

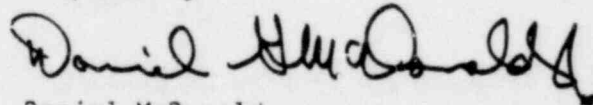
ENVIRONMENTAL QUALIFICATION OF SAFETY-RELATED
ELECTRICAL EQUIPMENT
IEB 79-01B

TECHNICAL EVALUATION REPORT
ARKANSAS NUCLEAR ONE-UNIT 2
DOCKET NO. 50-368

Dated: December 10, 1980

Licensee: Arkansas Power and Light Company
Type Reactor: Combustion and Engineering
Size: 912 MWe

Prepared by:

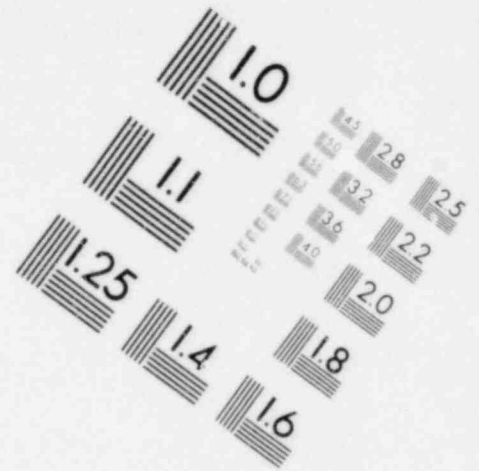
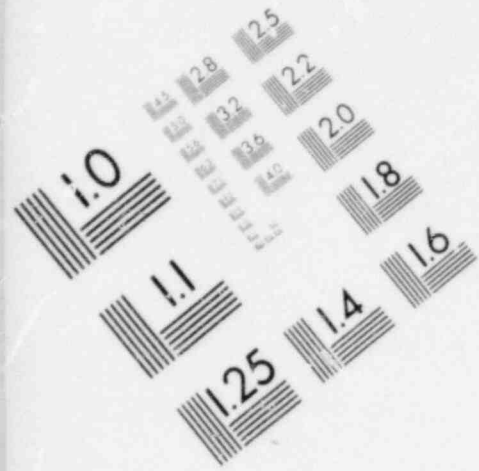


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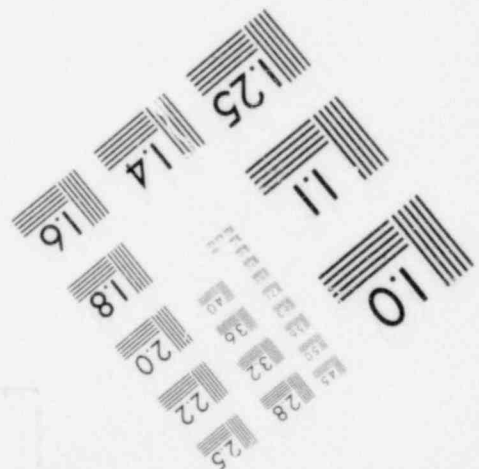
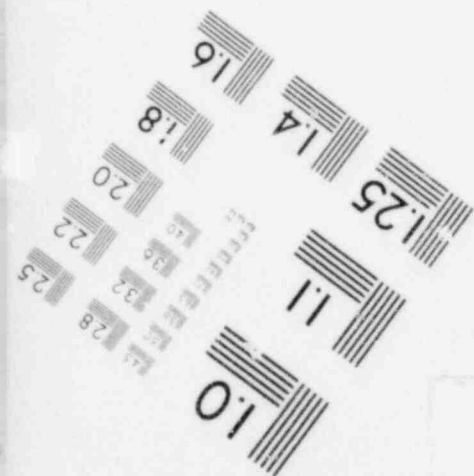
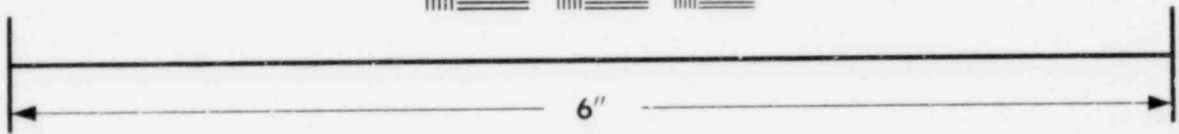
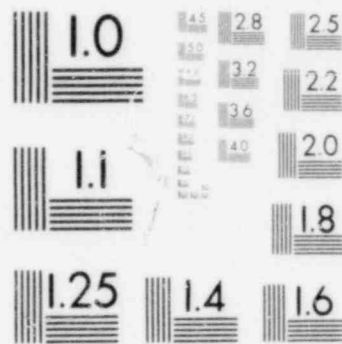
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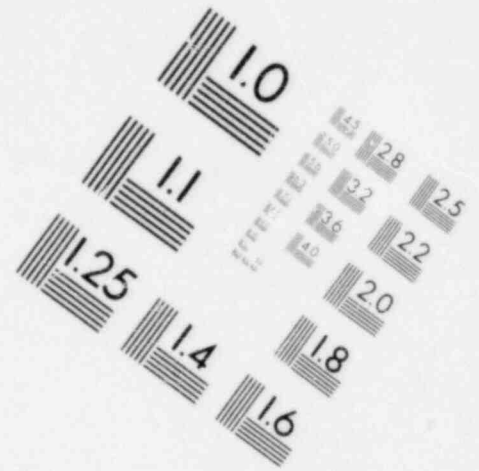
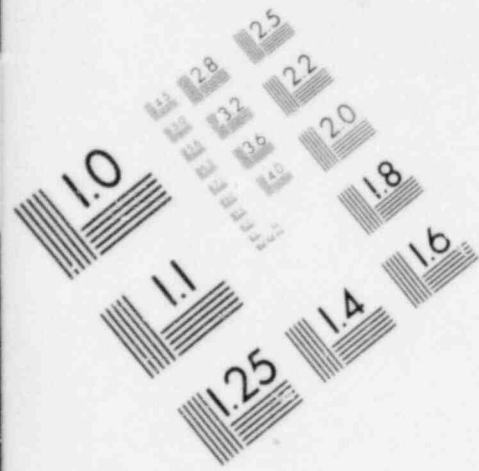
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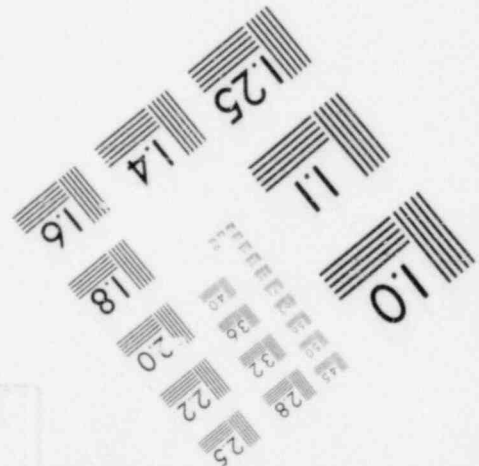
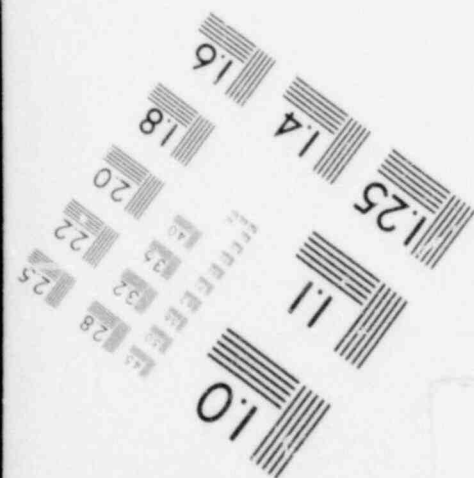
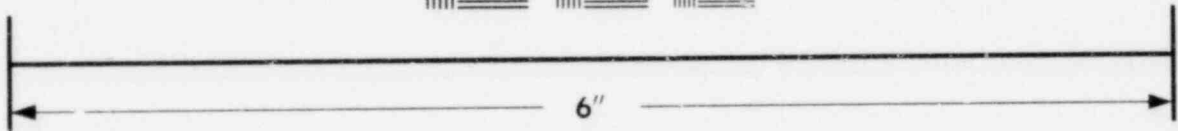
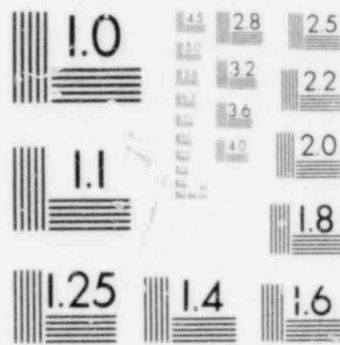


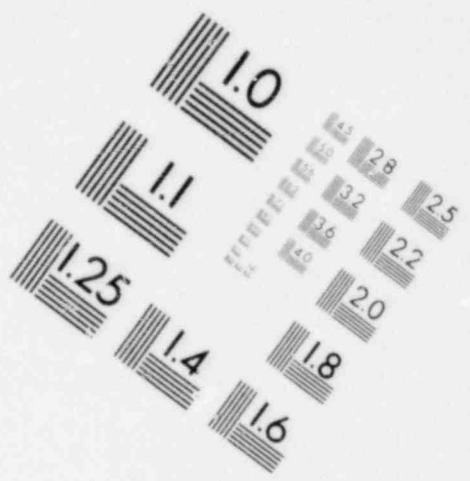
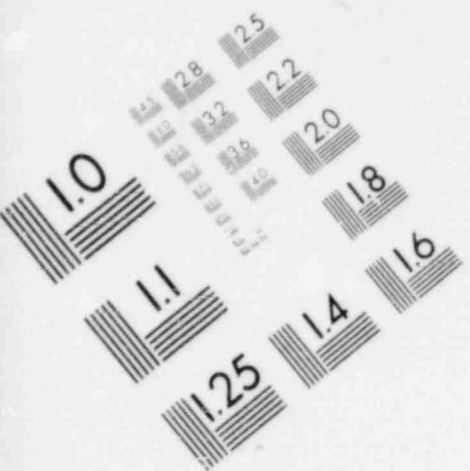
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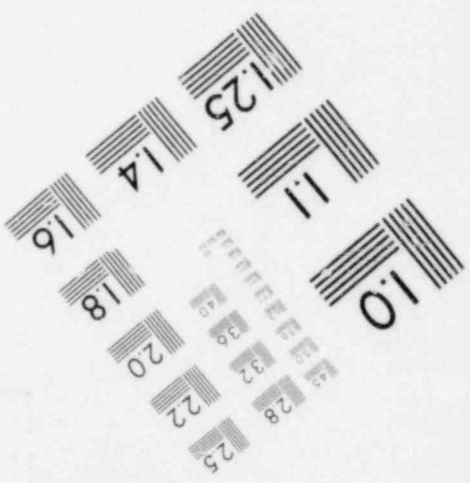
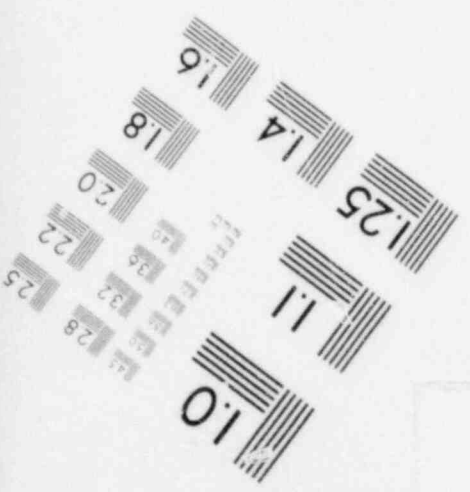
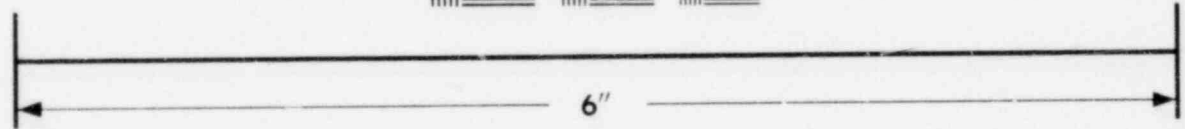
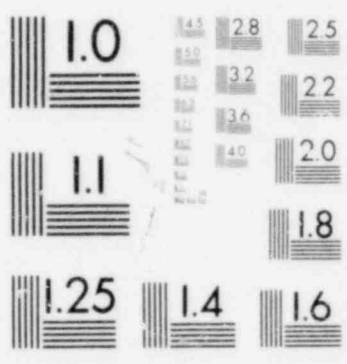


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1. Introduction

1.1 General

Equipment that is used to perform a necessary safety function must be capable of maintaining functional operability under all service conditions postulated to occur during its installed life and for the time it is required to operate. This requirement, which is embodied in General Design Criteria 1, 2, 4 and 23 of Appendix A and Sections III and XI of Appendix B to 10 CFR Part 50, is applicable to equipment located inside as well as outside of containment.

The staff evaluates the applicant'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 objective of this review is to provide reasonable assurance that the equipment can perform its intended function in the most limiting environment in which it is expected to be exposed.

The staff has 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. For the newer plants after 1971, qualification was judged on the basis of IEEE 323-1971. No regulatory guide was issued adopting the IEEE 323-1971 standard. For the newest 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 323-1974.

To promote more orderly and systematic implementation of equipment qualification programs in industry and to provide guidance to be used by the NRC staff for use in the ongoing licensing reviews, the staff has developed a number of positions on selected areas of equipment qualification. These positions are presented in NUREG-0588, "Interim Staff Position on Environmental Qualification of Safety-Related Equipment," and the Division of Operating Reactors (DOR), "Guidelines For Evaluating Environmental Qualification of Class IE Electrical Equipment in Operating Reactors."

1.2 Specific

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 to examine their installed safety-related electrical equipment and ensure appropriate documentation of its qualification to function under postulated accident conditions. Subsequently, February 8, 1979, the NRC Office of Inspection and Enforcement issued IE Bulletin 79-01 which was intended to raise the threshold of IE Circular 78-08 to the level of a 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.

On January 14, 1980, the NRC Office of Inspection and Enforcement, issued 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 15 facilities undergoing the Systematic Evaluation Program (SEP) review. This bulletin stated that the guidelines and criteria to be used in evaluating the adequacy of the safety-related electrical equipment qualification are the DOR guidelines and any problems arising from this review will be resolved using NUREG-0588 as a guide.

The requirements of IEB 79-01B were requested under provisions of 10 CFR 50.54(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.

The 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 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 NRR to assure overall consistency.

1.3 Criteria

The Nuclear Regulatory Commission ordered, in a memorandum and order dated May 23, 1980, that the DOR Guidelines and NUREG-0588 form the requirements which licensees and applicants must meet in order to satisfy those aspects of 10 CFR 50, Appendix A, General Design Criteria (GDC) - 4, which relates to environmental qualification of safety-related electrical equipment. Licensees of operating reactors were to comply with these requirements so that the applicable equipment in all operating plants shall meet the DOR guidelines or NUREG-0588. The NRC staff was directed to complete its review of environmental qualification based on licensee responses to IE Bulletin 79-01B and publish a safety evaluation report for each operating facility by February 1, 1981. By June 30, 1982, all safety-related electrical equipment in all operating plants shall be qualified to the DOR guidelines or NUREG-0588.

The regional reviewers held meetings with the licensees in their respective regions which resulted in staff positions being issued in a first supplement to IE Bulletin 79-01B dated February 29, 1980. Subsequently, the staff held meetings in various locations with the

licensees and interested parties during the week of June 13, 1980. These meetings resulted in a second supplement, dated September 30, 1980, which expanded the initial scope and highlighted staff positions affecting the licensees responses to IE Bulletin 79-01B.

An order was issued to the licensees, dated August 29, 1980, which requires the licensees to complete the tasks identified in IE Bulletin 79-01B on or before November 1, 1980. However, due to concerns relating to the inclusion of TMI lessons learned and Cold Shutdown Condition, the staff issued a third supplement, dated October 29, 1980 to IE Bulletin 79-01B. This supplement provided schedule relief under certain conditions for these items until February 1, 1981.

A second order was issued to all licensees, dated October 24, 1980, which required the facility license be modified to codify the documentation requirements of safety-related electrical equipment in the plant Technical Specification.

2. Technical Evaluation Report

2.1 Purpose

The objective of this technical evaluation is to review the licensee's submittals to verify that the licensee reviewed their safety-related electrical equipment for environmental qualification against the DOR guidelines and NUREG-0588 as required by IE Bulletin 79-01B and its supplements. This review is to identify equipment whose qualification program substantiates that it is capable of providing the performance and function required when exposed to harsh environments, and to identify equipment whose qualification program is deficient or inadequate. For equipment with deficiencies, the course of action detailed by the licensee to remedy the deficiency or definitive recommendations are to be provided which include a schedule for completion and the basis for continued operation.

2.2 Scope

IE Bulletin 79-01B requires that all safety-related electrical equipment exposed to a harsh environment be in accordance with the DOR guidelines or NUREG-0588. The harsh environments include the limiting conditions resulting from the entire spectrum of Loss of Coolant Accidents (LOCAs), High Energy Line Breaks (HELBs) inside and outside of containment, and fluids, which are recirculated from inside containment to accomplish long-term cooling subsequent to an accident.

To provide assurance that the licensee implemented the requirements of IE Bulletin 79-01B and provide input for a Safety Evaluation Report (SER), the principle reviewers developed a Technical Evaluation Report (TER) by:

- . Assessing the licensee's responses in relation to the requirements of the DOR guidelines as augmented by the supplements to the bulletin.
- . Using NUREG 0588 to resolve any open issues.
- . Performing and documenting an as-installed audit of equipment within a system identified in the master list.
- . Documenting and maintaining a current list of each outstanding item identified by either the reviewer or the licensee.
- . Identifying and documenting all Licensee Event Reports (LERs) submitted by the licensee.
- . Identifying all test reports, analysis and other basis referenced by the licensee which are considered to be supporting qualification data.
- . Identifying and documenting the plans, schedules and basis for continued operation for each outstanding item or LER.
- . Determining the acceptability of the plans, schedules and basis for continued operation or; forward for resolution during the safety evaluation review.

The results and conclusions contained in the TERs are valid assuming that the analysis and test reports referenced by the licensee in their submittal are acceptable. The principle reviewers, in most cases, have not audited the analysis and test reports due to the time constraints imposed by the Commission Memorandum and Order which requires that the SERs for all operating facilities be completed by February 1, 1981. However, the staff will audit selected analysis and test reports incorporating the results of their reviews with the TERs when developing the plant specific SER. The staff will also utilize the as-installed audit of equipment provided in Appendix B when evaluating the selected analysis and test reports.

The results of the TERs in conjunction with the staff's effort in developing the SERs will provide a level of assurance necessary to meet the requirements and goals identified in the Commission's Memorandum and Order dated May 23, 1980.

2.3 Procedure

The basis for this technical evaluation is the information provided by the licensee, Arkansas Power and Light Company, for Arkansas Nuclear One-Unit 2. 11, 14, 15 & 17. The staff's inspection of the as-installed equipment in the Reactor Coolant System which is located in the containment, will be conducted during the unit's refueling outage which

is scheduled for April 1981. This TER or the plant specific SER will be supplemented to incorporate the detailed identification of the components, interfaces and other observations during the inspection.

IE Bulletin 79-01B required the licensees to:

- . Provide a Master List which identifies the systems and electrical equipment required to function during and subsequent to an event and maintain the plant in a safe shutdown condition.
- . Provide written evidence of the qualification of the equipment identified.
- . Provide the service condition profiles.
- . Identify the flood levels.
- . Evaluate the qualification against the DOR guidelines and NUREG-0588.
- . Submit a Licensee Event Report LER for any electrical equipment determined as not being environmentally qualified.

Utilizing the information identified above, the staff assessed its adequacy in relation to the DOR guidelines², NUREG 0588³ and the supplements^{5,6&7} to IEB 79-01B which provides the Commission's requirements and staff positions. The Technical Evaluation section of this report contains the details identified in the scope. In addition, the safety-related equipment is grouped and identified by equipment numbers. The equipment items are then assigned into categories based on the results of this effort as defined in the scope.

The five category designations define in general terms the degree of compliance to the qualification criteria and defines subsequent actions required by the staff or licensee during the SER portion of the staffs overall effort. The categories and actions required are included in Appendix A of this report.

3. Technical Evaluation - Arkansas Nuclear One-Unit 2

The staff requested that the licensee's identify the procedures utilized in responding to the requirements of IE Bulletin 79-01B. Supplement Number 2, dated September 29, 1980⁸, provides the details and requirements for quality assurance programs relative to the environmental qualification of safety-related electrical equipment. The requirements for QA Programs are provided in Part 50, Appendix B, of the Code of Federal Regulations.

Appendix B of the licensees response¹⁷ indicates that all activities associated with responding to IE Bulletin 79-01B is being performed in accordance with the applicable portions of Appendix B to 10 CFR 50. The

licensee utilized the following organizations to assist in their response:

Bechtel Power Corporation
 Combustion Engineering Incorporated
 NUS Corporation
 Protopower, Incorporated

The detailed procedures used by the licensee identified in their response¹⁷ and the QA programs for future efforts relative to environmental qualification of electrical equipment should be documented and available for staff review upon request as indicated in Supplement Number 2⁶ to IE Bulletin 79-01B.

3.1 Identification of Safety-Related Equipment

The licensee identified the systems required to detect events, initiate protective actions, mitigate the consequences of events, bring the reactor to safe shutdown and supporting systems required for the events (e.g. cooling water, HVAC, etc.) identified in IEB 79-01B. The facility FSAR, drawings and emergency operating procedures were utilized. Tabulations of the systems which have equipment exposed to the harsh environments are provided in the licensee's second submittal¹⁷ as follows:

Table 3-1 LOCA/HELB Inside Containmentment

Table 3-2 HELB and Recirculated Fluids Outside Containmentment

The systems lists were compared to the "Q" list of systems developed by the staff.¹³ The licensee's second submittal¹⁷ added the following systems or provide the basis for exclusion.

<u>Q List</u>	<u>ANO-2</u>
Feedwater Control	Safety-related components included in Aux Feedwater System
Containment Air Purification/Cleanup	Not in ANO-2 Design
Containment Combustible Gas Control	H ₂ Recombiner System
Accumulators	Locked out per Tech. Spec. requirements
Residual Heat Removal	LPSI
Chemical and Volumes Control	Not required for accident mitigation or control
Power Operated Relief Valves	Reactor Coolant System
Component Cooling Water	Service Water (provides the safety function)

Safety Equipment Area Ventilation	HVAC
Reactor Coolant	Reactor Protection
Emergency Power	(Non Harsh Environment)
Control Room Habitability	(Non Harsh Environment)

The following "Q" list systems will be addressed in the licensee's subsequent submittal which will provide information relative to achieving cold shutdown and NUREG 0578-Lessons Learned:

- Pressurizer Spray
- Steam Dump
- Containment Radiation Monitor
- Containment Radiation Sample

Based on the information above, we have determined that the systems identified are within the guidance provided in Section 3.0 and Appendix A of the DOR Guidelines and are acceptable. Our requirements for the systems and equipment included in the licensee's effort to implement the requirements of NUREG 0578 and achieve cold shutdown are included in Section 3.2 of this report.

3.2 Master List

The licensee developed a master list based on their system evaluation as required by IEB 79-01B. Section 3 (Table 3-1, 3-2) of the licensee's response includes master lists for the equipment and components exposed to harsh environments.

The licensee has indicated in their IEB 79-01B status report¹⁶ that the information requested for equipment required to achieve cold shutdown and TMI lessons learned will be provided by January 1, 1981.

The information requested in IEB 79-01B Supplement 3⁷ includes:

- a. Qualification information for installed TMI Action Plan equipment must be submitted by February 1, 1981.
- b. Qualification information for future TMI Action Plan equipment (ref. NUREG 0737) which requires NRC pre-implementation review, must be submitted with the pre-implementation review data.
- c. Qualification information for TMI Action Plan equipment currently under NRC review should be submitted as soon as possible.

- d. Qualification information for TMI Action Plan equipment not yet installed which does not require pre-implementation review should be submitted to NRC for review by the implementation date.
- e. Qualification information for equipment required to achieve and maintain cold shutdown.

The licensee's commitment to provide the information requested in supplement 3 by January 1, 1980, meets the implementation schedule identified in the supplement and is therefore, acceptable.

3.3 Service Conditions

3.3.1 Inside Containment - LOCA

Environmental data for ANO-2 is provided in Enclosure 2, Part 5, attachments 1, 6, 10 & 12 of the licensee's submittal. The maximum environments identified in FSAR Table 3.11-2 are:

Temperature: 300^of

Pressure: 54 psig

Humidity: 100% R. H.

Chemical Spray: 15000 ppm boric acid solution, .1% sodium hydroxide by weight and 1% sodium thiosulfate by weight.

The data and profiles provided are based on the analysis in Section 6 of the FSAR. This meets Section 4.1 of the DOR Guidelines and is, therefore, acceptable.

3.3.1.1 Radiation

The licensee indicated the radiation levels used for qualification are based on Section 3.11 of the FSAR. Enclosure 2, Part 5, Attachment 12 of their submittal indicated an integrated dose value of 3.3×10^7 Rads.

Section 4.2.2 of the licensee's submittal describes the methodology and codes used to calculate the radiation levels outside of containment due to recirculating fluids. The values identified in the Appendix A equipment data sheets are 1.5×10^4 Rads to 1×10^7 Rads.

The licensee did not provide an assessment of beta radiation exposure for equipment inside of containment. The acceptability of the methodology and codes identified in Section 4.2.2 of the licensee's submittal and the referenced FSAR Section 3.11 will be resolved during the SER portion of the staff's review.

3.3.1.2 Submergence

The licensee identified the flood level as 343'-6" which included the limiting LOCA conditions identified in the FSAR. The acceptability of the licensee's basis for specific equipment subjected to submergence is included in Section 3.9 of this report.

3.3.1.3 Sprays

The licensee identified the requirement for the containment sprays to be at least 15000 ppm boric acid solution, 0.1% sodium hydroxide by weight and 1% sodium thiosulfate by weight. The consideration of sprays is included in Section 3.9 of this report.

3.4 High Energy Line Breaks (HELB)

3.4.1 HEL3 Inside Containment

The ANO-2 facility has an automatic containment spray system. The DOR guidelines, Section 4.2.1, indicates that LOCA qualified equipment inside containment is acceptable for HELBs if the automatic spray system is not subject to disabling single component failures. The licensee indicated the ANO-2 facility meets this requirement.

The staff performed a single failure evaluation of the containment spray system. We conclude that the system is not subjected to a disabling single component failure in accordance to the requirements of the DOR guidelines, Section 4.2.1, and that the LOCA qualified equipment inside containment is acceptable for HELBs.

3.4.2 HEL3 Outside Containment

The licensee indicated that FSAR Section 3.6 and Appendix 3A provides the results of their review of high energy line breaks. Additional analysis was performed where necessary to provide the required service conditions for the IEB 79-01B effort. The licensee's submittal¹⁷, Section 4.2, Tables 4-1 & 4-2 and Figures 4-1 through 4-10, provide the details of the methodology and results of the analysis. The systems included in the evaluation were those with a design temperature in excess of 200^of or design pressure in excess of 275 psig. The break size was assumed to be one-half ($\frac{1}{2}$) the pipe diameter in length and on-half ($\frac{1}{2}$) the wall thickness. The equipment considered in the evaluation was that required to place and maintain the plant in a cold shutdown condition.

The information provided in the licensee's submittal and FSAR included the following considerations and actions:

- A. Flow restrictions or limiting annuli
- B. Adequate vent area
- C. Protective enclosures
- D. Considerations of flooding
- E. Consideration of separation of equipment and single active component failure.
- F. Consideration of loss-of-offsite power

We have concluded, based on the considerations, information and actions taken, that the licensee meets the requirements of the DOR guidelines, Section 4.3.1. The acceptability of the licensee's basis for specific equipment subjected to HELBs outside of containment is included in Section 3.9 of this report.

3.4.3 Recirculated Fluids

The licensee indicated that the areas where fluids are recirculated from inside containment to accomplish long-term cooling were included as a service condition. Section 3.3.1.1 of this report, indicates the acceptability of the methodology and codes identified in the licensee's submittal¹⁷ will be resolved during the SER portion of the staff's review effort.

3.5 Margin

The DOR Guidelines indicate that special consideration was given to the time required to remain functional when establishing the criteria in Section 4.0 and the functional testing and failure criteria in Section 5.2 of the guidelines.

The normal operating temperature inside containment is approximately 120^of and the profiles indicate that the temperature returns to 160^of and recirculation is initiated within 1 hour 15 minutes of the event assuming minimum engineered safeguards. NUREG 0588, Section 3(4), requires that a type test be for a minimum of 1 hour in duration when the functional requirement is within the first seconds or minutes of an event and the DOR guidelines, Section 5.2, requires that the test duration be at least as long as the period from initiation until the service conditions return to the level that existed prior to the event.

The licensee has taken exception to the 1 hour requirement in Section 2 of their submittal¹⁷. The adequacy of the test duration to assure margin will be addressed in the Safety Evaluation Report (SER) which will incorporate an audit of selected analysis and test reports identified in Appendix C.

3.6 Aging

The licensee indicated that actions have been initiated to address aging including a schedule for implementation. However, the schedule is dependent on adequate responses from vendors and suppliers. The overall effort includes implementation of a program which:

1. Identification of materials of construction of each component.
2. Evaluation of materials of construction to identify materials known to be susceptible to thermal aging.
3. Based on available data, an expected life will be determined for each component.
4. Development of a periodic replacement program for certain components (or subcomponents) identified as having an expected life less than the design life of the facilities.

Section 7 of the DOR guidelines² indicate that the susceptibility of materials to thermal and radiation aging should be considered. In addition the guidelines indicate that an ongoing program should exist to review surveillance and maintenance records to identify any age related degradations.

We require that the licensee's program be modified to address the aging effects of radiation and the inclusion of inservice inspection and failure analysis to identify potential age related degradations and establish the necessary corrective actions.

We conclude that the overall program and schedule will be acceptable if the program is modified to include the items identified above. The basis for continued operation is the extent of the licensee's effort to date, the continuing effort and that aging generally a long time-frame parameter.

3.7 Documentation

The second supplement⁶ to IEB 79-003 and the order,⁹ dated October 24, 1980, requires the licensee have the documentation and data identified in the detailed worksheets which supports the qualification of the safety-related electrical equipment available for NRC audit. The second supplement⁶ identifies the type of information required and the locations where the records are to be maintained.

The staff requests the licensee provide a response to the order and supplement which discusses their compliance and identifies any deviations.

3.8 Site Inspection - Reactor Coolant System

An inspection of the installed components associated with the reactor coolant system will be conducted during the refueling outage scheduled for March 1981.

The detailed identification of the components and the observations recorded will be addressed in the SER or a supplement. The information will be incorporated in an audit of selected analysis and test reports identified in Appendix C.

3.9 Equipment Data Review

3.9.1 Qualification Status

The licensee provided the general status of the qualification and documentation for the equipment inside containment in Section 5.1 of their Submittal. 17 Test documentation exists for all equipment except two radiation monitors which are currently being tested. The licensee further indicates several areas, such as aging, radiation, etc, are outstanding items. The following actions are being taken:

- . Re-review need of component
- . Obtain additional documentation
- . Use of analysis or similarity
- . Additional tests
- . Modify, replace or protect component

The licensee has taken exception to the staffs position on replacement and spare parts identified in Supplement 2^o question 17. In addition, the Commission Order⁹ modifying the licensee states in part . . . The Commission directed, for replacement parts in operating plants, "unless there are sound reasons to the contrary, the 1974 standard in NUREG 0588 shall apply."

The resolution of this item will be included in the Safety Evaluation Report.

Justification for continued operation of the safety-related equipment not meeting all the applicable requirements of IEB 79-01B is provided in Section 3.9.4 of this report.

3.9.2 Equipment Located In Containment

Equipment Item: 1 pg I-001, 004, 007, 010
 Motor Operated Valve: EBV Systems Inc. - Electrip

Outstanding Items: Aging and Radiation
Category: IVb

Equipment Item: 2 pg I-002, 005, 008, 011, 013-20, 031-033, 050, 051
Motor Operated Valve: Limitorque Mod SMB-3, SMB-3-100, SMB-000-10
SMB-000-5, SMB-00-7½, SMB-1-40

Outstanding Items: Documentation, Time, Aging and Spray
Category: IVb

Equipment Item: 3 pg I-003, 006, 009, 012
Position Switch: NAMCO 180
Outstanding Items: Time and Aging
Category: IVb

Equipment Item: 4 pg I-021-025, 064-069, 070-077, 082-097
Pressure Transmitter: Rosemount Mod 1153AA6, 1153
Outstanding Items: Aging, Radiation and Submergence
Category: IVb

Equipment Item: 5 pg I-026
Level Sensor: EMS DeLeval Mod XM-36496
Outstanding Items: Radiation and Aging
Category: IVb

Equipment Item: 6 pg I-027-030
Valve Operator: Rotork Mod 70NAI(S), IINAI(S)
Outstanding Items: None
Category: Ia

Equipment Item: 7 pg I-034, 035, 048, 049
Valve Operator: Target Rock Mod. 74F-00-3-2
Outstanding Items: Time and Aging
Category: IVb

Equipment Item: 8 pg I-036-043
Containment Coolers: Reliance Mod EOA
Outstanding Items: Time and Aging
Category: IVb

Equipment Item: 9 pg I-044-047
Motor: Baldor Mod N-3534 TEFC
Outstanding Items: Spray, Radiation and Aging
Category: IVb

Equipment Item: 10 pg I-052-055
Pressure Transmitter: Foxboro Mod E-11
Outstanding Items: Aging
Category: IVb

Equipment Item: 11 pg I-056-063
RTD: Rosemount Type 104
Outstanding Items: Time, Radiation and Aging
Category: IVb

Equipment Item: 12 pg I-078, 079
Valve Operator: Limitorque Mod SMB-0010, SMB-0015
Outstanding Items: Documentation
Category: IVb

Equipment Item: 13 pg I-080, 081
H₂ Recombiner: Westinghouse Mod
Outstanding Items: Aging
Category: IVb

Equipment Item: 14 pg I-098-129
RCP Spreed Sensors: Bently Nevader Corp
Outstanding Items: Radiation
Category: IVb

Equipment Item: 15 pg I-130, 131
Radiation Detector: Victoreen Mod 877-1
Outstanding Items: Testing - Completion scheduled 12/80
Category: IVa

Equipment Item: 16 pg I-132
Cable: Raychem WCSF- - - N, ANK (See note on data sheet)
Outstanding Items: Aging
Category: IVb

Equipment Item: 17 pg I-133
Penetration Connectors: Conax 7590-1000 (See note on data sheet)
Outstanding Items: Radiation and Aging
Category: IVb

Equipment Item: 18 pg I-134
Cable: Anaconda (See note on data sheet)
Outstanding Items: Spray, Radiation and Aging
Category: IVb

Equipment Item: 19 pg I-135
Penetrations: Amphenol Sams 3X350MCM
Outstanding Items: Temperature, Pressure, Radiation and Aging
Category: IVb

Equipment Item: 20 pg I-136
Cable: Raychem (See data sheet)
Outstanding Items: Temperature, Pressure, Radiation and Aging
Category: IVb

3.9.3 Equipment Located Outside Containment

Equipment Item: 21 pg A-001, 003-005, 007, 008, 022-C24, 038, 041
 044-048, 050-052, 055-061, 078-080, 083-084, 087-089,
 091-093, 096, 097, 111-113, 130, 134, 140, 145, 146,
 150, 152
 Valve Operator: Limitorque SMB-00-10, SMB-5-350, SMB-000-5, SMB-000-2,
 SMB-000, SMB-40, SMB-00, SMB-0-15, SMB-00-7½
 Outstanding Items: Documentation and Aging
 Category: IVb

Equipment Item: 22 pg A-002, 006
 Valve Operator: Rockwell International Dwg #PD424721RV-B
 Outstanding Items: Documentation, Radiation and Aging
 Category: IVb

Equipment Item: 23 pg A-009-014;
 Motor: Reliance Mod H18MPACYA
 Outstanding Items: Radiation and Aging
 Category: IVb

Equipment Item: 24 pg A-015, 016
 Motor: American Air Flier Co - 10HP
 Outstanding Items: Documentation and Aging
 Category: IVb

Equipment Item: 25 pg A-107-021,
 Motor: Reliance 5HP
 Outstanding Items: Documentation and Aging
 Category: IVb

Equipment Item: 26 pg A-025, 026, 031-033, 036, 049, 062, 064, 070, 071
 Valve Operator: Electro/DYNE Type TN200/MB10
 Outstanding Items: Documentation and Aging
 Category: IVb

Equipment Item: 27 pg A-027-030
 E/H Valve Operator: CVI Corp Mod 2340-390
 Outstanding Items: Documentation
 Category: IVb

Equipment Item: 28 pg A-034
 Radiation Monitors: Westinghouse Mod 6S4
 Outstanding Items: Documentation and Aging
 Category: IVb

Equipment Item: 29 pg A-035, 037, 039, 040, 042, 043, 063, 065-069,
 136, 141, 144, 148

Flow Switch: ITT Barton Mod 289A, 288A
Outstanding Items: Documentation and Aging
Category: IVb

Equipment Item: 30 pg A-053, 054, 094, 095, 117, 118, 123, 124, 132,
133, 137, 138, 142, 143

Pressure Transmitter: Foxboro Mod E11GMSAE2, E11DM, E13DM-style B
Outstanding Items: Documentation Aging
Category: IVb

Equipment Item: 31 pg A-072-076, 098, 099, 131
Motor: Allis Chalmers 450HP MOD042, 600HPMOD 123
Outstanding Items: Documentation, Radiation and Aging
Category: IVb

Equipment Item: 32 pg A-077, 081, 086, 090
Flow Transmitter: Fisher Porter S/N7210A-5503A82,-81,-83,-84
Outstanding Items: Documentation and Aging
Category: IVb

Equipment Item: 33 pg A-085, 102-107
Valve Operator: Rotark Mod 70NA-2, 40A
Outstanding Items: Time
Category: IVb

Equipment Item: 34 pg A-108-110
Motor: G.E. Mod SK640AK233
Outstanding Items: Documentation
Category: IVb

Equipment Item: 35 pg A-114-116
Motor: Westinghouse Mod SBDP, SB
Outstanding Items: Documentation
Category: IVb

Equipment Item: 36 pg A-119-122
Valve Operator: Fisher Controls
Outstanding Items: Documentation
Category: IVb

Equipment Item: 37 pg A-125, 126
Radiation Element: Westinghouse Mod
Outstanding Items: Documentation
Category: IVb

Equipment Item: 38 pg A-127
Solenoid: Target Rock Mod 74F-010
Outstanding Items: Documentation
Category: IVb

Equipment Item: 39 pg A-128, 129
 Speed Transmitter: Terrysteam Turbine Co.
 Outstanding Items: Documentation
 Category: IVb

Equipment Item: 40 pg A-149, 151
 E/H Valve Operator: Weston Hydraulic Type C Diagonal W
 Outstanding Items: Documentation
 Category: IVb

Equipment Item: 41 pg A-153-156
 E/H Valve Operator: EBV Systems Inc. Type EFCO Matic 4
 Outstanding Items: Documentation
 Category: IVb

The following page numbers identify data sheets which do not include the manufacturer or model numbers:

HELB Outside Containment - pg A-027, 029, 135, 139 and 147

The manufacturer and model numbers are necessary to be able to include the equipment in the appropriate equipment items in this Section of the staffs TER and designate the Category. This information is required for the SER effort.

3.9.4 Justification For Continued Operation

The licensee has indicated that qualification data exists for all safety-related equipment inside of containment except for two radiation monitors which are being tested. We have indicated in Section 3.9.1 of this report the overall status and actions being taken by the licensee. The licensee's judgement that the equipment will function when required is based on

- . Time required to function
- . Extent of initial effort during licensing
- . Extent of IEB 79-01B effort to date
- . Data exists for in containment components
- . Similar qualified components
- . Short duration of HELB outside of containment
- . Adequate margin of safety exists

We have concluded, based on the information provided and the referenced material, that the justification is commensurate for the areas identified for the time required to resolve the open items. However, we request the licensee include the considerations identified in Section 4 of this report during their continuing effort to meet the requirements of IEB 79-01B.

4. Licensee Event Reports (LERs)

The licensee has indicated that, in their judgement, they have not identified any equipment which is not capable of meeting environmental qualification requirements for service intended. They have indicated in their submittal¹⁷ that equipment that has been found to fail under test conditions that are less severe than the events for ANO-2 will be identified in an LER as part of their continuing effort to implement IEB 79-01B.

The staff has identified in Supplement 1⁵ to IEB 79-01B that when a determination has been made that the existing data is inadequate or no data exists to support the judgement that the safety-related equipment will function in specified environments, when required, it is reportable per IEB 79-01B.

Therefore, not only known failures, but inadequate or no documentation maybe a basis for LERs. The staff has further indicated that the time and technical judgements to make the determination should be based on the significance of the specific components, functional requirements and degree of discrepancies. We, therefore, request that the licensee include these considerations in making their technical judgement to assure the continued safe operation of ANO-2.

5. Summary and Conclusion

The licensees actions in response to the Commissions Memorandum and Order have been detailed in this report. We have concluded, as the result of our evaluation, that the licensee has met the requirements of the order and provided adequate justification for continued operation pending the resolution of the open items in this report.

This evaluation is based on the licensees submittal, the FSAR, and the assumption that the referenced documentation which supplies the basis for the qualification is acceptable. An audit of these referenced documents will be conducted during the SER portion of the review and the results of the on-site inspection will also be included. The staff will identify the plant specific required actions and schedule for completion of the overall tasks related to environmental qualification of safety-related electrical equipment.

The areas requiring additional information, effort or resolution during the SER portion of the overall staff effort are:

Radiation	(Sec. 3.3.1.1 & 3.4.3)
Lessons Learned and Cold Shutdown	(Sec. 3.2)
Test Duration	(Sec. 3.5)
Aging	(Sec. 3.6)
Replacement and Spare Parts	(Sec. 3.9.1)
Manufacturer and Model Numbers	(Sec. 3.9.3)
Licensee Event Reports	(Sec. 4)
Audit of Installed System	(Sec 3.8)
Audit of Test Data and Analysis	(Sec 3.9.2, 3.9.3 and Appendix C)

The results of this evaluation does not imply that the unresolved items constitute an unsafe condition or that the equipment is unqualified. However, it does identify areas where additional effort, actions or information is needed.

6. References

1. Office of Inspection and Enforcement Bulletin number 79-01B, dated January 14, 1980.
2. Division of Operating Reactors (DOR), "Guidelines for Evaluating Environmental Qualification of Class IE Electrical Equipment in operating Reactors," Enclosure 4 to IEB 79-01B.
3. NUREG-0588, "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment," dated December 1979.
4. Commission Memorandum and Order, "Petition for Emergency and Remedial Action," dated May 23, 1980.
5. Supplement Number One to IEB 79-01B, dated February 29, 1980.
6. Supplement Number Two to IEB 79-01B, dated September 30, 1980.
7. Supplement Number Three to IEB 79-01B, dated October 29, 1980.
8. Order, dated August 29, 1980, requiring licensee submittal by November 1, 1980.
9. Order, dated October 24, 1980, requiring modification of license to codify documentation.
10. Arkansas Power and Light Company, Status of Response to IEB 79-01B, dated February 22, 1980
11. Arkansas Power and Light Company, Response to IEB 79-01B, dated February 28, 1980.
12. Screening Review of Licensees Responses to IEB 79-01B and Summary of Audit of Installed Systems at Arkansas Nuclear One - Units 1 and 2, Memo to V. Thomas (NRC) from D. McDonald (NRC) dated April 8, 1980.
13. IEB 79-01B, Identification of Systems and Parameters Monitored, Memo to V. Thomas (NRC) from D. McDonald (NRC) dated August 27, 1980.
14. Arkansas Power and Light Company, Supplemental Response to IEB 79-01B, dated April 14, 1980.
15. Arkansas Power and Light Company, Additional Information and Schedule, dated June 23, 1980
16. Arkansas Power and Light Company, Status of Response to IEB 79-01B and Request for Schedule Relief, dated October 9, 1980.
17. Arkansas Power and Light Company, Response to IEB 79-01B and Supplements 1, 2 and 3, dated October 31, 1980.

APPENDIX A

CATEGORY DEFINITIONS
AND REQUIRED ACTIONS

ACTION REQUIRED

CATEGORY	STAFF	LICENSEE
<p>I. <u>Equipment Is Qualified for Plant Life</u></p>		
<p>a.) Equipment meets all applicable requirements of DOR Guidelines or NUREG-0500.</p>	<p>Audit 20% - If discrepancies are found-continue Audit by 10% increments until either no discrepancies are found or report completed. Discrepancies should be recategorized.</p>	<p>If discrepancies are found - equipment will be requalified or replaced.</p>
<p>b.) Qualification by judgement may be acceptable with sufficient basis</p>	<p>Review each item to determine if sufficient basis is provided. If basis not sufficient recategorize.</p>	<p>Sufficient basis for qualification must be provided. If Basis is not acceptable to Staff Equipment must be requalified or replaced.</p>
<p>II. <u>Equipment Is Qualified With Restrictions</u></p>		
<p>Equipment meets all applicable requirements of DOR Guidelines or NUREG-0500 with the following exceptions:</p>	<p>Audit 20% - Same as Above</p>	
<p>a.) Equipment Qualification for service life less than plant life</p>	<p>Review program for replacement. Place approved schedules in computer databank.</p>	<p>If program is not acceptable, licensee must revise. If acceptable, technical specifications should be revised to include schedule.</p>
<p>b.) Equipment requires modification to meet qualification requirements, such as relocation or shielding.</p>	<p>Review safety significance, review program for correction.</p>	<p>Licensee will provide schedule and basis for continued operation. If schedule modification is not acceptable licensee must revise.</p>

CATEGORY	ACTION REQUIRED	STAFF	LICENSEE
<p>II. <u>Equipment are Exempted from Qualification</u></p> <p>Equipment where safety related function can be accomplished by redundant fully qualified equipment which meets single failure criteria.</p>	<p>Staff will review each item for sufficient basis. If sufficient basis is not provided equipment should be recategorized.</p>	<p>Sufficient basis should be provided. If basis is not acceptable to staff then equipment must be qualified or replaced.</p>	
<p>IV. <u>Qualification of Equipment Unresolved</u></p> <p>a.) Qualification testing scheduled but not complete.</p>	<p>Review schedule for providing qualification information - schedule should allow sufficient time to replace equipment if test is negative. Licensing judgement on operation of plant for interim.</p>	<p>Provide schedule for completing qualification testing. Justification for interim operation should be provided.</p>	<p>Same as above.</p>
<p>b.) Qualification records search still in progress.</p>	<p>Staff will review basis for continued operation and schedule for equipment replacement.</p>	<p>Licensee will provide LER and Basis for continued operation. If scheduled for equipment replacement is not acceptable, licensee will revise.</p>	
<p>V. <u>Equipment Not Qualified</u></p>			

APPENDIX B

SUMMARY

AUDIT OF INSTALLED SYSTEM

The staff has indicated in Section 3.8 of this Technical Evaluation Report that the details of the as-installed system for ANO-2 will be conducted during the currently scheduled refueling outage in March 1981. The results of the audit of the reactor coolant system will be incorporated in the SER or a supplement to the SER.

APPENDIX C

TEST REPORT AND ANALYSIS LIST

ANO-2 NUCLEAR 1
DOCUMENT LIST

EQUIPMENT: Electronic Transmitters

	DOCUMENT TITLE	TEST LAB/AGENCY MEGR. NAME	DOCUMENT ID NUMBER	REV. DATE
1.	Special High-Temperature Steam Application. Engineering Report on Electronic DP Transmitters	Fischer & Porter	DP-2204-51-B-000	December 2, 1968
2.	Qualification Tests of Differential Pressure Transmitters Under Nuclear Irradiation	Franklin Institute	F-C 2815	May, 1970
		Fischer & Porter	DP-2224-1 Rept 001	
3.	Environmental Qualification Test Program on Electronic Transmitters for Rosemont 1153GA9, Fischer & Porter 59EP1041BCXA, Fischer & Porter 13D2496QB, Foxboro E11AH	Wyle Labs Rosemont	26304	A
		Fischer & Porter Foxboro		April 12, 1979
4.	Maximum Credible Accident Test for E10 Series Differential and Gauge Pressure Transmitters and Supplemental Test for Function Box Assemblies	Franklin Institute Foxboro	T3-1013	June, 1973
5.	Radiation Test of E-10 Series Amphenol Standard and Radiation Resistant Types	Isomedix Foxboro	T3-1097	November, 1973

ANO-2 NUCLEAR 1
DOCUMENT LIST

EQUIPMENT: Electronic Transmitters (continued)

	DOCUMENT TITLE	TEST LAB/AGENCY MFR. NAME	DOCUMENT ID NUMBER	REV. DATE
6.	Radiation Test of E-10 Series Differential Pressure Transmitters of the MCA/RRW Type	Isomedix		
		Foxboro	T3-1068	August, 1973
7.	Seismic Vibration Test of E-10 Series Transmitters	Action Labs		
		Foxboro	T3-1091	October, 1973
8.	Qual. Test Report for Rosemont Pressure Transmitters Model 1153, Series A			
		Rosemont	3788	March 28, 1978

ANO-2 NUCLEAR 1
DOCUMENT LIST

EQUIPMENT: Electrical Penetrations

DOCUMENT TITLE	TEST LAB/AGENCY MFGR. NAME	DOCUMENT ID NUMBER	REV. DATE
1. Special Prototype Radiation and Environmental (LOCA) Tests of Medium and Low Voltage Electric Penetration Assembly	Amphenol	123-1045	A March 28, 1975
2. Design Verification Report	Amphenol	123-1275	May 5, 1972
3. Loss of Coolant Accident Testing of Utilized Header Penetration Assemblies	Amphenol	123-1247	April, 1973

ANO-2 NUCLEAR 1
DOCUMENT LIST

EQUIPMENT: Radiation Monitors

DOCUMENT TITLE	TEST LAB/AGENCY MFR. NAME	DOCUMENT ID NUMBER	REV. DATE
1. Temperature and Humidity Characteristics for the Production Unit Rate Meter Electronics of Radiation Monitor Equipment	N/A	N/A	N/A
	N/A	N/A	January 9, 1972
2. Production Test Procedures for Radiation Monitoring Prototype System	Westinghouse	T-852596	February 18, 1970
	Bechtel	6600-M-2217	12 September 10, 1979
3. Specification for Area and Process Radiation Monitoring Systems			

ANO-2 NUCLEAR 1
DOCUMENT LIST

EQUIPMENT: Vane-Type Fan Motors

DOCUMENT TITLE	TEST LAB/AGENCY MFCR. NAME	DOCUMENT ID NUMBER	REV. DATE
1. Qualification of a Fan and Motor Designed for Service in Nuclear Environment by Walter Blenko, Walter G. Stiltler (a Technical Paper by Reliance Employees)	N/A	N/A	
	Reliance Elec.	N/A	September 20-23, 1971 Published

ANO-2 NUCLEAR 1
DOCUMENT LIST

EQUIPMENT: Cables

	DOCUMENT TITLE	TEST LAB/AGENCY MFR. NAME	DOCUMENT ID NUMBER	REV. DATE
1.	Engineering Report Number 110E on Nuclear Qualification of Insulating Compounds	Franklin Institute		
		Okonite Co.	110E	November 12, 1970
2.	Engineering Memo on Effects of Radiation and Aging of Flamtrol Insulated Wire			
		Raychem	EM #517A	April 18, 1972
3.	Engineering Memo on the Effects of Radiation and Aging on a Coaxial Cable			
		Raychem	EM #518A	May 18, 1972
4.	Tests of Electrical Cables Under Simulated Reactor Containment Service Conditions	Franklin Institute	F-C3033	April, 1971
		Anaconda Wire and Cable Co.		
5.	Test of Raychem Flamtrol Insulated and Jacketed Electrical Cables Under Simultaneous Exposure to Heat, Gamma Radiation, Steam and Chemical Spray while Electrically Energized	Franklin Institute	F-C4033-1	January, 1975
		Raychem Corp.		

ANO-2 NUCLEAR 1
DOCUMENT LIST

EQUIPMENT: Cables (continued)

DOCUMENT TITLE	TEST LAB/AGENCY MFGR. NAME	DOCUMENT ID NUMBER	REV. DATE
6. Long-term testing of Electrical Cables Under Simultaneous Exposure to Radiation, Steam, and Chemical Spray	Franklin Institute	F-C3341	January, 1973
	Anaconda Wire and Cable Co.		

ANO-2 NUCLEAR 1
DOCUMENT LIST

EQUIPMENT: Gems Liquid Level Sensor

	DOCUMENT TITLE	TEST LAB/AGENCY MFR. NAME	DOCUMENT ID NUMBER	REV. DATE
1.	Environmental Exposure of Liquid Level Sensor	Isomedix		November, 1975
		Gems Sensor Div. of DELAVAL		
2.	Test of a Liquid Level Sensor Under Conditions Simulating a LOCA within the Containment of a Nuclear Power Generating Station	Franklin Institute	F-C3834	March, 1974
		Gems Sensor Div. of DELAVAL		

ANO-2 NUCLEAR 1
DOCUMENT LIST

EQUIPMENT: Limit/Position Switches

	DOCUMENT TITLE	TEST LAB/AGENCY MFR. NAME	DOCUMENT ID NUMBER	REV. DATE
1.	Qualification of NAMCO Control Limit Switch Model EA-740 to IEEE Stds. 344 ('75), 323 ('74), and 382 ('72)	National Acme Acme-Cleveland Dev. Co.		February 20, 1978
2.	Seismic Qualification Test Program for Limit Control Switches	Edward J. Walter Associates NAMCO, of Acme-Cleveland Co.		June, 1977
3.	Qualification of NAMCO Controls Limit Switch Model E-180	Acme Cleveland Co., NAMCO Controls Div.	N/A	November 21, 1977

ANO-2 NUCLEAR 1
DOCUMENT LIST

EQUIPMENT: Solenoid Valves

DOCUMENT TITLE	TEST LAB/AGENCY MFG. NAME	DOCUMENT ID NUMBER	REV. DATE
Seismic Qualification Test Program for ASCO Solenoid Valves HT 8321A AC & DC HPX 8320A266 (DC); HT831654 (DC)	Wyle Labs		
	Automatic Smith Co.		June 17, 1978
Seismic Test Report for ASCO Solenoid Valves HT 8321A5 (AC); HB 83028IU (AC)	SW Engineering Report		
	ASCO	122	October 6, 1976
Seismic Testing of One Solenoid Assembly TROMGETTA Q 515-A5	Wyle	58342	July 31, 1978
	TROMBETTA		
Seismic Testing of 1" Solenoid Valve - F008 1/4 HP Motor Etc. F Insulation	Wyle	58307	June 20, 1979
	Target Rock Gen. Elec.		
Seismic Analysis of the Target Rock Corp. 74 F Seis. Solenoid Operated Valves			
	Target Rock Corp.	1499	February 27, 1975

ANO-2 NUCLEAR 1
DOCUMENT LIST

EQUIPMENT: Solenoid Valves

DOCUMENT TITLE	TEST LAB/AGENCY MFR. NAME	DOCUMENT ID NUMBER	REV. DATE
Env. Test Report on TRC Model 72 V Type 1" Y Pattern Solenoid Valve	Target Rock Corp.	1	October 22, 1976
		1500	
Env. Test for Solenoid Valves	Target Rock Corp.	1382	July 3, 1973
	EAST/WEST Tech.	7610-6	<u>B</u> April 25, 1977
Env. Test Report on TRC Model 75 G-002-1" "Y" Pattern Solenoid Motor Valve	Target Rock Corp.	1827 B \	November 4, 1976