUIDELINE REQUIREMENTS,	(DESIGNATIONS: X — DEFICIENCY, L — LIMITING CONDITION)																				
EVIDENCE OF QUALIFICATION	X	X	X	X	X	X	X												X		
RELATIONSHIP TO TEST SPECIMEN		X	X	X																	
AGING DEGRADATION EVALUATED	X	X	X	X		X				X				L							
QUALIFIED LIFE ESTABLISHED	X	X	X	X		X			X	X	X	X	X	L	X		X	X	X		
PROGRAM TO IDENTIFY AGING		X	X	X		X			X								X	X	X		
QUAL. FOR STEAM EXPOSURE									X												
PEAK TEMPERATURE ADEQUATE																					
PEAK PRESSURE ADEQUATE																					
TEST DURATION ADEQUATE																					
REQUIRED PROFILE ENVELOPED																					
QUAL. FOR SUBMERGENCE											X										
QUAL. FOR CHEMICAL SPRAY											X										
QUAL. FOR RADIATION					X		X			X	X	X	X		X		X	X	X		
BETA RADIATION CONSIDERED																					
TEST SEQUENCE																					
TEST DURATION (1 HOUR — FUNCTION)																					
QUANTITY OF EQUIPMENT																					
EQUIPMENT INSPECTED AT SITE																					
QUALIFICATION CATEGORY,	(O — CATEGORY DESIGNATION)																				
IA. QUAL. FOR PLANT LIFE									O												
I-B. QUAL. BY JUDGEMENT																					
II-A. QUAL. FOR < PLANT LIFE																					
II-B. QUAL. PENDING MODIFICATION																					
II-C. QUAL. < PLANT LIFE/FRC REVIEW														O							
III. EXEMPT FROM QUAL.																					
IV-A. QUAL. TEST SCHEDULE																					
IV-B. QUAL. NOT ESTABLISHED												O	O		O		O	O	O		
V. EQUIP. NOT QUALIFIED						O				O	O										
VI. QUAL. IS DEFERRED	O	O	O	O	O		O	O													
REPLACEMENT SCHEDULE	MVA	M	M	M	M	M	M	M	P	P	TB	C	C	C	C	C	C	C	C		

Table 4-2 (Cont.)

Franklin Research Center, A Division of The Franklin Institute	FRC TASK 02.1787	REACTOR TYPE PWR	PLANT NAME R.E. Ginna Station	PAGE 3
EQUIPMENT ENVIRONMENTAL QUALIFICATION	PROJECT 02G-C5257-01		UTILITY Rochester Gas and Electric Company	
SEP PLANTS	DOCKET 50-244	NRC TAC 12381	DATE/ENGINEER	

SUMMARY REVIEW	EQUIPMENT ITEM NUMBER																			
	18	19	20	21A	21B	22	23	24	25	26	27	28	29A	29B	29C	30	31	32	33	34
GUIDELINE REQUIREMENTS, (DESIGNATIONS: X — DEFICIENCY, L — LIMITING CONDITION)																				
EVIDENCE OF QUALIFICATION		X	X	X	X					X	X		X	X	X	X	X	X		
RELATIONSHIP TO TEST SPECIMEN																X				
AGING DEGRADATION EVALUATED	L	L		L		X	L	X	L		X		X	X	X	X	X	X		
QUALIFIED LIFE ESTABLISHED	L	L		L		X	L	X	L		X		X	X	X	X	X	X		
PROGRAM TO IDENTIFY AGING	L	L		L		X	L	X	L		X		X	X	X	X	X	X		
QUAL. FOR STEAM EXPOSURE											X					X	X			
PEAK TEMPERATURE ADEQUATE											X		X	X	X	X	X			
PEAK PRESSURE ADEQUATE											X		X	X	X					
TEST DURATION ADEQUATE											X									
REQUIRED PROFILE ENVELOPED											X									
QUAL. FOR SUBMERGENCE						X		X				X								
QUAL. FOR CHEMICAL SPRAY						X		X								X				
QUAL. FOR RADIATION						X		X			X					X				
BETA RADIATION CONSIDERED																				
TEST SEQUENCE						X		X			X									
TEST DURATION (1 HOUR — FUNCTION)																				
QUANTITY OF EQUIPMENT																				
EQUIPMENT INSPECTED AT SITE																				
QUALIFICATION CATEGORY, (O — CATEGORY DESIGNATION)																				
IA. QUAL. FOR PLANT LIFE																				
I-B. QUAL. BY JUDGEMENT																				
II-A. QUAL. FOR < PLANT LIFE	O						O		O											
II-B. QUAL. PENDING MODIFICATION																				
II-C. QUAL. < PLANT LIFE/FRC REVIEW																				
III. EXEMPT FROM QUAL.																				
IV-A. QUAL. TEST SCHEDULE																				
IV-B. QUAL. NOT ESTABLISHED		O		O												O				
V. EQUIP. NOT QUALIFIED			O		O	O		O		O	O						O			
VI. QUAL. IS DEFERRED												O	O	O	O			O	O	
REPLACEMENT SCHEDULE	R	R	R		R	R	R	R		R	R									
	LT	LT	PT	PT	PT	T	PT	LT	LT	LT	RTD	B	D	G	M	M	MCC	P		

Table 4-2 (Cont.)

Franklin Research Center A Division of The Franklin Institute	FRC TASK 02.178F	REACTOR TYPE PWR	PLANT NAME R.E. Ginna Station	PAGE 4
EQUIPMENT ENVIRONMENTAL QUALIFICATION	PROJECT 02G-C5257-01		UTILITY Rochester Gas and Electric Company	
SEP PLANTS	DOCKET 50-244	NRC TAC 12381	DATE/ENGINEER	

SUMMARY REVIEW	EQUIPMENT ITEM NUMBER																					
	33	34	35	36	37	38	39	40	41	42	43	44										
GUIDELINE REQUIREMENTS.	(DESIGNATIONS: X — DEFICIENCY, L — LIMITING CONDITION)																					
EVIDENCE OF QUALIFICATION			X		X	X	X		X	X	X	X										
RELATIONSHIP TO TEST SPECIMEN			X			X				X	X											
AGING DEGRADATION EVALUATED			X		X	X	X		X	X	X	X										
QUALIFIED LIFE ESTABLISHED			X		X	X	X		X	X	X	X										
PROGRAM TO IDENTIFY AGING			X		X	X	X		X	X	X	X										
QUAL. FOR STEAM EXPOSURE			X		X				X													
PEAK TEMPERATURE ADEQUATE			X		X				X													
PEAK PRESSURE ADEQUATE			X		X																	
TEST DURATION ADEQUATE			X																			
REQUIRED PROFILE ENVELOPED			X																			
QUAL. FOR SUBMERGENCE																						
QUAL. FOR CHEMICAL SPRAY			X		X																	
QUAL. FOR RADIATION		X	X		X					X	X											
BETA RADIATION CONSIDERED		X	X																			
TEST SEQUENCE			X																			
TEST DURATION (1 HOUR = FUNCTION)																						
QUANTITY OF EQUIPMENT																						
EQUIPMENT INSPECTED AT SITE																						
QUALIFICATION CATEGORY.	(O — CATEGORY DESIGNATION)																					
IA. QUAL. FOR PLANT LIFE																						
I-B. QUAL. BY JUDGEMENT																						
II-A. QUAL. FOR < PLANT LIFE																						
II-B. QUAL. PENDING MODIFICATION																						
II-C. QUAL. < PLANT LIFE/FRC REVIEW																						
III. EXEMPT FROM QUAL.																						
IV-A. QUAL. TEST SCHEDULE																						
IV-B. QUAL. NOT ESTABLISHED		O																				
V. EQUIP. NOT QUALIFIED			O						O													
VI. QUAL. IS DEFERRED	O			O	O	O	O	O		O	O	O										
REPLACEMENT SCHEDULE				R																		
	S	SV	LS	A	M	M	SV	SG	M	M	A											

5. CONCLUSIONS

The tabulations presented in Section 4.8 represent a summary of the results of the equipment environmental qualification (EEQ) assessment conducted by FRC 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 deficiencies that have been identified are shown in the Equipment Environmental Qualification Summary Forms (Table 4-2). The review has shown that qualification documentation for many equipment items is inadequate or non-existent, and that additional information is essential.

The DOR Guidelines require the Licensee to have ongoing programs to review surveillance and maintenance records in order to assure that safety-related equipment that exhibits age-related degradation be identified and, if necessary, replaced. No evidence of such programs was included in the Licensee's submittal.

The Licensee has offered several system-related arguments to exempt certain equipment items from qualification review. Most of these arguments fall into two categories: (1) the backup system redundancy can adequately accomplish the function, or (2) the equipment need only survive for a few minutes in order to accomplish its intended function. The FRC conclusions regarding these arguments are given in Section 4 for each equipment item, and a more detailed analysis is presented in Appendix E.

The present assessment of the status of environmental qualification of the safety-related electrical equipment installed in R.E. Ginna Station involves only equipment located in the "harsh environment" areas and needed to ensure cold shutdown of the plant. The EEQ review of equipment items located in "mild" areas and equipment needed for TMI Action Plan compliance has been deferred by the Licensee until after February 1, 1981.

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APPENDIX A - ENVIRONMENTAL SERVICE CONDITIONS

This appendix contains a summary of the information concerning expected environmental service conditions in various locations within the plant (see Figure A-1), as provided in Reference 1.

Environment 1 - Inside Reactor Containment

Normal Operation

Temperature	60-120°F
Pressure	0 psig
Humidity	50% (nominal)
Radiation	< 1 rd/h (can be higher or lower near specific equipment items)

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 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 Ginna plant satisfies these criteria. The environmental conditions resulting from a feedline break are less severe than those from the MSLB.

The environmental parameters used for the assessment of qualification of equipment inside containment are:

Temperature and Pressure	Figure A-2*
Humidity	100% (nominal)
Spray	Solution of boric acid (2000 to 3000 ppm of boron) plus sodium hydroxide in water. Solution pH between 8 and 10.

*The calculated "worst-case" peak pressure is less than 53 psig and falls to 0 at about 8.3 hours.

Integrated Radiation Dose in Atmosphere	Figure A-3
Flooded Depth	7 feet (approx.)

Environment 2 - Auxiliary Building

Normal Operation

Temperature	50-104°F
Pressure	0 psig
Humidity	60% (nominal)
Radiation Dose Rate	< 10 mR/h (Areas near RHR piping, < 100 mR/h when RHR system is in operation)

Accident Conditions

Temperature	50-104°F (122°F near motors).
Pressure	0 psig
Humidity	60% (nominal)
Radiation*	Operating Floor (271 ft. elev.):
	Near Bus 14 and MCC 1C & 1L: 100 rd
	Other Areas: < 50 rd
	Intermediate Floor (253 ft. elev.):
	Near Bus 16 and MCC 1D & 1M: 900 rd
	Other Areas: < 500 rd
	Basement Floor (236 ft. elev.):
	Near CS, RHR, and SI Pumps and Associated Piping: 2.8 Mrd
	Other Areas: < 0.01 Mrd
Spray	N/A
Flooded Depth	N/A

*Assumed by FRC to be integrated doses, over the period 0-6 months.

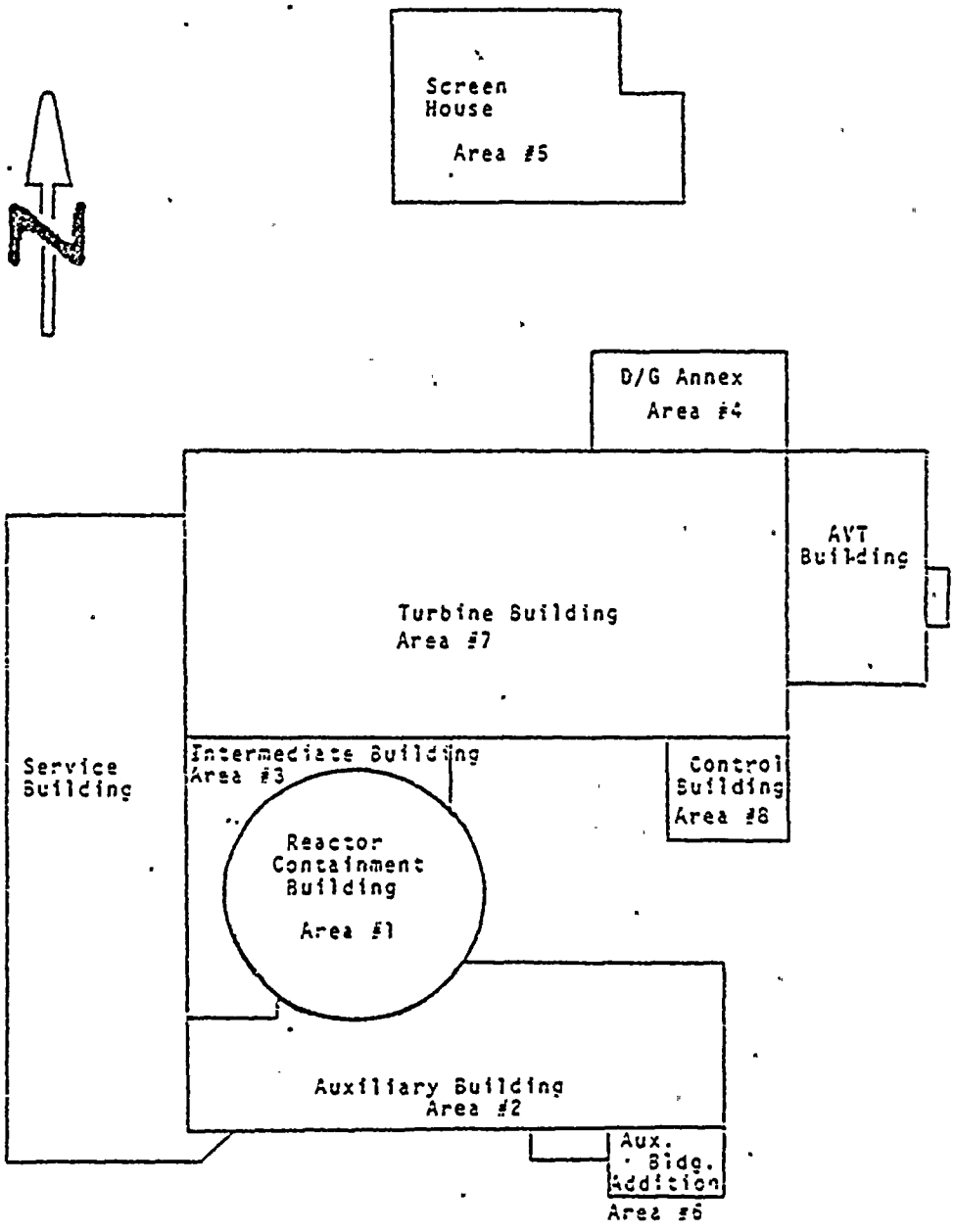

Figure A-1. Identification of Individual Buildings and Specific Areas at Ginna Plant [1]

FIGURE SUPPLIED BY THE LICENSEE

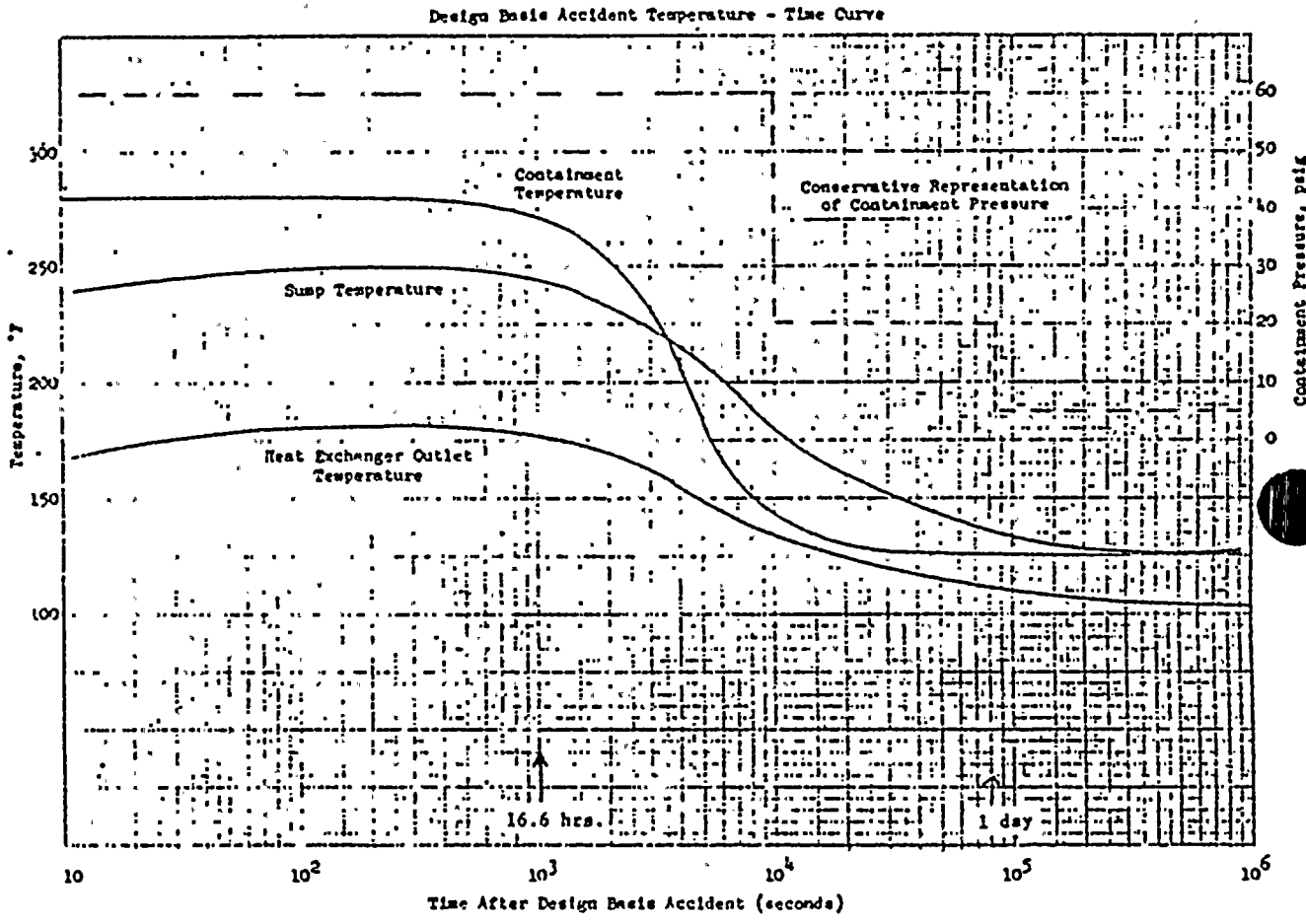

FIGURE SUPPLIED BY THE LICENSEE

Figure A-2. Design Basis Accident Temperature and Pressure as Functions of Time [1]

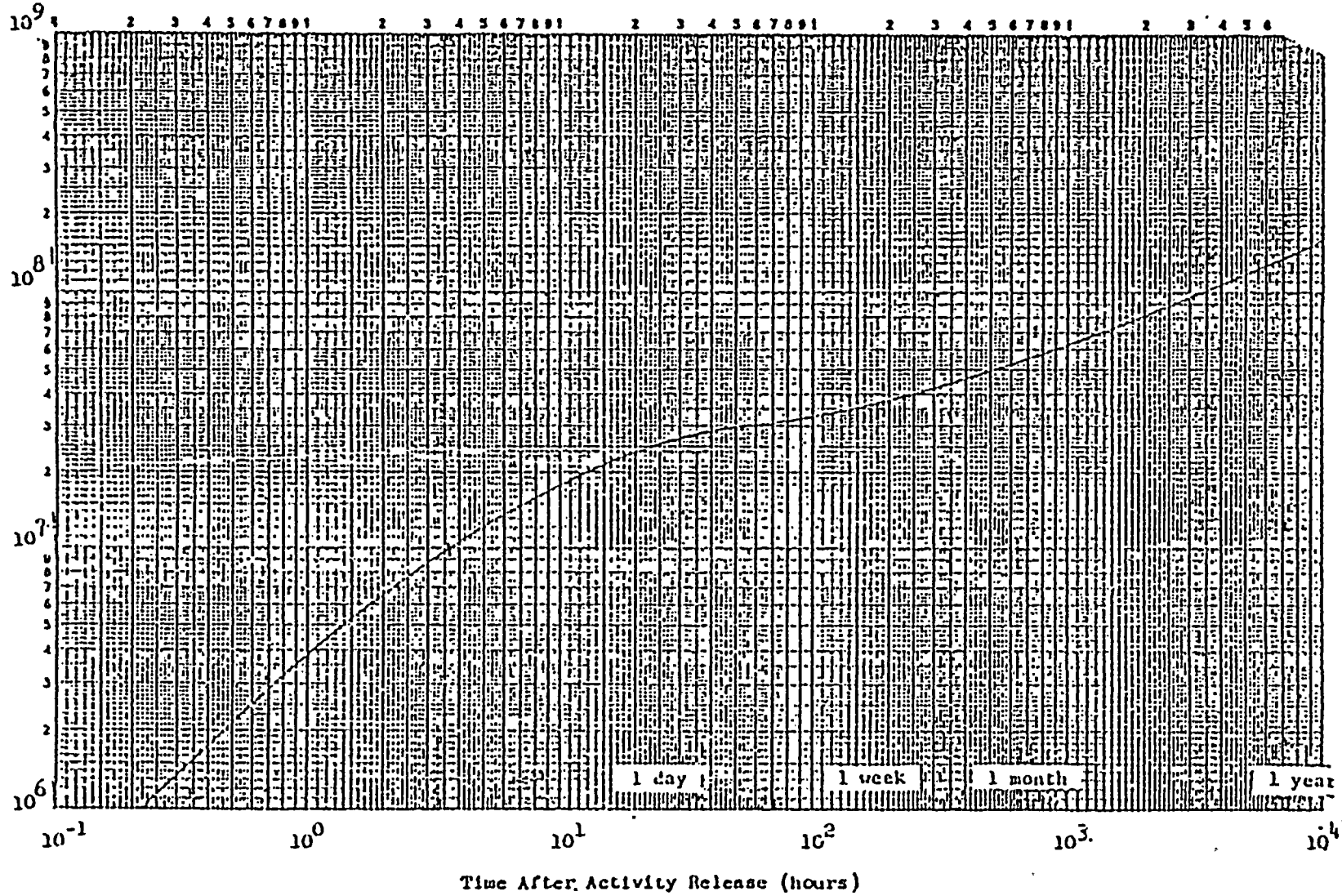

Figure A-3. Containment Atmosphere Integrated Gamma Dose [1]

FIGURE SUPPLIED BY THE LICENSEE

Environment 3 - Intermediate Building and Cable Tunnel

Normal Operation

Temperature	50-104°F
Pressure	0 psig
Humidity	60% (nominal)
Radiation Dose Rate	< 1 mR/h (higher near reactor coolant sampling lines)

Accident Conditions

Based Upon HELB or MSLB

Temperature	215°F for 30 min; then 104°F within 3 h and indefinitely thereafter
Pressure	0.8 psig for 30 min; then 0 psig within 3 h and indefinitely thereafter
Humidity	100% indefinitely
Radiation	N/A
Spray	N/A
Flooded Depth	0 ft

Based Upon LOCA Conditions

Temperature	115°F (estimated) near large motors and FW and SL piping; 104°F in open areas
Pressure	0 psig
Humidity	100%
Radiation	Negligible
Spray	N/A
Flooded Depth	0 ft

Environment 4 - Diesel Generator Rooms

Normal Operation

Temperature	60-104°F
Pressure	0 psig
Humidity	60% (nominal)
Radiation Dose Rate	Negligible

Accident Conditions

Temperature	< 104°F
Pressure	0 psig
Humidity	90% (estimated)
Radiation	Negligible
Spray	N/A
Flooded Depth	0 ft for both rooms simultaneously (Flooding of one room to approx. 1-ft depth could occur)

Environment 5 - Screen House

Normal Operation

Temperature	50-104°F
Pressure	0 psig
Humidity	60% (nominal)
Radiation Dose Rate	Negligible

Accident Conditions

Temperature	< 104°F
Pressure	0 psig
Humidity	60% (nominal)
Radiation	Negligible
Spray	N/A
Flooded Depth	1.5 ft

Environment 6 - Auxiliary Building Addition

Normal Operation

Temperature	60-120°F
Pressure	0 psig
Humidity	60% (nominal)
Radiation Dose Rate	Negligible

Accident Conditions

Temperature	60-120°F
Pressure	0 psig
Humidity	60% (nominal)
Radiation	Negligible
Spray	N/A
Flooded Depth	Approx. 2 ft

Environment 7 - Turbine Building

Normal Operation

Temperature	50-104°F
Pressure	0 psig
Humidity	60% (nominal)
Radiation Dose Rate	Negligible

Accident Conditions

Temperature	220°F for 30 min; then decreasing to 100°F within 3 h and indefinitely thereafter
Pressure	1.14 psig on Mezzanine and Basement levels; 0.7 psig on Operating Floor
Humidity	100%
Radiation	Negligible
Spray	N/A
Flooded Depth	1.5 ft in Basement

Environment 8 - Relay Rooms and Battery Rooms

Normal Operation

Temperature	50-104°F
Pressure	0 psig
Humidity	60% (nominal)
Radiation Dose Rate	Negligible

Accident Conditions

Temperature	< 104°F
Pressure	0 psig
Humidity	60% (nominal)
Radiation	Negligible
Spray	N/A
Flooded Depth	N/A

Environment 9 - Mechanical Equipment Room

Normal Operation

Temperature	50-104°F
Pressure	0 psig
Humidity	60% (nominal)
Radiation Dose Rate	Negligible

Accident Conditions (HELB)

Temperature	< 104°F
Pressure	0 psig
Humidity	60% (nominal)
Radiation	Negligible
Spray	None
Flooded Depth	Approx. 3 ft

Environment 10 - Control Room

Normal Operation

Temperature	50-104°F (usually maintained at 70-78°F)
Pressure	0 psig
Humidity	60% (nominal)
Radiation Dose Rate	Negligible

Accident Conditions

Temperature	104°F
Pressure	0 psig
Humidity	60% (nominal)
Radiation	Negligible
Spray	N/A
Flooded Depth	N/A

APPENDIX D - EVALUATION OF WESTINGHOUSE REPORT WCAP-7153*

D.1 DESCRIPTION OF WCAP-7153 METHODOLOGY AND DATA

The stated purpose of Westinghouse Report WCAP-7153 is to summarize the results of testing the thermal and radiolytic stability, corrosivity, and iodine capture efficiency of several solutions and to compare their suitability as nuclear reactor containment spray solutions for PWR plants. The issue considered here is the acceptability of the reported corrosion testing for generic application in environmental qualification assessments of safety-related equipment required to operate in the event of a LOCA or MSLB accident.

Two types of solutions are investigated in the Westinghouse study.* All contain 3000 ppm boron as boric acid and various concentrations of sodium hydroxide for alkalinity (pH) control. One group of solutions contains 0.065 molar sodium thiosulfate and the other group does not. Coupons of various metals representing materials of plant construction were weighed periodically to determine corrosion rates during exposure to aerated sprays of these solutions. Values of pH during tests were maintained at 7.0, 8.0, 9.0, or 9.3. Constant temperatures of either 200°F or 210°F were used for most tests, and a typical LOCA temperature profile was used (320°F for 2 days, 250°F for 4 days, 220°F for 2 weeks) for a small number of tests.

Examples of corrosion rates obtained are displayed in the following table.

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*Bell et al., Investigation of Chemical Additives for Reactor Containment Sprays, WCAP-7153, Westinghouse Atomic Power Division, March 1968.

CORROSION RATES IN ALKALINE BORATE SOLUTIONS

Material	Temperature (°F)	Alkalinity (pH)	Rate* (mils/month)
	With Sodium Thiosulfate		
Copper, type K pipe	200	9.3	8.3
Aluminum, 6061-T6	200	9.3	0.58
Mild steel	200	9.3	< 0.007
Galvanized steel	200	9.3	0.008
Monel	200	9.3	0.006
Mild steel	LOCA	9.3	< 0.008†
Stainless steel (unspecified)	LOCA	9.3	< 0.007†
Inconel	LOCA	9.3	< 0.008†
Zircaloy	LOCA	9.3	< 0.008†
	Without Sodium Thiosulfate		
Copper, type K pipe	200	9.3	0.020
Brass (shim stock unspecified)	200	9.3	0.014
Aluminum, 6061-T6	200	9.3	15.0
6061-T6	200	8.0	0.40
6061-T6	200	7.0	0.17
5250	210	9.0	75.0
5250	210	9.0	13.0**
5250	210	8.0	6.9**
1100	210	9.0	124.0**
1100	210	8.0	7.0**
3003	210	9.0	16.5**
3003	210	8.0	7.4**

* Rates are steady state values except as indicated and are converted to mils/month from weight loss per unit area data in WCAP-7153.
† Rates are average values obtained during LOCA testing.
**Rates are two-day average values.

D.2 DEVIATIONS FROM DOR GUIDELINES FOR EVALUATING QUALIFICATION

Section 4.1.4 of the Guidelines states that equipment should be exposed to the most severe chemical environment which could exist, specifically mentioning only the degree of alkalinity and, by inference from Section 4.1.1, temperature. The requirements of these Guidelines are not satisfied by the testing reported in WCAP-7153, in the following respects:

1. The corrosion testing reported in WCAP-7153 does not encompass the most severe chemical spray conditions obtained during either a LOCA or MSLB accident.

   a. Alkalinity -- Corrosion rates of aluminum and copper are expected to increase sharply with increased alkalinity at a pH of 9.3, the highest at which testing was accomplished. According to Appendix 6E, Section 1.3.2 [3], the pH of solution during the first hour may be about 10.

   b. Temperature -- The corrosion rates of all materials are expected to increase with increasing temperature. The highest test temperatures of aluminum and copper are 210°F and 200°F, respectively.

   c. Trace Elements -- Iodine and iodate arising from the capture of iodine by the solutions are expected to increase the corrosion rates of some steels by interfering with the formation of passivating oxide films.*

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*WCAP-7153 hypothesizes 50% release of iodine from a 1520 MWt core, or 3.8 kg of I_2, and a total core coolant inventory of 355,000 gallons. The equilibrium concentration of I_2 is therefore 1.11×10^{-5} molar. In the thiosulfate-containing medium, the I_2 reacts as follows,

$$I_2 + 2S_2O_3 = 2I^- + S_4O_6^=$$

to produce 2.22×10^{-5} molar iodide. Without thiosulfate, the I_2 reacts as follows,

$$3I_2 + 6OH^- = 5I^- + IO_3^- + 3H_2O$$

to produce 1.86×10^{-5} molar iodide and 3.7×10^{-6} molar iodate. It is likely that peak concentrations higher than these would be obtained before complete mixing of the spray additive with the core coolant.

Trace metals and anions which will result from corrosion and concrete leaching, and especially dissolved copper and halides, are expected to increase the corrosion rates of materials, especially pitting corrosion of aluminum and certain steels and stress cracking of certain stainless steels. These materials would be fed back onto all plant components by circulation of solution through a common sump.

No trace elements were added to the solutions during corrosion testing.

2. No testing of galvanic corrosion resulting from contact of dissimilar metals, such as might exist in actual components, is reported in WCAP-7153.

3. No testing of non-metallic materials, such as cable insulation or jacketing, or elastomer seals, is reported in WCAP-7153. It is possible, for example, that polyvinyl chloride cable jackets are degraded by alkaline hydrolysis in a 320°F, pH 10 environment which could be obtained in the initial stages of a LOCA. The Licensee does not indicate whether or not non-metallic materials are present in any of the equipment for which this report is cited as evidence for qualification.

D.3 CONCLUSION ON THE ACCEPTABILITY OF WCAP-7153

It is concluded that WCAP-7153 is not acceptable as the sole reference for the environmental qualification of safety-related equipment in containment that is exposed to spray solution in a PWR. No actual component or equipment testing is reported, no non-metallic component materials of fabrication are considered, and the temperatures of testing are not sufficiently severe. No analysis is presented by the Licensee to indicate that the solution composition, including trace elements, is, or would be, equivalent in severity to the solutions tested.. In addition, no analysis which considers the materials of construction is presented by the Licensee to indicate that the results of this report can be used to predict the expected performance of equipment.

APPENDIX E - EVALUATIONS OF LICENSEE EXPLANATIONS OF ADEQUACY OF EQUIPMENT BASED ON SYSTEM OPERATIONAL CONSIDERATIONS

In the October 31, 1980 submittal from Rochester Gas & Electric for the Ginna Station [1], the Licensee presented various system operational reasons provided a basis for the Licensee's position that certain equipment items should be exempt from the requirement for equipment environmental qualification programs. The Licensee's reasoning included: (a) backup system or equipment redundancy can adequately perform the required safety function, (b) the required time during which the equipment must provide a safety function following a design basis accident is very brief, and (c) the equipment is not required to provide accident-mitigating functions when exposed to harsh environments associated with specific design basis accidents.

The Licensee explanations were evaluated, and the results are presented in this appendix. The conclusions have also been included in the applicable sections of this Technical Evaluation Report.

E.1 AUXILIARY FEEDWATER SYSTEM/STANDBY AUXILIARY FEEDWATER SYSTEM

LICENSEE POSITION:

Equipment Item No. 8D
Valve Operators for MOVs 4027, 4028, 4007, 4008, 4000A, 4000B

As noted in TER C5257, these valves would not be used in the event of a HELB in the Intermediate Building. RG&E Emergency Procedures specifically call for actuating the Standby Auxiliary Feedwater System in the event the AFW system is inoperable. Since none of the Standby AFW system components will be exposed to a HELB, it is concluded that this system will be sufficient to provide the needed safety function. No "harsh" environmental qualification for the AFW valves is needed.

LICENSEE POSITION:

Equipment Item No. 11
Auxiliary Feedwater Pump Motors

As noted in TER C5257, these pumps are not required to function in the event of a HELB in the Intermediate Building. The Standby AFW system performs the required safety function. Procedures call for removing the AFW pumps from the safety-related bus, prior to connecting the standby system. Mechanical interlocks ensure that both sets of pumps cannot be powered from the diesels concurrently. No "harsh" environmental qualification for the auxiliary feedwater pumps is required.

FRC EVALUATION:

The AFW system at Ginna consists of a main AFW system and a standby AFW system. The main AFW system consists of three pumps (two motor-driven, each 200 gpm, and one turbine-driven, 400 gpm). Normally, each motor-driven pump supplies one steam generator but, with operator action, either motor-driven pump can provide feedwater to both steam generators. The turbine-driven pump normally provides feedwater to both steam generators. Flow from one motor-driven pump to one steam generator is sufficient to cool the plant to the temperature at which the RHR system can be used to bring the plant to a cold shutdown condition. A steam generator will boil dry in approximately 30 minutes without any feedwater flow and a reactor trip.

All three of the main AFW pumps are located in the same room and could be rendered inoperable as a result of a HELB. The standby AFW system was added

to provide independent AFW capability following such an event. The standby AFW system is in a separate plant area from the main AFW system. The standby AFW system consists of two motor-driven pumps. Each motor pump has a capacity of 200 gpm and supplies one steam generator. The pumps are in the same room but are separated by a partial wall. The standby AFW system functions independently of the main AFW system. The main AFW pumps are interlocked with the standby AFW system so that both are not simultaneously loaded onto their respective vital AC buses to prevent overloading the vital buses on loss of offsite power.

In recommendation 2.1.7 of NUREG-0578, TMI-2 Lessons Learned Task Force Status Report and Short-Term Recommendations, the task force recommended automatic initiation of all AFW systems. In NUREG-0611, Generic Evaluation of Feedwater Transients and Small Break Loss-of-Coolant Accidents in Westinghouse-Designed Operating Plants, the NRC staff further recommended that RG&E upgrade the AFW system automatic initiation signals and circuits to meet safety-grade requirements. RG&E responded to the recommendations of NUREG-0611 stating that the AFW pumps at Ginna were automatically initiated and that these circuits met safety-grade requirements. However, the pumps which are automatically initiated are the main AFW pumps which are capable of being rendered inoperable by a single HELB. In addition, the following characteristics of the AFW systems are germane to this problem:

- The primary source of water for the main AFW system is from two 30,000-gallon non-seismic Category I condensate storage tanks. The backup sources are the condenser hotwell and a non-seismic Category I 100,000-gallon condensate storage tank which can be connected. The pump, which transfers water from the hotwell or the 100,000-gallon tank to the 30,000-gallon tanks, is powered from a non-safety grade supply.

- Connection to the backup source requires operator action, which is estimated to take approximately 15 minutes.

- The main AFW system also has a secondary seismic Category I water source; namely, the service water system (SWS) which draws water from Lake Ontario. It is estimated to take approximately 5 minutes to connect to this source.

- The switchgear to disconnect potentially faulted AFW pump motors from their respective vital buses are located in the auxiliary building (away from the harsh environment) and have sufficient physical separation to preclude a common-mode failure of the independent power trains. The Licensee has verified that the fuse-and-breaker scheme for this equipment will prevent electrical faults from being reflected onto the vital buses.

- The primary source of water to the standby AFW system is the SWS.

The NRC staff is currently reviewing Licensee responses to NUREG-0611 as part of the AFW system reliability improvements stemming from the experiences at TMI-2. The results of this review may affect certain design features and/or environmental qualification requirements of the AFW system at Ginna. For the purposes of this report, the FRC conclusions presented below are based upon the current status of the system.

FRC CONCLUSION:

In view of the above discussion, FRC considers that the capability to manually initiate the standby AFW system does not provide sufficient justification for the position that environmental qualification of the main AFW pump motors and motor-operated valves is not necessary. Nonqualification could be justified if the standby AFW system met current standards for AFW system reliability (e.g., standby AFW pumps automatically initiated with a reliable source of feedwater; main AFW pumps placed in the backup role). At the same time, it should be noted that, in view of the developing requirements with regard to AFW system performance, FRC does not find technical deficiencies with the Licensee's position in that reasonable backup AFW capability has been provided at Ginna while these issues are being reviewed.

E.2 MEDIUM VOLTAGE SWITCHGEAR LOCATED OUTSIDE CONTAINMENT

LICENSEE POSITION:

Equipment Item No. 41
Reactor Coolant Pump Breakers Located in the Turbine Building

These breakers are exposed to a relatively mild (1 psig, 220°F) environment, must function within a short time (generally seconds), and fail-safe on a loss of power.

FRC EVALUATION:

Ginna Emergency Procedures require the operator to manually trip the reactor coolant pump (RCP) breakers in case of a main steam line or main feed line break when a low pressurizer pressure of 1715 psig is reached. At the time that the RCPs are tripped, the operator also initiates safety injection (SI) flow if SI had not been previously automatically initiated. Removal of reactor decay heat at this point (whether to maintain stable conditions or to cool down the plant) is through a combination of dumping steam from the operable steam generator (with natural circulation primary flow) and safety injection/charging makeup flow. Sufficient systems and equipment are available to achieve this purpose.

If the line break is such that the pressurizer pressure does not drop to 1715 psig or if it decreases slowly, continued RCP operation is desirable. Decay heat removal would be accomplished by normal forced-flow to the operable steam generator in lieu of natural circulation, and RCS volume and pressure control may be possible without initiating SI. The ability to retain normal RCS flow during the accident can be of great value to the operator in mitigating the consequences of an accident of this type by avoiding the complexities of plant control with SI and natural circulation.

FRC CONCLUSION:

FRC does not have technical objections to the Licensee's position that these breakers generally function in a short period of time and fail-safe on loss of power; however, in view of the above discussion, FRC finds that the RCP breakers should be environmentally qualified to remain functional during a MSLB or MFLB in the turbine building.

E.3 PRESSURIZER PRESSURE AND LEVEL TRANSMITTERS

LICENSEE POSITION:

Equipment Item No. 22
Pressurizer Pressure Transmitters

Equipment Item No. 24
Pressurizer Level Transmitters

Ginna Emergency Procedures specify that, unless pressurizer pressure, level, and other parameters appear stable and are returning to prescribed levels, safety injection flow is not to be terminated. Failure to terminate safety injection is not a safety concern. Therefore, lack of qualification for this instrumentation is not considered of immediate safety significance. It is recognized, however, that accurate primary system information would be extremely useful to the operator for diagnosing the status of the plant during accident conditions. RG&E, therefore, plans to replace the present instrumentation by June 1982 with fully qualified transmitters, located above any possible submergence level.

FRC EVALUATION:

FRC concurs with RG&E's plan for qualification of these instruments for the long term. FRC does not find technical discrepancies in the Licensee position stated above. At the same time, however, there is a concern that faulty indication due to failed instruments could lead the operator to take unwarranted action, such as terminating safety injection flow.

FRC CONCLUSION:

Until these instruments are replaced with qualified instruments, the Licensee should ensure that the emergency procedures are extremely conservative with regard to the utilization of unqualified instruments as the basis for operational decisions. For example, the procedures may require that two out of three level instruments agree as to both measured level and rate of level increase, along with three out of four pressure instruments in agreement (or some other conservative scheme of parameter agreement) before the operator is authorized to terminate safety injection flow.

E.4 STEAM GENERATOR LEVEL TRANSMITTERS

LICENSEE POSITION:

Equipment Item No. 26
Steam Generator Level Transmitters Located Inside Containment

The steam generator level transmitters, although useful for confirming secondary system heat removal capability, are not necessary for performing this function. For an accident inside containment, which would degrade the performance of the SG level transmitters, the main steam pressure transmitters, located outside containment, provide information regarding steam generator status. Auxiliary feedwater flow instrumentation for each steam generator, also located outside containment, provides the primary indication of the steam generator heat removal capability. Based on the latest information provided at the Westinghouse Emergency Operating Instructions seminar, the Ginna Emergency Procedures will be revised to reflect AFW flow indications as being of prime value as the main indication of secondary heat removal capability.

Nevertheless, in order to remove the possibility of operator confusion due to misleading instrument indications, the steam generator level transmitters will be replaced by June 1982. Qualification documentation will be made available when received.

FRC EVALUATION:

FRC concurs with RG&E's plan for qualification of these instruments for the long term. FRC does not find technical discrepancies in the Licensee position stated above, even though FRC believes that steam generator operation would be very difficult without operational level instruments. At the same time, however, precautions should be taken to ensure that the possibility of faulty indication causing the operator to take undesirable action, such as stopping auxiliary feedwater (AFW) flow, is minimized.

FRC CONCLUSION:

Until these instruments are replaced with qualified instruments, the Licensee should ensure that emergency procedures are extremely conservative with regard to use of unqualified instruments as the basis for operational decisions, such as securing AFW (e.g., procedure might require two of three level instruments in agreement and responding normally to changes in feed rate).

E.5 STEAM LINE FLOW TRANSMITTERS

LICENSEE POSITION:

Equipment Item No. 20
Steam Line Flow Transmitters Located Within Containment

RG&E has stated that these transmitters are not required to perform a safety function at a time they could be exposed to a HELB environment. Thus, the lack of complete qualification documentation is a moot point for these transmitters. For a steam line break inside containment, the steam line nonreturn check valves will assure that the intact steam generator will not blow down. Steam line isolation would be provided by the high-containment pressure signal.

For added assurance of steam line isolation in the event of a steam break inside containment, these transmitters will be replaced by June 1982 with fully qualified equipment. Qualification documentation will be made available when received.

FRC EVALUATION:

In the event of a MSLB inside containment, the main steam isolation valves (MSIVs) are automatically shut when a steam flow transmitter senses excessive steam flow. Shutting of the MSIVs in this case serves to backup the nonreturn check valve in the broken line which prevents a blowdown of the intact steam generator through the break. Should a single active failure of this check valve occur with the steam flow transmitters inoperable due to lack of qualification, blowdown of two steam generators would result for a short period of time until the MSIVs shut on high containment pressure (assuming no operator action). Reactor/turbine trip and safety injection actuation occur independently as a result of steam line low pressure signals, high flux and/or low pressurizer pressure or level signals.

FRC CONCLUSION:

FRC does not have major technical objections to the Licensee's position that the nonreturn check valves will normally isolate intact steam generators, but, in view of the above discussion, concurs with the Licensee's plan to replace this equipment.

E.6 MOTOR-OPERATED SAFETY INJECTION DISCHARGE VALVES

Valves MOV-878A and 878C, Hot Leg Injection Path Isolation Valves Located Inside Containment

LICENSEE POSITION:

The motorized valve actuators (MVAs) for valves MOV-878B and 878D, the injection path isolation valves to the cold leg injection points from the discharge of the safety injection pumps, have been included on the Licensee's list of valves considered for environmental qualification. The similar MVAs for the valves in the two hot leg injection paths (MOV-878A and 878C), however, have not been included. There is no indication from the Licensee as to whether or not these valves have been intentionally excluded from the list.

FRC EVALUATION:

According to Section 6.2.2 of the FSAR for Ginna, the safety injection pumps deliver water through four connections, one in each hot and cold leg of the reactor coolant system. The three high head pumps deliver into two separate headers, and each header in turn divides into two injection lines. Therefore, the ability is provided to isolate the pumps on separate headers and thereby ensure the delivery of the full flow from at least one pump for the special case of a broken injection line.

The motor-operated valves which isolate these four injection paths from the discharge headers of the pumps are MOV-878A, B, C, and D. The FSAR indicates that all four valves are opened upon receipt of a safety injection "S" signal. The Licensee has addressed qualification regarding the two valves in the cold leg injection lines (MOV-878B and 878D) but has not addressed the valves in the hot leg injection lines (MOV-878A and 878C).

These valves are located within containment and will be subject to a post-LOCA environment. The operability of these valves is essential to providing cooling water to the core in a LOCA, particularly if the pipe break is in one of the two cold legs. In this case, a large percentage of the cold leg injection may bypass the core by spilling through the break, while the hot leg injection will provide a majority of core cooling.

FRC CONCLUSION:

FRC considers that these valves should be addressed by the Licensee with regard to environmental qualification.

APPENDIX F - CORRELATION OF EQUIPMENT ITEM NUMBERS WITH REPORT SECTIONS OF DRAFT INTERIM AND TECHNICAL EVALUATION REPORTS

EQUIPMENT ITEM NO.	DRAFT INTERIM TECHNICAL EVALUATION REPORT SECTION	FINAL TECHNICAL EVALUATION REPORT SECTION
1A	3.3.3.2	4.5.2.6
1B	3.3.3.2	4.5.2.6
1C	3.3.3.2	4.7.1
2	3.3.3.3	4.7.5
3A	3.3.3.4	4.5.2.10
3B	3.3.3.4	4.5.2.10
4	3.3.3.5	4.5.2.11
5A	3.3.3.2	4.4.3
5B	3.3.3.2	4.7.4
6A	3.3.3.6	4.6.9
6B	3.3.3.6	4.6.9
7	3.3.3.7	4.4.4
8A	3.3.1.1	4.4.1
8B	3.3.3.1	4.3.3.4
8C	3.3.1.3	4.3.3.5
8D	3.3.1.4	4.3.3.1
8E	3.3.2.1	4.3.1.4
8F	3.3.1.2	4.4.2
8G	3.3.1.2	4.4.2
8H	3.3.2.2	4.3.3.2
8I	3.3.2.3	4.7.2
9	3.3.3.8	4.7.6
10A	3.3.3.9	4.7.7
10B	3.3.3.9	4.7.7
10C	3.3.3.9	4.7.7
11	3.3.1.5	4.6.2
12A	3.3.3.9	4.7.7
12B	3.3.3.10	4.7.8
13A	3.3.2.4	4.2.1.1
13B	3.3.2.5	4.6.3
14	3.3.2.6	4.6.4
15A	3.3.2.7	4.5.2.3
15B	3.3.2.7	4.5.2.3
15C	3.3.2.7	4.3.3.3
16A	3.3.3.11	4.5.2.7
17A	3.3.3.12	4.5.2.8
17B	3.3.3.12	4.5.2.8
17C	New item	4.5.2.9
18	3.2.5	4.3.1.3

CORRELATION OF EQUIPMENT ITEM NUMBERS WITH REPORT SECTIONS OF DRAFT INTERIM AND TECHNICAL EVALUATION REPORTS (Cont.)

EQUIPMENT ITEM NO.	DRAFT INTERIM TECHNICAL EVALUATION REPORT SECTION	FINAL TECHNICAL EVALUATION REPORT SECTION
19	3.2.6	4.5.2.2
20	3.3.2.12	4.6.7
21A	3.2.3	4.5.2.1
21B	3.3.2.13	4.6.8
22	3.3.2.8	4.6.5
23	3.2.1	4.3.1.1
24	3.3.2.9	4.6.6
25	3.2.4	4.3.1.2
26	3.3.3.15	4.6.11
27	3.3.3.13	4.6.10
28	3.3.3.14	4.7.9
29A	3.3.3.16	4.7.10
29B	3.3.3.16	4.7.10
29C	3.3.3.16	4.7.10
30	3.3.2.10	4.5.2.4
31	3.2.2	4.6.1
32	3.3.3.20	4.7.13
33A	3.3.3.21	4.7.14
33B	3.3.3.22	4.7.15
34	3.3.2.11	4.5.2.5
35	3.3.3.17	4.6.12
36	3.3.3.18	4.7.11
37	3.3.2.14	4.7.18
38	3.3.2.15	4.7.3
39	3.3.3.23	4.7.16
40	3.3.3.24	4.7.17
41	3.2.2	4.6.1
42	3.3.3.19	4.7.12
43	3.3.3.19	4.7.12
44	3.3.3.20	4.7.13

APPENDIX G - PROPERTIES OF CAST PHENOLIC RESINS

PHYSICAL PROPERTIES

	Specific Gravity	Specific Heat	Thermal Conductivity (c.g.s. units) x 10^{-4}	Thermal Expansion Coefft. (per °C) x 10^{-5}	Water Absorption* (mg)
Cast Resin	1.28-1.32	0.4-0.5	3-5	3-9	2-20
Moulding Material					
Wood-flour-filled	1.3-1.4	0.35-0.36	4-12	3-6	70-150
Chopped-cotton-fabric-filled	1.3-1.4	0.30-0.35	3-5	2-6	200-400
Mineral-filled	1.6-2.4	0.25-0.35	9-20	2-4	20-100
Laminated Material					
Paper-filled	1.3-1.4	0.3-0.4	5-8	2-3	15-300
Fabric-filled	1.3-1.4	0.3-0.4	5-8	2-3	200-300
Asbestos-filled	1.5-2.0	0.25-0.35	8-20	2-3	100-200

MECHANICAL PROPERTIES

	Ultimate Tensile Strength (lbf/in^2) x 10^3	Bending Strength (lbf/in^2) x 10^3	Ultimate Shear Strength (lbf/in^2) x 10^3	Ultimate Compression Strength (lbf/in^2) x 10^3	Modulus of Elasticity (in tension) (lbf/in^2) x 10^3	Modulus of Rigidity (in torsion) (lbf/in^2) x 10^3	Impact Strength*
Cast Resin	3-10	7-15	6-8	10-30	300-1,000		0.1-0.5
Moulding Material							
Wood-flour-filled	5-8	8-15	8-10	15-40	1,000-1,500	300-500	0.1-0.5
Chopped-cotton-fabric-filled	5-8	8-15	10-15	20-35	700-1,200	300-500	0.3-3.0
Mineral-filled	4-8	8-15	4-15	20-35	1,000-2,500		0.1-1.0
Laminated Material							
Paper-filled	8-25	15-30	5-12	20-40	1,000-3,000		0.2-2.0
Fabric-filled	8-20	15-30	5-12	30-45	500-1,500		1-5
Asbestos-filled	7-12	10-15	4-8	30-50	500-2,000		0.2-1.0

*Method of B.S. 771 for cast resin and moulding materials; B.S. 972 for laminated materials.

Reference: Ogorkiewicz, R.M. and P.D. Ritche, Phenolic Resins, LONDON ILIFFE Books Ltd., 1967.

APPENDIX H - EFFECTS OF NUCLEAR RADIATION DOSE RATE ON CABLE PERFORMANCE DURING A LOCA

More than 50 separate test reports on electrical cables were reviewed during the equipment environmental qualification evaluation. The major insulation materials used in the cable test samples were:

cross-linked polyethylene
chlorosulfonated polyethylene
ethylene propylene rubber
Neoprene
butyl rubber
silicone rubber.

(Proprietary flame-retardant additives and layered combinations of insulating materials and shields have also been used by various manufacturers to provide special features required by Licensees and their engineering contractors.)

Testing typically involved irradiation up to 200 Mrd at dose rates between 0.1 and 2.1 Mrd/h. Measurements of insulation resistance during the tests indicated that cable insulation resistance decreases with increasing dose rate, and that insulation resistance recovers after the exposure ceases. Typical reductions in insulation resistance are:

from 10^{11} to 10^{8} ohms at the low (0.1-0.25 Mrd/hr) dose rates
from 10^{11} to 10^{5} ohms at the higher (1-2 Mrd/hr) dose rates.

There are insufficient test data to determine the mathematical relationship between insulation resistance and dose rate. There is, however, test evidence that the dose rate effect combines with the pressure, temperature, humidity, and spray conditions to further reduce insulation resistance. For very high dose rates (i.e., greater than about 2 Mrd/h) during simulated LOCA conditions, insulation resistances in the range of 1000 to 10,000 ohms for 30 ft of cable (measured at 10 V dc) have been experienced.

During LOCA, the dose rates calculated in accordance with conservative NRC recommendations are typically 1 to 3 Mrd/h gamma and 10 Mrd/h beta during the first 10 hours of the LOCA. (These data are for a nominal 1000 MW(e) plant.) It can be seen that the dose rates for insulation subject to beta radiation exceed most test radiation dose rates by an order of magnitude.

There is concern, therefore, that exposed cables (i.e., cables not protected from beta radiation by cable tray covers or conduit) will not retain high enough insulation resistance to transmit reliable control and instrumentation signals without attenuation and distortion during the early stages (the first 10 hours) of a LOCA.

The Licensees of plants with exposed cables should carefully evaluate the possible effects of combined gamma and beta radiation dose rates, plus elevated temperature and moisture, on the ability of the cables to perform their functions. The evaluation should be based on available test data for the cables, or test data should be generated so that analysis can be performed.