

TECHNICAL EVALUATION REPORT
FINAL DRAFT
EQUIPMENT ENVIRONMENTAL QUALIFICATION

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR POWER STATION UNIT 3

NRC DOCKET NO. 50-296

NRC TAC NO. 42483

FRC PROJECT 05417

EG&G IDAHO, INC. SUBCONTRACT NO. K-7615

FRC TASK 6

Prepared by

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Prepared for

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January 31, 1981

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Because of schedule limitations, this report draft has not gone through the complete review cycle of FRC. While the overall conclusion is expected to remain the same, the reader is cautioned that some details of the report may change as the review is completed.

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1. INTRODUCTION

1.1 PURPOSE OF THE REVIEW

The NRC Office of Inspection and Enforcement (IE) issued Bulletin 79-01B, "Environmental Qualification of Class 1E Equipment" in January 1980. This Bulletin required the Licensee to perform a detailed evaluation of the environmental qualification of Class 1E electrical equipment required to function under postulated accident conditions and to submit a report on this action.

The objectives of the NRC Equipment Environmental Qualification Review program are to evaluate nuclear power plant safety-related electrical equipment in accordance with criteria established by the NRC and to identify (1) equipment whose qualification documentation is adequate, i.e., substantiates that equipment is capable of performing its specified design basis safety function when it is exposed to a harsh environment and (2) equipment whose qualification documentation is deficient, i.e., does not give reasonable assurance that the equipment is capable of performing its specified safety function.

To meet the overall program goals, the objective of this Technical Evaluation Report is to review the Licensee's submittals to determine if the Licensee reviewed its safety-related electrical equipment for environmental qualification in accordance with the DOR Guidelines and NUREG-0588 as required by IE Bulletin 79-01B. The NRC will perform an audit of the qualification documentation references as part of its safety evaluation program. If discrepancies are found, the audit will be extended.

1.2 GENERIC ISSUE BACKGROUND

Safety-related electrical equipment must be capable of performing design safety functions under all normal, abnormal, and accident conditions. Of particular concern is the assurance that equipment will remain operable during

and following exposure to the harsh environmental conditions (i.e., temperature, pressure, humidity (steam), chemical sprays, radiation, and submergence) imposed as a result of a design basis accident. These harsh environments are generally defined by the limiting conditions resulting from the complete spectrum of postulated break sizes, break locations, and single failures consequent to a loss-of-coolant accident (LOCA), main steam line break (MSLB) inside the reactor containment, or a high energy line break (HELB) outside reactor containment (such as a main steam or feedwater line break). The purpose of equipment qualification is to provide tangible evidence that equipment will operate on demand and to verify design performance, thereby establishing assurance that the potential for common-mode failure is minimized.

Qualification criteria applied during the licensing of the older nuclear plants have been modified over the years, and 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, 382-72, and 381-77. 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, Criteria 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 addition, qualification requirements are also embodied in 10CFR50 Appendix A, General Design Criteria 1, 2, and 23 and Appendix B, Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants, Criteria III and XI. These requirements are applicable to safety-related equipment located inside as well as outside of containment.

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

In 1977, the NRC staff instituted the Systematic Evaluation Program (SEP) to determine the degree to which the older operating nuclear 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 status 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 certain deficiencies within the scope of equipment addressed, definition of harsh environments, and adequacy of support documentation. It became apparent that generic criteria were needed 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 1E Electrical Equipment in Operating Reactors." (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. Originally it was intended that the Licensees would 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 under SEP Topic III-12. FRC was given the assignment to review equipment environmental qualification documentation

and to present the results in the form of a Technical Evaluation Report for each plant included in this program.

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 stated that the criteria to be used in evaluating the adequacy of the safety-related electrical equipment qualification are the DOR Guidelines. 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 [64]* which included a second document, "Guidelines for Identification of That Safety Equipment of SEP Operating Reactors for Which Environmental Qualification Is To Be Addressed," [64] together with the request that the Licensees review their plant systems and provide additional equipment environmental qualification information to the NRC on an accelerated schedule.

For non-SEP plants, the NRC Office of Inspection and Enforcement formed a task force including a principal reviewer in each region and a task leader from headquarters. The regional members are responsible for the technical

*For Reference, see Section 6.

review of the Licensees' responses to IE Bulletin 79-01B, and the task leader is responsible for the overall coordination of the review effort with NRC to assure overall consistency. The regional reviewers held meetings with the Licensees in their respective regions which resulted in staff positions being issued in a supplement to IE Bulletin 79-01B dated February 29, 1980.

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

On May 27, 1980, the NRC issued Memorandum and Order CLI-80-21, [67] 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.

In October 1980, EG&G awarded Franklin Research Center (FRC) a contract to provide assistance in the equipment environmental qualification review for 13 of the plants whose Licensees responded to IE Bulletin 79-01B. FRC was given the assignment to evaluate the Licensee's equipment environmental qualification submittal and to present the results in the form of a Technical Evaluation Report for each plant.

1.3 SPECIFIC ISSUE BACKGROUND

The staff held regional meetings with the Licensees and interested parties during the week of July 13, 1980 in various locations. The staff issued a second supplement to IE Bulletin 79-01B, a response to significant questions raised during the public meetings, and two Orders. The Order dated May 30, 1980 required the Licensees to comply with the previously issued Commission Memorandum and Order of May 27, 1980 (CLI-80-21). The above Orders

required the Licensees to complete the tasks identified in IE Bulletin 79-01B no later than November 1, 1980 to allow the staff to comply with the February 1, 1981 date imposed by the Commission Order. The responses to the questions were issued on February 29, 1980; and the second and third supplements to IE Bulletin 79-01B, highlighting the staff positions affecting the Licensees' responses, were issued September 29 and October 24, 1980, respectively.

1.4 SCOPE OF THE REVIEW

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 whose environment is adversely affected by that event. In addition, IE Bulletin 79-01B requires environmental qualification for all safety-related electrical equipment exposed to a harsh environment in accordance with the DOR Guidelines or NUREG-0588. Harsh environments include the limiting conditions resulting from (i) the entire spectrum of postulated line breaks resulting from a loss-of-coolant accident (LOCA) or a high energy line break (HELB) inside and outside of containment and (ii) radiation from fluids which are recirculated from inside containment to accomplish long-term cooling subsequent to an accident. 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 program were:

- "Guidelines for Evaluating Environmental Qualification of Class 1E Electrical Equipment in Operating Reactors" [64]
- "Guidelines for Identification of That Safety Equipment of SEP Operating Reactors for Which Environmental Qualification Is To Be Addressed" [64]
- NUREG-0588, "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment." [69]

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

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 to IE Bulletin 79-01B, [65] "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, with peak temperature and subsequent temperature/pressure profile as a function of time. If containment spray is to be used, the impact of the spray on required equipment should be accounted for.

The adequacy of a plant-specific profile is dependent on the assumptions and design considerations at the time the profiles were developed. The DOR Guidelines and NUREG-0588 provide guidance and considerations required to determine if the calculated plant-specific temperature/pressure profiles encompass the 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 [65] 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 [65] 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 equivalent to the period from the initiation of the accident until the service conditions return to normal. Supplement 2 to IE Bulletin 79-01B [65] 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 [66] 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:

- Qualification information for installed TMI Action Plan equipment must be submitted by February 1, 1981.

- Qualification information for future TMI Action Plan equipment (reference NUREG-0737, when issued), which requires NRC pre-implementation review, must be submitted with the pre-implementation review data.
- Qualification information for TMI Action Plan equipment currently under NRC review should be submitted as soon as possible.
- Qualification information for TMI Action Plan equipment not yet installed that does not require pre-implementation review should be submitted to NRC for review by the implementation date.
- Qualification information for equipment required to achieve and maintain a cold shutdown condition should not be submitted later than February 1, 1981.

2.2.6 TEST SEQUENCE (DOR GUIDELINES SECTION 5.2.3)

Supplement 2 to IE Bulletin 79-01B [65] provides the following additional criteria:

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

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

2.2.7 RADIATION (DOR GUIDELINES SECTIONS 4.1.2, 4.2.2, and 4.3.2, SUBITEM 2)

Supplement 2 to IE Bulletin 79-01B [65] 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 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 (RCS = reactor coolant system):

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

Gamma equivalents may be used when consideration of the contributions of beta exposure has been included in accordance with the guidance given in the DCR 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."

3. METHODOLOGY USED BY FRC

IE Bulletin 79-01B required the Licensee to:

- provide a master list which identifies the systems and electrical equipment required to function during and subsequent to an accident and to maintain the plant in a safe condition
- provide the environmental service conditions
- identify the submergence levels
- provide written evidence of the qualification of the equipment identified
- evaluate the qualification documentation using the DOR Guidelines and NUREG-0588
- submit a Licensee Event Report (LER) for electrical equipment determined not to be environmentally qualified.

The requirements of IE Bulletin 79-01B were requested under provisions of 10CFR50.54(f), "Conditions of Licenses," which requires the Licensee to submit written statements, signed under oath or affirmation, to enable the Commission to determine whether or not a License should be modified, suspended, or revoked.

To provide assurance that the Licensee implemented the requirements of IE Bulletin 79-01B and to provide a basis for the NRC Safety Evaluation Report (SER), FRC developed this Technical Evaluation Report (TER) by:

- assessing the Licensee's responses in relation to the general requirements of the DOR Guidelines as augmented by the supplements to the 79-01B Bulletin
- using NUREG-0588 to resolve open issues.

The results and conclusions contained in this report are valid assuming that the Licensee's analyses of test reports referenced in the Licensee submittal are correct. Review of test reports was not within the scope of FRC's assignment. However, the NRC staff will audit selected analyses and

test reports, incorporating the results of the reviews with the conclusions of the TERS, when developing the plant-specific SERs.

The Licensee, Tennessee Valley Authority, identified an extensive list of safety-related electrical equipment items in various locations of the Browns Ferry Nuclear Power Station Unit 3 in its submittals to the NRC. FRC analyzed the Licensee's listing and grouped together all identical equipment items located within plant areas that are exposed to the same environmental service conditions. This analysis resulted in a reduced listing containing 135 different equipment items that formed the basis for the review. Appendix A contains the environmental service conditions for each location, Appendix B contains a 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)
- analysis and/or justification of qualification
- Licensee-proposed remedies for qualification deficiencies.

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
- acceptability of Licensee-stated position concerning safety system or component function
- review and acceptability of qualification test reports and other qualification documentation.

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

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. Based on the FRC conclusion, each equipment item was assigned to one of the generic qualification categories provided by the NRC. NRC categories are described below.

All equipment item numbers discussed in Section 4 of this report are associated with Reference 68.

The NRC Office of Inspection and Enforcement conducted an on-site verification inspection of selected IE equipment to verify proper installation of equipment, overall interface integrity, location with respect to flood level for equipment inside the containment, and manufacturer's nameplate data. The manufacturer and model number from the nameplate data were compared to information given in the System Component Evaluation Work Sheets (SCEWS) of the Licensee's report. The details of this site inspection are documented in the IE Inspection Report Number 50-296/80-36 and will be addressed by the NRC.

NRC QUALIFICATION 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 that the equipment has been found to be qualified for the life of the plant.

- NRC Category I.b
EQUIPMENT FOR WHICH DEVIATIONS FROM THE DOR GUIDELINES ARE JUDGED ACCEPTABLE

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.

- NRC Category II.a
EQUIPMENT THAT FULLY SATISFIES ALL APPLICABLE REQUIREMENTS OF THE DOR GUIDELINES AND HAS A SERVICE LIFE LESS THAN PLANT LIFE

This category includes equipment items that are fully acceptable on the basis that all applicable criteria defined in the DOR Guidelines are satisfied and that the equipment is qualified for a specific time interval which is less than plant life.

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

This category includes equipment items which will be fully acceptable and will satisfy all applicable criteria defined in the DOR Guidelines provided that specific modifications are made on or before the designated date. When the modifications are complete, the equipment can be considered qualified.

- NRC Category II.c
EQUIPMENT FOR WHICH DEVIATIONS FROM THE DOR GUIDELINES ARE JUDGED ACCEPTABLE

This category includes equipment items which do not satisfy one or more of the applicable criteria defined in the DOR Guidelines; however, either sufficient bases have been presented to allow a determination that the specific deviations are judged to be acceptable for less than plant life or the specific deviations are judged by FRC to be acceptable for less than plant life based on review of the applicable qualification documentation associated with the general equipment environmental qualification program.

- NRC Category III
EQUIPMENT THAT IS EXEMPT FROM QUALIFICATION

This category includes equipment items which are exempt from qualification on the basis that (i) the equipment does not provide a safety function (i.e., should not have been included in the equipment list submitted by the Licensee), (ii) the specific safety-related function of the component can be accomplished by some other designated component which is fully qualified, or (iii) the equipment is not subject to a potentially adverse environment as a result of accidents for which proper operation of the equipment is required. In addition, any failure of the exempt component must not degrade the ability of a qualified component 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. Specific justification for interim plant operation prior to testing should be provided for each 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. Specific justification for interim plant operation should be provided for each item.

- 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: (i) documentation reflecting qualification as specified in the DOR Guidelines has not been made available for review, (ii) qualification documentation made available for review is inadequate, or (iii) the documentation indicates that the equipment item has not passed the 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

4.1 METHODOLOGY USED BY THE LICENSEE

The Licensee has submitted for Browns Ferry Units 1, 2, and 3 a rather voluminous equipment environmental qualification report (20 large volumes in total) dated October 31, 1980, in response to the January 14, 1980 NRC IE Bulletin 79-01B and Memorandum and Order CLI-80-21 dated May 23, 1980. All previous responses to IE Bulletin 79-01B (April 30 and July 18, 1980) are said to be superseded by this latest submittal. The final submittal [68] contained a general introductory section which described the Licensee's basic approach to qualification and evaluation methodology. A review by FRC has generated the following observations and comments.

4.1.1 COMPLETENESS OF EQUIPMENT LIST

The Licensee discussed the approach used in selecting the equipment for which qualification must be demonstrated. For example, the Licensee stated:

- As directed, TVA has evaluated the environmental qualification of the safety-related electrical components which experience the harsh environment due to Loss of Coolant Accidents (LOCA's) and High Energy Line Break (HELB) accidents. Only that equipment either required to function for accident mitigation (Category a, as defined in NUREG-0588, Appendix E) or required not to fail (Category b, as defined in NUREG-0588, Appendix E) during accident mitigation, including those required for cold shutdown, are contained in this report.
- The Evaluation Work Sheets (EWS) in Appendix C [68] and their supporting appendices provide documentation of qualification as defined by the DOR Guidelines.
- Browns Ferry Nuclear Emergency Operating Instructions were also used to identify safety functions, safety systems, and components.
- If a safety-related component's location in the plant was found to be outside the harsh areas, the item was deleted from the equipment list (although it still is required to be qualified for its nonaccident service environments). Before an item could be deleted, all associated items, especially cabling, were identified and their

locations reviewed against the harsh areas. This assured that input and output associated with the original item was fully reviewed for qualification.

FRC notes that IE Bulletin 79-01B Supplement 2 requires that qualification documentation for all operating reactors (as of May 23, 1980) be evaluated using the DOR Guidelines. When sufficient detail is not provided by the DOR Guidelines, NUREG-0588 Category II can be used. In addition, criteria to be used for evaluation of replacement components for these plants will be derived using NUREG-0588 Category I. NUREG-0588 Category I criteria will be applied for documentation associated with reactor facilities whose construction permit safety evaluation reports were issued after July 1, 1974. For facilities whose construction permits were issued prior to July 1, 1974, NUREG-0588 Category II will be applied. (NUREG-0588 Categories I and II refer to applicable criteria referenced to IEEE Standards 323-1974 and 1971, respectively.

FRC notes that the DOR Guidelines require the Licensee to review its emergency operating procedures to determine the electrical components needed or relied upon to perform safety functions or provide safety-related display information to the operator. FRC concludes that the Licensee methodology for identification of safety-related equipment is consistent with NRC requirements.

4.1.2 DEFINITION OF EQUIPMENT OPERATING TIME REQUIREMENTS

The Licensee has defined the equipment operating time as follows:

Operating time was defined as the time period during which a component must be available to perform its function. It was not considered to be the time actually required to perform an action (i.e., actual time required for a valve to close).

An operating time category was defined as specified time period starting at the accident initiation during which a component must be available to perform its function. This specified time period was given sufficient scope to incorporate all reasonable operating times required for the components in the category.

The following operating time categories were used:

- W - One hour following accident initiation
- X - One day following accident initiation

Y - Thirty days following accident initiation

Z - One year following accident initiation

W-Z Items marked as "W-Z" are components that fit into operating category A for the first hour following accident initiation and then fit into operating category B for the duration of the event and recovery (taken to be one year for this report). Isolation valves fall into this situation. They are required to close and then to remain closed.

X-Z Items marked as "X-Z" are components that fit into operating category A for the first 24 hours and then fit into operating category B for the year following the accident.

Y-Z Items marked as "Y-Z" are components that fit into operating category A for the first 30 days and then fit into operating category B for the remainder of the year following the accident.

Operating time categories were assigned based upon the review of components' functions. For components that perform multiple functions, each function was considered and the worst-case time requirement used for the components. General functions were defined as having the following operating times categories:

W & W-Z - Primary and secondary containment isolation (including SCTS initiation) following a LOCA or HELB inside primary containment; isolation for a HELB outside primary containment (i.e., the specific line that breaks); scram initiation (RPS), and open scram following a LOCA or HELB inside primary containment or a HELB in the main steam line valve vault.

X & X-Z - Primary and secondary containment isolation for HELBs outside primary containment (except for the line broken); scram initiation (RPS) and scram for HELBs outside primary containment (except for a main steam line break in the valve vault).

Y & Y-Z - High pressure ECCS

Z - All other functions.

FRC EVALUATION:

FRC concludes that the Licensee's approach to operating time is acceptable.

4.1.3 QUALIFIED LIFE

The Licensee has not adequately addressed the topic of qualified life for any of the safety-related equipment identified by the Licensee as essential for safe shutdown of the plant. The DOR Guidelines required that equipment with components susceptible to degradation caused by thermal or radiation environmental conditions are to have an established qualified life.

The Licensee should maintain detailed maintenance records to demonstrate that those components which can be degraded are replaced on a scheduled basis in order to restore the equipment and minimize the likelihood of equipment failure to perform a safety-related function.

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 for an applicable accident and to remain functional as long as required after the accident. The qualified life may depend on carrying out a specified maintenance program. The qualified life of some elements of an equipment assembly may be less than the qualified life of the assembly provided a program for replacement of such elements at intervals not exceeding their qualified lifetimes is specified and fulfilled. The qualified life of a particular equipment item may be changed during its installed life where justified by new information that permits a reanalysis of the qualification program.

It is necessary to establish a qualified life for every type of safety-related equipment that requires environmental qualification. A conservative choice of qualified life must be made to account for the assumptions and approximations made in the qualification program.

The Licensee stated:

At the time of procurement of the equipment, documented evidence of aging effects was not a requirement; however, TVA intends to meet the DOR Guidelines in Section 7.0. If the equipment contains material subject to aging degradation (the guidelines require that this determination be made), an analysis was done to determine the maintenance or change out interval. When there was insufficient documentation to determine the thermal or radiation aging effects on a piece of equipment, a program of either further analysis of materials

(when a detailed list of materials is obtained), or type testing was instituted. If neither of these options were available, a replacement or relocation plan was established. In general, the procurement specification required equipment whose intended service, determined either by repairs or replacements, was for the design life of the plant for 40 years; therefore, in our engineering judgment the device will be able to perform its safety function in the interim time period required for completely documenting qualification.

FRC notes that the salient points of the Licensee's methodology are:

- If equipment contains materials subject to aging degradation, an analysis was conducted to determine the maintenance or change out interval.
- When insufficient documentation existed to allow determination of aging effects, an analysis program or type testing was instituted.
- An equipment replacement or relocation program was established in lieu of analysis or type where appropriate.
- Procurement specifications required 40 years design life; therefore the equipment will be able to perform safety functions in this interim period while complete documentation is being completed.

FRC concludes (i) that the procurement specifications requiring a 40-year design life provide absolutely no assurance that the degradation effects due to aging-related stresses on equipment have been reduced, accounted for, or eliminated and (ii) that the Licensee's basis approach to aging is acceptable; however, FRC has found no substantive evidence of the use of the stated methodology and the subsequent Licensee conclusions and action relative to the actual evaluation of the individual equipment items in the EWS data.

4.1.4 LICENSEE EVENT REPORTS (LER)

The Licensee has stated:

Item 6 of the bulletin required "Licenses Event Reports" (LER) be issued when a component is found not capable of performing its intended safety function. Section 5.2 of the report provides a Summary of Equipment Qualification Status which included the LER number issued when the above determination has been made.

FRC notes, however, that the Licensee has left the LER column blank in Section 5.2 of the report. It is not clear whether there are no LERs or the Licensee has not completed its listing.

4.1.5 LICENSEE'S GENERIC POSITIONS WITH RESPECT TO THE DOR GUIDELINES

A. MARGIN

The Licensee states:

In Section 6.0 of the DOR guidelines it is stated that margin only applies to type testing and that the guidelines in Section 4.0 for establishing service conditions include conservatisms which assure margins between the service conditions specified and the actual conditions which could realistically be expected in a design basis event. Based upon the above statements and the fact that all calculations for establishing service conditions meet or exceed the DOR Guidelines given in Section 4.0, no additional margin was considered for qualification by analysis. As stated in DOR Guidelines, Section 6.0, additional margin for the service conditions for type testing needs to be considered only if Section 4.0 and Section 5.2 of the DOR Guidelines are not met; since the guidelines of Section 4.0 are met, margin was considered only if Section 5.2 was not met.

FRC concludes that this position is acceptable.

B. ACCURACY

The Licensee states:

As stated in Enclosure 3 to IE Bulletin 79-01B, specified and demonstrated accuracies of all instruments for their trip functions and/or post-accident requirement must be provided. When the documentation did not clearly demonstrate the specified accuracy during the environmental extremes resulting from a DBE, a program of either further search for documentation that address accuracy or type testing was instituted. In our engineering judgement, the following two statements provide justification for continued operation during the interim time period required to obtain completely documented qualifications: (1) in general, the procurement specifications required and the vendor's demonstrated accuracies are much more stringent than system requirements, (2) surveillance tests are conducted periodically as required by the technical specifications to confirm the validity of the manufacturer's stated accuracy.

FRC concludes that the Licensee's position is acceptable for interim operation until full qualification can be obtained.

C. OPERATING DATA

The Licensee states:

Substantial percentages of the systems components installed in plant locations other than inside primary containment, have well established industrial rating at or above the limits required for operation during and/or after the required DBE's. In cases where operating data is used as a justification for interim qualification. This qualification will be supplemented at a later date by either type testing and/or further analysis. If neither of these options are available, a replacement plant was instituted.

FRC notes that NRC required a definitive resolution by November 1980 from the Licensee on all qualification issues.

The Licensee's position is in variance with this requirement.

D. RELATIVE HUMIDITY

The Licensee states:

The humidity ranges from 30 to 80 percent for areas outside primary containment. The values given in Section 3.0, Table 1, note E of this report are peak values and probability of occurrence is extremely low. There are redundant fans servicing areas where there is essential equipment. Most industrial grade electrical equipment can function properly in the reactor zone building ambient humidity.

FRC concludes that this generic position is (i) not clear and (ii) does not alleviate the need for humidity to be addressed by the Licensee as an environmental service condition.

E. TYPE TESTING

The Licensee states:

In Section 5.1 of the DOR Guidelines, type testing is preferred but not required for equipment subjected to severe temperature, pressure, and steam service condition. However, analysis is acceptable if supported by test data, for the other service conditions. At the time of equipment procurement, type testing was not a required method of proving qualification. To the extent that an analysis is not conclusive to verify qualification per the DOR

guidelines, a type testing program or a replacement plan was initiated. TVA will provide justification for the interim operation until adequate qualification information is available to meet the DOR Guidelines.

FRC notes that the DOR Guidelines state:

Type Testing is the preferred method of qualification for electrical equipment located inside containment required to mitigate the consequences of design basis events, i.e., Class IE equipment (see Section 3.0 above). As a minimum, the qualification for severe temperature, pressure, and steam service conditions for Class IE equipment should be based on type testing. Qualification for other service conditions such as radiation and chemical sprays may be by analysis (evaluation) supported by test data.

FRC concludes that type testing is required, and that the Licensee's generic position regarding analysis and further search for qualification documentation is not in accordance with NRC requirements.

F. RADIATION

The Licensee states:

- Beta Radiation - According to Section 4.1 of the DOR Guidelines, beta radiation has low penetrating power in comparison to gamma rays of equivalent energy. Of the general classes of electrical equipment in the plant containment (e.g., cables, instrument transmitters, valve operators, containment penetrations), electrical cable is considered the most vulnerable to damage from beta radiation. For other equipment whose enclosure provides adequate shielding, beta radiation need not be considered. For any equipment that is determined unshielded (e.g., cable) or is shielded by sheet metal of 20 gauge or less, an analysis of the qualification of the equipment related to beta radiation was included as attachments to the EWS's.
- Gamma Radiation - From Table C-1 in Appendix C in the DOR Guidelines and references 1 and 2 below, there is substantial test data available to demonstrate that most conventional material used in electrical equipment has a gamma radiation threshold exceeding 10^4 rads; the exception is solid-state devices containing N-MOS integrated circuits which have a threshold of 10^3 rads (see Table C-1). Teflon has a threshold for damage of approximately 3.5×10^4 rads (for 20 percent decreases in elongation). Electrical properties (e.g., resistivity) of these materials are sufficiently conservative initially, such that substantial changes can be tolerated without causing equipment failures or malfunction.

Threshold is defined from the above referenced table as the radiation exposure required to change at least one physical property of the material. The threshold is not a point of failure or end of useful life; therefore, there is a band of tolerance from the threshold point to the failure point which may vary by an order of magnitude or more.

On the above basis and the existing test data, it is not considered necessary to perform a qualifications test or analysis on electrical equipment for radiation of less than 10^4 rads which would degrade the safety function of the equipment.

FRC agrees with the Licensee's position.

4.1.6 REQUIRED SIGNATURES

The Licensee has stated:

- To ensure completeness and accuracy of the EWS, signatures of a preparer, reviewer, and quality assurance engineer are required on each of the EWS. Any appendixes for which the preparer or reviewer of EWS was not directly responsible will also contain preparer and reviewer signatures.
- The most significant changes to the EWS were as follows: 1) use of appendixes, 2) use of permanent notes, 3) required signatures, and 4) use of unique numbering system for the EWS and their appendixes.

FRC notes that none of the sheets appears to be signed by a quality assurance engineer.

4.1.7 CHEMICAL SPRAY

The Licensee states:

Chemical spray is not applicable for this report since no chemical injection is used. (This is a permanent note N/A on all EWS sheets.)

FRC notes that the DOR Guidelines require demineralized water sprays to be addressed. In addition, the effects of in-leakage must be considered. The Licensee has not complied with this requirement.

4.1.8 DESCRIPTION OF QUALIFICATION/REPLACEMENT PLAN

The Licensee states:

It is TVA's intention to comply fully with the requirements of Bulletin 79-01B. This section addresses the requirements stated in item 4 of the bulletin for "outstanding items." It is not possible to submit a detailed qualification/replacement plan at this time.

The following items have a great impact on our inability to supply a detailed schedule at this time:

- a. Limitations on industry's capability for testing large numbers of components.
- b. Availability of qualified replacement equipment.
- c. Unit outage schedules.

TVA has a contract with Wyle Laboratories to do any testing that is required to prove qualification of any questionable equipment. Wyle will also provide TVA a detailed schedule of all tests they plan to conduct for TVA.

When we receive schedules of testing from Wyle Lab, we will inform the NRC as stated in your letter dated October 1, 1980, from D. G. Eisenhut to licensees of operating plants. TVA will make a best faith effort to test equipment as soon as possible. However, if problems are encountered with either the testing or qualificability of the equipment, the justification for continued operation will be reviewed as well as a safety review. It is our plan to schedule first the items that have the greatest impact on safety.

The qualification status of all equipment is listed in Table 5.2. The status of all items falls into one of four categories as listed below.

Category I - Components qualified to DOR guidelines.

Category II - Components for which analysis indicating qualification but that lack documentation to prove qualification to DOR guidelines.

Category III - Items that will be qualified by either analysis or type testing or a combination of these methods.

Category IV - Equipment to be replaced.

For Category IV equipment checks were made to determine the availability of qualified equipment on the market. In general, even if qualified equipment is available the delivery has a long and indefinite lead time.

TVA will submit a detailed schedule for qualifying or replacing all open items by February 1, 1981. This schedule will be developed in conjunction with Wyle Labs.

FRC concludes that the Licensee has not complied with the NRC requirement that the Licensee must submit all qualification information to NRC by November 1, 1980. With this information, an exact schedule for equipment replacement and specific justification for interim operation must be provided for any item which does not conform to Guidelines requirements.

4.2 EQUIPMENT QUALIFIED FOR PLANT LIFE

This section includes equipment items which are fully acceptable on the basis that (i) all criteria defined in Section 2 of the report are satisfied or (ii) sufficient data exist to determine acceptability by judgment.

4.2.1 NRC Category I.a

EQUIPMENT THAT FULLY SATISFIES ALL APPLICABLE REQUIREMENTS OF THE DOR GUIDELINES

This section normally 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. For Browns Ferry Unit 3, no equipment items fall into this category.

4.2.2 NRC Category I.a

EQUIPMENT FOR WHICH DEVIATIONS FROM THE DOR GUIDELINES ARE JUDGED ACCEPTABLE

This section normally 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. For Browns Ferry Unit 3, no equipment items fall into this category.

4.3 EQUIPMENT QUALIFIED WITH RESTRICTIONS

This section includes equipment items fully acceptable on the basis that (i) all criteria defined in Section 2 of this report are satisfied; (ii) the equipment is qualified for a time interval less than plant life; or (iii) the equipment requires specific modification which, when completed, will establish full qualification.

4.3.1 NRC Category II.a

EQUIPMENT THAT FULLY SATISFIES ALL APPLICABLE REQUIREMENTS OF THE DOR GUIDELINES AND HAS A SERVICE LIFE LESS THAN PLANT LIFE

The following equipment items are fully acceptable on the basis that all applicable criteria defined in the DOR Guidelines are satisfied and that the equipment is qualified for a specific time interval which is less than plant life.

4.3.1.1 Equipment Item No. 24 Solenoid Valve Target Rock Model 73FF-005 (Licensee Reference 34)

The Licensee has shown that this equipment is qualified to function in a post-accident environment, and that the equipment is qualified for a specific time interval less than plant life.

4.3.1.2 Equipment Item No. 132 Electrical Penetration Assembly GE Model NS04 (Licensee Reference 23)

The Licensee has provided documentation that shows this equipment to be qualified to function in a post-accident environment, but for a time interval less than plant life.

4.3.2 NRC Category II.b

EQUIPMENT THAT FULLY SATISFIES ALL APPLICABLE REQUIREMENTS OF THE DOR GUIDELINES PROVIDED THAT SPECIFIC MODIFICATIONS ARE MADE

The equipment items in this category will be fully acceptable and will satisfy all applicable criteria defined in the DOR Guidelines provided that specific modifications are made on or before the designated date. When the modifications are completed, the equipment can be considered qualified. For Browns Ferry Unit 3, no equipment items fall into this category.

4.3.3 NRC Category II.c

EQUIPMENT FOR WHICH DEVIATIONS FROM THE DOR GUIDELINES ARE JUDGED ACCEPTABLE

This section includes equipment items which do not satisfy one or more of the applicable criteria defined in the DOR Guidelines; however, either sufficient bases have been presented to allow a determination that the specific deviations are judged to be acceptable for less than plant life, or the specific deviations are judged by FRC to be acceptable for less than plant life based on review of other applicable qualification documentation associated with the general equipment environmental qualification program. For Browns Ferry Unit 3, no equipment items fall into this category.

4.4 NRC Category III
EQUIPMENT THAT IS EXEMPT FROM QUALIFICATION

Equipment items in this category are exempt from qualification on the basis that (i) the equipment does not provide a safety function (i.e., should not have been included in the equipment list submitted by the Licensee), (ii) the specific safety-related function of the component can be accomplished by some other designated component which is fully qualified, or (iii) the equipment is not subject to a potentially adverse environment as a result of accidents for which proper operation of the equipment is required. In addition, any failure of the exempt component must not degrade the ability of a qualified component to perform its required safety-related function. For Browns Ferry Unit 3, no equipment items fall into this category.

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 qualification of equipment items in this category has been judged deficient or inadequate based upon FRC's 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. Specific justification for interim plant operation prior to testing should be provided for each item. For Browns Ferry Unit 3, no equipment items fall into 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 following equipment items is deficient or inconclusive based upon FRC's 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. Specific justification for interim plant operation should be provided for each item.

4.5.2.1 Equipment Item No. 1

Solenoid Valves

AAA Model S02

(Licensee reference not cited)

The Licensee has not provided qualification information for this equipment item and requests permission for continued use of the solenoid valve based on

the contention that similar solenoid-operated valves have successfully operated in the environment specified for this equipment item. The Licensee will type test this item or replace it with qualified equipment during the next refueling outage.

- 4.5.2.2 Equipment Item No. 2
Flow Indicating Switch
Fischer & Porter Model 10A2235A-55AR1011
(Licensee reference not cited)

This equipment item has not been qualified, but the manufacturer's specifications indicate that this type switch has been tested and found to operate successfully at temperatures of 250°F and atmospheric pressure. TVA states that it will type test or replace this equipment (no date specified).

- 4.5.2.3 Equipment Item No. 3
Differential Pressure Switch
Dwyer Model 3302
(Licensee reference not cited)

This equipment item has not been qualified to operate in a post-accident environment. The Licensee will replace this item with qualified equipment during the next refueling outage that follows delivery of qualified equipment.

- 4.5.2.4 Equipment Item No. 4
Solenoid Valve
ASCO Model HB830281RU
(Licensee reference not cited)

The Licensee failed to submit qualification documentation for this equipment item, but bases justification for continued operation on tests of similar valves from the same manufacturer. The Licensee will type test this item or replace it with qualified equipment during the next refueling outage.

- 4.5.2.5 Equipment Item No. 5
Pressure Differential Modifier
Honeywell Model: Relay Assembly R7165-1.078
Terminal Assembly 127700
(Licensee reference not cited)

The Licensee has failed to provide sufficient qualification information for this equipment item, but will type test the item or replace it with qualified equipment during the next refueling outage.

- 4.5.2.6 Equipment Item No. 6
Pressure Differential Indicating Controller
Fischer & Porter Model 53EL3311BB1B ESL-01
(Licensee reference not cited)

The Licensee has failed to provide sufficient qualification information for this equipment, but will type test the device or replace it with qualified equipment during the next refueling outage.

- 4.5.2.7 Equipment Item No. 7
Pressure Differential Transmitter
Fischer & Porter Model 10B2494TBAB
(Licensee Reference 62)

The Licensee has provided documentation that shows this item to be qualified for radiation dose after an accident. Other environmental conditions have not been evaluated, however, and the Licensee will either type test this equipment or replace it with a qualified device during the next refueling outage.

- 4.5.2.8 Equipment Item Nos. 8, 11, and 13
Solenoid Valve
ASCO Models HB830081RU, HV200-924-1F, and HT8262A203A
(Licensee reference not cited)

The Licensee has failed to provide sufficient qualification documentation for this item, but will either type test this item or replace it with qualified equipment during the next refueling outage.

- 4.5.2.9 Equipment Item Nos. 9 and 10
Temperature Element
Weed Model SP6011AA3C275SN42
(Licensee reference not cited)

The Licensee has failed to provide sufficient qualification documentation for these equipment items, but will type test the items or replace them with qualified equipment during the next refueling outage.

- 4.5.2.10 Equipment Item No. 12
Flow Transmitter
GE/MAC Model 50-554212BKZZ3
(Licensee reference not cited)

The Licensee has failed to provide sufficient qualification documentation, but will either type test this item or replace it with qualified equipment during the next refueling outage.

- 4.5.2.11 Equipment Item No. 14
Pressure Transmitter
Bailey Model 551
(Licensee reference not cited)

The Licensee has failed to provide sufficient qualification documentation for this equipment and will either type test this item or replace it during the next refueling outage.

- 4.5.2.12 Equipment Item No. 15
Flow Transmitter
GE/MAC Model 555
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment during the next refueling outage.

- 4.5.2.13 Equipment Item No. 16
Temperature Switch
Penwal Model 18002-27
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment during the next refueling outage.

- 4.5.2.14 Equipment Item No. 17
Solenoid Valve
ASCO Model HTX8300B61U
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment during the next refueling outage.

- 4.5.2.15 Equipment Item No. 18
Solenoid Valve
ASCO Model 8300C61U
(Licensee reference not cited)

The Licensee has failed to submit sufficient qualification documentation for this equipment and does not state the intention to replace or type test it.

- 4.5.2.16 Equipment Item No. 25
Solenoid Valve
ASCO Model HT8211C94
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment during the next refueling outage.

- 4.5.2.17 Equipment Item No. 26
Indicator Pressure Converter
Fisher Controls Model 546
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment during the next refueling outage.

- 4.5.2.18 Equipment Item No. 27
Pressure Switch
Custom Components Model 630GH
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment during the next refueling outage.

- 4.5.2.19 Equipment Item Nos. 29 and 31
Thermostat
Honeywell Models T675A1508 and T675A1540
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment during the next refueling outage, by June 1982.

- 4.5.2.20 Equipment Item No. 30
Damper Motor
Honeywell Model M445A
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment during the next refueling outage, by June 1982.

- 4.5.2.21 Equipment Item Nos. 36 and 37
Motor
GE Models 5K4254XL2 and 5K6226XJ201A
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment during the next refueling outage.

- 4.5.2.22 Equipment Item No. 48
Level Indicator Switch
Yarway Model 4418C
(Licensee Reference 46)

The Licensee has failed to provide adequate qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will retest this equipment.

- 4.5.2.23 Equipment Item No. 53
Temperature Element
Calmatic Model 158B706LP016
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment during the next refueling outage.

- 4.5.2.24 Equipment Item Nos. 58 and 59
Flow Transmitter
GE/MAC Model 50-555111LBOAA3AAA
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment during the next refueling outage.

- 4.5.2.25 Equipment Item No. 64
Limit Switch
Micro Switch Models OPD-AR and OPD-AR30
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment during the next refueling outage.

- 4.5.2.26 Equipment Item No. 66
Temperature Switch
Fenwal Model 40-104014-103
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment during the next refueling outage.

- 4.5.2.27 Equipment Item No. 67
Temperature Element
Fenwal Model 28-232106-304
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment during the next refueling outage.

- 4.5.2.28 Equipment Item No. 73
Limit Switches
NAMCO Model D1200G
(Licensee reference not cited)

The Licensee has failed to obtain qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment during the next refueling outage.

- 4.5.2.29 Equipment Item No. 76
Pressure Transmitter
GE/MAC Model Series 50 and 55
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment during the next refueling outage.

- 4.5.2.30 Equipment Item No. 77
Power Supply
GE Models 570012FAAC1 and 583001AAGK1
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment.

- 4.5.2.31 Equipment Item No. 79
Temperature Element
American Standard Model 158B7079P051
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment.

- 4.5.2.32 Equipment Item Nos. 85 and 86
Temperature Element
Scam Model S51-1
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment.

- 4.5.2.33 Equipment Item Nos. 90 and 96
Turbine Control Valve
Terry Turbines Types GS and CCS
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment.

- 4.5.2.34 Equipment Item No. 92
Pressure Switch
Mercoid Models DA-7043-804 and DA-23-804
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment.

- 4.5.2.35 Equipment Item No. 94
Square Root Converter
GE Model 565100AAAC1
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment.

- 4.5.2.36 Equipment Item No. 99
Level Switch
Robertshaw Model SL-202-A2X
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment.

- 4.5.2.37 Equipment Item No. 105
Pump Motor
GE Model 5K6348XC23A
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will perform further tests to verify qualification of this equipment.

- 4.5.2.38 Equipment Item No. 107
Pump Motor
GE Model 5K6336XC198A
(Licensee reference not cited)

The Licensee has failed to provide sufficient qualification documentation to show that this item will successfully function in a post-accident environment, and states that further evaluation is necessary to determine qualification of this equipment item.

- 4.5.2.39 Equipment Item No. 109
Hydrogen Element
GE Model 47E226428G2
(Licensee reference not cited)

The Licensee has failed to provide sufficient qualification documentation to show that this item will successfully function in a post-accident environment, and states that further evaluation is necessary to determine qualification of this equipment item.

- 4.5.2.40 Equipment Item No. 110
Level Switch
GEMS Model XM-36425
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment.

- 4.5.2.41 Equipment Item No. 111
Solenoid Valve
Versa Model VEG-3521
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment.

- 4.5.2.42 Equipment Item No. 112
Limit Switch
Micro Switch Model BZE6-2RN
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment.

- 4.5.2.43 Equipment Item No. 113
Level Switch
Autocon Model M-4
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment.

- 4.5.2.44 Equipment Item No. 114
Temperature Element
Thermo-Elect Model B7582-1
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment.

- 4.5.2.45 Equipment Item No. 115
Level Switch
Meletron Model 9241-6SS10A
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment.

- 4.5.2.46 Equipment Item No. 117
Solenoid Valve
ASCO Model HVA86-030
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment.

- 4.5.2.47 Equipment Item No. 118
Position Switch
Micro Switch Model BZE6-2RN
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment.

- 4.5.2.48 Equipment Item No. 119
CRD Scram Inlet Valve
ASCO Model HVA-90-405-2A
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment.

- 4.5.2.49 Equipment Item No. 120
Level Switch
Robertshaw Model SL-305-E3-X
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment.

4.5.2.50 Equipment Item No. 121
Ion Chamber
GE Model 237X731G001
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment.

4.5.2.51 Equipment Item No. 122
Sensor and Converter
GE Model 194X927G014,12
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment.

4.5.2.52 Equipment Item No. 123
Fission Product Monitor
GE, Model Not Stated
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment.

4.5.2.53 Equipment Item No. 124
TIP System Valve Assembly
GE Model 136B1302G2
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment.

4.5.2.54 Equipment Item No. 125
Transformer
GE Model 11CH2L4
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that the item will successfully function in a post-accident environment.

4.5.2.55 Equipment Item No. 126
Motor Control Center
International Switchboard Corp., Model Not Stated
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee states that it is pursuing the acquisition of the appropriate qualification information.

4.5.2.56 Equipment Item No. 127
Motor Control Center
GE Model 7700 Series
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee states that it is pursuing the acquisition of the appropriate qualification documentation.

4.5.2.57 Equipment Item No. 129
Solenoid Valve
Target Rock Model 1/2 SMS-A-01-1
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment. The Licensee will either type test the item or replace it with qualified equipment.

4.5.2.58 Equipment Item No. 32
Motor-Operated Valve
Limitorque Model SMB-000
(Licensee Reference 40)

The Licensee has provided documentation that shows this item to be qualified in all areas except operating time. However, the Licensee states that substantial aging tests have been conducted and that, in its judgment, this more than satisfies the requirements of the DOR Guidelines.

FRC finds this evidence to be inconclusive and necessitates further testing.

- 4.5.2.59 Equipment Item No. 68
Pump Motor
GE Model 5K326PK-234A
(Licensee reference not cited)

The Licensee states that redundant equipment is available to mitigate the accident; consequently, it suggests that this equipment item need not be qualified. No qualification information is presently available to the Licensee or FRC. The Licensee should pursue qualification of this equipment.

- 4.5.2.60 Equipment Item Nos. 42 and 43
Pressure Solenoid Operator
Automatic Valve Corp. CS497
(Licensee Reference 42)

The Licensee has provided insufficient documentation to enable evaluation of qualification for this equipment item.

- 4.5.2.61 Equipment Item No. 41
Differential Pressure Indicator Switch
Barton Model 278
(Licensee reference not cited)

The Licensee has failed to provide qualification documentation to show that this item will successfully function in a post-accident environment.

The Licensee requests approval for interim operation based on the post-accident information provided by redundant low pressure instrumentation for MSIVs.

- 4.5.2.62 Equipment Item Nos. 22 and 23
Solenoid Valve
Valcor Model 526D
(Licensee Reference 33)

The Licensee has provided documentation that shows this device to be qualified to function in a post-accident environment. However, in view of IE Bulletin 90-23, validity of the testing should be verified.

4.5.2.63 Equipment Item No. 133
Penetration Assembly
GE Series 100
(Licensee Reference 22)

The Licensee has provided documentation that shows this equipment to be qualified to function in a post-accident environment. However, in view of IE Bulletin 77-06, the qualification status should be verified.

4.6 NCR 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 following equipment items has been judged to be deficient or inadequate, based upon PRC's 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: (i) documentation reflecting qualification as specified in DOR Guidelines has not been made available for review, (ii) documentation reflecting qualification has been made available for review and is totally inadequate, or (iii) the documentation indicates that the equipment item has not successfully passed required tests. The following equipment items are therefore considered unqualified.

4.6.1 Equipment Item Nos. 19, 20, and 21
Solenoid Valve
ASCO Model HB830081F
(Licensee Reference 32)

The Licensee has provided documentation that shows this equipment to be unqualified. The Licensee will retest the item or replace it with qualified equipment.

4.6.2 Equipment Item No. 28
Component Assembly
Nuclear Measurement Corp., Model Not Stated
(Licensee References 35, 36, and 37)

The Licensee has provided documentation that shows this equipment does not fulfill Guidelines requirements for temperature, humidity, and radiation dose. The Licensee will retest these monitors to determine if they will function in the post-accident environment specified in this area of the plant.

- 4.6.3 Equipment Item Nos. 33, 34, and 35
Motor-Operated Valve
Limitorque Model SMB-000
(Licensee Reference 40)

The Licensee has provided qualification documentation that shows this item to be unqualified according to DOR Guidelines. The Licensee will either type test the item or replace it with qualified equipment during the next refueling outage.

- 4.6.4 Equipment Item No. 39
Pressure Solenoid Operator
Target Rock Model 1/2 SMS-A-01
(Licensee Reference 41)

The Licensee has provided documentation that shows this equipment does not fulfill Guidelines requirements for radiation dose, aging, and operating time. The Licensee will either retest this equipment or replace it with qualified equipment.

- 4.6.5 Equipment Item Nos. 44 and 45
Temperature Switch
Fenwal Model 17002-40
(Licensee Reference 43)

The Licensee has provided documentation that shows this equipment to be qualified in all areas except radiation and aging. The Licensee will retest this equipment or replace it with qualified items.

- 4.6.6 Equipment Item Nos. 46 and 47
Pressure Switch
Barksdale Model B2T-A12SS
(Licensee References 44 and 45)

The Licensee has failed to provide adequate qualification documentation to show that this item will successfully function in a post-accident environment.

- 4.6.7 Equipment Item Nos. 49 and 50
Pressure Switch
Barton Model 288
(Licensee References 47 and 48)

The Licensee has failed to provide adequate qualification documentation to show that this item will successfully function in a post-accident environment.

- 4.6.8 Equipment Item Nos. 51 and 52
Level Indicator Switch
Barton Model 288A
(Licensee References 47 and 48)

The documentation provided by the Licensee shows this equipment to be unqualified to successfully function in a post-accident environment.

- 4.6.9 Equipment Item Nos. 55, 56, 61, 62, 81, 82, 83, 84, and 95
Motorized Valve Actuators
Limatorque Models SMB-2, SMB-00, SMB-3, SMB-0, and SMB-1
(Licensee Reference 49)

The documentation provided by the Licensee fails to show this equipment item is qualified to meet post-accident environmental specifications. The Licensee will subject this equipment to a retest to establish possible qualification.

- 4.6.10 Equipment Item Nos. 54, 57, and 60
Motorized Valve Actuator
Limatorque Models SMB-2 and SMB-00
(Licensee Reference 49)

The Licensee has failed to provide adequate aging documentation for this equipment item, but argues for its permanent exemption from the DOR Guidelines based on Limatorque Test Reports B0003, B-0027, and 600198, which show that this equipment performed successfully at temperatures higher than post-accident temperatures, although for a shorter time.

In response to the Licensee's position, FRC finds this equipment unqualified.

- 4.6.11 Equipment Item No. 65
Solenoid Valve
ASCO Model X8300-B61F
(Licensee Reference 42)

The Licensee has provided documentation from ASCO Test Report AQ5-21678/TR that shows this equipment to be unqualified in the areas of aging and test duration.

- 4.6.12 Equipment Item No. 70
Solenoid Valve
ASCO Model WPHTX8300B45F,R
(Licensee Reference 42)

The Licensee has provided test report documentation that shows this item to be unqualified in the area of test duration. Aging effects for this valve have not been evaluated.

- 4.6.13 Equipment Item No. 75
Flow Switch
Barton Model 289
(Licensee References 53-55)

The Licensee has provided documentation that shows this equipment does not fulfill Guidelines requirements exposure for radiation, test duration, and aging. The Licensee will subject this equipment to further qualification testing or replace it with qualified equipment.

- 4.6.14 Equipment Item No. 78
Level Transmitter
Rosemount Model 1151 Series
(Licensee References 56 and 57)

The Licensee has provided documentation that shows this equipment does not fulfill Guidelines requirements for operating time and radiation exposure. Aging qualification has not been documented.

- 4.6.15 Equipment Item Nos. 88 and 89
Temperature Switch
Penwal Model 17023-6
(Licensee References 3 and 43)

The Licensee has provided documentation that shows this item does not fulfill Guidelines requirements for radiation and aging. The Licensee considers the effects of aging due to the normal environmental conditions negligible.

FRC finds this equipment to be unqualified.

- 4.6.16 Equipment Item No. 91
Pressure Switch
Barksdale Model PIH-M85SSV
(Licensee References 44 and 45)

The Licensee has provided documentation that shows this equipment does not fulfill Guidelines requirements for temperature, radiation exposure, and operating time. The Licensee will retest this equipment or replace it with qualified devices.

- 4.6.17 Equipment Item No. 93
Pressure Switch
Static-O-Ring Models 6N-AA21 and 6N-AA21-V
(Licensee Reference 58)

The Licensee has provided documentation that shows this equipment does not fulfill Guidelines requirements for temperature, radiation exposure, and operating time. The Licensee will retest this equipment and replace it if it proves to be unqualified to suitably function in a post-accident environment.

- 4.6.18 Equipment Item No. 97
Pressure Switch
Barksdale Model D2H-M150SS
(Licensee References 44 and 45)

The Licensee has provided documentation that shows this equipment does not fulfill Guidelines requirements for temperature, operating time, and aging

effects. The Licensee will retest this equipment to verify qualification or replace it with qualified equipment.

- 4.6.19 Equipment Item No. 98
Motor Operator
Limitorque Model SMB-4T
(Licensee Reference 49)

The Licensee has provided test data that shows this equipment does not fulfill Guidelines requirements for temperature and operation duration.

- 4.6.20 Equipment Item No. 100
Pressure Switch
Static-O-Ring Model FN-AA3
(Licensee Reference 58)

The Licensee has provided documentation that shows this equipment does not fulfill Guidelines requirements for radiation exposure, temperature, operating time, and aging effects. The Licensee will either retest the equipment or replace it with qualified equipment.

- 4.6.21 Equipment Item Nos. 101 and 103
Motor Operator
Limitorque Models SMB-5T and SMB-4
(Licensee Reference 49)

The Licensee has provided documentation from Limitorque Test Reports 600197, B-0027, and B-0003 that shows this equipment does not fulfill Guidelines requirements for temperature, operating time, and radiation effects. The Licensee will continue testing to verify conclusions of the previously referenced test reports.

- 4.6.22 Equipment Item No. 102
Motor Operator
Limitorque Model SMB-4
(Licensee Reference 49)

The Licensee has provided documentation that shows this equipment to be unqualified in the area of operating time. Aging criteria have not been addressed.

- 4.6.23 Equipment Item No. 104
Differential Pressure Indication Switch
Barton Model 289A
(Licensee References 48 and 53)

The Licensee has provided documentation that shows this equipment does not fulfill Guidelines requirements for temperature, radiation exposure, and operation time.

- 4.6.24 Equipment Item No. 106
Flow Switch
Barton Model 289
(Licensee References 53 and 54)

The Licensee has provided documentation that shows this equipment does not fulfill Guidelines requirements for radiation exposure, operating time, and aging effects. The Licensee will either provide further qualification documentation or replace the item with qualified equipment.

- 4.6.25 Equipment Item No. 108
Solenoid Valve
ASCO Models X8315 and C28
(Licensee Reference 42)

The Licensee has referenced ASCO qualification test report AQ5-21678/TR covering the 8300 series ASCO valves and finds them qualified in all areas except operation time and aging effects. In TVA's judgment, this equipment is of sufficient quality to function successfully in a design based post-accident environment.

FRC judges this equipment item to be unqualified until further documentation can be provided to verify qualification.

- 4.6.26 Equipment Item No. 116
Level Switch
Barksdale Model D2H-M18SS
(Licensee References 44 and 45)

The Licensee has provided documentation that shows this equipment to be unqualified in the areas of operating time and aging requirements.

- 4.6.27 Equipment Item No. 128
Motor Generator
Louis Allis Model 8-127033
(Licensee References 4 and 59)

The Licensee has provided documentation that shows this equipment to be unqualified in the areas of operating time and aging effects.

- 4.6.28 Equipment Item No. 131
Terminal Block
GE Models EB-5 and CR15182
(Licensee References 24, 25, and 26)

The Licensee has provided documentation that shows this equipment to be unqualified in the area of radiation effects.

- 4.6.29 Equipment Item No. 134
Switches
GE and Cutler Hammer Models GE-CR2940 and CH-10250T
(License Reference 61)

The Licensee has provided qualification documentation that shows this item is unqualified in the areas of operating time and radiation. The Licensee will continue equipment testing to determine the ultimate qualification of this equipment item.

- 4.6.30 Equipment Item No. 38
Motorized Valve Actuators
Rotork Model 14A
(Licensee Reference 63)

The Licensee has provided documentation that shows this item to be qualified in all areas except operating time and temperature.

- 4.6.31 Equipment Item Nos. 40 and 63
Pressure Solenoid Operator
ASCO WPHIX8300B68F
(Licensee Reference 42)

The Licensee has provided documentation that shows this equipment to be unqualified in the areas of radiation, aging, and operating time. Further

testing is necessary to show that this equipment is qualified to adequately operate in a post-accident environment.

- 4.6.32 Equipment Item No. 74
Pressure Switch
Barton Model 289
(Licensee References 53-55)

The Licensee has provided documentation that shows this device to be unqualified in the areas of test duration and aging.

- 4.6.33 Equipment Item No. 69
Explosive Valve
Conax Model 1832-117
(Licensee References 50 and 51)

The Licensee has provided data from test report References 50 and 51 that shows this equipment to be unqualified in the areas of radiation and aging effects. The Licensee suggests that specification for radiation level is unnecessarily conservative and that this valve is qualified to operate successfully for up to 30 days in a post-accident environment. However, this information has not resolved qualification of this equipment item.

- 4.6.34 Equipment Item No. 80
Pressure Switch
Static-O-Ring Model 12N/AA4
(Licensee Reference 58)

The Licensee has provided documentation that shows this equipment is unqualified in the areas of operating time, radiation, and aging effects.

- 4.6.35 Equipment Item Nos. 71 and 72
Limit Switch
NAMCO Model EA740-50100
(Licensee Reference 52)

The Licensee has provided documentation from Reference 52 (Acme-Cleveland Development Co. Test Report 2/20/78) that shows this equipment to be qualified in all areas for up to 7 years. However, the report notes that the Licensee

must use a qualified method for sealing the switch. The seal has not been addressed.

4.6.36 Equipment Item No. 87
Temperature Element
Scam Model S51-1
(Licensee reference not cited)

The Licensee has provided documentation which shows this equipment to be unqualified in the areas of aging and temperature requirements.

4.7 NRC Category VI
EQUIPMENT FOR WHICH QUALIFICATION IS DEFERRED

This section includes equipment items which have been addressed by the Licensee in the equipment environmental qualification submittal but for which 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. 130
Junction Boxes
Various Model Numbers
(Licensee References 19 and 20)

FRC judges junction boxes to be non-electrical equipment and, hence, chooses not to evaluate their longevity or reaction to post-accident environmental conditions in this TER.

4.7.2 Equipment Item No. 135
Cable - See Manufacturers List

The Licensee has failed to provide documentation that correlates cable type with its respective manufacturer and location to enable a proper evaluation of its environmental qualification. FRC, therefore, defers qualification until substantive documentation has been provided by TVA.

5. CONCLUSIONS

FRC's review of the qualification documentation and other information submitted by the Tennessee Valley Authority for these equipment items and their applications in the Browns Ferry 3 plant has resulted in the following categories:

<u>NRC Category</u>	<u>Compliance With The DOR Guideline Requirements</u>	<u>Quantity Of Equipment Items</u>
I.a	Equipment Fully Satisfies All Applicable Requirements for Life of the Plant	0
I.b	Equipment Does Not Meet All Applicable Requirements for Life of the Plant; However, Deviations are Judged Acceptable	0
II.a	Equipment Fully Satisfies All Applicable Requirements for Less Than Plant Life	2
II.b	Equipment Fully Satisfies All Applicable Requirements Provided That Specific Modifications are Made	0
II.c	Equipment for Which the Licensee Has Not Provided Evidence of Full Compliance with the Guidelines, but Which is Judged by FRC To Be Satisfactory for Less Than Plant Life Based on Total EEQ Program Review	0
III	Equipment is Exempt from Qualification	0
IV.a	Equipment has Qualification Testing Scheduled	0
IV.b	Equipment has High Likelihood of Operability; However, Proper Qualification Documentation is Not Available	73
V	Equipment is Unqualified	58
VI	Equipment for Which Qualification is Deferred	2

In general, the major deficiencies that have been identified are shown in the summary review sheets at the end of the section.

The conclusions stated herein represent a summary of the results of the equipment environmental qualification evaluation conducted by FRC in accordance with the methodology presented in Section 3. The conclusion results are largely based on the available qualification documentation provided by the Licensee. The results of the review do not necessarily imply that the equipment is unreliable, unsafe, or represents a significant plant safety issue; they do imply, however, that qualification documentation is inadequate and that additional information is required.

The Equipment Environmental Qualification Summary Form presented on the following pages shows the overall results of the FRC review. The entries on this form delineate the overall status of each specific equipment item with respect to compliance with the Guideline criteria defined in Section 2.0 and the resultant qualification categories defined in Section 3.0. The following designations are used:

- X = A deficiency with respect to compliance with a Guideline requirement. Deficiencies result in equipment items categorized as unqualified or qualification not established.
- L = A limiting condition with respect to qualification in that the qualified life has not been established by the Licensee.
- C = NRC Qualification Category.
- R = Replacement of the equipment by the Licensee is planned.



Franklin Research Center
 A Division of The Franklin Institute
 The Benjamin Franklin Parkway, Philadelphia, Pa. 19103

FRC TASK
4004.6

REACTOR
TYPE
BWR

PLANT NAME
BROWNS FERRY 3

PAGE
1

PROJECT
02G-C5417-01

UTILITY
TVA

EQUIPMENT ENVIRONMENTAL
QUALIFICATION

IEB-79-01B

DOCKET
50-296

NRC TAC

DATE/ENGINEER
12/16/80

SUMMARY REVIEW

EQUIPMENT ITEM NUMBER

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

GUIDELINE REQUIREMENTS,

(DESIGNATIONS: X - DEFICIENCY, L - LIMITING CONDITION)

EVIDENCE OF QUALIFICATION

RELATIONSHIP TO TEST SPECIMEN

AGING DEGRADATION EVALUATED

QUALIFIED LIFE ESTABLISHED

PROGRAM TO IDENTIFY AGING

QUAL. FOR STEAM EXPOSURE

PEAK TEMPERATURE ADEQUATE

PEAK PRESSURE ADEQUATE

TEST DURATION ADEQUATE

REQUIRED PROFILE ENVELOPED

QUAL. FOR SUBMERGENCE

QUAL. FOR CHEMICAL SPRAY

QUAL. FOR RADIATION

BETA RADIATION CONSIDERED

TEST SEQUENCE

TEST DURATION (1 HOUR + FUNCTION)

QUANTITY OF EQUIPMENT

2 2 15 5 3 3 3 3 / 2 4 / 3 2 2 3 2 5 2

EQUIPMENT INSPECTED AT SITE

QUALIFICATION CATEGORY,

0 - CATEGORY DESIGNATION

I-A. 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

0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

V. EQUIP. NOT QUALIFIED

0 0

VI. QUAL. DEFERRED

REPLACEMENT SCHEDULE

R



Franklin Research Center
 A Division of The Franklin Institute
 The Benjamin Franklin Parkway, Phila. Pa. 19103

FRC TASK
4004.6

REACTOR TYPE
BWR

PLANT NAME
BROWNS FERRY 3

PAGE
2

EQUIPMENT ENVIRONMENTAL QUALIFICATION

PROJECT
02G-C547-01

UTILITY
TVA

12B-79-01B

DOCKET
50-296

NRC TAC

DATE/ENGINEER
12/16/80

SUMMARY REVIEW

EQUIPMENT ITEM NUMBER

21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40

GUIDELINE REQUIREMENTS, (DESIGNATIONS: X - DEFICIENCY, L - LIMITING CONDITION)

EVIDENCE OF QUALIFICATION

RELATIONSHIP TO TEST SPECIMEN

AGING DEGRADATION EVALUATED

QUALIFIED LIFE ESTABLISHED L L L

PROGRAM TO IDENTIFY AGING

QUAL. FOR STEAM EXPOSURE

PEAK TEMPERATURE ADEQUATE

PEAK PRESSURE ADEQUATE

TEST DURATION ADEQUATE

REQUIRED PROFILE ENVELOPED

QUAL. FOR SUBMERGENCE

QUAL. FOR CHEMICAL SPRAY

QUAL. FOR RADIATION

BETA RADIATION CONSIDERED

TEST SEQUENCE

TEST DURATION (1 HOUR + FUNCTION)

QUANTITY OF EQUIPMENT 1 9 4 4 2 2 2 3 1 4 4 3 2 2 3 3 2 1 1

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

III. EXEMPT FROM QUAL.

IV-A. QUAL. TEST SCHEDULE

IV-B. QUAL. NOT ESTABLISHED O O O O O O O O O O O O

V. EQUIP. NOT QUALIFIED O O O O O O O O O O

VI. QUAL. IS DEFERRED

REPLACEMENT SCHEDULE



Franklin Research Center
 A Division of The Franklin Institute
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FRC TASK
4004.6

REACTOR
TYPE
BWR

PLANT NAME
Browns Ferry 3

PAGE
6

EQUIPMENT ENVIRONMENTAL
QUALIFICATION

PROJECT
02G-C5417-01

UTILITY
TVA

IEB-79-018

DOCKET
50-296

NRC TAC

DATE/ENGINEER
12/16/80

SUMMARY REVIEW

EQUIPMENT ITEM NUMBER

101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120

GUIDELINE REQUIREMENTS.

(DESIGNATIONS: X - DEFICIENCY, L - LIMITING CONDITION)

EVIDENCE OF QUALIFICATION

RELATIONSHIP TO TEST SPECIMEN

AGING DEGRADATION EVALUATED

QUALIFIED LIFE ESTABLISHED

PROGRAM TO IDENTIFY AGING

QUAL. FOR STEAM EXPOSURE

PEAK TEMPERATURE ADEQUATE

PEAK PRESSURE ADEQUATE

TEST DURATION ADEQUATE

REQUIRED PROFILES ENVELOPED

QUAL. FOR SUBMERGENCE

QUAL. FOR CHEMICAL SPRAY

QUAL. FOR RADIATION

BETA RADIATION CONSIDERED

TEST SEQUENCE

TEST DURATION (1 HOUR - FUNCTION)

QUANTITY OF EQUIPMENT

EQUIPMENT INSPECTED AT SITE

QUALIFICATION CATEGORY.

0 - CATEGORY DESIGNATION

I-A. 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

V. EQUIP. NOT QUALIFIED

VI. QUAL. IS DEFERRED

REPLACEMENT SCHEDULE

6. REFERENCES

1. IPECA S-61-402 Paragraph 3.9 and Appendix D.
2. TVA Engineering Report No. 1943.
3. Wyle Laboratory Report No. 43854-3.
4. NUREG-0588 Material List.
5. TVA Engineering Report No. 1946.
6. TVA Engineering Report No. 1944.
7. Parkinson and sisan, October 1970.
8. Blodgett and Fisher, June 1968.
9. Asaka and Yamamoto, 1973.
10. Anaconda-Continental Test Report No. 79117.
11. Franklin Institute Test Reports F-C4113 and FC-5120.
12. Rockbestos Test Report, dated July 1977, amended 1979.
13. TVA Engineering Report 1942.
14. TVA Engineering Report 1928.
15. TVA Engineering Report 1923.
16. TVA Engineering Report 1945.
17. TVA Engineering Report 1947.
18. Franklin Institute Test Report F-C2935.
19. TVA Engineering Report 1950A.
20. TVA Engineering Report 1950B.
21. TVA Engineering Report 1925.
22. TVA Engineering Report 1926.
23. TVA Engineering Report 1921.
24. GE Letter dated February 3, 1978 to H. J. Green.
25. Westinghouse letter dated March 9, 1978 to F. W. Chandler.
26. BWR Owners Group Report 081-A-01 dated September 23, 1980.
27. MIL-C-49142.
28. GE Report EPAQ-57.
29. GE Report EPAQ-60.

30. GE Report EPAQ-10.
31. GE Prototype Test Data - Epoxy Life Tests.
32. ASCO Report No. AQ5-21678/TR.
33. Valcor Doc. No. QR-526 dated February 15, 1979.
34. Target Rock Report No. 1827A dated November 4, 1976.
35. TVA Specification 3350.
36. NMC Test Report NMC-PT-7630 Rev. O.
37. NMC Drawing 0082445 Rev. D, February 9, 1978.
38. Appendix I to Sheet MEB-63-01.
39. Appendix II to Sheet MEB-64-02.
40. Appendix II to Sheet MEB-67-01.
41. Target Rock Test Report 2199A.
42. ASCO Report AQ5-21678/TR.
43. Fenwal Engineering Report 6350.
44. Wyle Laboratories Report Q5R018A012.
45. Barksdale Qualification Procedure 9993.
46. Lockheed Test Report 3232-3155 dated March 22, 1973.
47. Barton Engineering Report R3288A-1.
48. Wyle Summary Report QSR-027-A-02.
49. Limitorque Test Reports B003, B0027, and No. 600198.
50. Conax Test Report TR-39
51. Wyle Summary Report QSR-146-A-01
52. Acme Cleveland Devel Co. Test Report, dated 2/20/78
53. Barton Engineering Report R3-288A-1
54. Wyle Summary Report QSR-029-A-01
55. Wyle Summary Reports E12-3 and E12-N010
56. Rosemount Test Reports 37327B and 127227
57. Wyle Report QSR-048-A-01
58. Viking Lab Report 30203-2
59. Louis Allis Document S40EJ4-099-630 of 10/10/79
60. TVA Engineering Report 1927
61. Wyle Lab Report QSR-002-A-02
62. Franklin Institute F-C2815 Final Report

63. Rotork Report, "A" Range Nuclear Qualification
64. Letter from G. Lainas, NRC, to A. Schwencer, NRC. Subject: Electrical Equipment Environmental Qualification, dated February 19, 1980.
65. Letter from Norman C. Moseley, NRC, to B. H. Grier, J. P. O'Reilly, J. G. Keppler, K. V. Sezfrit, R. H. Engelken, NRC. Subject: IE Supplement No. 2 to Bulletin 79-01B, Environmental Qualification of Class 1E Equipment, dated September 29, 1980.
66. Letter from Norman C. Moseley, NRC, to B. H. Grier, J. P. O'Reilly, J. G. Keppler, K.V. Sezfrit, R. H. Engelken, NRC. Subject: IE Supplement No. 3 to Bulletin 79-01B, Environmental Qualification of Class 1E Equipment, dated October 24, 1980.
67. U.S. NRC Memorandum and Order (CLI-80-21) pursuant to the Petition for Emergency and Remedial Relief filed with the NRC on November 4, 1977.
68. TVA response to NRC IE Bulletin 79-01B Environmental Qualification of Class 1E Equipment for Browns Ferry 1, 2, and 3, dated October 31, 1980.
69. NUREG 0588.

APPENDIX A - ENVIRONMENTAL SERVICE CONDITIONS

This appendix contains temperature/pressure profiles or tables referenced by the Licensee in the "Environment Specifications" column on the EWS. Three tables in this appendix are used to locate the appropriate figure or table which defines the temperature/pressure values for each room. The temperatures/pressures given in either figures or tables are assumed to linearly return to ambient in 24 hours. The three tables are as follows:

- Table B.0 (1,2,3), Room Number, Name, and Plant Location

This table relates the room number to a room name and to a specific plant location (See plant arrangement drawings, sheets 1-6 for plant locations).

See pages A-2 through A-9.

- Table B.00 (1,2,3) - Environmental Temperature/Pressure

Curves - Room Number Designation

This table relates various room numbers to figures or Table B.1 (1,2,3) which are in this appendix for temperature and pressure.

See pages A-10, A-11, and A-19 through A-53.

- Table B.1 (1,2,3) - Temperature/Pressure (Selected Areas)

This table gives selected temperature/pressure values for selected areas that are not contained in a profile.

See pages A-12 through A-18.

TABLE B.0 (1,2,3)

Room Number, Name, and Plant Location

<u>Room No.</u>	<u>Room Name</u>	<u>Plant Location*</u> (Sheet 1-6)
0	Inside Primary Containment (Drywell)	Sheet 2
00	Inside Primary Containment (Wetwell)	wetwell
1	HPCI Pump (or Turbine) Room; elevation 519.0'	Sheet 1
2	S. W. RHR Pump Room; elevation 519.0'	Sheet 1
3	N. W. RICI and Core Spray Pump Room; elevation 519.0'	Sheet 1
4	N. E. Core Spray Pump Room; elevation 519.0'	Sheet 1
5	S. E. RHR Pump Room; elevation 519.0'	Sheet 1
6	Pressure Suppression Chamber (HPCI Torus Room); elevation 519.0'	Sheet 1
7	Main Steam Vault Room	Sheet 2
8	Open Area; elevation 565.0'	Sheet 2
9	Open Areas; elevation 593.0'	Sheet 3
10	RWCU Pump Room; elevation 593.0'	Sheet 3
11	RWCW Heat Exchange Room; elevation 593'	Sheet 3
12	Open Areas; elevation 621.25	Sheet 4
13	South Open Areas; elevation 639.0'	Sheet 5
14	North Open Area; elevation 639.0'	Sheet 5
15	Units 1-3 Refueling Floor; elevation 564.0'	Sheet 6
16	Unit 1-3; elevation 593; RWCW BW receiving tank rm	Sheet 3

*Unit 1 locations same as Unit 3.

TABLE B.O (1,2,3) (continued)

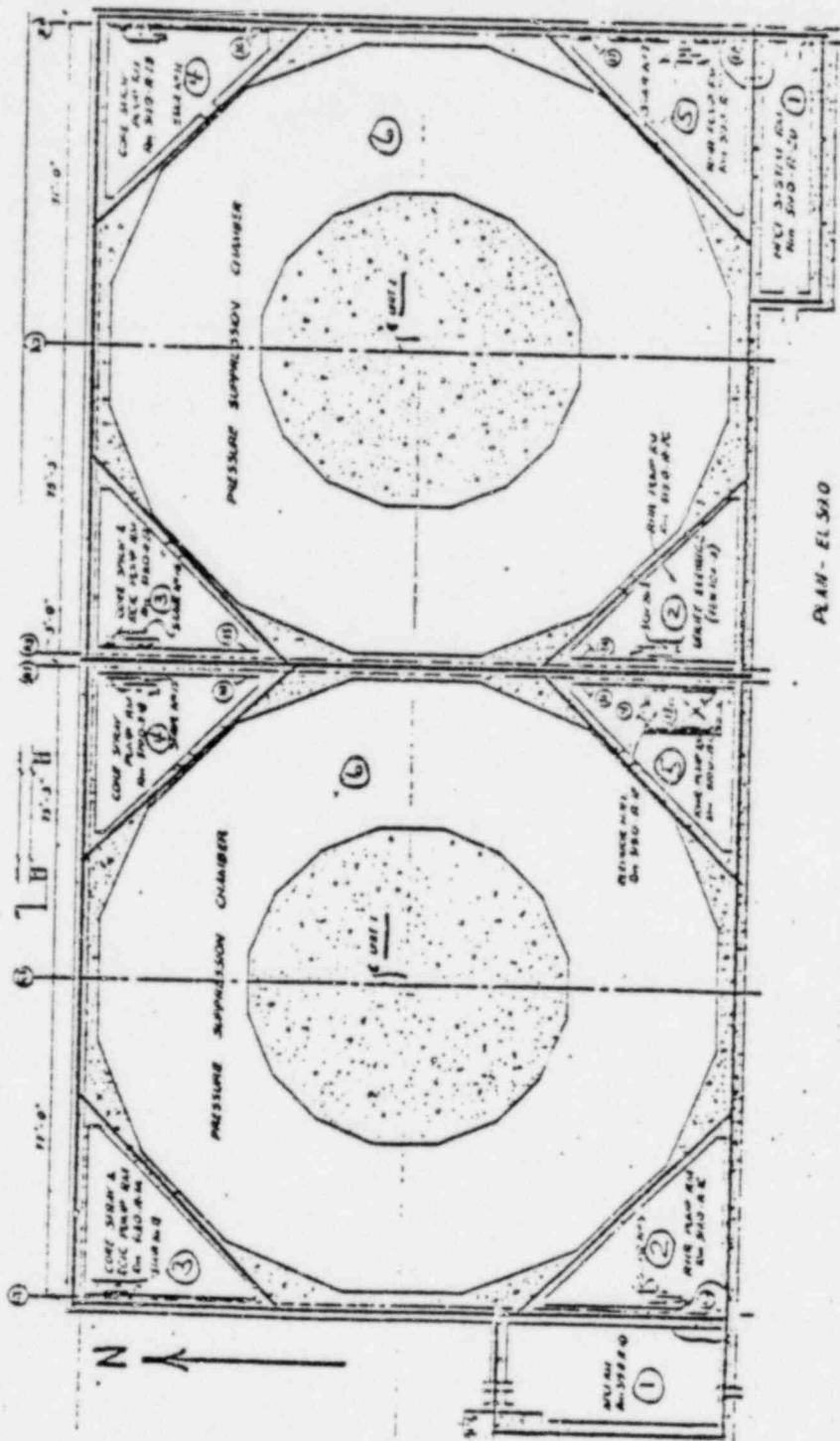
Room Number, Name, and Plant Location

<u>Room No.</u>	<u>Room Name</u>	<u>Plant Location (Sheet 1-6)</u>
17A	Unit 1-3; elevation 639; RWCU Demineralizer A	Sheet 5
17B	Unit 1-3; elevation 639; RWCU Demineralizer B	Sheet 5
18	Unit 1-3; elevation 621.25; Clean up Demin Vlv Rm	Sheet 4

Table B.O

FIGURE SUPPLIED
BY THE LICENSEE

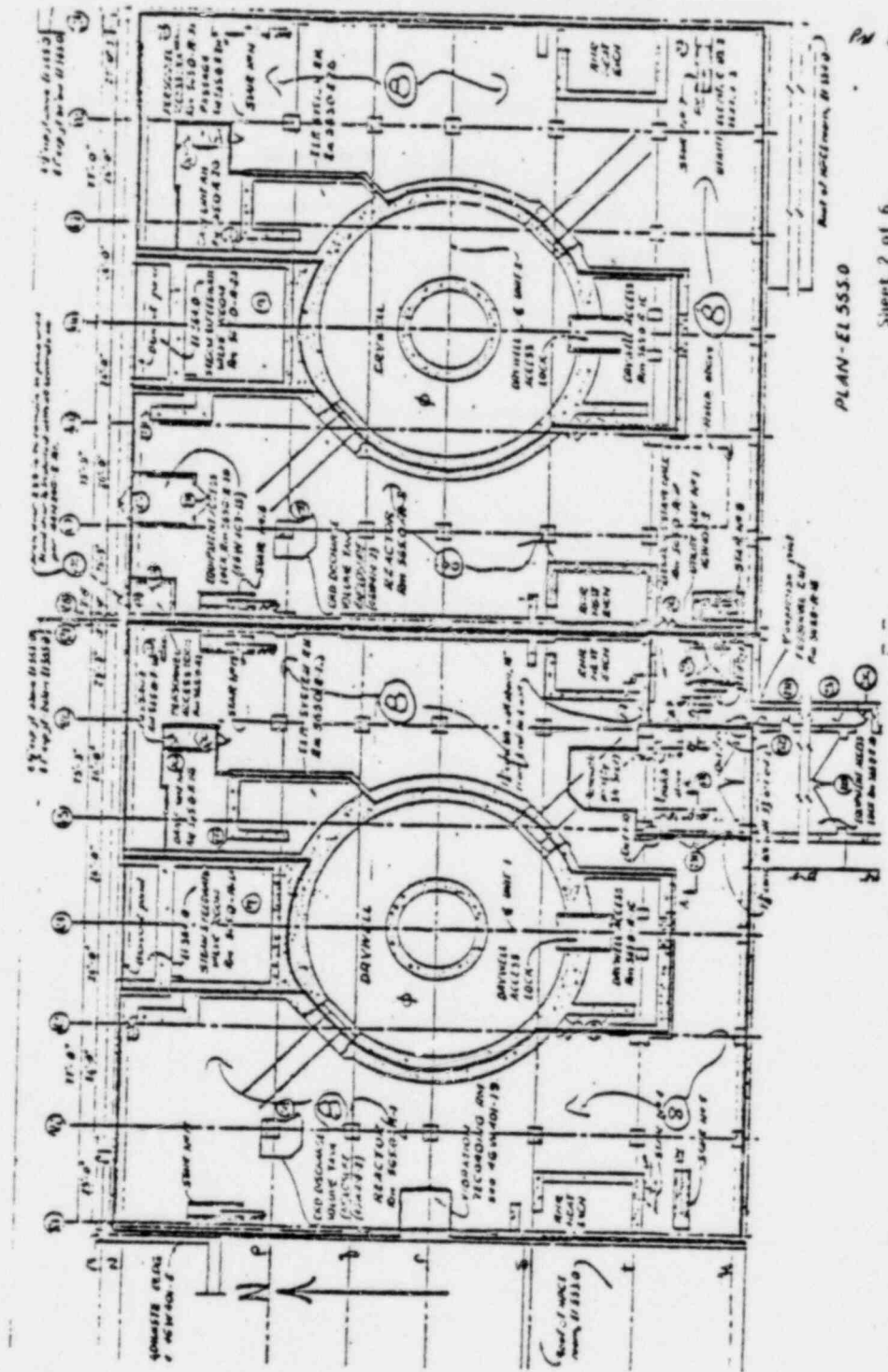
A-3



Sheet 1 of 6
Appendix B
TABLE B.0 (1, 2, 3)

Table B.0 - Sheet 1 of 6

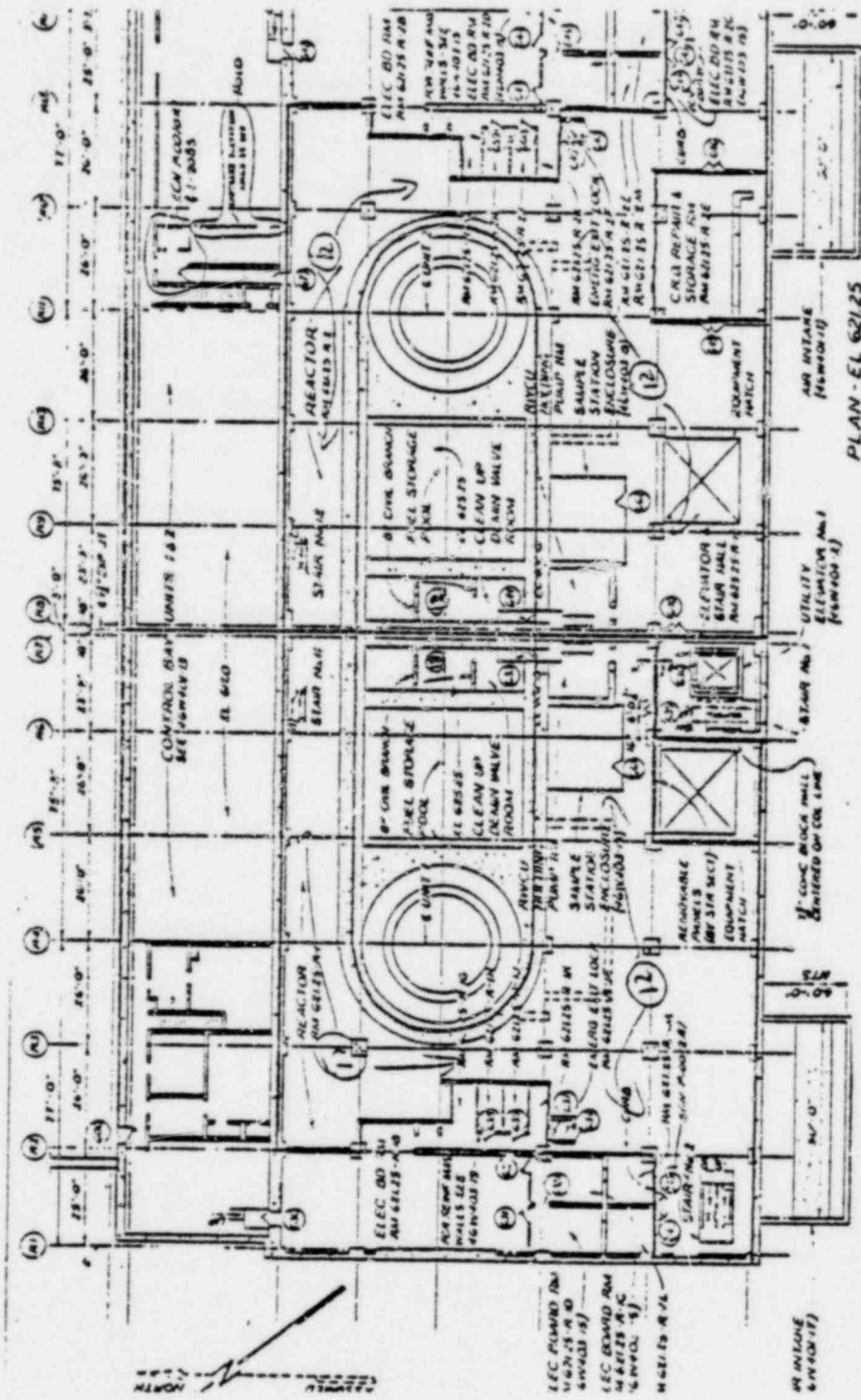
FIGURE SUPPLIED
BY THE LICENSEE



PLAN-EL 555.0

Sheet 2 of 6
Appendix B
Table B.0 (1,2,3)

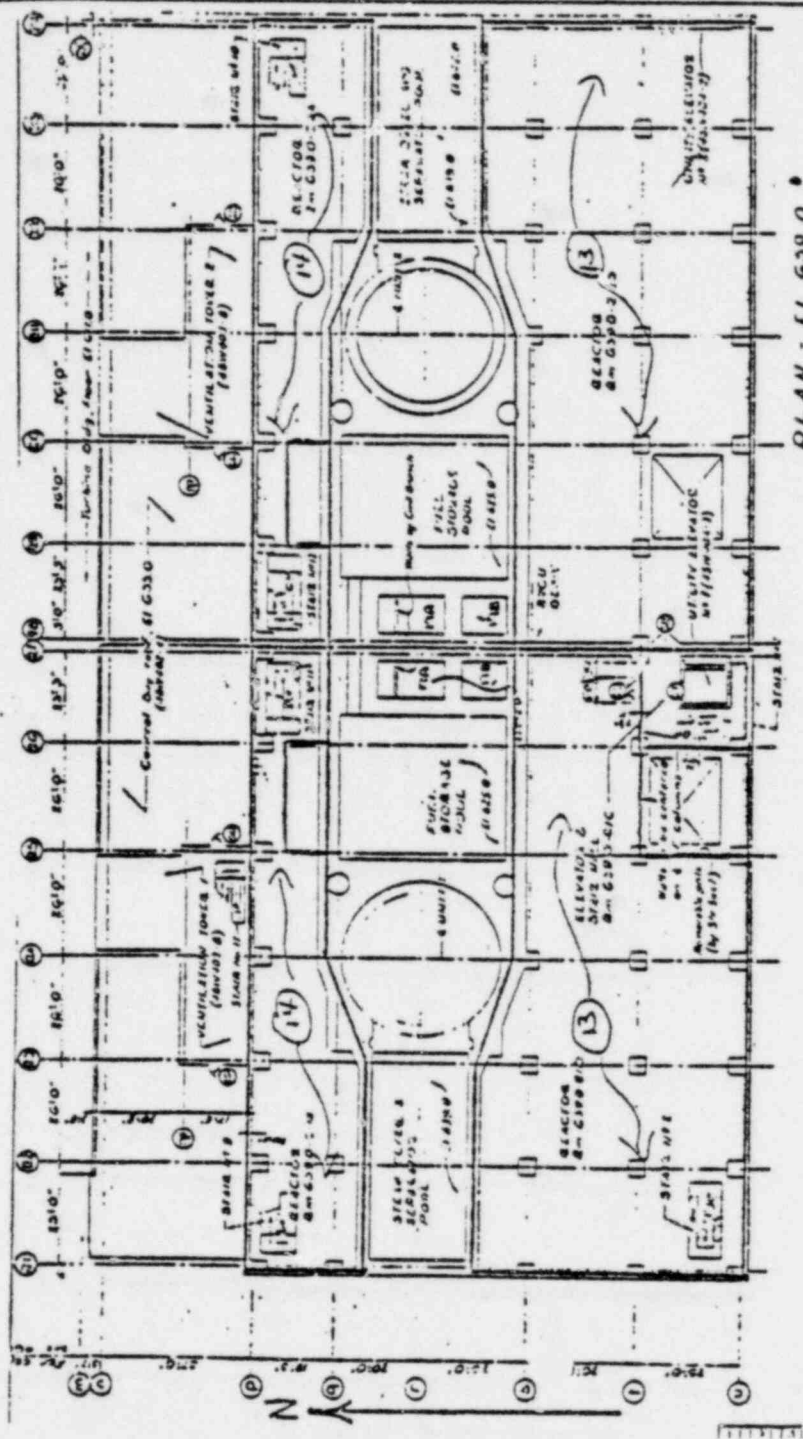
Table B.0 - Sheet 2 of 6



Sheet 4 of 6
Appendix B
TABLE B.0 (1,2,3)

FIGURE SUPPLIED
BY THE LICENSEE

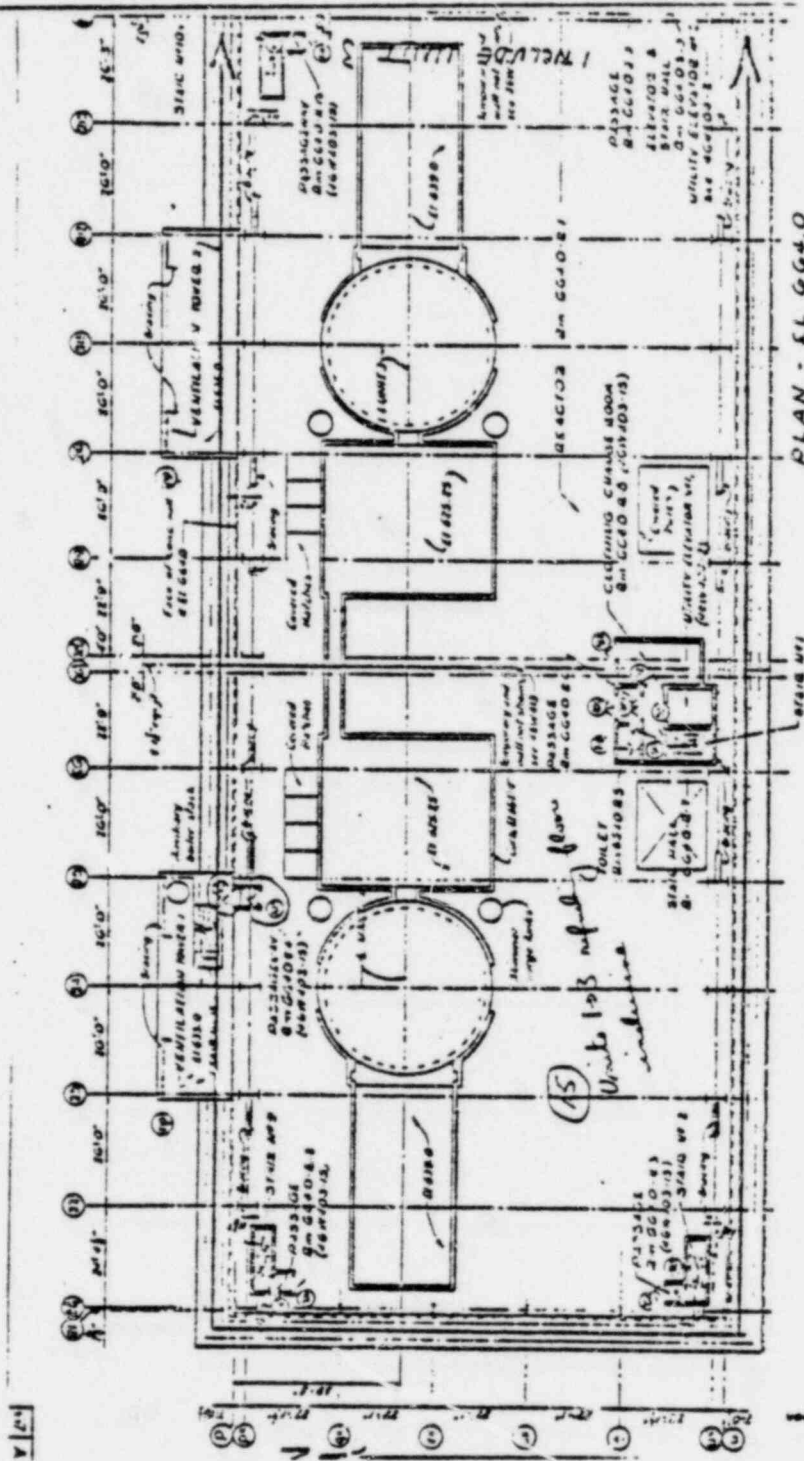
Table B.0 - Sheet 4 of 6



PLAN - LL G39.0

Sheet 5 of 6
Appendix B
TABLE B.0 (1.2.3)

FIGURE SUPPLIED
BY THE LICENSEE



Sheet 6 of 6
Appendix B
TABLE B.0 (1,2,3)

FIGURE SUPPLIED
BY THE LICENSEE

TABLE B.00 (1,2,3)

ENVIRONMENTAL TEMPERATURE/PRESSURE CURVES - ROOM NUMBER DESIGNATIONS*

Room No. Designation	Unit 1		Units 2 and 3	
	Temperature	Pressure	Temperature	Pressure
0	Figure B.0 (1,2,3)	Figure B.0 (1,2,3)	Figure B.0 (1,2,3)	Figure B.0 (1,2,3)
00 (Metwell)	B.00 (1,2,3)	B.00.0 (1,2,3)	B.00 (1,2,3)	B.00.0 (1,2,3)
1	B.1 (1)	Table B.1 (1,2,3)	B.1 (2,3)	Table B.1 (1,2,3)
2	B.2 (1)		B.2 (2,3)	
3	B.3 (1)		B.3 (2,3)	
4	B.4 (1)		B.4 (2,3)	
5	B.5 (1)		B.5 (2,3)	
6	B.6 (1)		B.6 (2,3)	
7	B.7 (1)		B.7 (2,3)	
8	B.8 (1)		B.8 (2,3)	
9	B.9 (1)		B.9 (2,3)	
10	B.10 (1)		B.10 (2,3)	
11	B.11 (1)		B.11 (2,3)	
12	B.12 (1)		B.12 (2,3)	
13	B.13 (1)		B.13 (2,3)	
14	B.14 (1)		B.14 (2,3)	
15	Table B.1 (1,2,3)		Table B.1 (1,2,3)	
16	B.16 (1)**		B.16 (2,3)**	

**Same as room 9 for units 1, 2, and 3

FIGURE SUBMITTED BY THE LICENSEE

TABLE B.00 (1,2,3)

ENVIRONMENTAL TEMPERATURE/PRESSURE CURVES - ROOM NUMBER DESIGNATIONS* (Continued)

Room No. Designation	Unit 1		Units 2 and 3	
	Temperature	Pressure	Temperature	Pressure
17A	Table B.1 (1,2,3)	Table B.1 (1,2,3)	Table B.1 (1,2,3)	Table B.1 (1,2,3)
17B	↓	↓	↓	↓
18				

*Figure Designation:



*Table Designation:

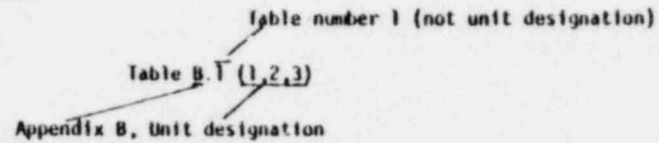


FIGURE SUPPLIED
BY THE LICENSEE

TABLE B.1 (1,2,3)

TEMPERATURE - PRESSURE (Selected Areas)

Unit 1		Unit 2 & 3	
Time	Compartment (1)	Time	Compartment (1),(10), & (11)
2 sec	1.3 psig	Same as for unit 1	
5 "	1.1 "		
30 "	.8 "		
50 "	0. "		

Time	Compartment (10)	Time	All Remaining Area
.02 sec	2.4 psig	1 sec	.1 psig
.6 "	.8 "	30 "	.5 "
5 "	1.3 "	45 "	.5 "
45 "	1.3 "	50 "	.1 "
47 "	.2 "	120 "	0. "

Time	Compartment (11)	All Units Compartment 7	
Time	All Remaining Area	Time	Steam Valve Vault
1 sec	2.4 psig	.1 sec	1.7 psig
10 "	3.4 "	3 "	7.1 "
45 "	3.8 "	4 "	4.5 "
47 "	.4 "	5 "	2.7 "
55 "	.1 "	6 "	2.0 "
120 "	0. "	10 "	1.8 "
		150 "	1.8 "

Temperature-Pressure (Compartment 15, 17A, 17B, 18) - All Units

Room No.	Temperature (^o F)	Pressure (PSIA)
15	120	15.0
17A	105	Atm.
17B	105	Atm.
18	110	Atm.

Table B.1

FIGURE SUPPLIED BY THE LICENSEE

TABLE 1
 BROWNS FERRY NUCLEAR PLANT
 SUMMARY OF OPERATIONAL ENVIRONMENTAL CONDITIONS

Plant Location	Elevation	Building Location	Operational Condition	Pressure Extreme (PSIA)	Peak Temperature (°F)	Peak Humidity (%)	Total 40-Yr Integrated Dose (Rads)	Integrated Accident Dose (Rads)
Outside	--	--	2	ATM	96-100	100	5 x 10 ²	NA
			5	11.4	NA	NA	NA	NA
Reactor Building	541.5	Drywell	1	15.6	140	100	1 x 10 ⁸	NA
			2	15.6	150	100	1 x 10 ⁸	NA
			3	69.4	325	100	NA	Center ⁸ 1 x 10 ⁹ 2 x 10 ⁹
			4	NA	NA	NA	NA	Edge ⁷ 4 x 10 ⁷ 4 x 10 ⁹
			5	15.6	NA	NA	NA	NA
519.0	Wetwell		1	ATM	95	100	NA	NA
			2	ATM	105	100	NA	NA
			3	43.2	158	100	NA	2 x 10 ⁸
			4	NA	NA	NA	NA	NS
			5	ATM	NA	NA	NA	NA
519.0	HPCI Room		1	ATM*	95	98	2 x 10 ⁴	NA
			2	ATM*	105	98	2 x 10 ⁴	NA
			3	ATM*	150	100	NA	3 x 10 ⁴
			4	15.7	300	100	NA	NS
			5	11.4	NA	NA	NA	NA
519.0	SW Pump Room		1	ATM*	95***	98	2 x 10 ⁴	NA
			2	ATM*	105***	98	2 x 10 ⁴	NA
			3	ATM*	160	100	NA	3 x 10 ⁷
			4	15.0	292(U1) 158(U2&3)	100	NA	NS
			5	11.4	NA	NA	NA	NA

FIGURE SUPPLIED
 BY THE LICENCEE

TABLE 1
BIOWMS FERRY NUCLEAR PLANT
SUMMARY OF OPERATIONAL ENVIRONMENTAL CONDITIONS

Plant Location	Elevation	Building Location	Operational Condition	Pressure Extreme (PSIA)	Peak Temperature (°F)	Peak Humidity (%)	Total 40-Yr Integrated Dose (Rads)	Integrated Accident Dose (Rads)
Reactor Building	519.0	MW Pump Room	1	ATM*	95	98	2×10^4	NA
			2	ATM*	105	98	2×10^4	NA
			3	ATM*	160	100	3×10^7	NA
			4	15.0	297	100	NS	NA
			5	11.4	NA	NA	NA	NA
	519.0	ME Pump Room	1	ATM*	95	98	2×10^4	NA
			2	ATM*	105	98	2×10^4	NA
			3	ATM*	160	100	3×10^7	NA
			4	15.0	171(U1)	100	NS	NA
			5	11.4	160(U2&3)	NA	NA	NA
	519.0	SE Pump Room	1	ATM*	95	98	2×10^4	NA
			2	ATM*	105	98	2×10^4	NA
			3	ATH	160	100	3×10^7	NA
			4	15.0	139(U1)	100	NS	NA
			5	11.4	294(U2&3)	NA	NA	NA
Pressure Suppression Chamber	519.0		1	ATM*	95***	98	1.5×10^5	NA
			2	ATM*	105***	98	1.5×10^5	NA
			3	ATH	170	100	3×10^7	NA
			4	15.0	217(U1)	100	NS	NA
			5	11.4	220(U2&3)	NA	NA	NA
Main Steam Valve Vault	565		1	ATM*	140	98	2×10^6	NA
			2	ATM*	160	98	2×10^6	NA
			3	ATH	140	100	NA	3×10^4
			4	21.5	308	100	NS	NA
			5	11.4	NA	NA	NA	NA

FIGURE SUBMITTED
BY THE LICENSEE

Table 1 (Continued)

TABLE 1
BROWNS FERRY NUCLEAR PLANT
SUMMARY OF OPERATIONAL ENVIRONMENTAL CONDITIONS

Plant Location	Elevation	Building Location	Operational Condition	Pressure Extreme (PSIA)	Peak Temperature (°F)	Peak Humidity (%)	Total 40-Yr Integrated Dose (Rads)	Integrated Accident Dose (Rads)
Reactor Building	565	General Floor Area	1	ATH*	90	98	1 x 10 ⁵	NA
			2	ATH*	100	98	1 x 10 ⁵	NA
			3	ATH	140	100	2.1 x 10 ^{7**}	NA
			4	15.0	147(01)	100	NS	NA
			5	11.4	157(02&3)	NA	NA	NA
Reactor Building	593	General Floor Area	1	ATH*	90	98	2 x 10 ⁴	NA
			2	ATH*	100	98	2 x 10 ⁴	NA
			3	ATH	135	100	2.1 x 10 ^{7**}	NA
			4	15.0	214(01)	100	NS	NA
			5	11.4	211(02&3)	NA	NA	NA
Reactor Building	593	Reactor Water Cleanup Pump Rooms	1	ATH*	120	98	1.4 x 10 ⁷	NA
			2	ATH*	130	98	1.4 x 10 ⁷	NA
			3	ATH	135	100	3 x 10 ⁴	NA
			4	15.9	220	100	NS	NA
			5	11.4	NA	NA	NA	NA
Reactor Building	593	Heat Exchanger Room	1	ATH*	125	98	1.4 x 10 ⁷	NA
			2	ATH*	135	98	1.4 x 10 ⁷	NA
			3	ATH	135	100	3 x 10 ⁷	NA
			4	18.2	227(01)	100	NS	NA
			5	11.4	221(02&3)	NA	NA	NA
Reactor Building	621	General Floor Area	1	ATH*	90	98	1 x 10 ³	NA
			2	ATH*	160	98	1 x 10 ³	NA
			3	ATH	185	100	3 x 10 ⁴	NA
			4	15.0	174(01)	100	NS	NA
			5	11.4	199(02&3)	NA	NA	NA

BY THE LICENSEE

Table 1 (Continued)

FIGURE SUPPLEMENTED
BY THE LICENSEE

TABLE 1
BROWNS FERRY NUCLEAR PLANT
SUMMARY OF OPERATIONAL ENVIRONMENTAL CONDITIONS

Plant Location	Elevation	Building Location	Operational Condition	Pressure Extreme (PSIA)	Peak Temperature (°F)	Peak Humidity (%)	Total 40-Yr Integrated Dose (Hads)	Integrated Accident Dose (hads)	
Reactor Building	639	General Floor Area (South)	1	ATM*	90	98	1 x 10 ³	NA	
			2	ATM*	100	98	1 x 10 ³	NA	
			3	ATM	130	100	100	NA	3 x 10 ⁴
			4	15.0	135(01)	100	NA	NS	
			5	11.4	178(02&3)	NA	NA	NA	NA
Reactor Building	639	General Floor Area (North)	1	ATM*	90	98	1 x 10 ³	NA	
			2	ATM*	100	98	1 x 10 ³	NA	
			3	ATM	130	100	100	NA	3 x 10 ⁴
			4	15.0	153(01)	100	NA	NS	
			5	11.4	174(02&3)	NA	NA	NA	NA
Reactor Building	664	Refueling Floor	1	ATM*	90	98	1 x 10 ³	NA	
			2	ATM*	100	98	1 x 10 ³	NA	
			3	15.0	120	100	NA	3 x 10 ⁴	
			4	NA	NA	NA	NA	NS	
			5	11.4	NA	NA	NA	NA	NA
Reactor Building	593.0	RUCU BW Receiving Tank Room	1	ATM*	95	98	5.3 x 10 ⁷	NA	
			2	ATM*	105	98	5.3 x 10 ⁷	NA	
			3	ATM	135	100	NA	3 x 10 ⁴	
			4	15.0	214(01)	100	NA	NS	
			5	11.4	211(01&2)	NA	NA	NA	NA
Reactor Building	639.0	RUCU Desmineralizer A	1	ATM*	90	90	2.1 x 10 ⁸	NA	
			2	ATM*	100	90	2.1 x 10 ⁸	NA	
			3	ATM	100	90	NA	3 x 10 ⁴	
			4	ATM	105	90	NA	NS	
			5	11.4	NA	NA	NA	NA	NA

Table 1 (Continued)

TABLE 1
 BROWNS FERRY NUCLEAR PLANT
 SUMMARY OF OPERATIONAL ENVIRONMENTAL CONDITIONS

Plant Location	Elevation	Building Location	Operational Condition	Pressure Extreme (PSIA)	Peak Temperature (°F)	Peak Humidity (%)	Total 40-Yr Integrated Dose (Rads)	Integrated Accident Dose (Rads)
Reactor Building	639.0	RUCU Demineralizer B	1	ATH*	90	90	2.1×10^8	NA
			2	ATH*	100	90	2.1×10^8	NA
			3	ATH	100	90	NA	3×10^4
			4	ATH	105	90	NA	NS
			5	11.4	NA	NA	NA	NA
Cleanup Demineralizer Valve Room	621.5	Cleanup Demineralizer Valve Room	1	ATH*	95	90	1.7×10^5	NA
			2	ATH*	105	90	1.7×10^5	NA
			3	ATH	105	90	NA	3×10^4
			4	ATH	110	90	NA	NS
			5	11.4	NA	NA	NA	NA

FIGURE SUPPLIED
 BY THE LICENSEE

NOTES

A. Operational condition definitions:

1. Normal average day.
2. Abnormal conditions, outside temperature 96-100°F and maximum river water temperature exists. The maximum duration for this condition is 8 hours during a 24-hour period but may occur on a daily basis for a 2- or 3-week period. (Outside design temperature is 95°F.)
3. LOCA/HELB inside primary containment.
4. HELB outside primary containment.
5. Tornado (sudden pressure drop of 3.0 pounds per square inch).

B. ATH indicates a pressure equal to atmospheric pressure will be present. Normal atmospheric pressure at the Browns Ferry site is 14.4 pounds per square inch.

C. ATH* indicates a pressure slightly below atmospheric.

D. All dose rates and integrated dose rates shown are upper limits for the summation of the gamma and beta contributions unless otherwise indicated. All dose rates are for LOCA; HELB is not significant (denoted NS). Maximum dose rates for these elevations are indicated by **. Actual values may vary significantly depending on location. Total radiation dose rates can be obtained by adding the 40-year integrated and accident dose rates.

E. Normal humidity is 30 to 80 percent.

F. For operational condition 3, the drywell and wetwell pressure and temperature values are peak values. For transient conditions, see attachment 1.

G. For operational condition 4, temperatures shown are peak values for transient conditions (see attachment 2).

H. Pressure, humidity, and radiation parameters apply to units 1-3. Temperatures are applicable to all units unless otherwise indicated. *** indicates space temperatures may reach 150°F during normal shutdown mode.

I. Primary containment areas are not subject to a chemical spray.

J. Reactor building equipment is not subject to submergence.

K. NA indicates not applicable for this operating condition.

E40298.20

FIGURE SUPPLIED
BY THE LICENSEE

FIGURE SUPPLIED BY THE LICENSEE

TER-C5417-6

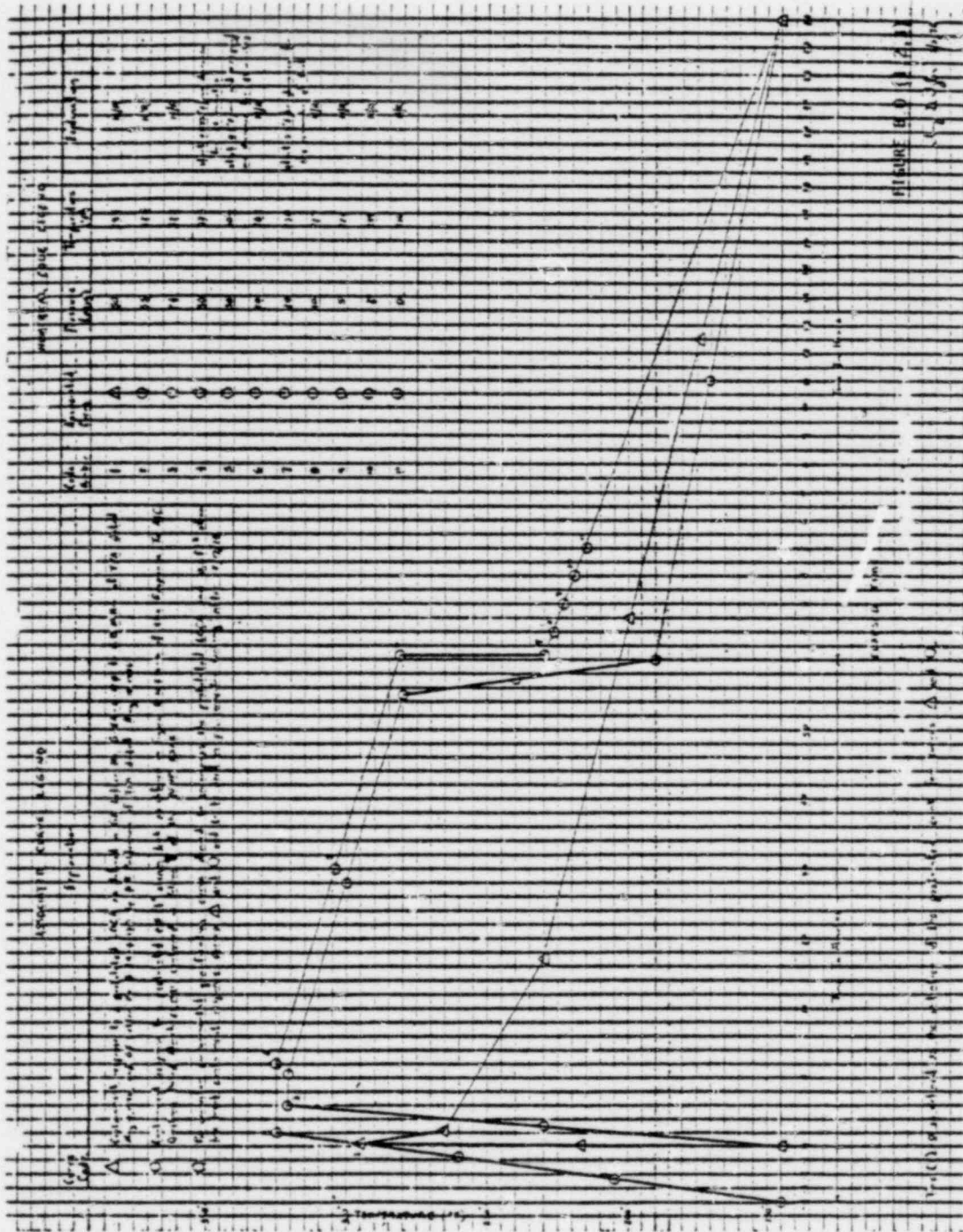


Figure B.0

FIGURE SUPPLIED
BY THE LICENSEE

TER-C5417-6

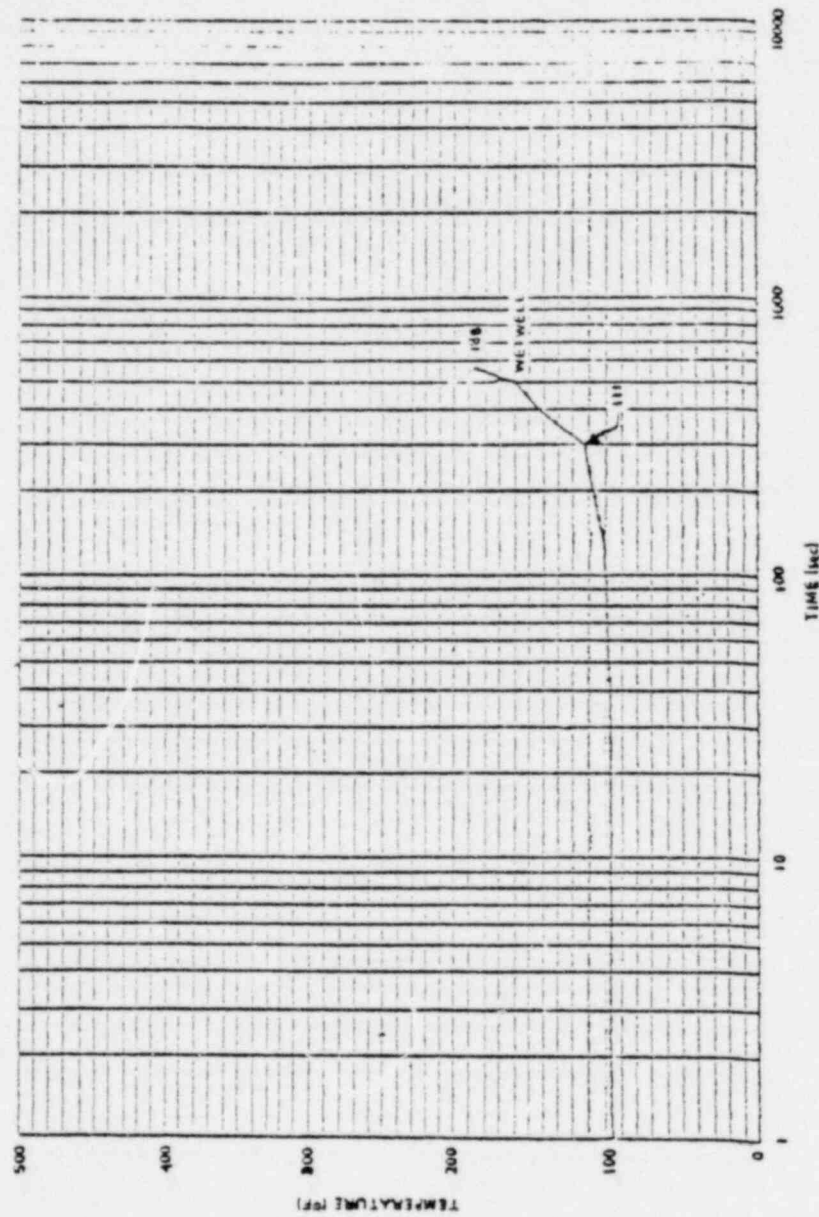


Figure B.00 (1, 2, 3). IBA Wetwell Temperature Response

Figure B.00 - IBA Wetwell Temperature Response

FIGURE SUPPLIED
BY THE LICENSEE

TER-C5417-6

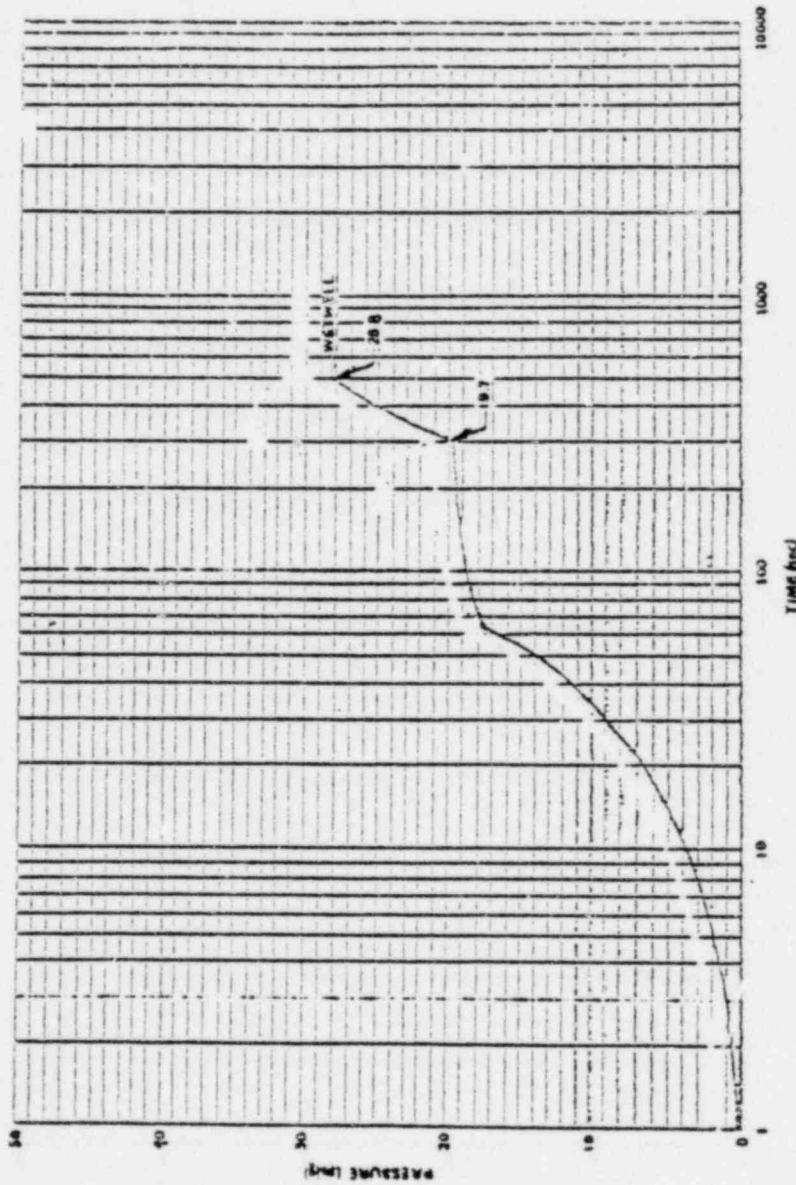


Figure B.00.0(1,2,3) IBA Containment Pressure Response

Figure B.00 - IBA Containment Pressure Response

FIGURE SUPPLIED
BY THE LICENSEE

TER-C5417-6

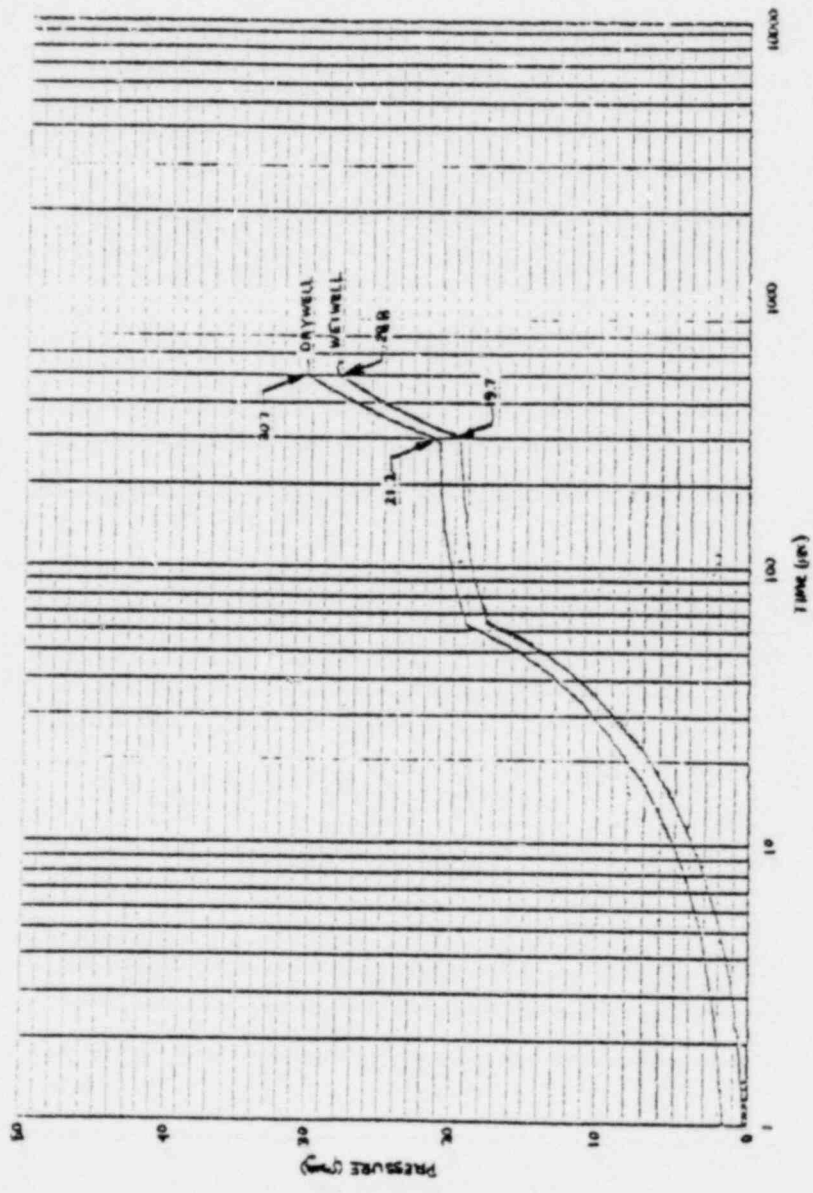


Figure C.1-5 IBA Containment Pressure Response

Figure C.1-5 - IBA Containment Pressure Response

FIGURE SUPPLIED
BY THE LICENSEE

TER-C5417-6

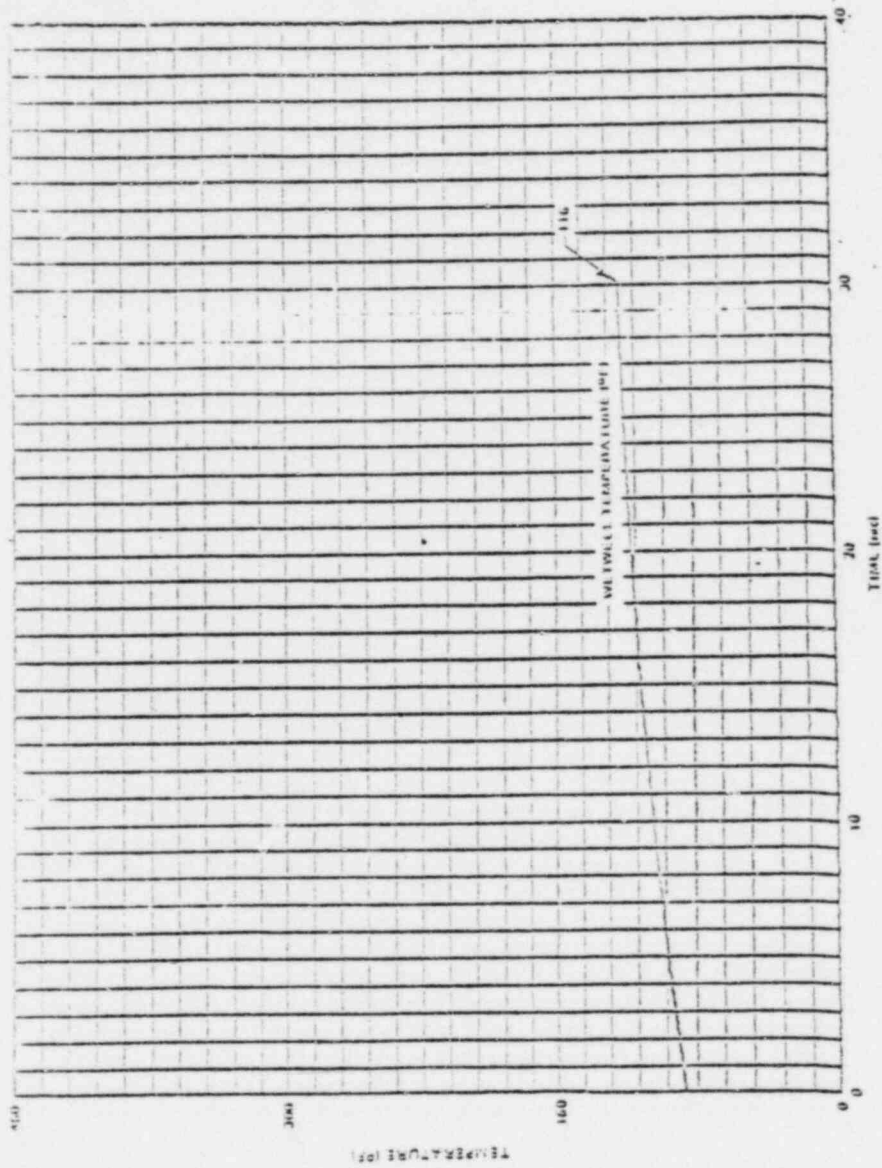
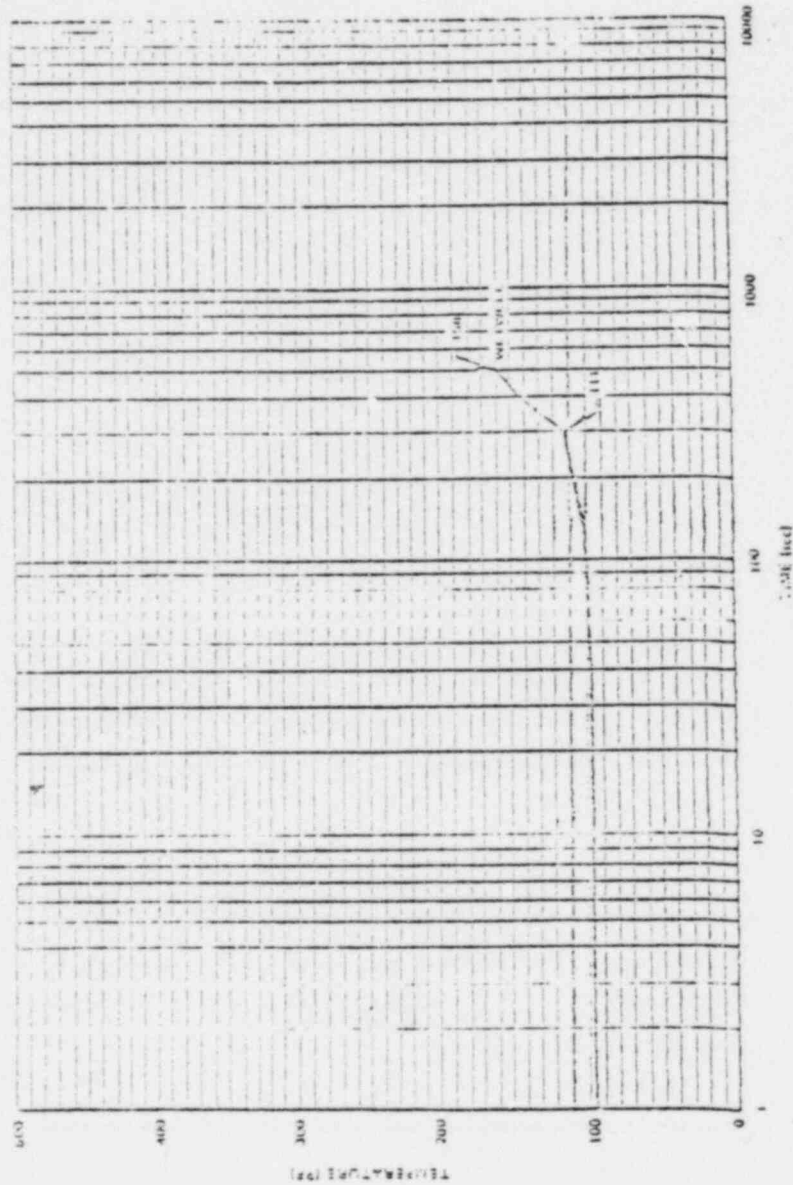


Figure C.1-1 DBA Wetwell Temperature Response

Figure C.1-1 - DBA Wetwell Temperature Response

FIGURE SUPPLIED
BY THE LICENSEE

TER-C5417-6



C.1-2
TEMPERATURE RESPONSE
TEMPERATURE (°C) vs. TIME (hr)

Figure C.1-2 - IBA Wetwell Temperature Response

FIGURE SUPPLIED
BY THE LICENSEE

TER-CS417-6

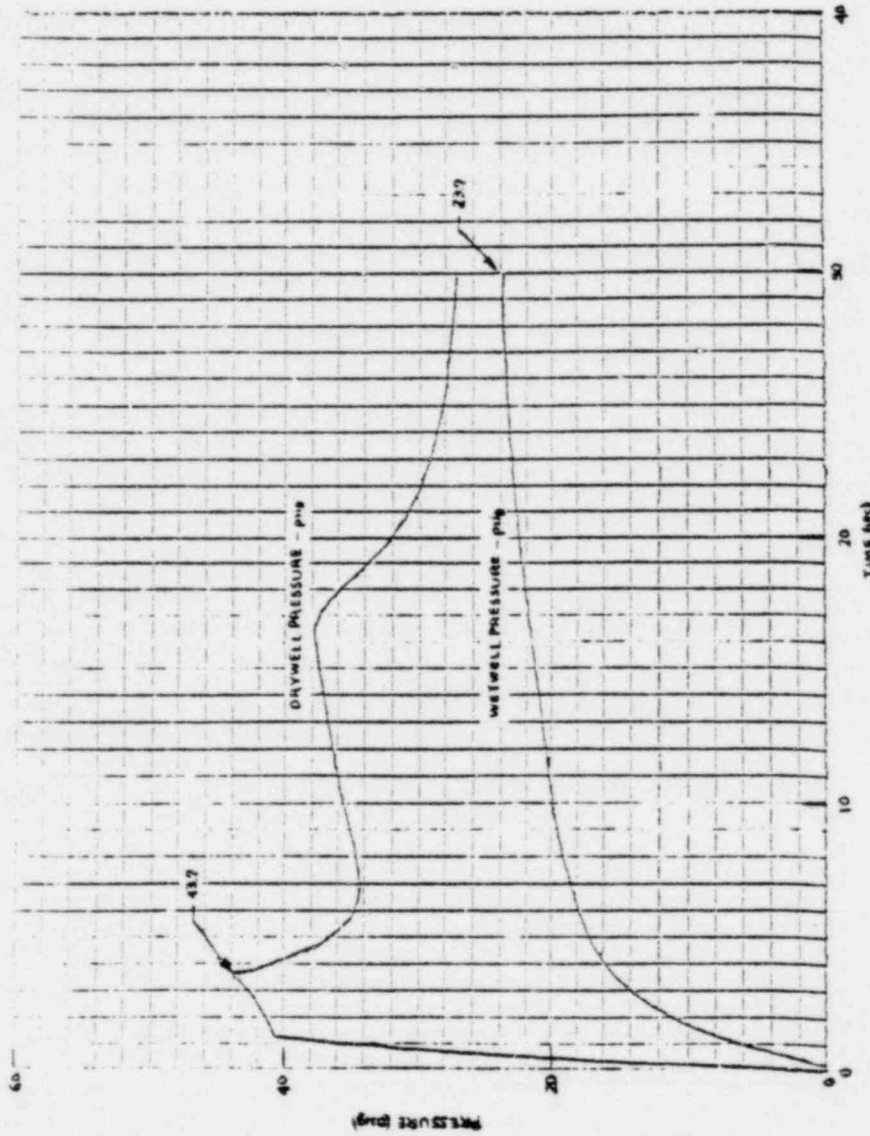


Figure C.1-4 DBA Containment Pressure Response

Figure C.1-4 - DBA Containment Pressure Response

Figure B.1 (1)

A-26

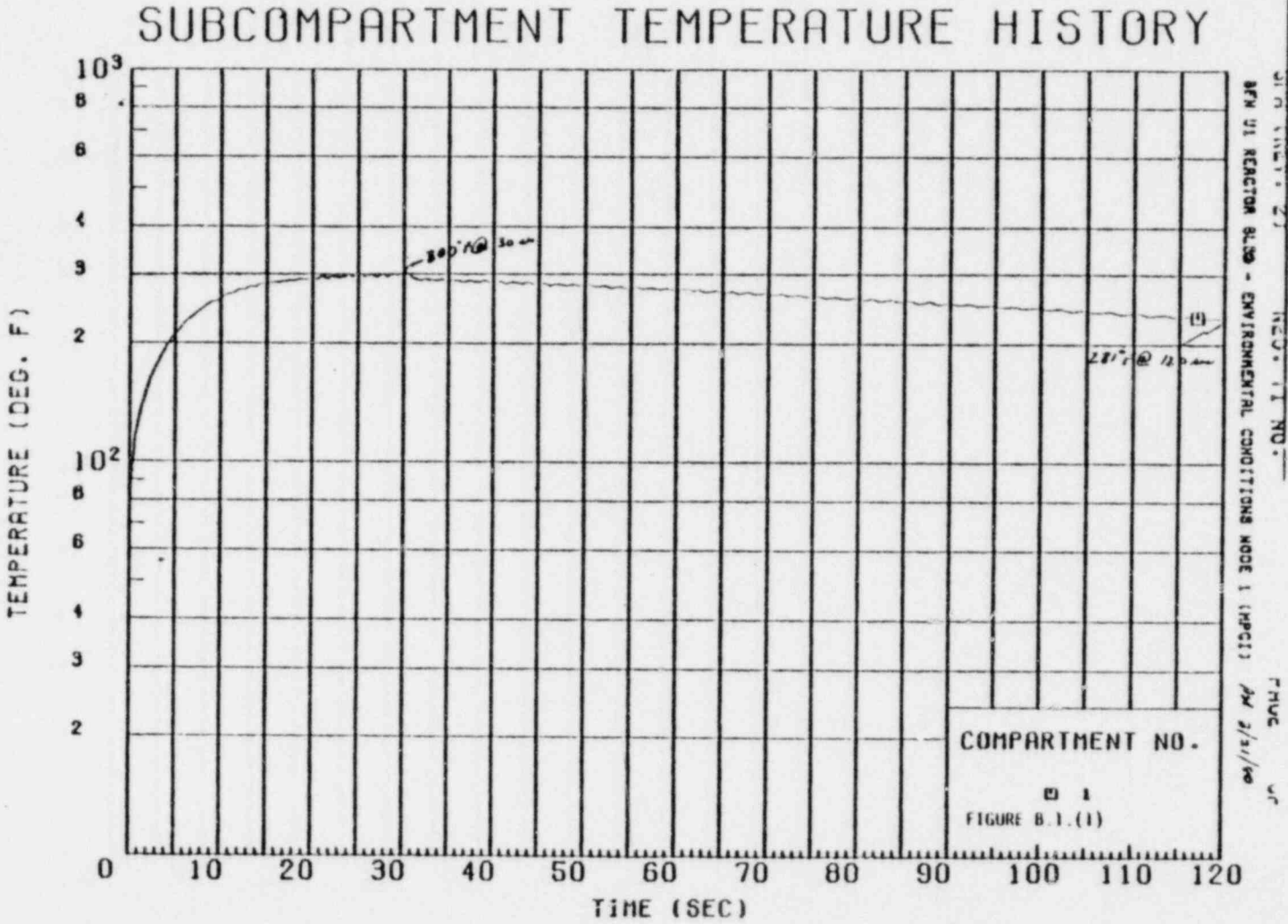


FIGURE SUPPLIED
BY THE LICENSEE

TER-C5417-6

FIGURE SUPPLIED
BY THE LICENSEE

TER-C5417-6

SPM (REV. 2) NEG. TI NO. PAGE OF

SPM VI REACTOR BLDG - ENVIRONMENTAL CONDITIONS MODE 1 (INCL) 4/2/64

SUBCOMPARTMENT TEMPERATURE HISTORY

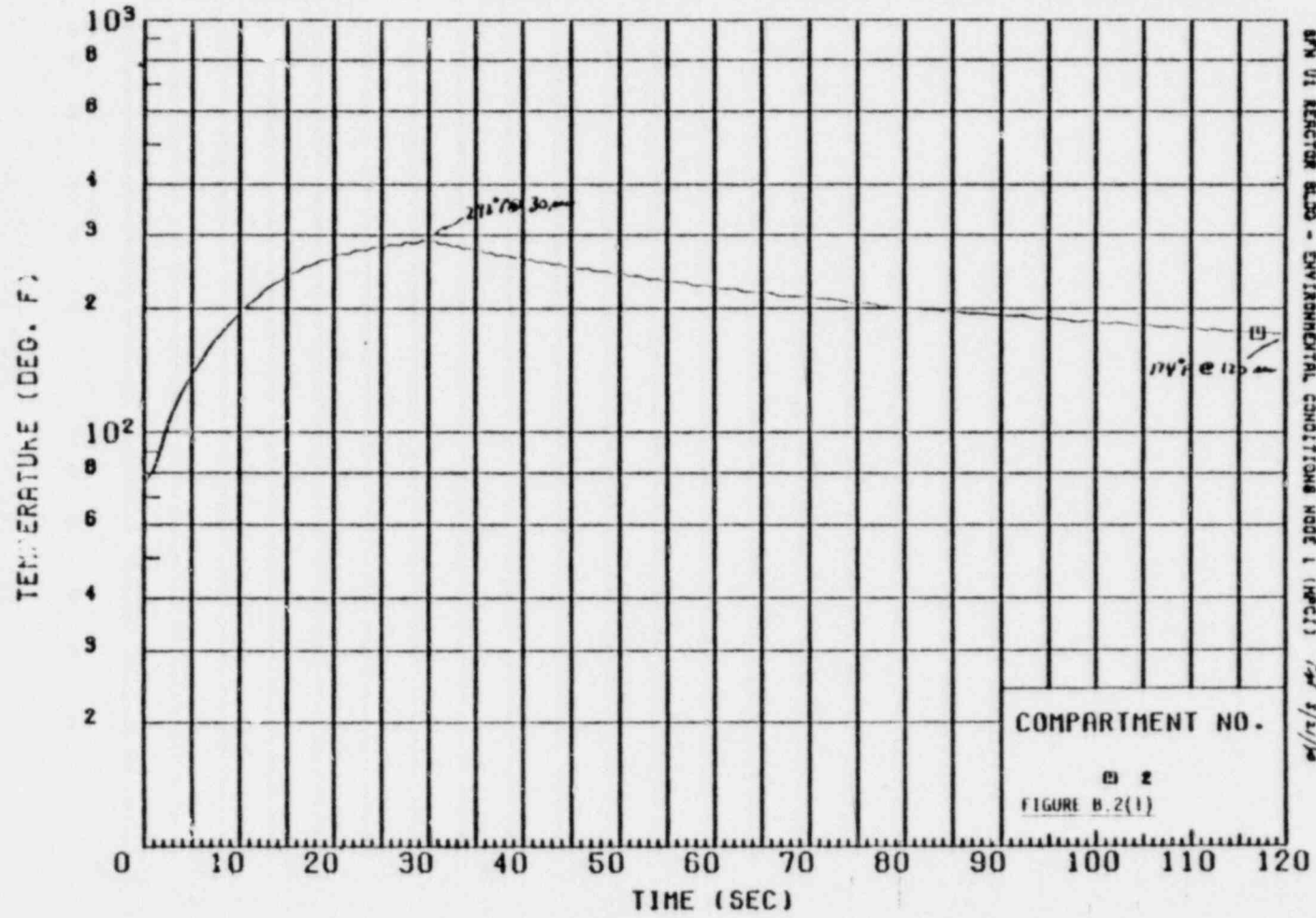


FIGURE SUPPLIED
BY THE LICENSEE

TER-C5417-6

SPH (REV. 2) NEG. TI NO.
9FM U1 REACTOR 9L00 - ENVIRONMENTAL CONDITIONS MODE 3 (R/C1)
PROG OF 4/1/70

SUBCOMPARTMENT TEMPERATURE HISTORY

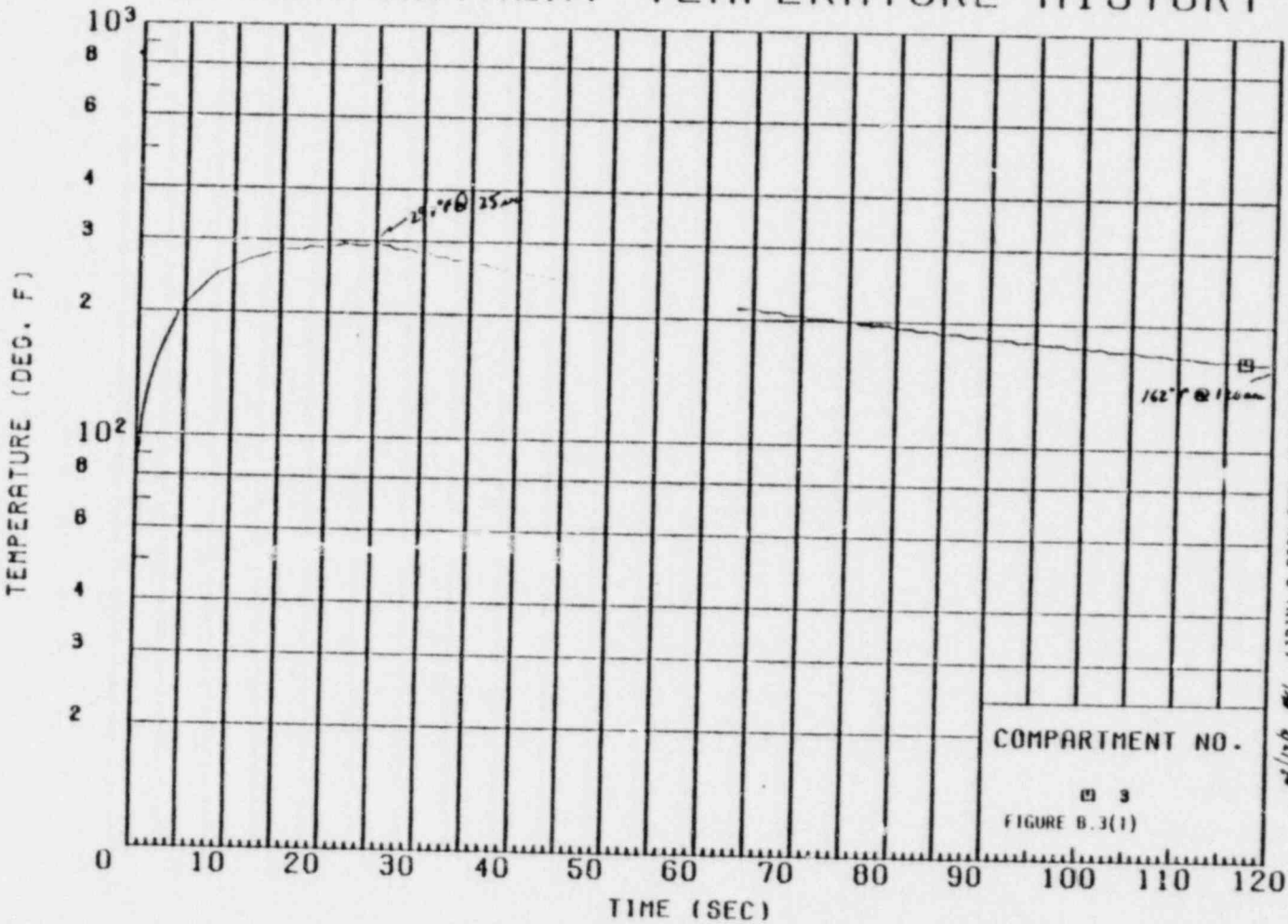


FIGURE SUPPLIED
BY THE LICENSEE

TER-C5417-6

SPR (REV. 2) NEC. TI NO.
SFR U1 REACTOR BLDG - ENVIRONMENTAL CONDITIONS NODE 8 (R/C2)

PAGE 0F

SUBCOMPARTMENT TEMPERATURE HISTORY

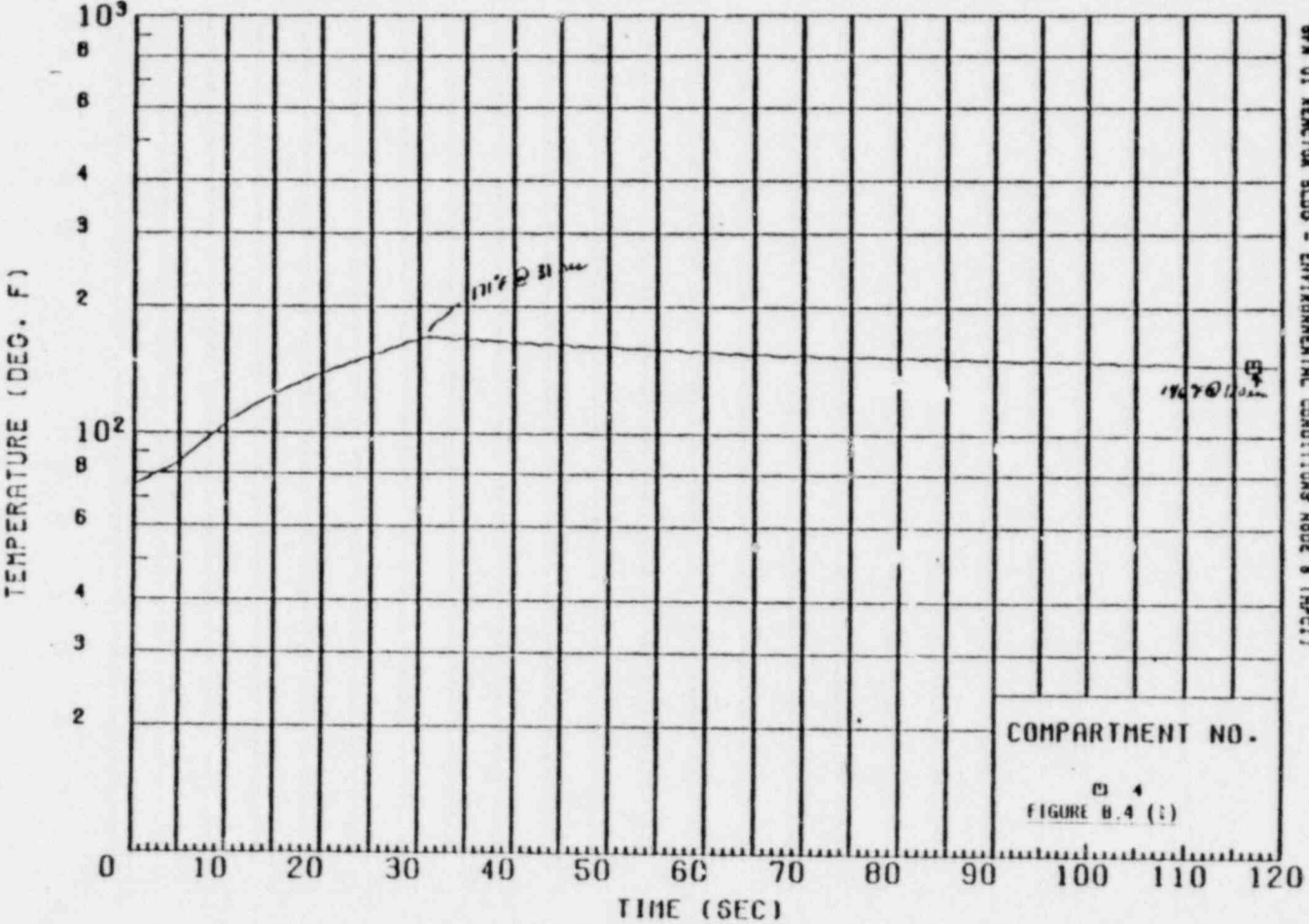


Figure B.4 (1)
A-29

FIGURE SUPPLIED
BY THE LICENSEE

TER-C5417-6

SPA (REV. 2)

NEG. T1 NO.

PAGE OF

BFW UI REACTOR BLDG - ENVIRONMENTAL CONDITIONS MODE 6 (MPC)

SUBCOMPARTMENT TEMPERATURE HISTORY

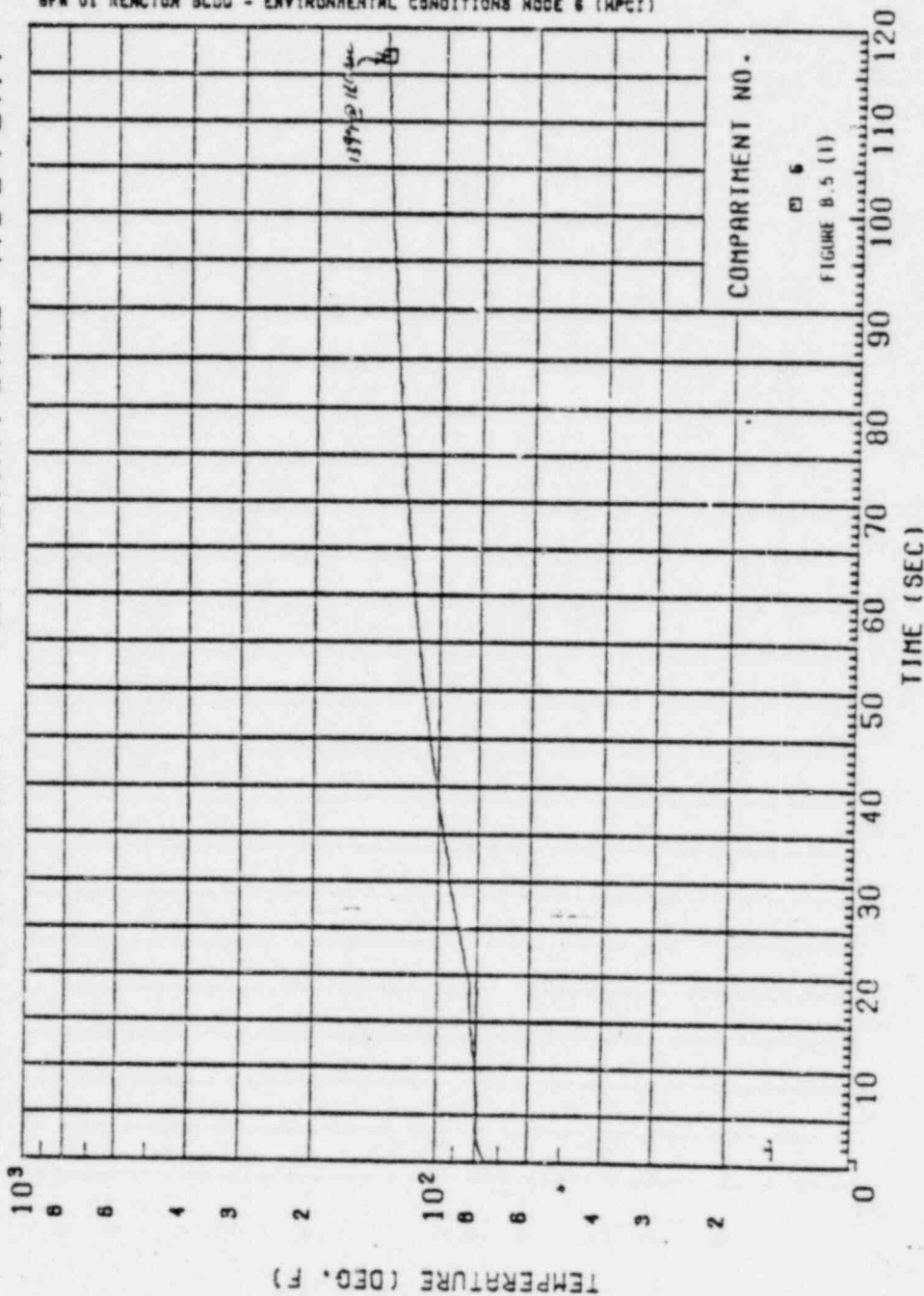
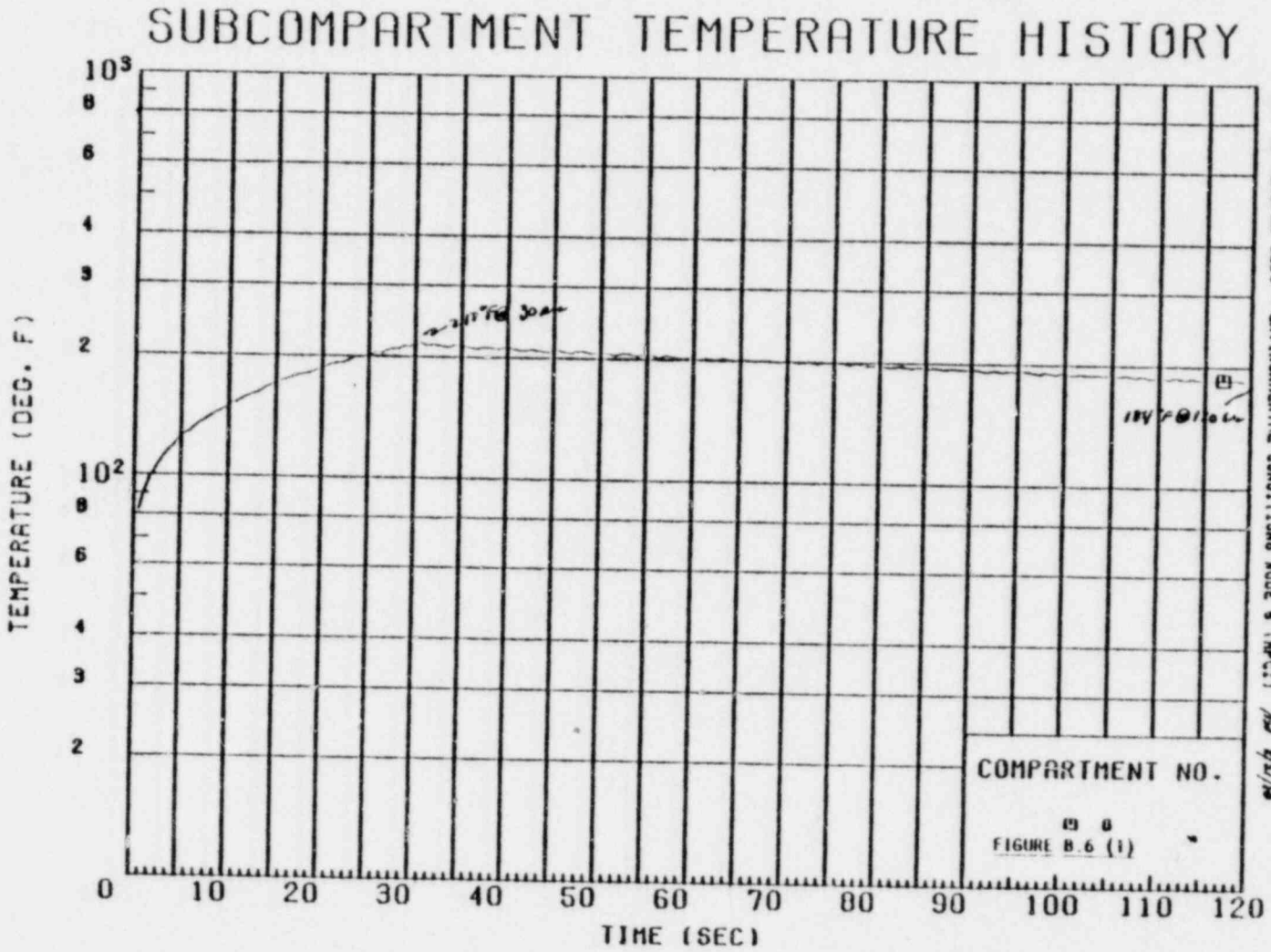


Figure B.5 (1)

Figure B.6 (1)

A-31



SPR (REV. 2) NEG. T1 NO. PRICE OF
BPN V1 REACTOR BLDG - ENVIRONMENTAL CONDITIONS MODE 8 (MPC1) \$4.50

FIGURE SUPPLIED
BY THE LICENSEE

TER-C5417-6

FIGURE SUPPLIED
BY THE LICENSEE

TER-C5417-6

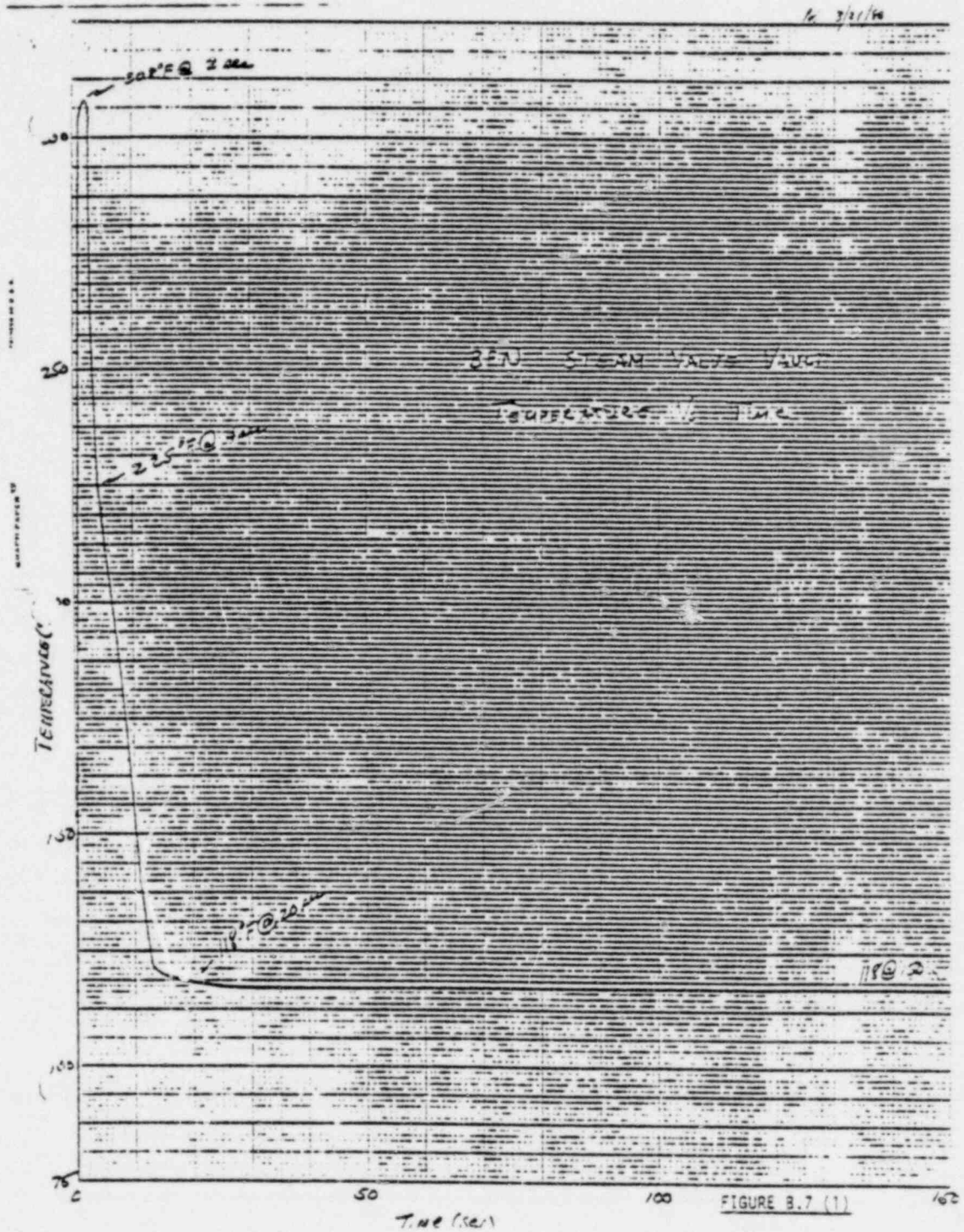
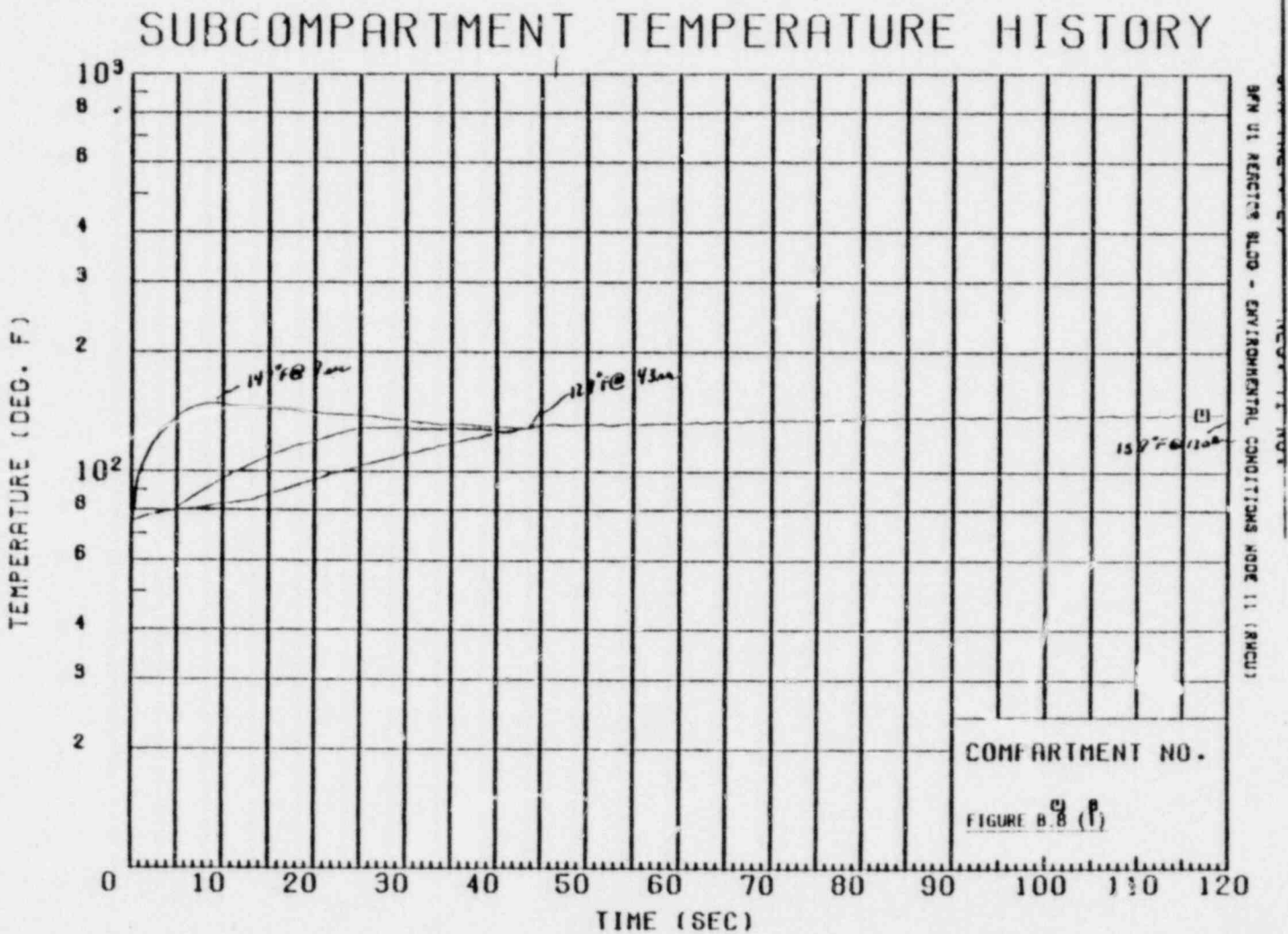


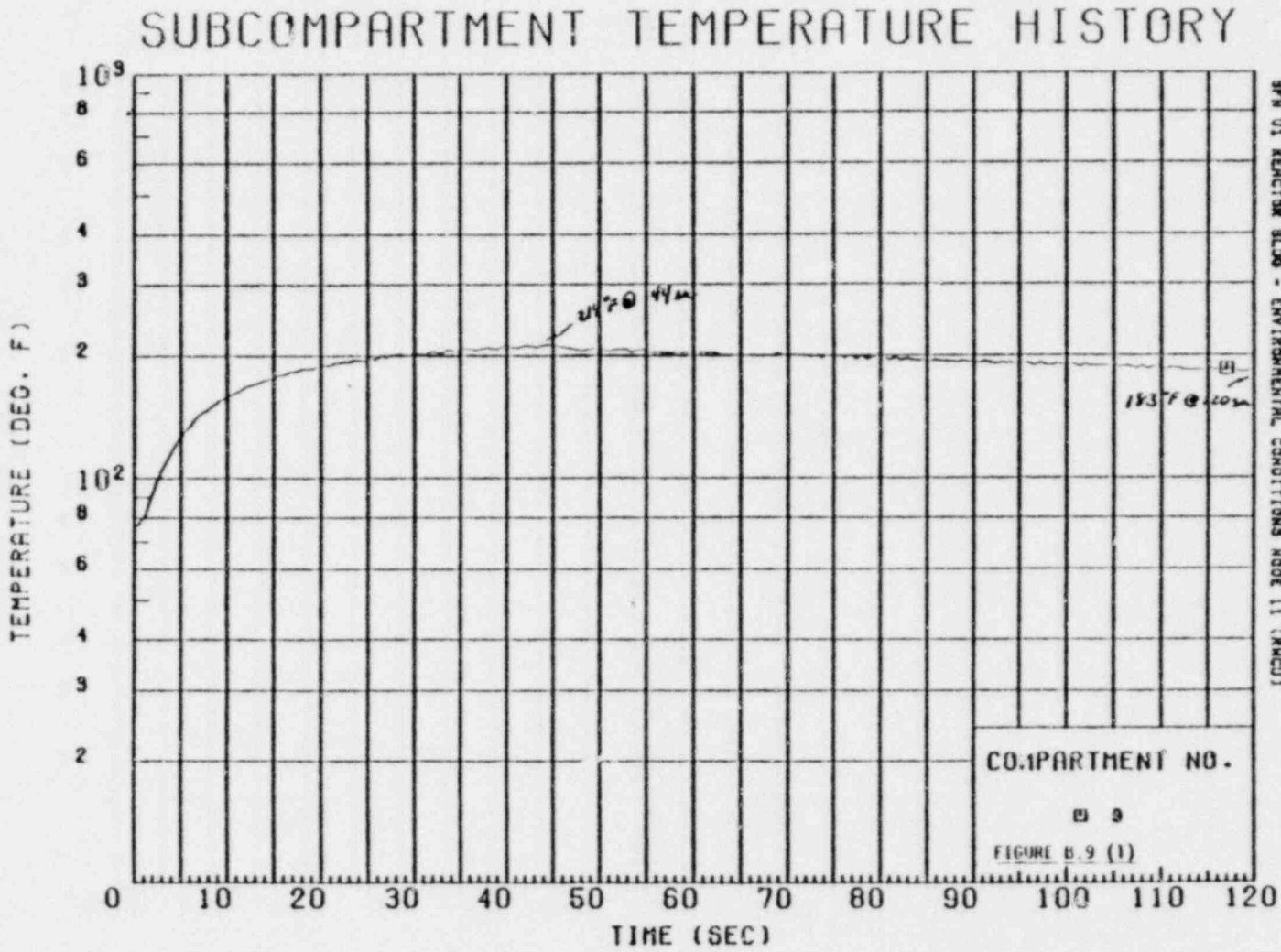
Figure B.7 (1)

Figure B.8 (1)
A-33



TER-05417-6

FIGURE SUPPLIED
BY THE LICENSEE



SPR (REV. 2) NEO. TI NU.
SPN 01 REACTOR SLUG - ENVIRONMENTAL CONDITIONS NODE 11 (RMCU)

FIGURE SUPPLIED
BY THE LICENSEE

FIGURE SUPPLIED
BY THE LICENSEE

TER-C5417-6

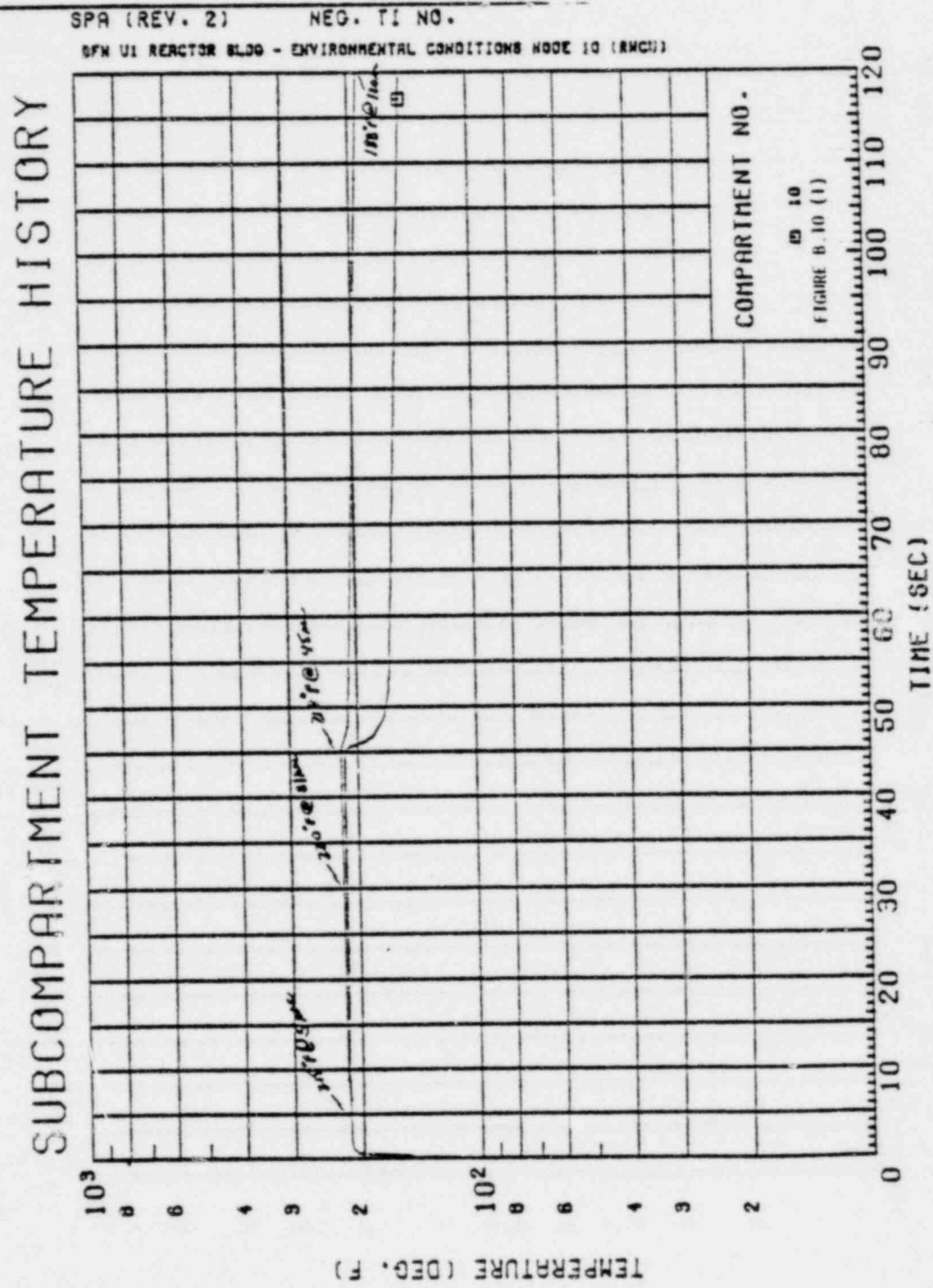
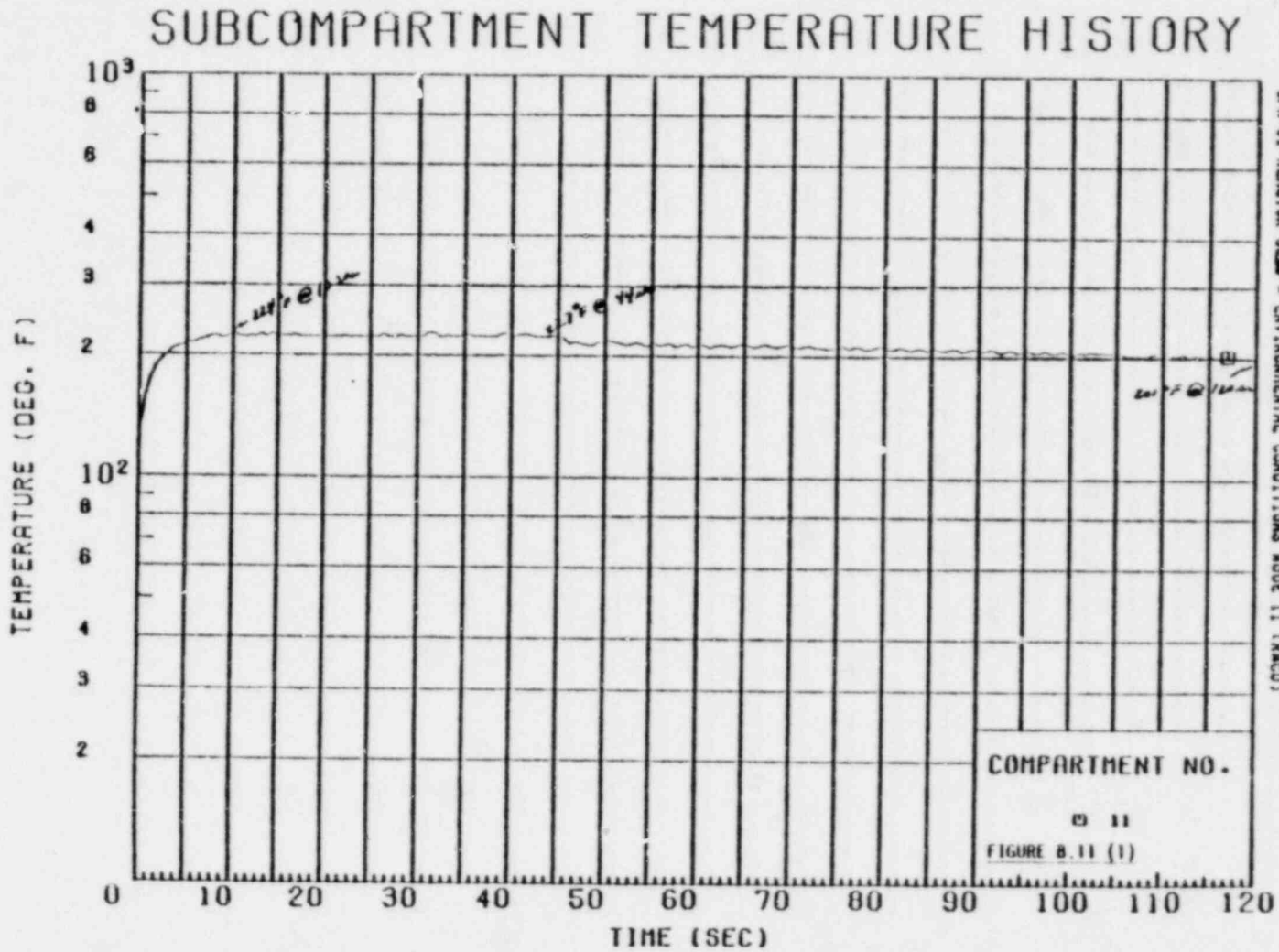


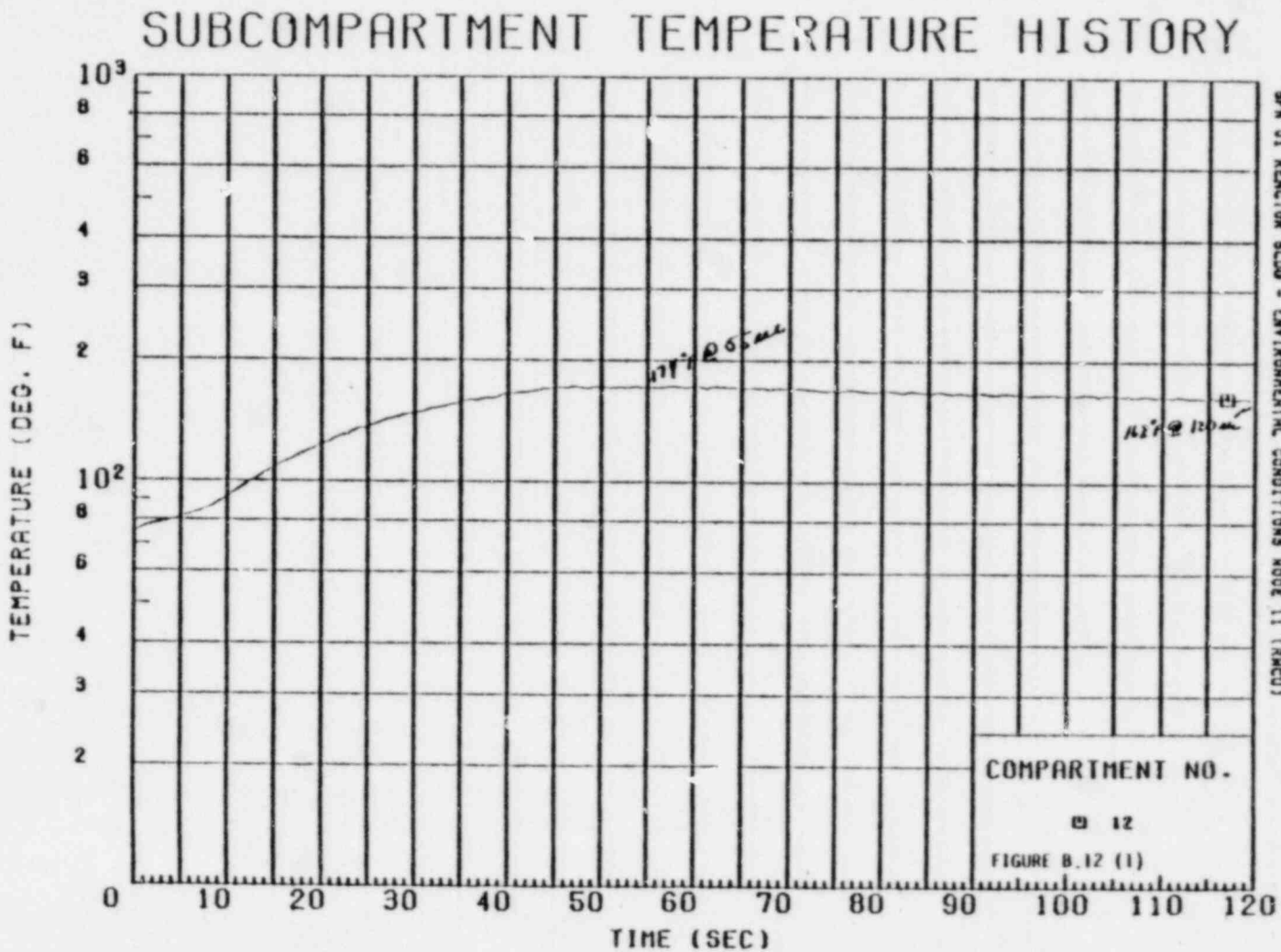
Figure B.10 - (1)

Figure B.11 (1)
A-36



SPR (REV. 2)
NEG. T1 NO.
B/N U1 REACTOR SUB - ENVIRONMENTAL CONDITIONS MODE 11 (RUCU)

FIGURE SUPPLIED
BY THE LICENSEE



SFH (REV. 2) NEG. T1 NO.
SFN 01 REACTOR BLDG - ENVIRONMENTAL CONDITIONS MODE 11 (RMCU)

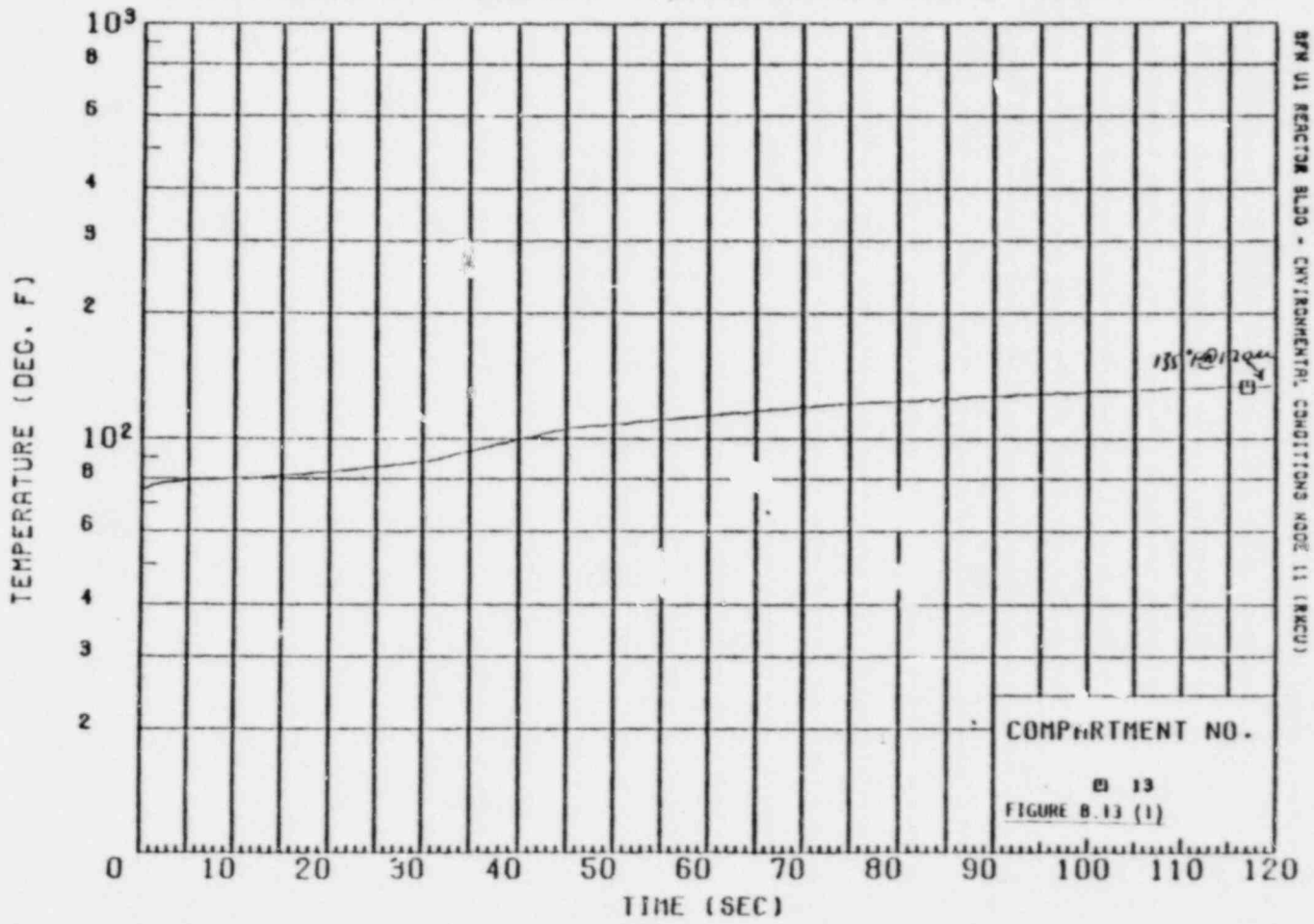
FIGURE SUPPLIED
BY THE LICENSEE

FIGURE SUPPLIED
BY THE LICENSEE

TER-C5 417-6

SPA (REV. 2) NEG. TI NO. PAGE OF
MFM U1 REACTOR BLDG - ENVIRONMENTAL CONDITIONS MODE 11 (RACU)

SUBCOMPARTMENT TEMPERATURE HISTORY



COMPARTMENT NO.
E 13
FIGURE B.13 (1)

FIGURE SUPPLIED
BY THE LICENSEE

TER-C5417-6

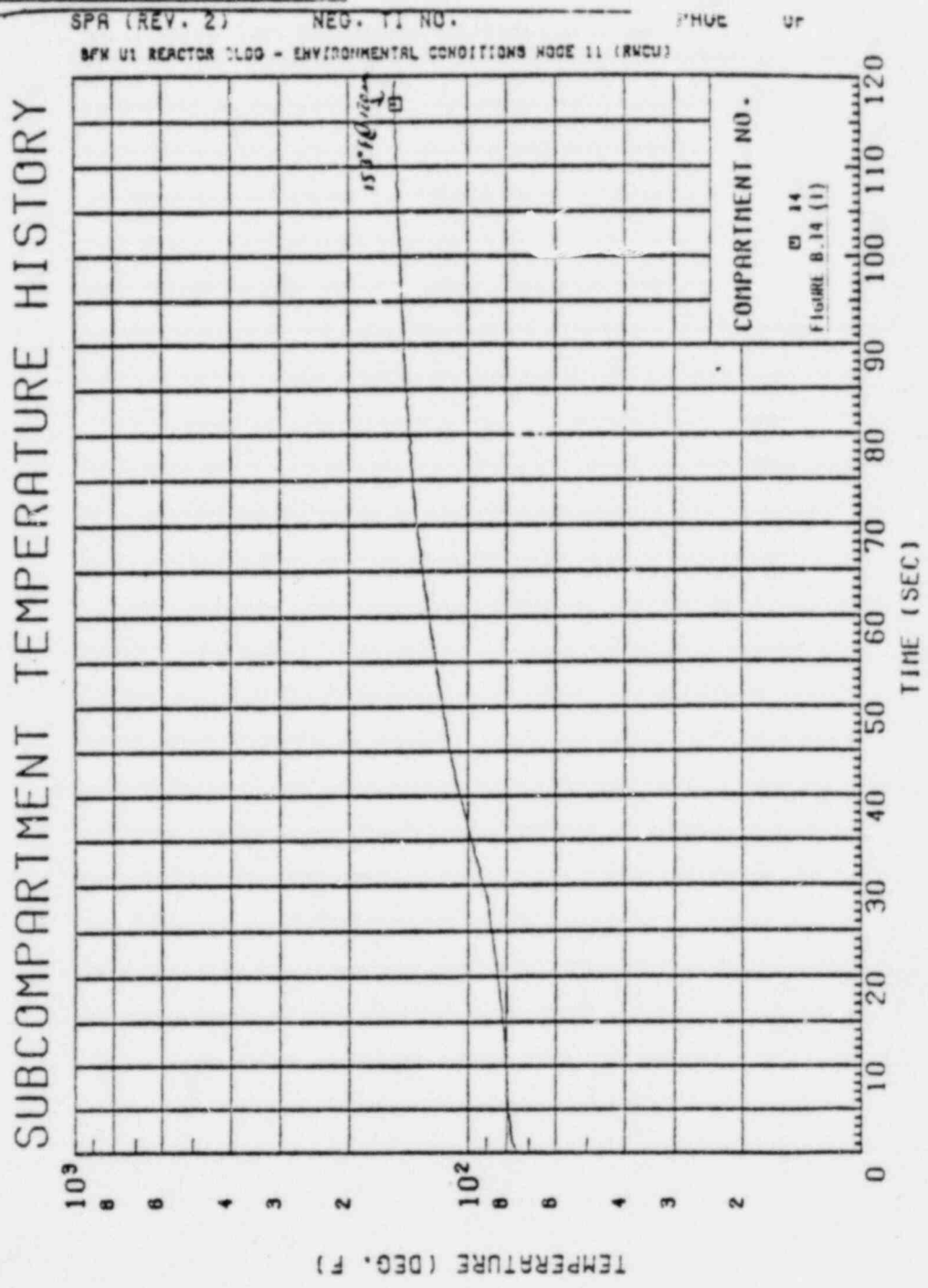


Figure B.14 (1)

FIGURE SUPPLIED
BY THE LICENSEE

TER-CS 417-6

SUBCOMPARTMENT TEMPERATURE HISTORY

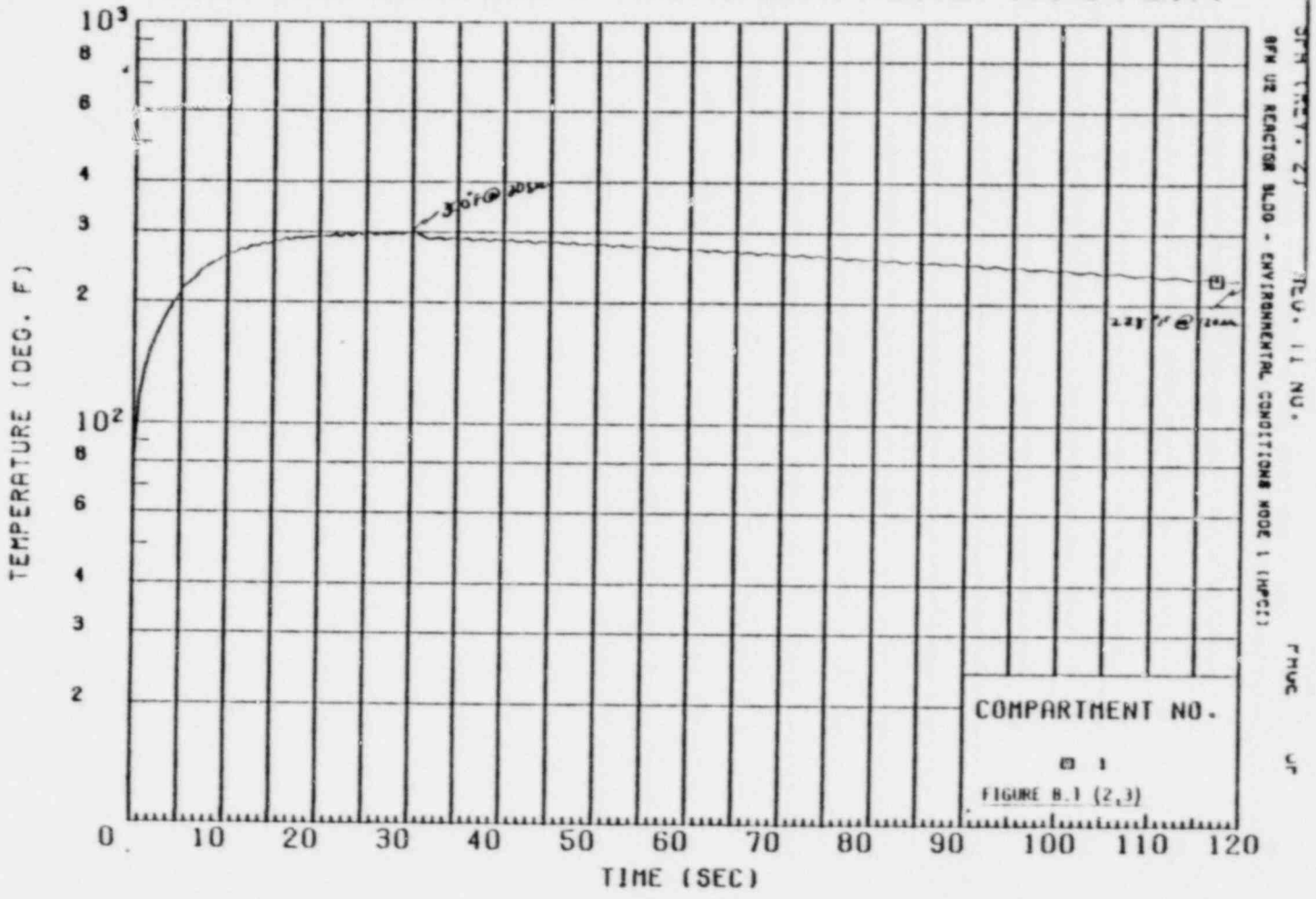


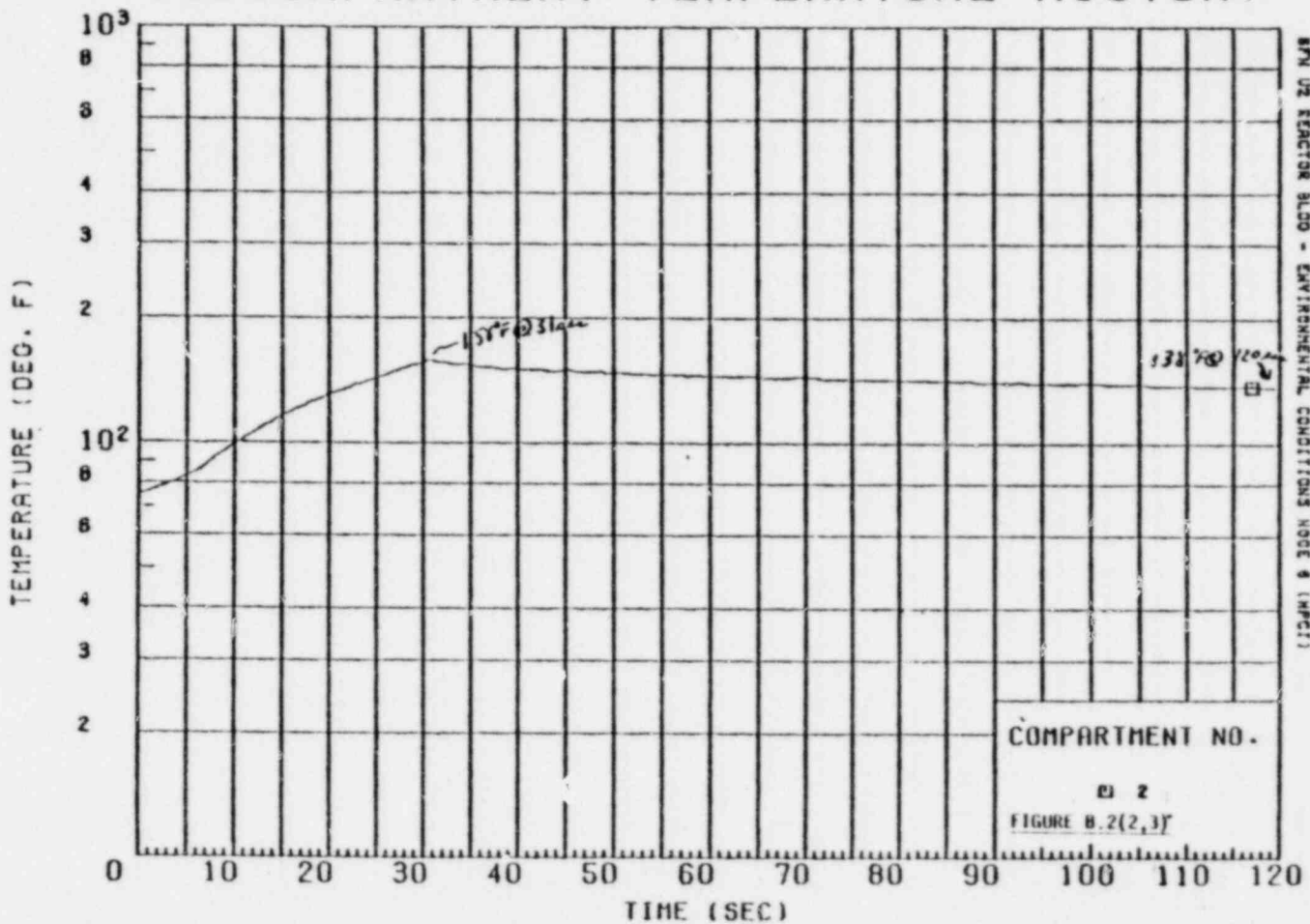
Figure B.1 (2,3)

A-40

Figure B.2 (2,3)

A-41

SUBCOMPARTMENT TEMPERATURE HISTORY



SPR. (REV. 2) NEQ. T1 NO. PRCE OF
 RPN UZ REACTOR BLDG - ENVIRONMENTAL CONDITIONS HOSE & IMPCT)

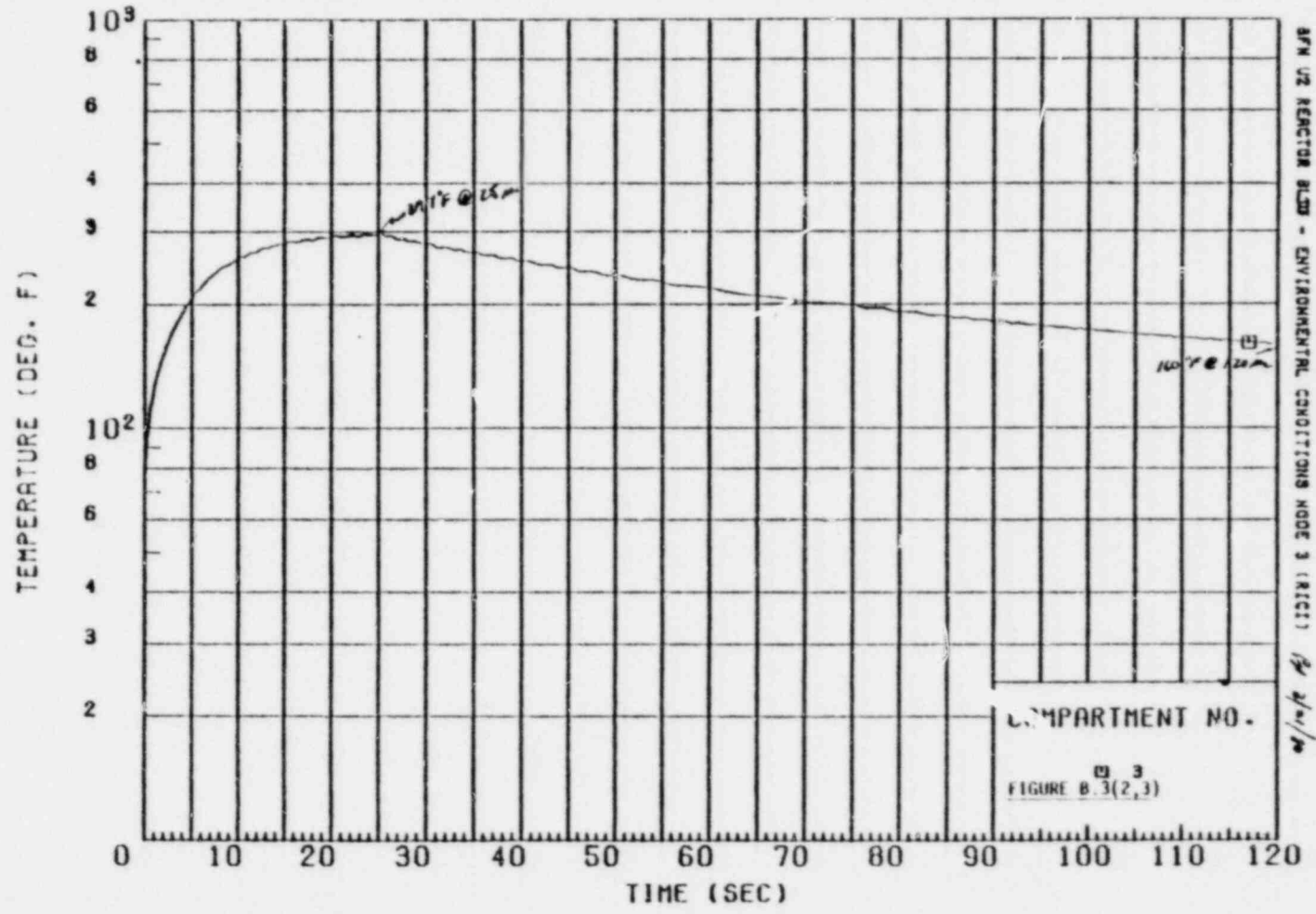
FIGURE SUPPLIED
 BY THE LICENSEE

TER-C5417-6

Figure B.3 (2,3)

A-42

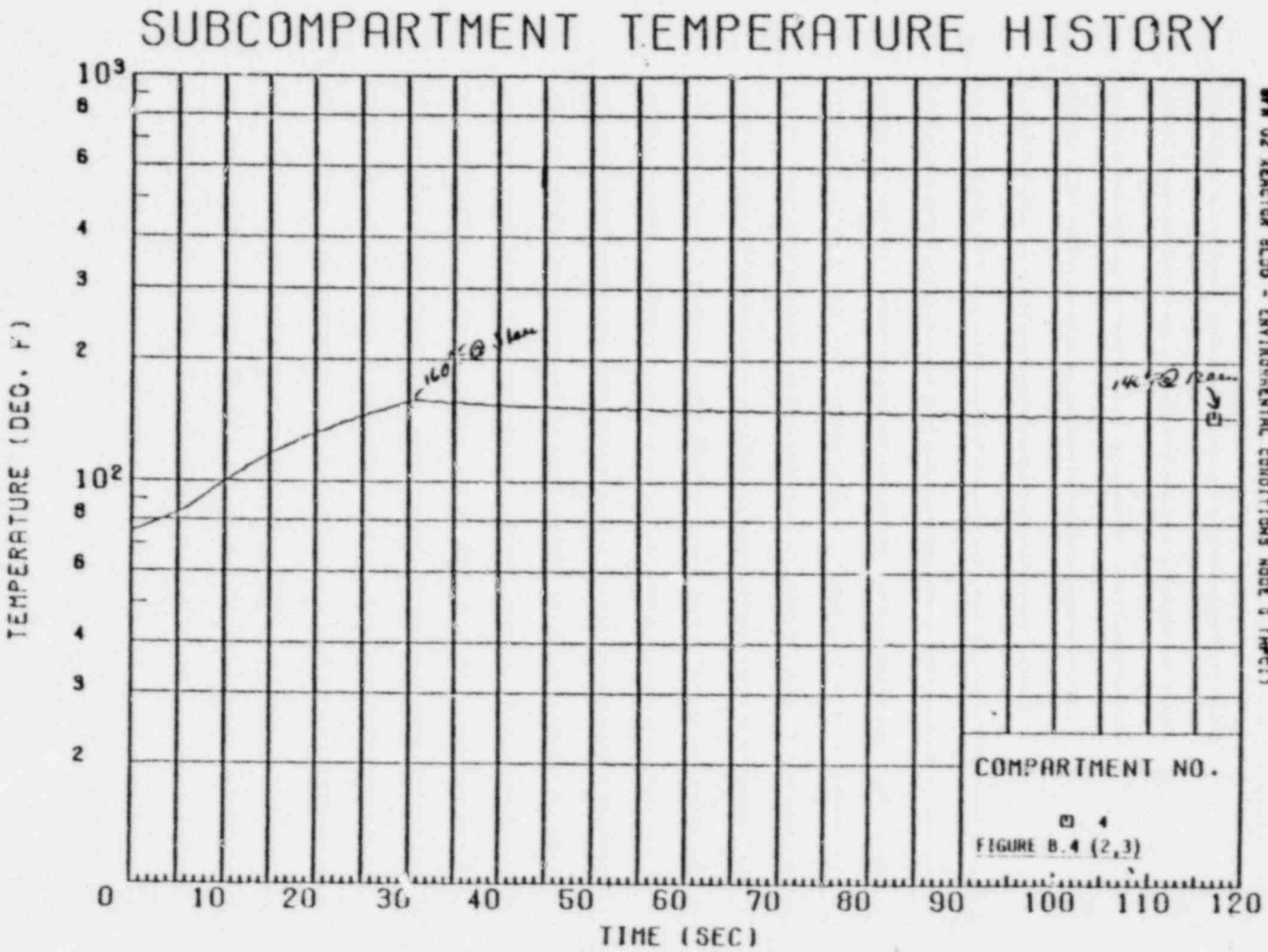
SUBCOMPARTMENT TEMPERATURE HISTORY



SPH (REV. 2) REQ. TI NO. PAGE OF
AFM VZ REACTOR BLDG - ENVIRONMENTAL CONDITIONS MODE 3 (RICE) 2/2/70

FIGURE SUPPLIED
BY THE LICENSEE

Figure B.4 (2,3)



SPR (REV. 2) NEG. TI NO. PAGE 0F
BWR U2 REACTOR BLDG - ENVIRONMENTAL CONDITIONS NODE 2 (MPC1)

FIGURE SUPPLIED
BY THE LICENSEE

FIGURE SUPPLIED
BY THE LICENSEE

TER-CS417-6

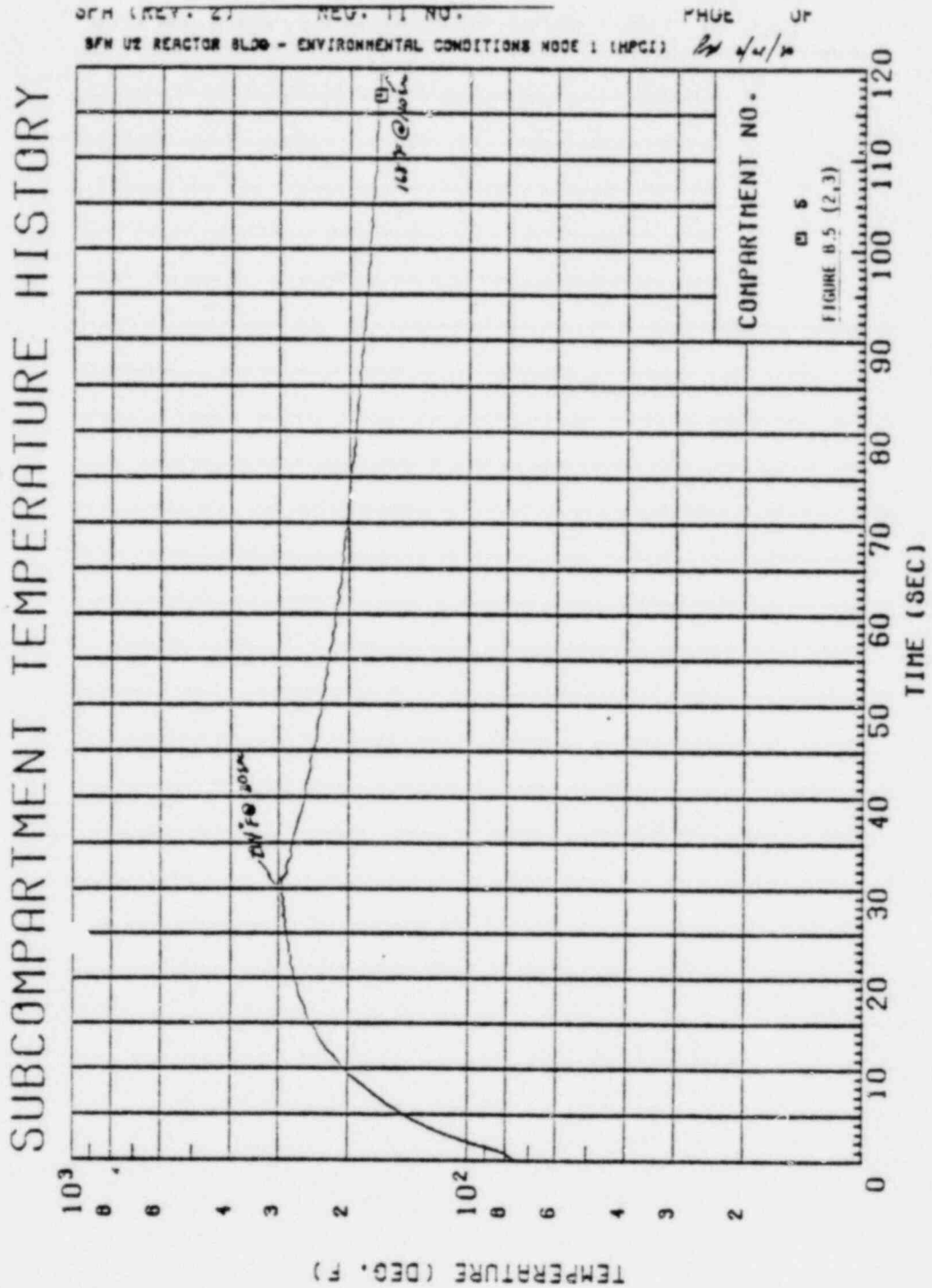


Figure B.5 (2,3)

FIGURE SUPPLIED
BY THE LICENSEE

TSR-05417-6

SUBCOMPARTMENT TEMPERATURE HISTORY

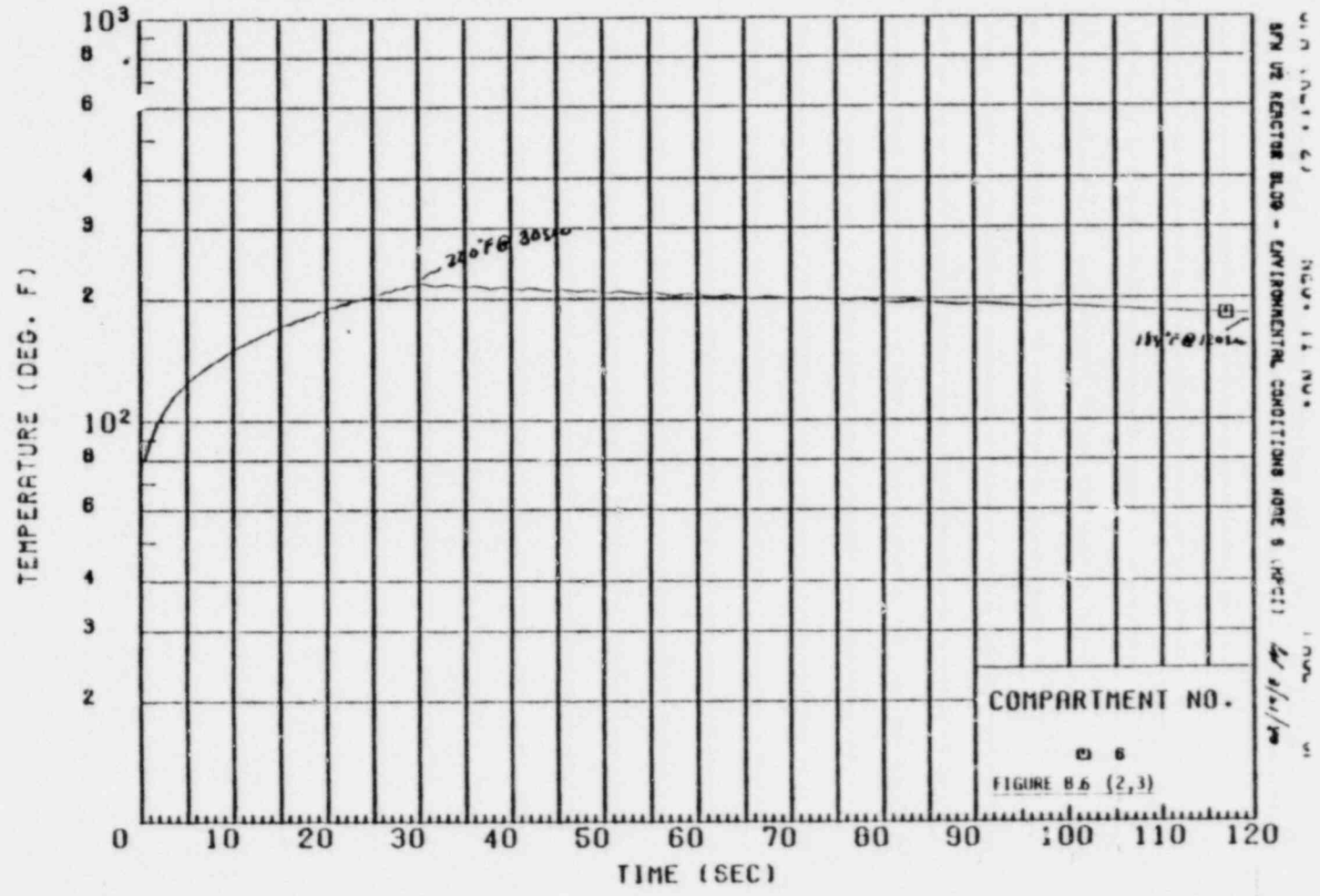


Figure B.6 (2,3)

A-45

FIGURE SUPPLIED
BY THE LICENSEE

TER-C5417-6

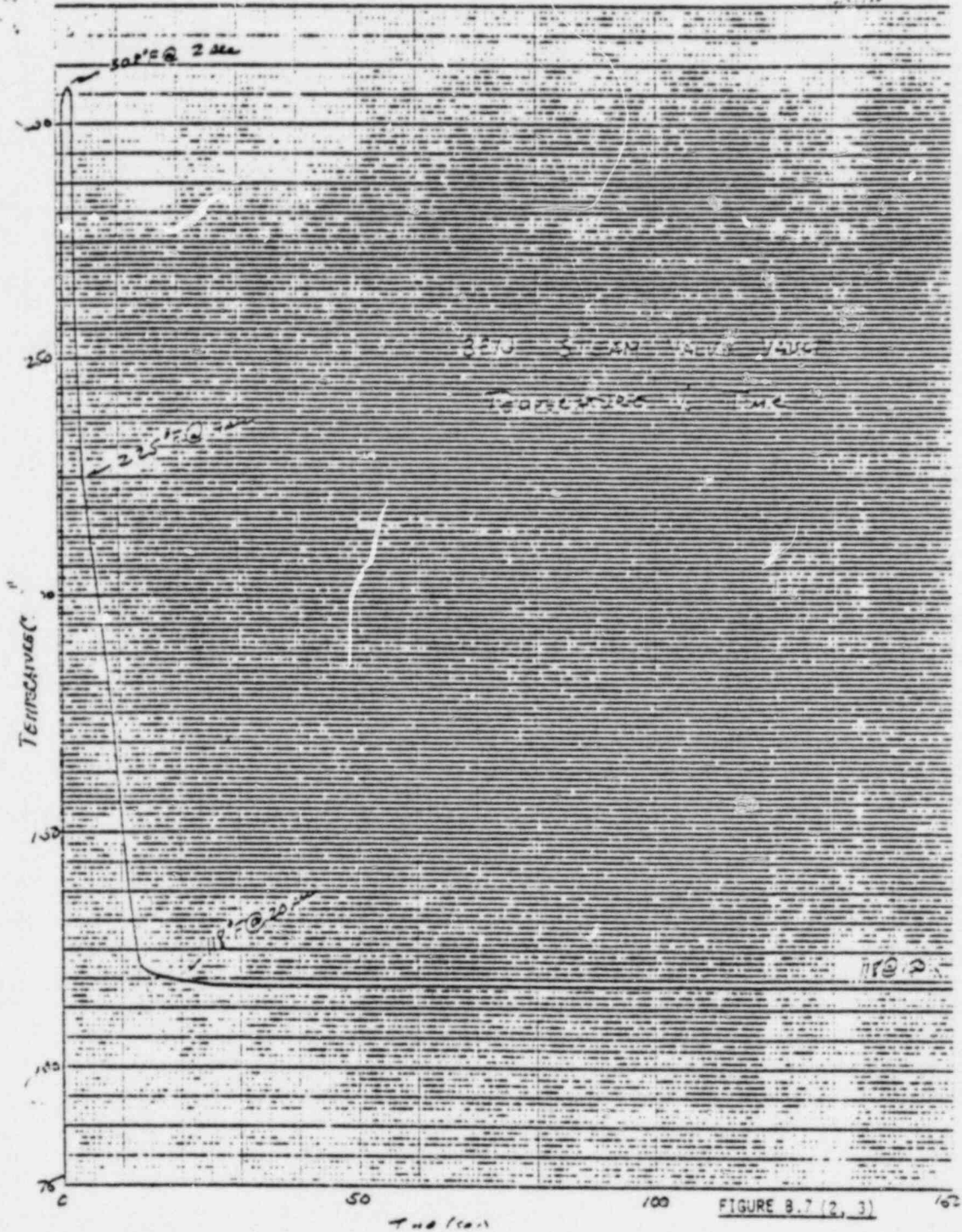


Figure B.7 (2,3)

Figure B.8 (2,3)

A-47

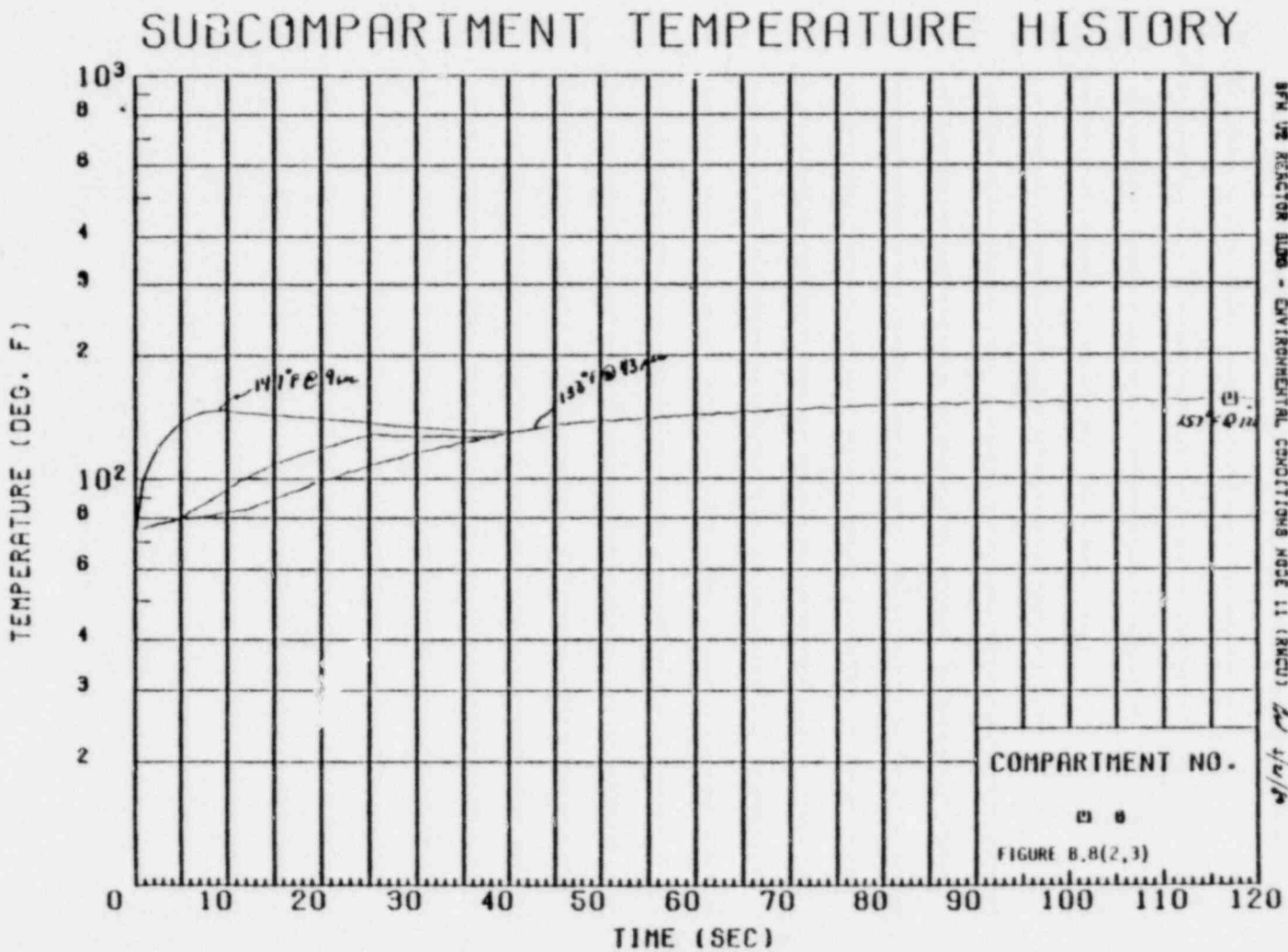
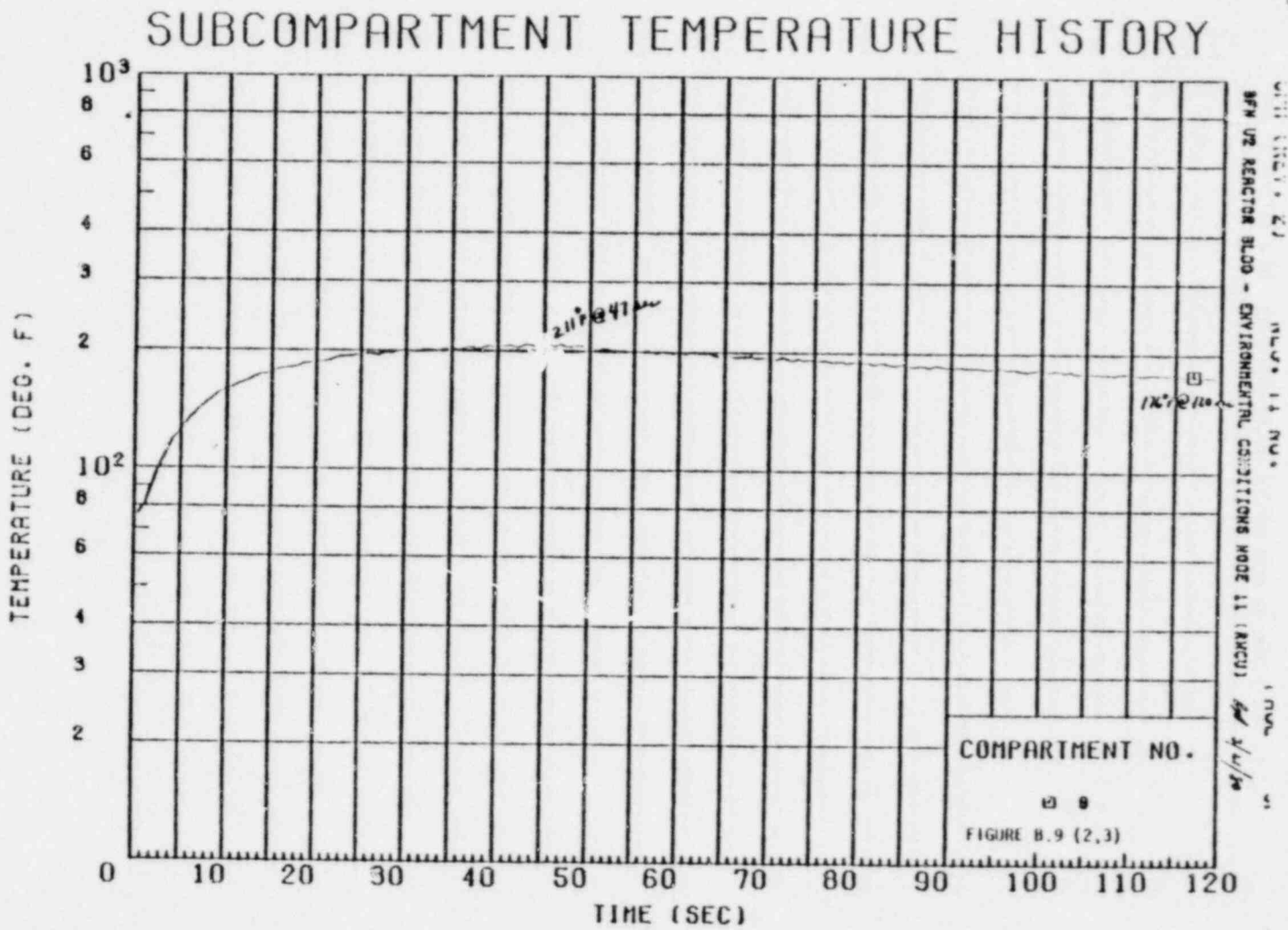


FIGURE SUPPLIED
BY THE LICENSEE



TER-CS 417-6

FIGURE SUPPLIED
BY THE LICENSEE

Figure B.10 (2,3)

A-49

SUBCOMPARTMENT TEMPERATURE HISTORY

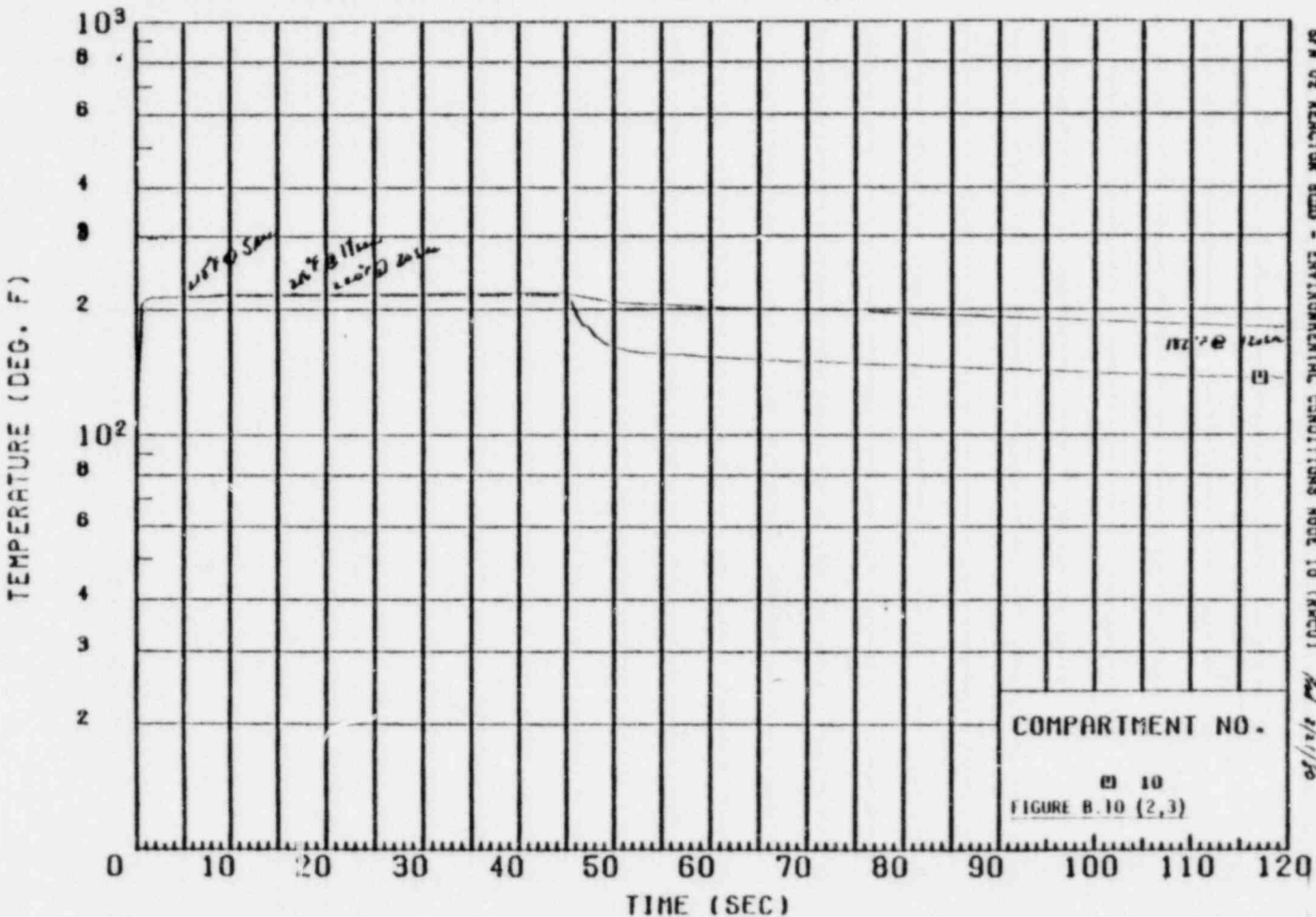


FIGURE SUPPLIED
BY THE LICENSEE

FIGURE SUPPLIED
BY THE LICENSEE

TER-C5417-6

SFH (REV. 2) NEG. TI NO. PROJ OF
S/M US REACTOR BLDG - ENVIRONMENTAL CONDITIONS MODE 11 (RUCU) 3/1/70

SUBCOMPARTMENT TEMPERATURE HISTORY

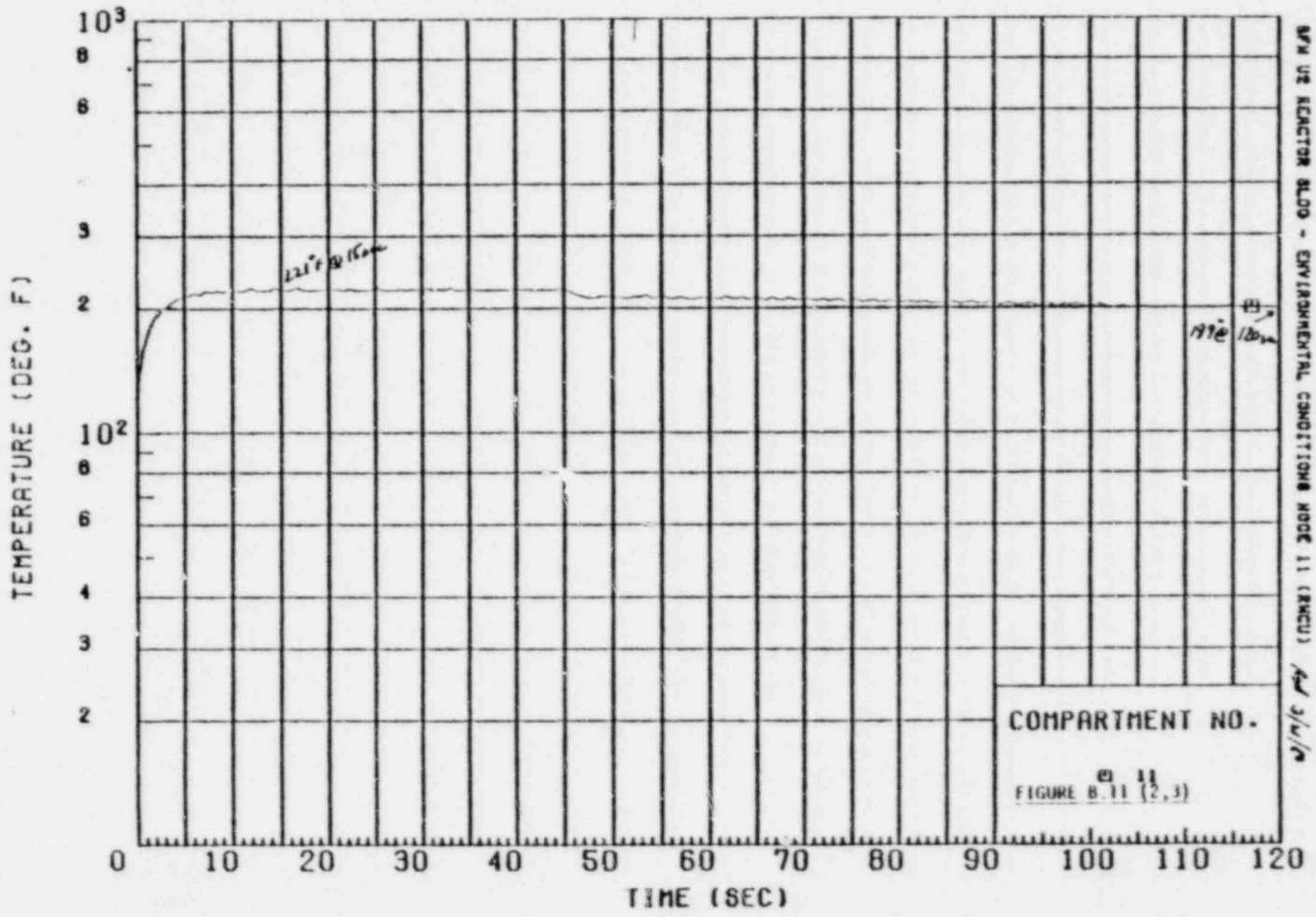


Figure B.11 (2,3)

FIGURE SUPPLIED
BY THE LICENSEE

SUBCOMPARTMENT TEMPERATURE HISTORY

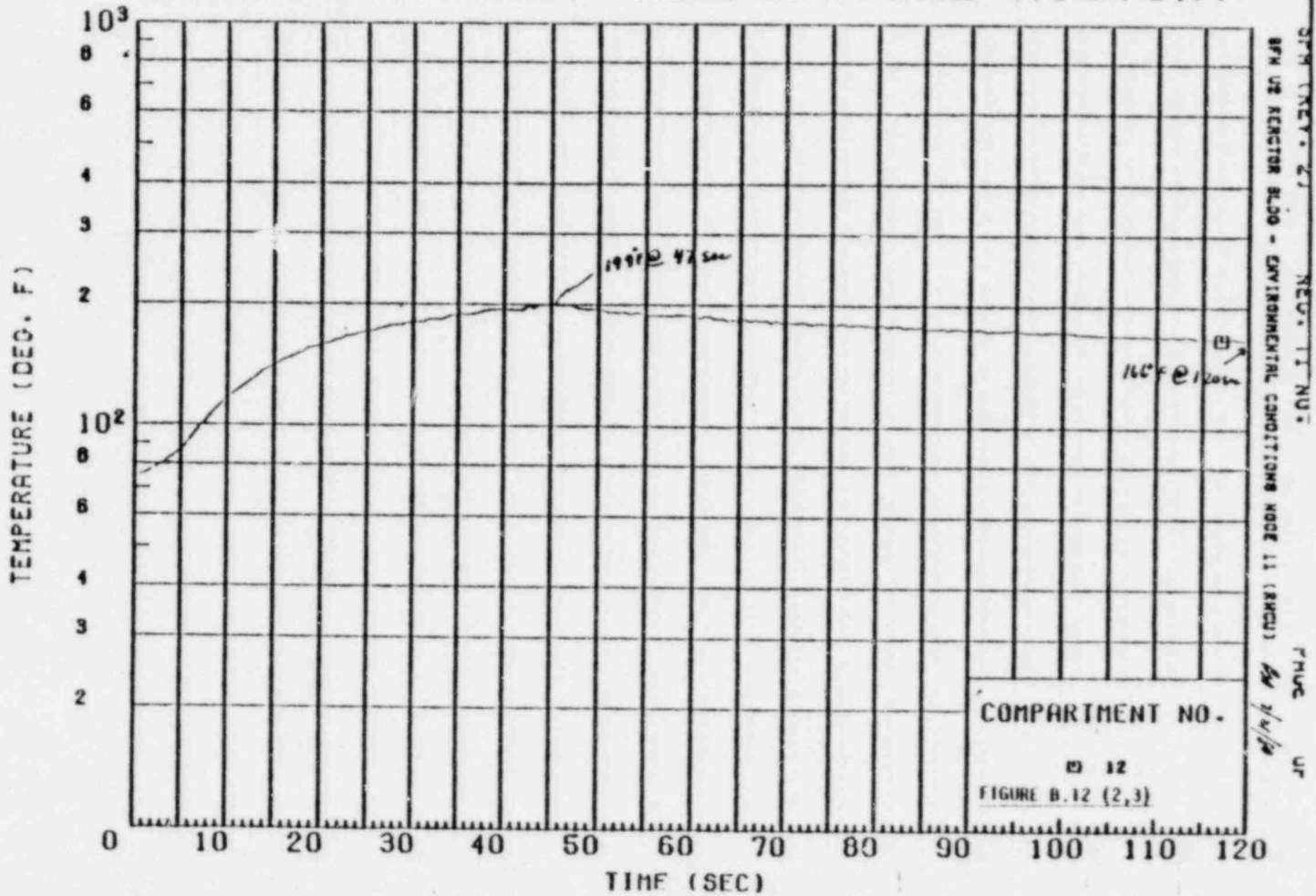
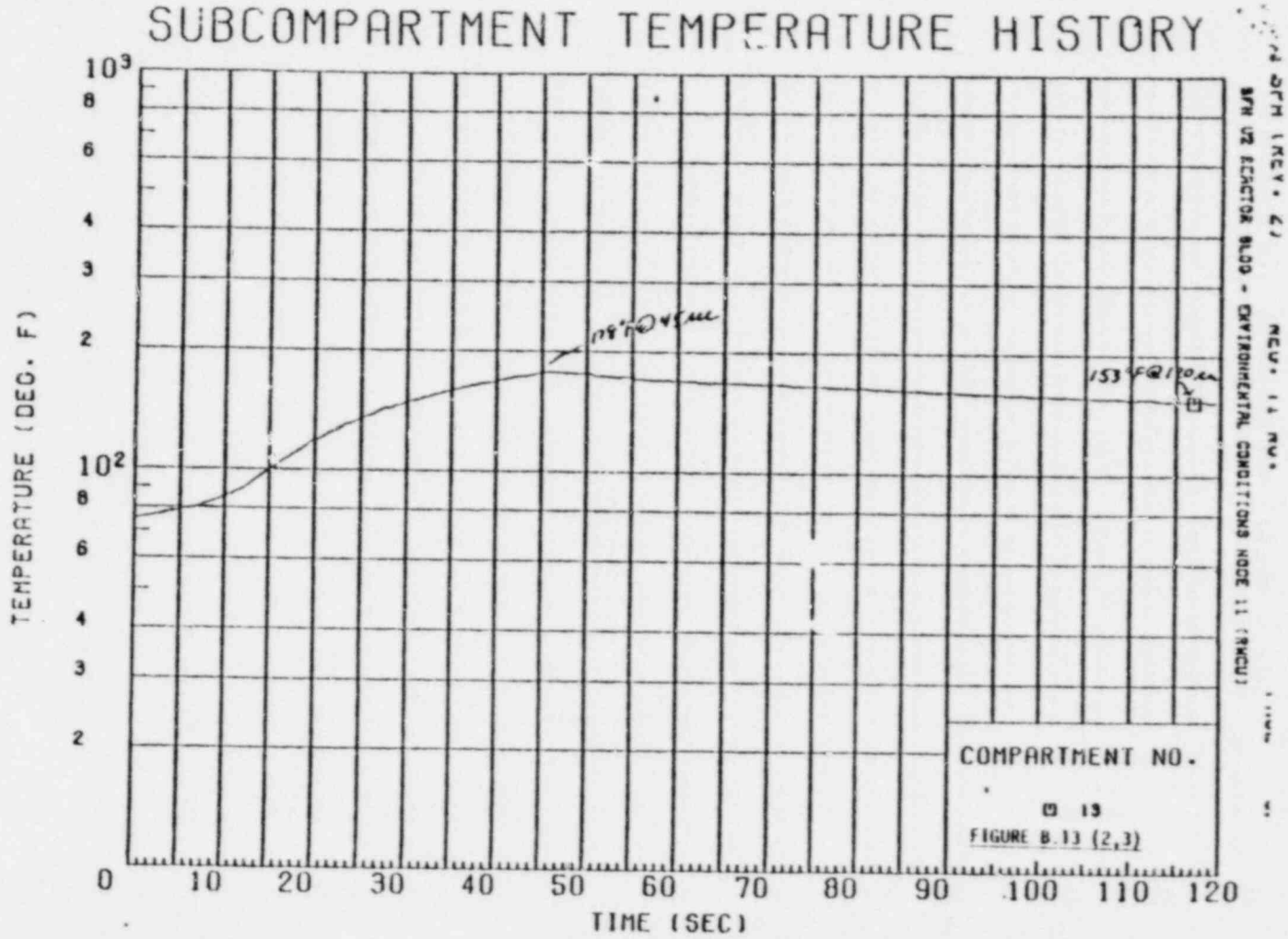


FIGURE SUPPLIED
BY THE LICENSEE

Figure B.13 (2,3)

A-52



TER-C5417-6

Figure B.14 (2,3)

A-53

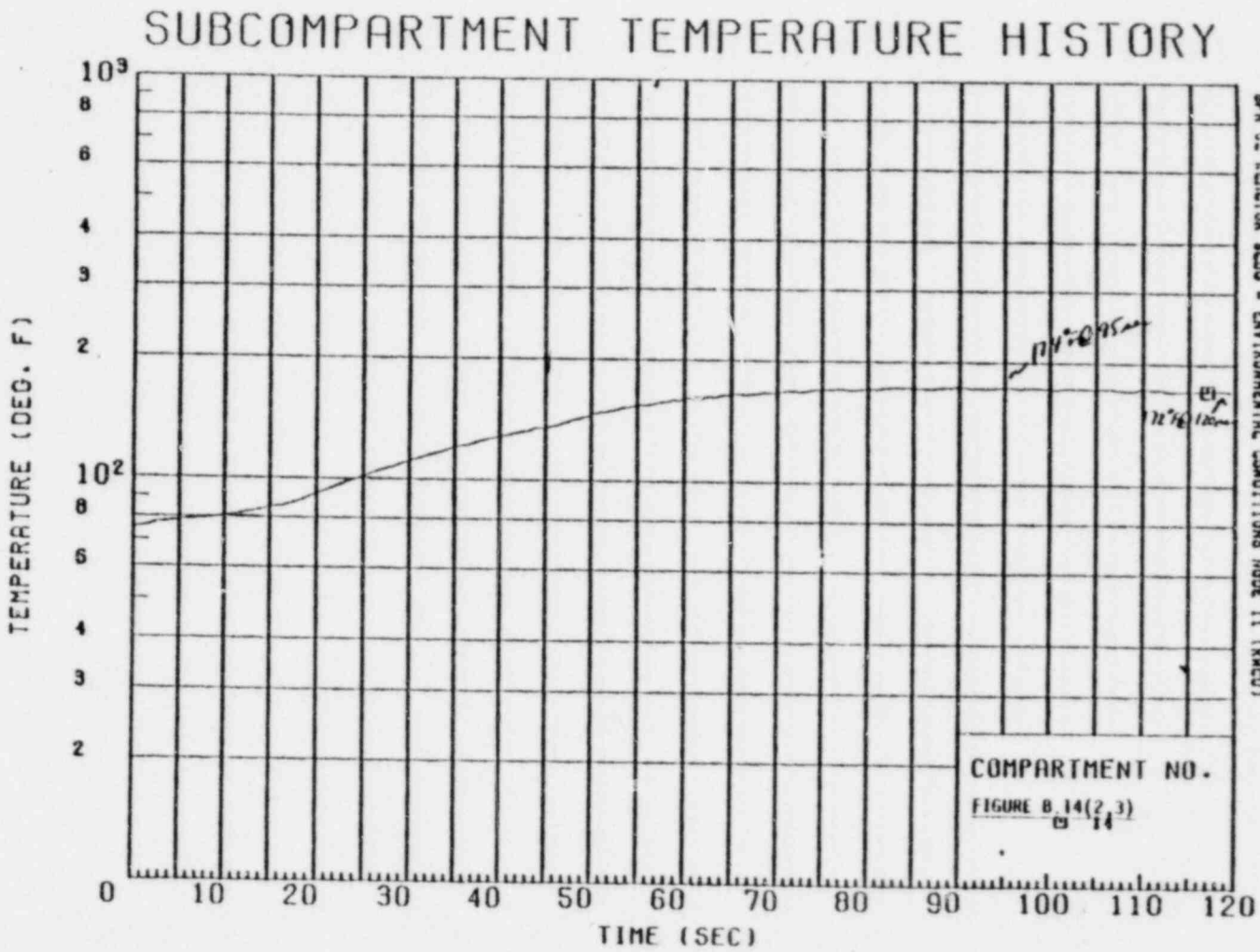


FIGURE SUPPLIED
BY THE LICENSEE

With respect to environmental service conditions, the Licensee has stated:

A. Service Conditions

The environmental conditions present in plant areas that can affect safety-related equipment have been established. The following categories were used to bound anticipated plant conditions.

1. Normal - The temperature, pressure, humidity, and radiation ranges that are expected to be present when the plant is in any of the technical specification modes of operation.
2. Abnormal- Conditions that could exist for all areas for a short period of time that may occur once or more a year.
3. Accident- Environmental conditions that would be experienced as a result of high energy pipe breaks outside containment, or a large, intermediate or small LOCA or main stream line break inside containment.

All analyses performed to determine the service conditions were performed consistent with the guidelines of IE Bulletin 79-01B and NUREG-0588 and in accordance with either TVA quality assurance procedure EP 3.03 or General Electric's internal quality assurance program.

B. Temperature and Pressure Inside Containment

The controlling breaks for the pressure response of the drywell and wetwell and the temperature response of the wetwell are the large LOCA Design Basis Accident (DBA) and the Intermediate Break Accident (IBA). The DBA and a 0.5 ft² steam leak produce the most severe temperature transient in the drywell. The containment pressure and temperature response for all breaks were evaluated by the methods discussed in General Electric Report No. NEDO-20533, June 1974. Mass and energy releases were calculated using the methods also discussed in the above General Electric report. Details of the analyses are provided in FSAR, section 14 and General Electric Report NEDO-24580.

C. Outside Containment

High Energy Line Breaks

Plant areas outside containment were reviewed to determine areas where high energy piping was located and could potentially produce effects that would impact safety-related equipment. The areas affected by high energy line breaks are the reactor building and the main steam valve vaults.

1. Reactor Building

The high energy lines located in the reactor building are:

- (1) High Pressure Coolant Injection (HPCI) steam supply to the pump turbine - 547°F, 1020 psia, quality - 1.
- (2) Reactor Core Isolation Cooling (RCIC) supply to the RCIC pump turbine - 547°F, 1020 psia, quality - 1.
- (3) Reactor Water Cleanup (RCU) system - 547°F, 1020 psia, quality - 0.

Single-ended circumferential ruptures at the fluid conditions listed above were postulated. Mass and energy releases for all steam supply lines except one break of the RCU were generated using the Moody critical flow correlation assuming an fL/D equal to zero. Upstream pressure and temperature, and therefore mass flow rates, were assumed to remain constant until the line was isolated. These steam supply lines isolate automatically on high temperature in the reactor building. Temperature sensors are located in the vicinity of the line to assure rapid detection and isolation. Isolation times include signal process time, valve stroke time, and break detection time. The sensors used are redundant, class 1E, and electrically trained.

Mass and energy release of the remaining RCU break was generated using the RETRAN computer code. Only this break requires operator action for isolation. Isolation was assumed to occur 10 minutes after the break is. Detection based on high fluid temperature at the discharge of the nonregenerative heat exchangers.

The steam valve vault was modeled using three nodes and were input into the COMPARE-MOD1 computer code. No heat sinks were considered.

The valve vaults at Browns Ferry were constructed with large blowout panels to provide pressure relief to the turbine building in the event of a pipe break. These paths were included in the model.

2. Radiation Environment

The radiation environments inside the drywell and in the reactor building after a design basis LOCA were calculated consistent with the requirements of IE Bulletin 79-01B and NUREG-0588.

Initial airborne sources in the drywell were calculated assuming an instantaneous release of 100 percent of the core inventory of iodine. Transfer of iodine from the drywell free volume to the water in the torus was conservatively calculated as a function of time until the airborne concentration was reduced by a factor of 200 (considered to be at equilibrium). Sources in the water in the torus were calculated assuming an instantaneous release of 1 percent of the core inventory of the solid fission products and the iodine transferred from the drywell. Airborne activity in the reactor building was calculated based on a design basis leak rate from the primary containment and design flow of the SGTs.

Source terms were calculated at various time after an accident allowing for decay and dose rates were calculated with a point-kernel-with-buildup computer code. Radiation exposures in the reactor building due to recirculation of the torus water through the RHR and containment spray systems were also calculated. These dose rates were then integrated over the duration of the accident.

3. Main Steam Valve Vaults

The high energy lines in the valve vaults are the main steam lines and the main feedwater lines. Breaks in the main steam line are controlled from an environmental standpoint due to the large line size and the high energy associated with the steam. Conditions of the main steam are 550°F, 1050 psia, quality - 1.

A double-ended rupture of the main steam coincident with a break of the 4-inch RCIC steam line was evaluated. Mass and energy releases were provided by General Electric. Break flow was terminated by isolation of the main steam lines based on signals from safety-related sensors.

4. Operation Environmental Conditions

An environmental listing of service conditions are tabulated in Table 1. The service conditions considered were pressure, temperature, humidity, and radiation. Normal and abnormal space ambient temperatures for nonaccident conditions were obtained from information used in the initial design phase of the plant in conjunction with data accumulated at the plant site in various spaces, for all units, under extreme outside temperature conditions (100°F outside atmosphere). Pressures and temperatures for accident conditions were obtained from transient curves and analysis which studied the effects of a LOCA on reactor zone spaces. Environmental service and conditions were only considered in the reactor zone and primary containment. The control bay and electrical board room were not considered since their atmospheres did not interface with the reactor zone environment. The environmental table of service conditions was developed for various plant conditions including the following: normal average day, abnormal conditions (outside temperature 96-100° and maximum river water temperature exists), LOCA/HELB inside primary containment, HELB outside primary containment, and tornado (sudden pressure drop by 3 pounds per square inch).

APPENDIX B - EQUIPMENT ITEM TABLE

This appendix contains the list of safety-related electrical items for Browns Ferry Nuclear Plant Unit 3 provided by the Licensee in the October 31 response to IE Bulletin 79-01B. This listing shows the equipment items by manufacturer and model number, plant locations, and time required to function as determined by the Licensee.

PLANT NAME: BROWNS FERRY 3

<u>ITEM NO.</u>	<u>EQUIPMENT ITEM DESCRIPTION</u>	<u>LOCATION</u>	<u>LICENSEE SUBMITTAL PAGE REFERENCES</u>	<u>QUALIFICATION REFERENCES</u>
1	Solenoid Valve	8	EEB-32-1001	None
	AAA	8	EEB-32-1002	None
	SO2			
2	F Indicating Switch	12	EEB-43-1001	None
	Fischer & Porter 10A2235A-55AR1011	12	EEB-43-1002	None
3	Differential Pressure Switch Dwyer 3302	14	EEB-64-1001	None
		14	EEB-64-1002	None
		14	EEB-64-1003	None
		14	EEB-64-1004	None
		14	EEB-64-1005	None
		15	EEB-64-1006	None
		15	EEB-64-1007	None
		15	EEB-64-1008	None
		15	EEB-64-1009	None
		15	EEB-64-1010	None
		15	EEB-64-1011	None
		15	EEB-64-1012	None
		14	EEB-64-1026	None
		14	EEB-64-1041	None
15	EEB-64-1042	None		
4	Solenoid Valve ASCO HB830281RU	15	EEB-64-1013	None
		15	EEB-64-1023	None
		12	EEB-64-1024	None
		14	EEB-64-1025	None
		14	EEB-64-1028	None
5	Differential Pressure Modifier Honeywell R7165-1078 Relay Assm. 122700 Terminal Assm.	14	EEB-64-1014	None
		15	EEB-64-1015	None
		15	EEB-64-1038	None
6	Differential Pressure Indicator Controller Fischer & Porter 53EL3311BB1B ESL-01	14	EEB-64-1016	None
		15	EEB-64-1017	None
		15	EEB-64-1018	None

<u>ITEM NO.</u>	<u>EQUIPMENT ITEM DESCRIPTION</u>	<u>LOCATION</u>	<u>LICENSEE SUBMITTAL PAGE REFERENCES</u>	<u>QUALIFICATION REFERENCES</u>
7	Differential Pressure	14	EEB-64-1019	None
	Transmitter	15	EEB-64-1020	None
	Fischer & Porter	15	EEB-64-1021	None
	10B2494TBAB			
8	Solenoid Valve	8	EEB-64-1022	None
	ASCO	8	EEB-64-1034	None
	HV200-924-2	8	EEB-64-1035	None
9	Temperature Element Weed SP6011AA3C2755N42	6	EEB-64-1027	None
10	Temperature Element	0	EEB-64-1039	None
	Weed SP6011AA3C2755N42	0	EEB-64-1040	None
11	Solenoid Valve	13	EEB-64-1029	None
	ASCO	13	EEB-64-1030	None
	HB830081RU	15	EEB-64-1031	None
		15	EEB-64-1032	None
12	Flow Transmitter GE/MAC 50-554212BKZ23	14	EEB-65-1001	None
13	Solenoid Valve	8	EEB-67-1001	None
	ASCO	9	EEB-67-1002	None
	HT8262A203A	9	EEB-67-1003	None
14	Pressure Transmitter	9	EEB-67-1007	None
	Bailey 551	8	EEB-67-1008	None
15	Flow Transmitter	12	EEB-84-1007	None
	GE/MAC 555	12	EEB-84-1008	None
16	Temperature Switch	12	EEB-69-1001	None
	Fenwal	12	EEB-69-1002	None
	18002-27	12	EEB-69-1003	None
		12	EEB-69-1004	None
		16	EEB-69-1005	None
		16	EEB-69-1006	None
		16	EEB-69-1007	None
	16	EEB-69-1008	None	

<u>ITEM NO.</u>	<u>EQUIPMENT ITEM DESCRIPTION</u>	<u>LOCATION</u>	<u>LICENSEE SUBMITTAL PAGE REFERENCES</u>	<u>QUALIFICATION REFERENCES</u>
17	Solenoid Valve	3	EEB-71-1001	None
	ASCO	3	EEB-71-1002	None
	HTX8300B61U			
18	Solenoid Valve	6	EEB-74-1001	None
	ASCO	6	EEB-74-1002	None
	8300C61U	6	EEB-74-1003	None
		6	EEB-74-1004	None
		4	EEB-77-1006	None
19	Solenoid Valve	3	EEB-75-1002	None
	ASCO	3	EEB-75-1004	None
	HB830081F			
20	Solenoid Valve	12	NEB-64-49A	None
	ASCO			
	HB830081F			
21	Solenoid Valve	8	NEB-64-053A	32
	ASCO			
	HB830081F			
22	Solenoid Valve	6	EEB-76-1001	33
	Valcor	6	EEB-76-1002	33
	526D	6	EEB-76-1003	33
		6	EEB-76-1004	33
		6	EEB-76-1005	33
		6	EEB-76-1006	33
		6	EEB-76-1007	33
		6	EEB-76-1012	33
		6	EEB-76-1013	33
23	Solenoid Valve	0	EEB-76-1008	33
	Valcor	0	EEB-76-1009	33
	526D	0	EEB-76-1010	33
		0	EEB-76-1011	33
24	Solenoid Valve	8	EEB-84-1001	34
	Target Rock	8	EEB-84-1002	34
	73FF-005	8	EEB-84-1003	34
		8	EEB-84-1013	34
25	Solenoid Valve	12	EEB-84-1005	None
	ASCO	12	EEB-84-1006	None
	HT8211C94			

<u>ITEM NO.</u>	<u>EQUIPMENT ITEM DESCRIPTION</u>	<u>LOCATION</u>	<u>LICENSEE SUBMITTAL PAGE REFERENCES</u>	<u>QUALIFICATION REFERENCES</u>
26	Indicator Pressure Converter Fisher Controls 546	12 12	EEB-84-1009 EEB-84-1010	None None
27	Pressure Switch Custom Components 630GH	12 12	EEB-84-1011 EEB-84-1012	None None
28	Assembly Nuclear Measurements Corp.	9,R20,S 8,R18,U 8,R19,U	EEB-90-0003 EEB-90-0006 EEB-90-0009	35, 36, 37 35, 36, 37 35, 36, 37
29	Thermostat Honeywell T675A1508	14	MEB-63-01	38
30	Damper Motor Honeywell M445A	0,6,8,15	MEB-64-01	None
31	Thermostat Honeywell T675A1540	2,3,4,5	MEB-64-02	39
32	Motor-Operated Valve Limiterque SMB-000	9 7 8	MEB-67-01 NEB-1-013 NEB-23-029	40 40 40
33	Motor-Operated Valve Limiterque SMB-000	0 0	MEB-67-02 NEB-1-012	40 40
34	Motor-Operated Valve Limiterque SMB-000	6 6	MEB-71-01 MEB-73-01	40 40
35	Motor-Operated Valve Limiterque SMB-000	1 2 3	MEB-73-02 MEB-74-01 MEB-71-02	40 40 40
36	Motor GE 5K4254XL2	3 3	MEB-77-02 MEB-77-03	None None

<u>ITEM NO.</u>	<u>EQUIPMENT ITEM DESCRIPTION</u>	<u>LOCATION</u>	<u>LICENSEE SUBMITTAL PAGE REFERENCES</u>	<u>QUALIFICATION REFERENCES</u>
37	Motor GE 5K6226XJ201A	2 5	MEB-77-05 MEB-77-07	None None
38	Motor-Operated Valve Rotork 14A	12,13	MEB-78-01	None
39	Pressure Solenoid Operator Target Rock 1/2 SMS-A-01	0	NEB-1-002	41
40	Pressure Solenoid Operator ASCO WPHTX8300B68F	0 0	NEB-1-002A NEB-43-030	42 42
41	Differential Pressure Switch Indicator Barton 278	4	NEB-1-003	None
42	Solenoid Operator Automatic Valve Corp. C-5497	0	NEB-1-005	None
43	Solenoid Operator Automatic Valve Corp. C-5497	7	NEB-1-007	None
44	Temperature Switch Penwal 17002-40	7	NEB-1-008	43
45	Temperature Switch Penwal 17002-40	11	NEB-69-81	43
46	Pressure Switch Barksdale B2T-A12SS	9 9 9	NEB-3-015 NEB-3-018 NEB-3-021	44, 45 44, 45 44, 45

<u>ITEM NO.</u>	<u>EQUIPMENT ITEM DESCRIPTION</u>	<u>LOCATION</u>	<u>LICENSEE SUBMITTAL PAGE REFERENCES</u>	<u>QUALIFICATION REFERENCES</u>
47	Pressure Switch Barksdale B2T-A12SS	2 2	NEB-71-84 NEB-73-128	44, 45 44, 45
48	Level Indicator Switch Yarway 4418C	9 9 9 9 9	NEB-3-016 NEB-3-017 NEB-3-019 NEB-3-022 NEB-3-021	46 46 46 46 46
49	Pressure Switch Barton 288	9 8	NEB-3-021A NEB-75-226	47, 48 47, 48
50	Pressure Switch Barton 288	4 2	NEB-68-72A NEB-71-83	47, 48 47, 48
51	Level Indicator Switch Barton 288A	9	NEB-3-023	47, 48
52	Level Indicator Switch Barton 288A	2	NEB-73-129	47, 48
53	Temperature Element Calmatic 158B7061P016	8 8 8	NEB-23-025 NEB-23-027 NEB-74-209	None None None
54	Motor-Operated Valve Limiterorque SMB-2	8 9 9 9 9 8 8 9 9 9	NEB-23-026 NEB-74-205 NEB-75-222 NEB-75-224 NEB-74-196 NEB-74-196A NEB-74-197 NEB-74-197A NEB-75-235 NEB-75-237 NEB-74-206	49 49 49 49 49 49 49 49 49 49 49
55	Motor-Operated Valve Limiterorque SMB-2	8 8	NEB-68-069 NEB-73-130	49 49

<u>ITEM NO.</u>	<u>EQUIPMENT ITEM DESCRIPTION</u>	<u>LOCATION</u>	<u>LICENSEE SUBMITTAL PAGE REFERENCES</u>	<u>QUALIFICATION REFERENCES</u>
56	Motor-Operated Valve	1	NEB-73-149	49
	Limiterorque	3	NEB-75-217	49
	SMB-2	4	NEB-75-234	49
57	Motor-Operated Valve	6	NEB-73-168B	49
	Limiterorque	6	NEB-73-147	49
	SMB-2	6	NEB-74-204	49
		6	NEB-74-193	49
		6	NEB-74-195	49
58	Flow Transmitters GE 50-555111B0AA3AAA	8	NEB-23-028	None
59	Flow Transmitters	3	NEB-71-116	None
	GE	3	NEB-75-220	None
	50-555111B0AA3AAA	1	NEB-73-165	None
		2	NEB-74-189	None
		2	NEB-74-190A	None
		4	NEB-75-223	None
		5	NEB-74-199	None
	5	NEB-74-203	None	
60	Motor-Operated Valve	8	NEB-20-029	49
	Limiterorque	6	NEB-70-82	49
	SMB-00	7	NEB-71-96	49
		12	NEB-74-207	49
		6	NEB-74-194	49
61	Motor-Operated Valve	0	NEB-71-85	49
	Limiterorque	0	NEB-74-208	49
	SMB-00			
62	Motor-Operated Valve	3	NEB-71-107	49
	Limiterorque	3	NEB-71-108	49
	SMB-00	3	NEB-71-109	49
		4	NEB-74-230	49
63	Solenoid Valve ASCO WPHTX8300B68F	0	NEB-43-030	42
64	Limit Switch	0	NEB-43-031	None
	Micro Switch	0	NEB-43-033	None
	OPD-AR			
	OPD-AR30			

<u>ITEM NO.</u>	<u>EQUIPMENT ITEM DESCRIPTION</u>	<u>LOCATION</u>	<u>LICENSEE SUBMITTAL PAGE REFERENCES</u>	<u>QUALIFICATION REFERENCES</u>
65	Solenoid Valve ASCO X8300-B61F	12	NEB-43-032	42
66	Temperature Switch Fenwal 40-104014-103	14	NEB-63-034	None
67	Temperature Element Fenwal 28-232106-304	14	NEB-63-035	None
68	Pump Motor GE 5K326PK-234A	14	NEB-63-037	None
69	Explosive Valve Conax 1832-117	14	NEB-63-038	50, 51
70	Solenoid Valve ASCO WPHTX8300B45F,R	8 8 12 8 8	NEB-64-039 NEB-64-040 NEB-64-047 NEB-64-053 NEB-76-242	42 42 42 42 42
71	Limit Switch NAMCO EA740-50100	0 0 0 0	EEB-1-1007 EEB-1-1009 EEB-1-1004 EEB-1-1005	52 52 52 52
72	Limit Switch NAMCO EA740-50100	7 7 7 7	EEB-1-1008 EEB-1-1010 EEB-1-1003 EEB-1-1006	52 52 52 52
73	Limit Switch NAMCO D1200G	12 8 8 8 8 8 8 8 12	NEB-64-052 NEB-64-054 NEB-64-056 NEB-64-056A NEB-76-239 NEB-64-041 NEB-64-043 NEB-64-045 NEB-64-048	None None None None None None None None None

<u>ITEM NO.</u>	<u>EQUIPMENT ITEM DESCRIPTION</u>	<u>LOCATION</u>	<u>LICENSEE SUBMITTAL PAGE REFERENCES</u>	<u>QUALIFICATION REFERENCES</u>
73	(Cont.)	8	NEB-64-050	None
		8	NEB-76-239A	None
		8	NEB-76-239B	None
		8	NEB-76-239C	None
		8	NEB-85-268A	None
74	Pressure Switch Barton 289	8	NEB-64-046	53, 54, 55
75	Pressure Switch Barton 289	3 1 1 3	NEB-71-115 NEB-73-164 NEB-74-188 NEB-75-219	53, 54, 55 53, 54, 55 53, 54, 55 53, 54, 55
76	Pressure Transmitter GE/MAC 551032CAAEL 552032KAAT1 556220BAAA1 50-551032EAA1 50-551032GAAK1 50-551032CAAY1 50-551032EAAK1 50-551032GAAN1	9 6 9 3 3 3 2 1 2 5 6	NEB-64-058 NEB-64-059 NEB-64-063 NEB-71-097 NEB-71-105 NEB-71-110 NEB-73-157 NEB-73-163 NEB-74-190 NEB-74-200 NEB-74-210	None None None None None None None None None None None
77	Power Supply GE 583001AAGK1 570012FAAC1	12 12	NEB-64-060 NEB-71-098	None None
78	Level Transmitter Rosemount 1151 Series	6 6	NEB-64-061 NEB-64-067	56, 57 56, 57
79	Temperature Element American Standard 158B7079P051	6 6	NEB-64-062 NEB-64-063	None None
80	Pressure Switch Static-O-Ring 12N/AA4	9 9 9	NEB-64-064 NEB-64-065 NEB-64-066	58 58 58
81	Motor-Operated Valve Limatorque SMB-3	0 0	NEB-69-070 NEB-74-186	49 49

<u>ITEM NO.</u>	<u>EQUIPMENT ITEM DESCRIPTION</u>	<u>LOCATION</u>	<u>LICENSEE SUBMITTAL PAGE REFERENCES</u>	<u>QUALIFICATION REFERENCES</u>
82	Motor-Operated Valve Limiterorque SMB-0	0	NEB-69-73	49
83	Motor-Operated Valve Limiterorque SMB-0	11	NEB-69-74	49
84	Motor-Operated Valve Limiterorque SMB-0	3 5 2 1 3 1 4	NEB-71-100 NEB-73-160A NEB-74-179A NEB-73-169 NEB-75-214 NEB-73-161 NEB-75-227	49 49 49 49 49 49 49
85	Temperature Element Scam S51-1	2 5 1 3	NEB-74-213 NEB-74-213A NEB-73-174 NEB-71-120	None None None None
86	Temperature Element Scam S51-1	8 12 17A 17B 18 11 10 8	NEB-74-213B NEB-74-213C NEB-69-76 NEB-69-77 NEB-69-78 NEB-69-79 NEB-69-80 NEB-74-181	None None None None None None None None
87	Temperature Element Scam S51-1	6 6 6	NEB-74-213D NEB-71-121 NEB-73-175	None None None
88	Temperature Switch Fenwal 17023-6	3 1 1 1 1	NEB-71-089 NEB-11-089A NEB-73-131 NEB-73-132 NEB-73-136	3, 43 3, 43 3, 43 3, 43 3, 43
89	Temperature Switch Fenwal 17023-6	6 6 6 6	NEB-71-090 NEB-73-135 NEB-73-141 NEB-73-142	3, 43 3, 43 3, 43 3, 43

<u>ITEM NO.</u>	<u>EQUIPMENT ITEM DESCRIPTION</u>	<u>LOCATION</u>	<u>LICENSEE SUBMITTAL PAGE REFERENCES</u>	<u>QUALIFICATION REFERENCES</u>
90	Valve	3	NEB-71-101	None
	Terry Turbines	3	NEB-71-102	None
	Type GS	3	NEB-71-103	None
		3	NEB-71-122	None
		3	NEB-71-123	None
		3	NEB-71-125	None
91	Pressure Switch Barksdale PIH-M855SV	3	NEB-71-104	44, 45
92	Pressure Switch	3	NEB-71-104	None
	Mercoid	1	NEB-73-158	None
	DA-7043-804	3	NEB-75-216	None
	DA-23-804	4	NEB-75-229	None
93	Pressure Switch	3	NEB-71-112	58
	Static-O-Ring	1	NEB-73-162	58
	6N-AA21-V 6N-AA21			
94	Square Root Converter GE 565100AAAC1	12	NEB-71-114	None
95	Motor-Operated Valve	3	NEB-71-117	49
	Limiterque	3	NEB-71-118	49
	SMB-1	3	NEB-71-119	49
		3	NEB-75-221	49
		2	NEB-74-179	49
96	Turbine Controls	1	NEB-73-148	None
	Terry Turbines	1	NEB-73-154	None
	Type CCS	1	NEB-73-151	None
		1	NEB-73-155	None
		1	NEB-73-171	None
		1	NEB-73-172	None
		1	NEB-73-173	None
		1	NEB-73-173A	None
97	Pressure Switch Barksdale D2H-M150SS	1	NEB-73-156	44, 45

<u>ITEM NO.</u>	<u>EQUIPMENT ITEM DESCRIPTION</u>	<u>LOCATION</u>	<u>LICENSEE SUBMITTAL PAGE REFERENCES</u>	<u>QUALIFICATION REFERENCES</u>
98	Motor-Operated Valve	1	NEB-73-167	49
	Limitorque	1	NEB-73-166	49
	SMB-4T	1	NEB-73-170	49
99	Level Switch	6	NEB-73-176	None
	Robertshaw SL-202-A2X			
100	Pressure Switch	2	NEB-73-180	58
	Static-O-Ring	2	NEB-73-180A	58
	5N-AA3	5	NEB-73-184	58
		5	NEB-73-184A	58
101	Motor-Operated Valve	0	NEB-74-191	49
	Limitorque			
	SMB-5T			
102	Motor-Operated Valve	9	NEB-74-192	49
	Limitorque			
	SMB-4			
103	Motor-Operated Valve	0	NEB-74-202	49
	Limitorque			
	SMB-4			
104	Differential Pressure	4	NEB-74-198	48, 53
	Switch			
	Indicator			
	Barton 289A			
105	Pump Motor	5	NEB-74-211	None
	GE	2	NEB-74-212	None
	5K6348XC23A			
106	Flow Switch	4	NEB-75-232	53, 54
	Barton 289			
107	Pump Motor	4	NEB-75-238	None
	GE	3	NEB-75-238A	None
	5K336XC198A			
108	Solenoid Valve	8	NEB-76-240	42
	ASCO	8	NEB-76-241	42
	X8315			

<u>ITEM NO.</u>	<u>EQUIPMENT ITEM DESCRIPTION</u>	<u>LOCATION</u>	<u>LICENSEE SUBMITTAL PAGE REFERENCES</u>	<u>QUALIFICATION REFERENCES</u>
109	Hydrogen Element GE 47E226428G2	0	NEB-76-243	None
110	Level Switch GEMS XM-36425	0	NEB-77-244	None
111	Solenoid Valve Versa VSG-3521	6	NEB-77-249	None
112	Limit Switch Micro Switch BZE6-2RN	6 6	NEB-77-249A NEB-77-249B	None None
113	Level Switch Autocon M-4	2 5 4 4	NEB-77-250 NEB-77-251 NEB-77-260 NEB-77-261	None None None None
114	Temperature Element Thermo-Elect B7582-1	0 4	NEB-77-252 NEB-77-259	None None
115	Level Switch Meletron 9241-6SS10A	13	NEB-78-262	None
116	Level Switch Barksdale D2H-M18SS	13	NEB-78-265	44, 45
117	Solenoid Valve ASCO HVA86-030	8 8	NEB-85-267 NEB-85-268	None None
118	Position Switch Micro Switch BZE6-2RN	8 8	NEB-85-272 NEB-85-273	None None
119	Solenoid Valve ASCO HVA-90-405-2A	8	NEB-85-274	None

<u>ITEM NO.</u>	<u>EQUIPMENT ITEM DESCRIPTION</u>	<u>LOCATION</u>	<u>LICENSEE SUBMITTAL PAGE REFERENCES</u>	<u>QUALIFICATION REFERENCES</u>
120	Level Switch Robertshaw SL-305-E3-X	8	NEB-85-276	None
121	Ion Chamber GE 237X731G001	7 7 7 7	NEB-90-279 NEB-90-280 NEB-90-281 NEB-90-282	None None None None
122	Sensor and Converter GE 194X927G014,12	15 15	NEB-90-283 NEB-90-284	None None
123	Fission Product Monitor GE No Model No.	0 6	NEB-90-286 NEB-90-286A	None None
124	TIP Valve Assembly GE L36B1302G2	8	NEB-NM-287	None
125	Transformer GE 11CH2L4	12 12 13	EEB-APS-0001 EEB-APS-0002 EEB-APS-0003	None None None
126	Motor Control Center International Switch- board Corp.	9 12	EEB-APS-0005 EEB-APS-0006	None None
127	Motor Control Center GE 7700 Series	8	EEB-APS-0004	None
128	Motor Generator Louis Allis Co. 8-127033	12 12 12 12	EEB-APS-0199 EEB-APS-0200 EEB-APS-0201 EEB-APS-0202	59 59 59 59
129	Solenoid Valve Target Rock 1/2 SMS-A-01-1	0 0	EEB-1-1001 EEB-1-1002	None None
130	Junction Box	Various	Numerous	19, 20

<u>ITEM NO.</u>	<u>EQUIPMENT ITEM DESCRIPTION</u>	<u>LOCATION</u>	<u>LICENSEE SUBMITTAL PAGE REFERENCES</u>	<u>QUALIFICATION REFERENCES</u>		
131	Terminal Block GE EB-5 and CR15182	4	EEB-77-0066	24, 25, 26		
		15	EEB-78-0062	24, 25, 26		
		0	EEB-84-0058	24, 25, 26		
		0	EEB-84-0061	24, 25, 26		
		12	EEB-63-0069	24, 25, 26		
		Various	EEB-64-0068	24, 25, 26		
		6	EEB-76-0079	24, 25, 26		
		8	EEB-90-0158	24, 25, 26		
		9	EEB-67-0044	24, 25, 26		
		0	EEB-01-0105	24, 25, 26		
		131 (Cont.)	(Cont.)	7	EEB-01-0106	24, 25, 26
				8	EEB-23-0039	24, 25, 26
				12	EEB-43-0027	24, 25, 26
				0	EEB-43-0028	24, 25, 26
				12	EEB-43-0029	24, 25, 26
0	EEB-32-0015			24, 25, 26		
0	EEB-74-0395			24, 25, 26		
Various	EEB-74-0396			24, 25, 26		
Various	EEB-73-0129			24, 25, 26		
Various	EEB-75-0147			24, 25, 26		
Various	EEB-69-0106			24, 25, 26		
Various	EEB-71-0252			24, 25, 26		
132	Electrical Penetration Assemblies GE NS04			0	EEB-NM-0025	15
				0	EEB-NM-0026	15
				0	EEB-NM-0027	15
		0	EEB-NM-0028	15		
		0	EEB-NM-0029	15		
		0	EEB-NM-0030	15		
		0	EEB-NM-0031	15		
		0	EEB-NM-0032	15		
		0	EEB-NM-0033	15		
		0	EEB-64-0014	23		
		0	EEB-64-0015	23		
		6	EEB-76-0067	23		
		6	EEB-76-0068	23		
		6	EEB-76-0069	23		
		6	EEB-76-0070	23		
		6	EEB-76-0071	23		
		0	EEB-68-0036	23		
		0	EEB-68-0037	23		
		0	EEB-68-0038	23		
		0	EEB-68-0039	23		
0	EEB-69-0092	23				
0	EEB-69-0093	23				
0	EEB-01-0095	23				

<u>ITEM NO.</u>	<u>EQUIPMENT ITEM DESCRIPTION</u>	<u>LOCATION</u>	<u>LICENSEE SUBMITTAL PAGE REFERENCES</u>	<u>QUALIFICATION REFERENCES</u>
132	(Cont.)	0	EEB-01-0096	23
		0	EEB-01-0097	23
		0	EEB-01-0098	23
		0	EEB-01-0099	23
133	Electrical Penetration Assembly GE Series 100	0	EEB-76-0072	22
134	Switches	4	EEB-77-0069	61
	GE and Cutler Hammer	0	EEB-74-0402	61
	GE-CR2940	8	EEB-23-0042	61
	CH-10250T	7	EEB-01-0109	61
		Various	EEB-75-0150	61
		Various	EEB-73-0138	61
		Various	EEB-74-0339	61
		11	EEB-69-0110	61
		Various	EEB-71-0255	61
135	Cable (See Manufacturers List)	Various	Numerous	

APPENDIX C - SAFETY SYSTEMS FOR WHICH ENVIRONMENTAL
QUALIFICATION IS TO BE ADDRESSED

The Licensee has submitted a list of safety-related systems that must function in order to mitigate the consequences of a design basis accident. This information was submitted in response to IE Bulletin 79-01B and was included in the Licensee's October 31 response.

- Main Steam
- Feedwater
- Fuel Oil
- Residual Heat Removal Service Water
- Raw Cooling Water
- Ventilating
- Air Conditioning
- Control Air
- Sampling
- Standby Liquid Control
- Primary Containment
- Standby Gas Treatment
- Emergency Equipment Cooling Water
- Reactor Recirculation
- Reactor Water Cleanup
- Reactor Building Closed Cooling Water
- Reactor Core Isolation Cooling
- High Pressure Coolant Injection
- Residual Heat Removal
- Core Spray
- Containment Inerting
- Radwaste
- Fuel Pool Cooling
- Containment Atmosphere Dilution
- Control Rod Drive
- Neutron Monitoring
- Radiation Monitoring
- Auxiliary Power

APPENDIX D - CABLE MANUFACTURERS LIST

1. Brand-Rex
2. Rome Cable
3. Cyprus
4. American Insulated Wire
5. Plastic Wire & Cable Corp.
6. General Cable
7. Continental Wire & Cable
8. PWC
9. Tamaqua
10. Boston Insulated Wire
11. Okonite
12. Rockbestos
13. Belden Corp.
14. ITT Surp.
15. Sumitomo Shoji
16. Essex
17. Phelps Dodge
18. Triangle Conduit & Cable
19. GE Cable Corp.
20. Sies Electric
21. Graybar
22. Simplex Wire & Cable
23. Times Wire & Cable
24. Dearborn Wire
25. Alpha Wire Corp
26. Belden
27. Consolidated Wire
28. Anaconda
29. Collyer Insulated Wire

APPENDIX E - EQUIPMENT ITEM CROSS-REFERENCE LIST

<u>EQUIPMENT ITEM</u>	<u>FINAL TECHNICAL EVALUATION REPORT SECTION</u>
1	4.5.2.1
2	4.5.2.2
3	4.5.2.3
4	4.5.2.4
5	4.5.2.5
6	4.5.2.6
7	4.5.2.7
8	4.5.2.8
9	4.5.2.9
10	4.5.2.9
11	4.5.2.8
12	4.5.2.10
13	4.5.2.8
14	4.5.2.11
15	4.5.2.12
16	4.5.2.13
17	4.5.2.14
18	4.5.2.15
19	4.6.1
20	4.6.1
21	4.6.1
22	4.5.2.62
23	4.5.2.62
24	4.3.1.1
25	4.5.2.16
26	4.5.2.17
27	4.5.2.18
28	4.6.2
29	4.5.2.19
30	4.5.2.20
31	4.5.2.19
32	4.5.2.58
33	4.6.3
34	4.6.3
35	4.6.3
36	4.5.2.21
37	4.5.2.21
38	4.6.30
39	4.6.4
40	4.6.31
41	4.5.2.61
42	4.6.31

<u>EQUIPMENT ITEM</u>	<u>FINAL TECHNICAL EVALUATION REPORT SECTION</u>
43	4.5.2.60
44	4.6.5
45	4.6.5
46	4.6.6
47	4.6.6
48	4.5.2.22
49	4.6.7
50	4.6.7
51	4.6.8
52	4.6.8
53	4.5.2.23
54	4.6.10
55	4.6.9
56	4.6.9
57	4.6.10
58	4.5.2.24
59	4.5.2.24
60	4.6.10
61	4.6.9
62	4.6.9
63	4.6.31
64	4.5.2.25
65	4.6.11
66	4.5.2.26
67	4.5.2.27
68	4.5.2.59
69	4.6.33
70	4.6.12
71	4.6.35
72	4.6.35
73	4.5.2.28
74	4.6.32
75	4.6.13
76	4.5.2.29
77	4.5.2.30
78	4.6.14
79	4.5.2.31
80	4.6.34
81	4.6.9
82	4.6.9
83	4.6.9
84	4.6.9
85	4.5.2.32
86	4.5.2.32
87	4.6.36
88	4.6.15

<u>EQUIPMENT ITEM</u>	<u>FINAL TECHNICAL EVALUATION REPORT SECTION</u>
89	4.6.15
90	4.5.2.33
91	4.6.16
92	4.5.2.34
93	4.6.17
94	4.5.2.35
95	4.6.9
96	4.5.2.33
97	4.6.18
98	4.6.19
99	4.5.2.36
100	4.6.20
101	4.6.21
102	4.6.22
103	4.6.21
104	4.6.23
105	4.5.2.37
106	4.6.24
107	4.5.2.38
108	4.6.25
109	4.5.2.39
110	4.5.2.40
111	4.5.2.41
112	4.5.2.42
113	4.5.2.43
114	4.5.2.44
115	4.5.2.45
116	4.6.26
117	4.5.2.46
118	4.5.2.47
119	4.5.2.48
120	4.5.2.49
121	4.5.2.50
122	4.5.2.51
123	4.5.2.52
124	4.5.2.53
125	4.5.2.54
126	4.5.2.55
127	4.5.2.56
128	4.6.27
129	4.5.2.57
130	4.7.1
131	4.6.28
132	4.3.1.2
133	4.5.2.63
134	4.6.9
135	4.7.2