Nutherm INTERNATIONAL, INC.

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April 21, 1988

United States Nuclear Regulatory Commission
Attention: Mr. James C. Stone, Acting Chief
Vendor Inspection Branch
Division of Reactor Inspection and Safeguards
Office of Nuclear Reactor Regulation
Washington, D.C. 20555

RE: Docket No. 99900779/87-01

Gentlemen:

On February 23, 1988 Nutherm International (NI) provided the NRC an interim response to your Inspection Report dated January 25, 1988. This response addressed the corrective and preventive actions that had either been taken or were scheduled to be taken in response to each of the NRC nonconformances. Implementation dates were provided for those actions that had been completed, and dates were forecasted for actions not complete as of February 23, 1988. This letter includes a summary of all actions taken to resolve the NRC nonconformances, enhance our quality program and investigate the allegations in the anonymous letter. To assist in your review this response has incorporated all information from our February 23 response, exclusive of the attachments.

ERCI, Inc., whose qualifications were submitted as Attachment II to our February 23, 1988 response, has completed an independent review of our Quality Assurance Manual, Quality Assurance Procedures and other related procedures, i.e. Engineering Standards. Attachment I is the ERCI, Inc. report on their review, Attachment II the Quality Assurance Manual revision log and Attachment III the Quality Assurance Procedure revision log.

As of this writing Nutherm has implemented all ERCI, Inc. recommended new procedures and changes to the Quality Assurance Manual and Quality Assurance Procedures. As delineated in our response interim measures were taken as necessary to assure that all tasks completed since the applicable regulatory review satisfy applicable regulatory and customer requirements. Based on this review and implementation of these recommendations we are confident the NI quality program is now in accordance with the applicable requirements of Appendix B to 10CFR Part 50 and Part 21. To insure this confidence is not misplaced we have engaged ERCI, Inc. to conduct another review this summer of both our quality and qualification programs to confirm continued implementation.

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ERCI, Inc. also conducted a technical audit of the adequacy of Nutherm's Equipment Qualification program. This technical audit was conducted by Mr. Gary Toman of ERCI's Power Engineering Group who has extensive experience in the conduct of equipment qualification reviews for a number of utilities. Mr. Toman's resume is attached to his report on the technical audit, included herein as Attachment IV. Two completed projects (both completed in 1986) were randomly selected for this audit. The projects included a heater system with a control panel exposed to a harsh environment radiation condition and a D.C. power panel that required seismic testing.

The purpose of this technical audit was to determine if the qualification basis for these projects was adequate, and if any errors or omissions in reporting or testing had significant adverse effects on the qualification status. This audit required ERCI, Inc. to review qualification test records covering several years and dating back as far as August, 1983. Only two items from this technical audit caused concern, and even these two items would not invalidate the qualification status of the equipment. The two projects selected are representative of the type of equipment qualification work performed by Nutherm and were complex enough to provide for a review of a significant sample of records. Based on the results of the review, it is Nutherm's position that projects completed to date have been properly qualified.

Our evaluation of the allegations in the anonymous letter of September 2, 1987 is complete and is enclosed as Attachment V. As indicated in our previous response, we broke the allegation letter down into discrete allegations (31 total) as delineated in Attachment I to our February 23 response. For each allegation which, if valid, could have an effect on the qualification of NI supplied safety related equipment we describe the investigation method. Where we agreed that the condition existed and needed to be corrected, the corrective actions and steps to prevent recurrence are listed.

In addition to the action stated above, NI is pleased to inform you that Mr. Sven Akerman joined our staff on April 4, and was appointed Manager of the Quality Assurance Department effective April 18, 1988. We feel that Mr. Akerman will significantly strengthen NI's Quality Assurance team. A copy of his resume is attached as Attachment VI.

The following section addresses, by NRC reported nonconformance, corrective action taken to correct specific nonconformances identified by the NRC in your letter of January 25 including the interim measures taken by NI to assure compliance of work in progress, preventive actions taken by NI to assure that these conditions do not occur in all future work, and an evaluation of the nonconformance upon the validity of NI's Certificate of Conformance for previously supplied hardware. Within our response the letter designation refers to the nonconformance sub-part, as specified in the nonconformance.

NONCONFORMANCE B.1

Contrary to Criterion II, "Quality Assurance Program," of Appendix B to 10 CFR Part 50, and Section 2 of the NI QA Manual (QAM):

a. Section 10 of the QAM does not prohibit a person from inspecting their own work;

b. Section 10 of the QAM does not require QA inspection and monitoring activities in NI's equipment testing facility; and

c. NI has not established procedures to control its periodic use of rented measuring and test equipment (M&TE).

CORRECTIVE ACTIONS

A.I) Section 10 of the Quality Assurance Manual (QAM) was revised to specifically provide that inspection must be independent of the individual performing the work and the supervisor responsible for the work being inspected.

B.I) Quality Control Inspection Procedure (QCI) 18.4.01 requiring random surveillance inspection of laboratory testing was issued on December 30, 1987.

B.II) Quality Assurance Procedure (QAP) 10.0.00 requiring establishment of a controlled inspection plan for each test procedure was issued on April 11, 1988.

B.III) Section 10 of the QAM was revised to specifically delineate equipment qualification testing as an activity requiring an inspection program.

C.I) Measuring and Test Equipment (MTE) Procedure 2.4.01 requiring all rented equipment to be entered into the calibration control log was issued December 30, 1987.

C.II) A group of randomly selected inspections, examination and test documents confirmed compliance with the procedural requirement in QAP 12.4.01 issued December 30, 1987 that inspectors and laboratory technicians record instrument control or serial number and calibration dates on all MTE used, including rental equipment.

C.III) A review was made of the sources of rented MTE to assure they are properly qualified vendors with a documented quality program that requires notification to renters prior to calibration expiration dates.

STEPS TO PREVENT RECURRENCE

A.I) Section 10 of the QAM and related procedures were reviewed by ERCI and revised where necessary to insure compliance with 10 CFR Part 50, Section 10.

A.II) Periodic internal audits, procedurally specified document review and inspection will insure compliance with the QAM and QAP preventing recurrence of the nonconforming condition.

B.I) Section 10 of the QAM and related procedures were reviewed by ERCI and revised where necessary to insure compliance with 10 CFR Part 50, Section 10.

B.II) Periodic internal audits, procedurally specified document review and inspection will insure compliance with the QAM and QAP's, including the above referenced corrective actions, presenting recurrence of the nonconforming condition.

C.I) Section 12 of the QAM and related procedures were reviewed by ERCI and revised where necessary to insure compliance with 10 CFR Part 50, Section 12.

C.II) Periodic internal audits, procedurally specified document reviews and inspections will insure compliance with the QAM and QAP's, including the above referenced corrective actions, preventing recurrence of the nonconforming condition.

EVALUATION OF NONCONFORMANCE EFFECT ON
CERTIFICATES OF CONFORMANCE

A.I) Although lab technicians were improperly signing for test performance in a signature block labeled QA Inspector and the review of lab tests was improperly documented in a signature block labeled QA Approval the tests and results were reviewed by the Laboratory Manager. Accordingly, it is reasonable to conclude this nonconformance does not impair the qualification of safety-related equipment.

B.I) Failure to establish appropriate QA inspection and monitoring activities in the equipment testing facility is mitigated by the qualification of lab technicians as Level II electrical inspectors, review of their work by the laboratory manager, documentation of test results and the size of the organization simplifying communications and informal observance of tests. The review of randomly selected equipment qualification by ERCI did not reveal any impairment in the qualification of safety-related equipment.

C.I) The use of rental equipment only from qualified vendors who maintained notification procedures for calibration dates, the short-term nature of Nutherm rentals and the procedurally dictated recording of calibration dates, including rental equipment mitigates this nonconformance providing reasonable assurance the nonconformance did not impair the qualification of safety related equipment.

NONCONFORMANCE B.2

Contrary to Criterion III, "Design Control," and Criterion VI, "Document Control," of Appendix B to 10 CFR Part 50; Section 3.0, 4.0, and 5.0 of NI's QAM and NI QAP #3.0.00:

a. NI "Qualification Results Index" (QRI) forms, which are used as specific hardware instruction riders to NI's generic functional and test procedures that designate design parameters for testing, do not indicate that an independent technical review was performed. Additionally, QRI's do not correctly and/or fully translate the design requirements into test parameters [illegible] standards;

b. Equipment Qualification procedures and functional test procedures did not indicate that an independent review was performed to verify technical adequacy; and

c. In the pre-1986 time period the engineering manager did not perform the required design verification activity for several design drawings.

CORRECTIVE ACTIONS

A.I) Test Specimen Work Order and Test Results Procedure 9.7.11.03 was revised November 25, 1987 to ensure that adequate testing is performed. The Test Specimen Work Order form replaced the QRI effective September 9, 1987. This same procedure requires an engineering review and approval of test results. As an interim measure. Engineering Instruction 25-EI1, "Method for Determining Procedure Referenced Ratings," was issued to define additional design parameters for testing. This has now been replaced by procedural requirements in QAP 11.0.00 Test Control.

A.II) New QAP 3.0.01 delineating in detail the method and approval process for designation of design parameters for testing and translation of design requirements was issued on April 10.

A.III) New QAP 11.0.00 detailing the method of providing test parameters and quality standards to the test lab was issued on April 10.

A.IV) QAP 11.0.00 requires Engineering to provide test parameters and review test results.

B.I) QAP 6.0.00 was revised to provide engineering review and approval of all equipment qualification and functional test procedures with Quality Assurance approval where applicable.

B.II) QAP 11.0.00 requires Engineering to prepare the test procedure, requires specification by engineering of exact test parameters and delineates the requirements to perform a technical adequacy review incorporating the project plan, QAP 3.0.01.

C.I) QAP 3.0.00 was revised to incorporate design review and approval requirements by the Engineering Manager. This process includes defining design input requirements and completing a design checklist.

C.II) New QAP 3.0.02 defining the method of preparing and approving engineering calculations was issued.

STEPS TO PREVENT RECURRENCE

A.I) Section 3 and 11 of the QAM and related procedures were reviewed by ERCI and revised where necessary to insure compliance with 10 CFR Part 50, Criterion III and 10 CFR Part 50, Criterion XI, respectively.

A.II) Periodic internal audits and procedurally specified controls will insure compliance with the QAM and QAP preventing recurrence of the nonconforming condition.

B.I) Section 6 and 11 of the QAM and related procedures were reviewed by ERCI and revised where necessary to insure compliance with 10 CFR Part 50, Criteria VI and 10 CFR Part 50, Criterion XI, respectively.

B.II) Periodic internal audits and procedurally specified controls will insure compliance with the QAM and QAPs presenting recurrence of the nonconforming condition.

C.I) Section 3 of the QAM and related procedures were reviewed by ERCI and revised where necessary to insure compliance with 10 CFR 50, Criterion III.

C.II) Periodic internal audits and procedurally specified controls will insure compliance with the QAM and QAPs preventing recurrence of the nonconforming condition.

EVALUATION OF NONCONFORMANCES EFFECT ON CERTIFICATES OF CONFORMANCES

A.I) A review by ERCI of randomly selected qualification projects did not disclose any deficiencies in translation of design parameters for testing that would impair the qualification of safety related equipment.

A.II) QRI's 1494, 1495, 1403, 1467, sic 1496 (1759), 1514, sic 1529 (1579), 1526, 1570 and 1540 noted as item 2(a) on pages 2 and 3 of the NRC notice of nonconformance along with the related test results were evaluated by a qualified engineer. The engineer determined that the technicians interpretation of the manufacturers or other source information was adequate to qualify the components as stated in the applicable Certificate of Conformance.

No test results were found which would compromise the equipment qualification process or the devices ability to function. Accordingly, this nonconformance does not impair the qualification of safety related equipment.

B.I) A review by ERCI of randomly selected qualification projects did not disclose any deficiencies in qualification and functional test procedures that would impair the qualification of safety related equipment.

B.II) The equipment qualification and functional test procedures listed below and noted as Item 2(b) on pages 3 and 4 of the NRC notice of nonconformance were reviewed by a qualified engineer and found to be technically adequate. The procedures describe and translate the applicable technical requirements of the procedure referenced industry standards into acceptable test methods. Accordingly, the procedural nonconformance did not impair the qualification of safety related equipment.

Procedure Number	Date of Issuance
9.7.10.30	5/86
9.7.10.29	5/86
9.7.10.22	12/85
9.7.10.17	11/85
9.7.10.6	11/85
9.7.10.10	4/86
9.7.10.39	9/29/86
9.7.10.26	1/86
7.2.07	2/85
7.2.06	3/86
7.2.13	10/86

C.I) Although certain procedural deficiencies in design approvals by qualified personnel have occurred as identified and others may exist design verification has always been performed through documented qualification and production testing as permitted in ANSI N45.2.11. Accordingly, the procedural deficiency does not impair the qualification of safety related equipment.

C.II) Drawing No. 7023-56767-53, Project 1759 noted as Item 2(c) on page 4 of the NRC notice of nonconformance was reviewed by a qualified engineer who found the design requirements had been properly incorporated reflecting

the project specification requirements and applicable Nutherm engineering standards. Accordingly, this nonconformance does not impair the qualification of safety related equipment.

C.III) The drawing numbers listed below and noted as Item 2(c) on page 4 of the NRC notice of nonconformance were noted to have been reviewed and approved by a qualified engineer in its final revision.

Drawing 7013-55215-53, Project 1167
Drawing 7023-56994-33, Project 2169
Drawing 4033-56689-33, Project 1712
Drawing 1023-55953-33, Project 1497

Accordingly, this nonconformance does not impair the qualification of safety related equipment.

C.IV) Drawing No. 5001-54983-43, Project 1214 noted as Item 2(c) on page 4 of the NRC notice of nonconformance was reviewed by a qualified engineer who also reviewed the related test results and quality assurance inspection reports to ascertain the items built to these drawings had been tested properly to permit design verification by actual test. Accordingly, this nonconformance does not impair the qualification of safety related equipment.

NONCONFORMANCE B.3

Contrary to Criterion X, "Inspection," of Appendix B to 10 CFR Part 50, NI is not providing adequate QA inspection/verification control of quality related activities as follows:

a. NI has failed to implement the QA inspection or monitoring program for its equipment testing facility;

b. NI management allows the same technician who performed equipment test activities to inspect his/her own work and sign the "QA inspector approval" block; and

c. NI management allowed the equipment test facility supervisor to sign the "QA Approval" block for testing results that were performed by his technicians.

CORRECTIVE ACTIONS

A.I) QCI Procedure 18.4.01 was implemented December 30, 1987 requiring in-process monitoring and surveillance inspection of activities being performed in the equipment test facility. This monitoring and inspection is being performed by Quality Assurance personnel independent of the actual work performed or the supervision thereof. The procedure requires the inspections to be unannounced random inspections with a minimum of five such inspections of each lab technician each month. It is anticipated frequency of these inspections will be reduced depending upon historical results and the documented experience of each technician since the procedure described in A.II, below will significantly expand normal inspection activities.

A.II) In accordance with new QAP 10.0.00 a controlled inspection plan prepared by Engineering, reviewed and approved by Quality Assurance has been prepared for each test procedure designating witness and/or hold points for Quality Assurance inspections and monitoring of the technical procedures.

B.I) All forms utilizing the "QA Inspector" signature block for signature by the technician performing the test activities have been revised to remove the misleading "QA Inspector" designation. Such forms for work-in-process at the time of Nutherm's voluntary suspension of work on November 19 were revised by lineouts of this designation initialed by the Quality Assurance Manager prior to resumption of work on November 24.

B.II) Inspection activities by Quality Assurance delineated in corrective actions A.I and A.II for this nonconformance will provide the proper required inspection.

C.I) All forms utilizing the "QA Approval" signature block for signature by the equipment test facility supervisor will be revised to remove the "QA Approval" designation. Such forms for work in process at the time of Nutherm's voluntary suspension of work on November 19 were revised by lineouts of this designation initialed by the Quality Assurance Manager prior to resumption of work on November 24.

C.II) QAP 11.0.00 now requires submission of test results to Engineering for review and approval.

STEPS TO PREVENT RECURRENCE

A.I) Section 10 of the QAM and related procedures were reviewed by ERCI and revised where necessary to insure compliance with 10CFR Part 50, Criterion X.

A.II) Periodic internal audits and procedurally specified document reviews will insure compliance with the QAM and QAP's preventing recurrence of the nonconforming condition.

B.I) The corrective actions specified in B.I and B.II and QAP 6.0.01 implemented December 10, 1987 enhancing control of forms will prevent recurrence of this nonconforming condition.

C.I) The corrective actions specified in C.I. and C.II and QAP 6.0.01 implemented December 10, 1987 enhancing control of forms will prevent recurrence of this nonconforming condition.

EVALUATION OF NONCONFORMANCE EFFECT ON CERTIFICATES OF CONFORMANCE

A.I) A review by ERCI of randomly selected qualification projects including numerous tests did not disclose any differences in testing that would impair the qualification of safety related equipment.

A.II) Test results utilized in qualification are reviewed by Engineering prior to use in qualification and the test performances were reviewed by the Laboratory Manager. Although these processes are not adequate to fulfill the specific requirements of Criterion X, they provide reasonable assurance that errors in testing, if any, would not impair the qualification of safety related equipment.

B.I) Although use by the technicians performing the work of the signature block designated "QA Inspector" for signature was misleading, the technicians performing the work were qualified as Level II electrical inspectors.

The history of the form use supports the position that this was inadvertently created by historical form changes and not through deliberate intention to deceive. Accordingly, this use is not viewed as evidence of deceptive practices. Failing definition as an intentional deceptive practice the use of the wrong designation did not impair the qualification of safety related equipment.

C.I) Use by the lab supervisor of a signature block designated "QA Approval" for signature was misleading. The history of the form use supports the position that this inadvertently created by historical form changes and not through deliberate intention to deceive. Accordingly, this use is not viewed as evidence of deceptive practice. Failing definition as an intentional deceptive practice use of the wrong designation did not impair the qualification of safety related equipment.

NONCONFORMANCE B.4

Contrary to Criterion XI, "Test Control," of Appendix B to 10 CFR Part 50, NRC observations of equipment tests and record reviews indicate that NI is neither adequately controlling nor effectively monitoring its safety-related activities that are being performed in its equipment test facility.

CORRECTIVE ACTIONS

A.I) Since April 10 test requirements, test parameters and acceptance criteria are included in all test procedures and test instructions.

A.II) Since April 10, 1988, all test procedures have Inspection Plans.

A.III) Since November 24, 1987 all test results are reported to Engineering for evaluation.

A.IV) As delineated under nonconformance B.3, inspection activities in the test lab have been significantly enhanced.

A.V) QAP 9.7.6.03 has been revised to more completely describe the testing process and controls thereof.

A.VI) QAP 11.0.00 defining and expanding test control methods was issued.

STEPS TO PREVENT RECURRENCE

A.I) Section 11 of the QAM and related procedures were reviewed by ERCI and revised where necessary to insure compliance with 10 CFR Part 50, Criterion XI.

A.II) Periodic internal audits and procedurally specified document reviews will insure compliance with the QAM and QAP preventing recurrence of the nonconforming condition.

EVALUATION OF NONCONFORMANCE EFFECT ON CERTIFICATES OF COMPLIANCE

A.I) A review by ERCI of randomly selected qualification projects included numerous tests did not disclose any deficiencies in testing that would impair the qualification of safety related equipment.

A.II) The "undervoltage" relay baseline functional test for Project 2605 noted as item 4(a) on page 5 of the NRC notice of nonconformances was verified as having subsequently been properly performed. Additionally, the Equipment Qualification Manager has evaluated the effect of performing this test improperly at this point in the test sequence. A review of previous testing by the same technicians utilizing the same procedure showed the technicians had properly calculated the loading. Since baseline function testing utilizing this procedure is repetitive after each qualification test it is reasonable to conclude the failure observed was an isolated incident and would not affect the quality of safety-related activities.

A.III) The AC contactor device tested for BPC-2475 noted as Item 4(b) on page 5 of the NRC notice of nonconformance was retested utilizing the required inductive load and adjustable AC power supply with no test anomalies.

Review of previous testing on other projects and other devices utilizing Technical Procedure 9.7.10.10, Rev. 3 disclosed the testing had been performed at the full rated load which has been evaluated by Engineering to provide adequate assurance for qualification. Accordingly, this nonconformance does not affect the quality of safety related activities.

A.IV) The conflict of test results for Project 1841 noted as Item 4(c) on page 5 of your notice of nonconformances indicating a total load of 11 amperes recorded with a voltage meter with a maximum read out capability of 10 amperes was investigated. This investigation disclosed that to obtain readings above 10 amperes on this digital meter with available decimal read outs to 3 1/2 digits a current transformer of 1:1000, NI 132 was consistently utilized. This is documented by examination of numerous test results showing use of this meter for readings well in excess of the 10 amps nominal meter reading and a statement from the laboratory technicians of utilization of a current transformer in cases where amperage exceeded nominal rating of the meter. Failure to record the use of the calibrated current transformer will be monitored through procedural changes described elsewhere in this report. Based on this review it is reasonable to conclude the nonconformance reflects a failure to record use of equipment and not failure to apply required loads. Accordingly, the nonconformance would not impair the qualification of safety related equipment.

A.V) QAP 9.7.6.03 noted as Item 4(d) on page 5 of your notice of nonconformances has been revised to specifically delineate IEEE 323 E.Q. report requirements. This procedure was not relied upon to assure compliance with IEEE-323 requirements. Each report was signed by the Equipment Qualification Manager who is qualified to fulfill this position. All reports specify requirements met and the ERCI independent review of qualification reports did not disclose any report deficiencies in this regard. It is reasonable to conclude this procedural deficiency did not impair the qualification of safety related equipment.

A.VI) The failure to follow the recording dictated in Technical Procedure 9.7.10.10 noted as Item 4(e) on page 6 of the NRC notice of nonconformance was evaluated by Engineering as a procedural deficiency. The procedure was revised to provide for recording the voltage and current only at the initiation of the test since this is a continuous test utilizing resistive load banks where the voltage and current will not vary. Accordingly, the failure noted to follow the procedure did not impair the qualification of safety related equipment.

NONCONFORMANCE B.5

Contrary to Criterion XVII "Quality Assurance Records," of Appendix B to 10 CFR Part 50, adequate records were not in evidence to indicate personnel qualification for several past and present NI employees. The following NI employee files [identified by employee initials] were found to be either incomplete, incorrect, or indeterminate as to the relevant experience and/or education: HB, CG, GW, SS, DW, GJ, SDJ, LH, and PB.

CORRECTIVE ACTIONS

A.I) Personnel qualification requirements have been specified, in writing, for all classifications of personnel who are required to perform work that can affect the quality of safety-related activities. These qualification requirements were reviewed and found to be appropriate.

A.II) Position titles of all employees engaged in quality related activities were documented, and acknowledgement of the title obtained from the employee.

A.III) QAP's were reviewed to ascertain that qualification requirements have been delineated for position titles utilized in the procedures.

A.IV) Personnel files of all current employees performing nuclear safety-related work were reviewed to assure that sufficient documentation existed to satisfy the requirements specified in corrective action A.I. Independent verification was obtained of the documentation for objective qualification criteria of education and work experience.

A.V) All quality assurance personnel files were re-indexed and any required information in personnel department files either moved to the quality assurance files or copied and included therein.

A.VI) HB, SDJ, and LH are current employees whose personnel files were enhanced as specified in A.IV and A.V. CG, GW, SS, DW, GJ, and PB are former employees whose personnel files were enhanced as specified in A.V. None of these individuals were designated managers and all work performed by the required manager approval. (See Nonconformance B.2)

STEPS TO PREVENT RECURRENCE

A.I) Section 17 of the QAM and related procedures were reviewed by ERCI and revised where necessary to insure compliance with 10 CFR Part 50, Criterion 17.

A.II) Periodic internal audits and procedurally specified documentation will insure compliance with the QAM and QAP's preventing recurrence of the nonconforming condition.

EVALUATION OF NONCONFORMANCE EFFECT ON CERTIFICATES OF CONFORMANCE

A.I) The absence of documentation within personnel files in itself would not impact the certificates of conformance. Review of cited instances and all current employee files showed adequate confirmed documentation was available to qualify the individuals to the work level assigned. Accordingly, performance of their assigned responsibilities within the quality program would not impair the qualification of safety-related activities.

NONCONFORMANCE B.6

Contrary to Criterion XVIII, "Audits," of 10 CFR Part 50, NI management allowed the last two QA departments annual audits to be led by a QA inspector that has direct QA responsibilities. The report numbers are QA-86-AE, dated 12/23/86, and QA-85, dated 12/06/85.

CORRECTIVE ACTIONS

A.I) QAP 18.4.00 was revised to require an independent review of the functions of the Quality Assurance Department no less frequently than annually.

STEPS TO PREVENT RECURRENCE

A.I) Section 18 of the QAM and related procedures were reviewed by ERCI and revised when necessary to insure compliance with 10 CFR Part 50, Section 18.

EVALUATION OF NONCONFORMANCE EFFECT ON CERTIFICATES OF CONFORMANCE

A.I) The reason for the improper utilization of quality assurance personnel was documented as resulting from all qualified lead auditors being Quality Assurance employees and/or managers. It seems reasonable to conclude the lack of independence resulted from an error in judgement rather than an effort to preclude an independent review. Additionally, the lead auditor for the Quality Assurance audits has certified he conducted the audit and reported the results independently.

Accordingly, although the necessary independence did not exist it can be reasonably concluded that the failure to perform the internal audits with the proper degree of independence would not impair the qualification of safety-related equipment.

Sincerely,

NUTHERM INTERNATIONAL, INC.

William J. Eckert
Chairman of the Board

Leonard Hinson
President

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Attachments

Review of Nutherm International, Inc. QA Program
By
ERCI Inc. Personnel

The Nutherm International, Inc. (NI) Quality Assurance Program consisting of the Quality Assurance Manual, Revision 0, and the implementing procedures listed on the Table of Contents, dated February 9, 1988, for the Quality Assurance Implementing Procedures Manual were reviewed between February 17, 1988 and March 5, 1988. The review was conducted by a team consisting of John Hansel, John Gelzer, John Daly, Charles Vincent, and Richard Zill.

The review team utilized 10 CFR 50 Appendix B, NUREG-0800 (NRC Standard Review Plan), and applicable ANSI Standards to which NI is committed.

The review resulted in recommendations for revision to both the QA Manual and the implementing procedures. These recommendations consisted of both significant changes required for compliance of the written program to the governing documents and "enhancements" which provided such things as more detailed instructions, clarified responsibilities, required reviews, and records requirements.

Most recommendations were forwarded to NI on March 3, 1988 and the remainder provided on March 7. All recommendations were discussed between John Hansel and John Gelzer of ERCI Inc., and management of NI on March 7 and 8. Discussions centered around reasons for certain of the recommendations and clarifications of NI's organizational relationships and methods of doing business. Also discussed were the identification of significant changes vs. enhancements and the timing of incorporation of them into the applicable documents. All of the ERCI recommendations were accepted by NI except those that required modification due to organization or business requirements. It is ERCI's opinion that these modifications to their recommendations were necessary and did not alter the intent of the modification as originally presented.

Tabulations of the QA Manual sections and implementing procedures that were reviewed are shown on the following pages. These tabulations reflect the consensus of March 8. All recommendations, whether significant or enhancements, were incorporated.

John L. Hansel

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Review Conducted by ERCI, Inc.

NI QA MANUAL REVIEW

QAM Section	Comments	Significant Changes Required	Enhancement Changes
Section 1	Yes	Yes	
Section 2	No		
Section 3	Yes	Yes	
Section 4	Yes		Yes
Section 5	Yes	Yes	
Section 6	No		
Section 7	Yes	Yes	
Section 8	Yes		Yes
Section 9	Yes	Yes	
Section 10	Yes	Yes	
Section 11	Yes	Yes	
Section 12	Yes	Yes	
Section 13	No		
Section 14	Yes		Yes
Section 15	Yes		Yes
Section 16	No		
Section 17	Yes	Yes	
Section 18	Yes		Yes
Section 19	Yes	Yes	

Review Conducted by ERCI, Inc.

NI IMPLEMENTING PROCEDURES REVIEW

Procedure No.	Comments	Significant Changes Required	Enhancement Changes
1.00.00	Yes	Yes	
2.2.01	Yes		Yes
2.7.01	Yes		Yes
2.7.02	Yes	Yes	
2.7.04	Yes	Yes	
3.0.00	Yes	Yes	
3.0.01**	New		
3.0.02**	New		
3.1.03*	No		
3.10.00	No		
4.00.00	No		
4.01.00	Yes	Yes	
5.00.00	Yes		Yes
6.0.00	Yes	Yes	
6.0.01	Yes		Yes
6.1.00	Yes		Yes
6.2.00*	Yes	Yes	
6.4.02	No		
7.1.00	Yes	Yes	
7.6.00	Yes		Yes
8.1.00*	Yes	Yes	
8.2.00.1	Yes		Yes

Procedure No.	Comments	Significant Changes Required	Enhancement Changes
8.2.01	Yes		Yes
8.4.01	No		
9.7.6.03	Yes		Yes
9.7.6.05*	Yes		Yes
9.7.6.06*	Yes		Yes
9.7.6.07*	Yes		Yes
9.7.6.09	No		
9.7.6.10*	Yes		Yes
9.7.9.01	No		
9.7.11.01*	Yes		Yes
9.7.11.02	Yes		Yes
9.7.11.03*	Yes		Yes
9.7.11.07*	Yes		Yes
9.7.16*	No		
10.0.00**	New		
10.7.00*	Yes	Yes	
11.0.00**	New		
12.2.00	Yes	Yes	
12.4.00*	Yes	Yes	
13.2.00	Yes	Yes	
15.2.02	Yes	Yes	
16.1.00	Yes		Yes
17.1.00	No		
18.1.00	Yes	Yes	
18.1.01	Yes	Yes	

Procedure No.	Comments	Significant Changes Required	Enhancement Changes
18.2.03	Yes	Yes	
18.2.04*	Yes	Yes	
18.4.00*	Yes	Yes	
18.10.00	No		
19.1.00	No		

*Deleted after March 8 review as specified in "Revision Log" in accordance with ERCI recommendation.

**Added after March 8 review but subsequently reviewed and found acceptable by ERCI.

INDEX OF REVISION AND ADDITION

DATE	QAM SECTION	DESCRIPTION	QA MGR.	CHM.
April 18, 1988	Definitions	Added definitions for Basic Component; Commercial Grade Item; Dedication Process; Dedicated; Reject; and Retest; corrected typographical error in Inspector definition from employed to employee and in Inspection definition from predetermine to predetermined.	4-18-88	4/15/88
	1.2	Deleted erroneous Figure I.1 reference and added reference to implementing procedures in first paragraph.		
	1.3a.	Added approve.		
	3.2	Added fourth paragraph assigning responsibility for qualification tests.		
	3.3	Added controlled to first paragraph; added new third paragraph.		
	3.4	Deleted or checking from second and third paragraph;added to confirm that design intent is achieved to third paragraph.		
	3.5	Deleted Nutherm non-applicable portion of first paragraph.		
	4.6	Added nuclear safety-related.		
	5.2	Added new second and fourth paragraphs.		

INDEX OF REVISION AND ADDITION

DATE	QAM SECTION	DESCRIPTION	QA MGR.	CHM.
April 18, 1988	5.3	Added new paragraphs e. and g.	4-18-88	4/15/88
	5.4	Deleted generated and added reviewed and approved in second paragraph; added fourth paragraph.		
	7	Complete rewrite to more specifically assign responsibilities and elaborate program requirements.		
	8.2	Complete rewrite to more specifically delineate responsibilities.		
	8.4	Added by marking or tagging; corrected typographical error from clean to clear in first paragraph.		
	8.5	Expanded to provide examples of documentation requirements.		
	9	Complete rewrite to more specifically delineate responsibilities, provide examples of control mechanisms and define control for non-defined special processes.		
	10.1	Complete rewrite to more specifically define scope.		
	10.2	Complete rewrite to more specifically delineate responsibilities.		
	10.3a	Deleted Inspection personnel and add Individuals performing inspections shall not have performed the work and		

INDEX OF REVISION AND ADDITION

DATE	QAM SECTION	DESCRIPTION	QA MGR.	CHM.
April 18, 1988	11	Complete rewrite to more specifically delineate responsibilities and content of documentation.	4-18-88	4/15/88
	12.2	Complete rewrite to more specifically delineate responsibilities.		
	12.6	Added second paragraph specifying review method.		
	12.7	Added section clarifying method of handling and storage.		
	12.8	Changed section designation and added paragraph assigning system responsibility.		
	14.3	Deleted rebuilding and added reworking, repairing.		
	15.4	Complete rewrite of second sentence to more specifically state disposition methods.		
	17.4	Deleted Raw Data classification, paragraph 17.4.3.		
	17.5	Deleted Raw Data reference in third paragraph.		
	17.6	Complete rewrite to more specifically list storage requirements.		
	18.5	Added immediately to responsible management in fifth paragraph.		
	18.6	Deleted if possible in fourth paragraph.		
	19.4	Added and NRC to third paragraph.		

INDEX OF REVISION AND ADDITION

QAP PROCEDURE NUMBER	TITLE	REVISION DESCRIPTION
1.0.00	Quality Assurance Department Organization	Complete rewrite to specify qualifications for functional responsibilities and to revise organizational chart.
2.2.01	Quality Assurance Program Commitment to Codified Standards	Revised paragraph 3.1 to clarify Quality Assurance Managers responsibility; inserted "applicable" in front of requirements on paragraphs 4.1 through 4.7.
2.7.01	Practice for Control and Administration of NDT Personnel Training	Add "-1980" at the end of paragraph 1.3; delete "effect" and add "permanently retained by Nutherm" at the end of paragraph 8.5.
2.7.02	Quality Assurance Training of Personnel	Complete rewrite to enhance training descriptions for Quality Assurance personnel.
2.7.04	Training Program for Inspection and Test Personnel	Complete rewrite to more fully describe training program for inspection and test personnel.
3.0.00	Design Control	Complete rewrite to enhance detail description of design control.

9-20-88

QA Manager Date

INDEX OF REVISION AND ADDITION

QAP PROCEDURE NUMBER	TITLE	REVISION DESCRIPTION
3.0.01	Project Plan	New procedure describing method of establishing and documenting project plan.
3.0.02	Preparation and Review of Engineering Calculations	New procedure to establish guidelines and controls for calculations.
3.1.03	Procedure for Engineering Specification Review	Deleted. Incorporated into Procedure 3.0.01.
4.01.00	Procurement Documentation	Added paragraphs 3.2 and 3.3 defining responsibilities of Engineering Manager; added to paragraph 4.3 --- "required by Nutherm Quality Assurance Manual Section 4 and customer specifications".
5.00.00	Instructions, Procedures and Drawings	Complete rewrite to clarify control documents utilized in activities affecting quality and establish a hierarchy for these documents.
6.0.00	Document Control	Complete rewrite to define and incorporate documents in document control system.
6.0.01	Form Control System	Complete rewrite to place form control responsibility with document control.

4-20-88

QA Manager Date

INDEX OF REVISION AND ADDITION

QAP PROCEDURE NUMBER	TITLE	REVISION DESCRIPTION
6.1.00	Preparation and Control of the Quality Assurance Manual	Complete rewrite to clarify method of preparing, reviewing, approving, revising, and controlling Quality Assurance Manual.
6.2.00	Quality Assurance and Manufacturing Package Formulation and Distribution	Deleted. Incorporated into Procedures 3.0.00 and 3.0.01.
7.1.00	Receiving Inspection	Complete rewrite to enhance delineation of receiving instructions and to incorporate Procedure 10.7.00.
7.6.00	Completion of Weld Filler Material Control Report	Complete rewrite to clarify method of maintaining weld filler report.
8.1.00	Warehouse	Deleted. Incorporated into Procedure 13.2.00.
8.2.00.1	Electrical Wire Traceability Log Instructions	Added new paragraph 3.0 defining responsibility; delete "--inventory or--" in paragraph 5.2.
8.2.01	Traceability Procedure for Sheet Metal, Angle, C Channel, Copper Bus Bar, Flat Bar Stock and Hinges	Added new paragraph 3.0 defining responsibility; inserted "--by Quality Assurance--" in paragraph 4.1.
9.7.6.03	Equipment Qualification Control	Complete rewrite to clarify requirements and control of equipment qualification.

4-20-88

QA Manager Date

INDEX OF REVISION AND ADDITION

QAP PROCEDURE NUMBER	TITLE	REVISION DESCRIPTION
9.7.6.05	Assigning Record of Anomaly and Resolutions Document Number	Deleted. Transferred to Equipment Qualification Department controlled internal instructions.
9.7.6.06	Assigning Document Numbers for Thermal Aging Documents	Deleted. Transferred to Equipment Qualification Department controlled internal instructions.
9.7.6.07	Assigning Certificate of Compliance Document Numbers	Deleted. Transferred to Equipment Qualification Department controlled internal instructions.
9.7.6.10	Record of Evaluation (ROE) Between Test and Qualified Device	Deleted. Incorporated into Procedure 9.7.6.03 and Equipment Qualification Department controlled internal instructions.
9.7.11.01	Method of Qualification General Procedure	Deleted. Incorporated into Procedure 9.7.6.03.
9.7.11.02	Control of Test Specimens	Complete rewrite to more specifically delineate control of test specimens.
9.7.11.03	Test Specimen Work Order and Test Results	Deleted. Incorporated into Procedures 9.7.6.03 and 11.0.00.
9.7.11.07	Irradiation of Test Specimens	Deleted. Transferred to technical procedures.

4-20-88

QA Manager Date

INDEX OF REVISION AND ADDITION

QAP PROCEDURE NUMBER	TITLE	REVISION DESCRIPTION
9.7.16	Record of Anomaly and Resolutions	Deleted. Incorporated into Procedure 9.7.6.03 and Equipment Qualification Department controlled internal instructions.
10.0.00	Inspection Plan	New procedure establishing inspection plans for test procedures.
10.7.00	Class N Receipt Inspection	Deleted. Incorporated into Procedure 7.1.00.
11.0.00	Test Control	New procedure providing control system for all test activities affecting quality.
12.2.00	Control of Calibrated Measuring and Test Equipment	Complete rewrite to incorporate Procedure 12.4.00.
12.4.00	Calibration Frequency	Deleted. Incorporated into Procedure 12.2.00.
13.2.00	Storage of Materials and Components	Complete rewrite to incorporate Procedure 8.1.00.
15.2.02	Nonconformance Control	Added paragraph 4.12 to clarify disposition of reportable NCRs.

4-20-88

QA Manager Date

INDEX OF REVISION AND ADDITION

QAP PROCEDURE NUMBER	TITLE	REVISION DESCRIPTION
16.1.00	Request for Corrective Actions Procedure	Added ". after employees" deleted "-- or clients that want to request---" and inserted "-- RCA's will be utilized for identifying and tracking clients requests for--" in paragraph 2.1; deleted "--the review board--" in paragraph 4.5 and inserted therein "--management--"; deleted "--time to complete by." in paragraph 4.6 and inserted therein "--required date for completion;" deleted "--its file is in" and added "files" after office in paragraph 4.8; added ", (3) the originator" in paragraph 5.0.
18.1.00	Audit System	Added last sentence of paragraph 4.1 to define progress elements as "--- 18 criteria of 10CFR50, Appendix B; inserted "audits or" in paragraph 4.3; added paragraph 5.4.7 to provide for review of audit findings for 10CFR50, Part 21 reportability.
18.1.01	Management Review of Overall Program Assurance System	Complete rewrite to provide for independent management review of Quality Assurance Department.

4-20-88

QA Manager Date

INDEX OF REVISION AND ADDITION

QAP PROCEDURE NUMBER	TITLE	REVISION DESCRIPTION
18.2.03	Procedure for Extension of Internal Audits	Complete rewrite to clarify language.
18.2.04	Procedure for Extension of Calibration Due Date	Deleted as not required.
18.4.00	Nutherm International, Inc. Internal Audit Schedule	Deleted as not required.

4-20-88

QA Manager Date

ERC INTERNATIONAL

ATTACHMENT IV

March 29, 1988
Serial No. 88032915840117

Messrs. W.J. Eckert and L.F. Hinson
Nutherm International, Inc.
501 South Eleventh Street
Mt. Vernon, IL 62864

Subject: Technical Audit of the Adequacy of Nutherm's Equipment Qualification Basis. ERCI Project 15840, Marcn 23-25, 1988.

Dear Sirs:

This letter and its attachments are presented to document the technical audit that was performed on March 23-25, 1988. During that time, the project records for projects GPU-1900 (a dc power panel, primarily requiring seismic testing) and AAF-1645 (a heater system with control panel with harsh environment radiation conditions) were examined. The project reports were prepared in June and October 1986, respectively. These two projects were chosen randomly with the exception that AAF-1645 was substituted for an earlier selection so that a harsh environment project would be evaluated. Because of Nutherm's frequent practice of using results from previous tests as the basis of qualification, review of these two packages gives insight into a much broader period of qualification efforts. The data packages required review of results from testing programs for the period from August 1983 through July 1986. As such, the conclusions from these reviews are applicable to periods starting well before 1986 and extending almost to the present.

Attached are reviews of various documents that relate to the projects. The review was performed to evaluate the technical adequacy of the qualification process. Quality assurance concerns were purposely not addressed in most instances. The goal was to determine if the qualification basis was adequate and if any errors or omissions in reporting or testing had significant adverse effects on the qualification status of equipment produced by Nutherm.

While the attached evaluations indicate a large number of areas in which improvements could and should be made, only two items caused concern, and even those two items would not invalidate the qualified status of the equipment produced under the projects reviewed. Nearly all of the items identified in the attachments were rectifiable by use of additional test data that are readily available, did not adversely affect the conservatism of the results, or can be shown to be insignificant due to the conservative nature of the design and application of the panels.

2260 Butler Pike
Plymouth Meeting, PA 19462-1412
(215) 834-0970
Telecopier: (215) 834-0978

The two areas of concern related to functional test circuit definition being left to the laboratory technician during DBE testing, and to the adequacy of failure evaluations for components that are not rejected for use in Class 1E applications. With respect to test circuit setup and functional testing, the technician should be provided with an approved circuit for functional testing during DBEs to assure that the desired parameters are adequately applied and monitored (see Attachment 5 for further discussion). With respect to failure evaluations, if corrective measures are to be performed on test specimens, the need to reperform previous qualification steps must be evaluated to assure that the modifications have been adequately qualified (see Attachment 6, Observations 5 and 6).

Also, for assumptions to be made about "fail-safe" failure modes, the failure must be thoroughly understood. As indicated above, these concerns have no direct effect on the qualification status of the items shipped under the projects that were evaluated. Evaluation of the required environments, additional tests, and an understanding of the devices concerned show that the equipment is sound. However, if improvements are not made to planning, implementation, and reporting of tests, a probability exists that errors will not always be covered by conservatisms or that a failure will not be evaluated properly and a significant safety concern will result.

During the audit, the present equipment dedication procedure was also evaluated. The techniques employed were sound and reasonable. Comparison of the purchased part to an "EQ library specimen" is an excellent concept. Performance of 100% receipt inspection and functional test is also a sound process. As we discussed in our exit meeting, it is recommended that the basis for the choice of functional tests be documented. There is no industry standard that requires such documentation, but it would record the basis for the tests and the reasons why other seemingly important, but unneeded or undesirable tests have been purposely omitted.

As we discussed, there is a need for more formal procedural and reporting systems in the area of equipment qualification. However, careful review of the project files and Nutherm practices has provided sufficient proof that the observed deficiencies in testing and reporting did not have a significant effect on the qualified status of the projects reviewed. The conservatisms in the design and the multiplicity of test programs provide assurance that the qualification of the products is adequate.

During the audit, it was obvious that Nutherm is in the process of an overall upgrade of its procedures and their implementation process. Nearly all of my comments are or will shortly be covered by the new controls. To assure that the new controls are working and have filled the voids, Nutherm should consider having a technical audit performed at some later date when the perturbations calm down. In this way, assurance can be achieved that corrective action has been successful.

Yours truly,

Gary J. Toman

Gary J. Toman
Principal Engineer

Attachments: 1-7
Resume of G.J. Toman

EVALUATION OF ALLEGATING IN ANONYMOUS LETTER OF SEPTEMBER 2, 1987

ALLEGATION 1

Allegation: Correct testing sequence is not followed.

Answer: Nutherm affirms this allegation is invalid. All tests used for qualification are sequenced in accordance with IEEE 323, 1974. No variations from proper sequence were noted in the ERCI review of qualification data. The test sequences used for qualification are always reported in our qualification reports to our customers.

ALLEGATION 2

Allegation: Raw test data is unavailable to review.

Answer: Nutherm affirms this allegation is invalid. Raw test data is retained for no less than the minimum periods specified by the applicable section of 10 CFR Part 50, Appendix B and ANSI N45.2. All raw test data required for the ERCI review of qualification was readily available.

ALLEGATION 3

Allegation: Function tests are not performed by competent qualified lab technicians.

Answer: Nutherm affirms this allegation is invalid. Although competence is a subjective determination, personnel files of the laboratory technicians were reviewed with all found to be properly qualified in accordance with ANSI N45.2.6 as Level II electrical technicians. Education and experience from other than Nutherm were independently confirmed and documented in files.

ALLEGATION 4

Allegation: The testing procedures are inadequate.

Answer: Nutherm affirms that this allegation was valid in part. Nutherm and ERCI's review of test procedures revealed some test procedures with inadequate definitions of test parameters, test method, and test acceptance criteria.

Corrective action and steps to prevent recurrence are addressed in our response to Nonconformance B.2. However, the ERCI review (Reference ERCI Letter Attachments 3, 4, and 5) of randomly selected projects and the related testing did not reveal any instance where deficiencies noted would impair the qualifications of system related equipment.

ALLEGATION 5

Allegation: The testing procedures were not part of the environmental package sent to the client.

Answer: Nutherm affirms this allegation is valid in part. Test procedures are always submitted when requested by the client, but otherwise are retained at Nutherm.

However, this allegation does not create a quality concern in that there is no requirement either in Nutherm's quality program or industry standards that test procedures be included in the qualification report sent to the client.

ALLEGATION 6

Allegation: Devices are not tested per field conditions as required in customer specification.

Answer: Nutherm affirms this allegation is invalid. ERCI's review (Reference ERCI Letter Attachments 6 and 7) of randomly selected projects revealed all items tested were tested in accordance with customer specification. Additionally, qualification reports submitted to the customer delineate all environmental testing and results in detail.

ALLEGATION 7

Allegation: Parts have been irradiated many times with repeated failures at specified contractual levels.

Answer: Nutherm affirms this allegation is invalid. All items irradiated are indexed on a computer file and review thereof disclosed no generic failures at qualified levels. In cases where parts were irradiated more than one time, the irradiation levels to be utilized for qualification were based on only one irradiation. Radiation certificates and subsequent functional test results are submitted to the customer in the qualification report.

ALLEGATION 8

Allegation: Parts involved in these failures have not been changed out in the field.

Answer: Nutherm affirms this allegation is valid. Parts that fail at a particular radiation level are not generic failures. Almost any part can fail radiation if the level is high enough. In attempting to determine this level numerous failures will occur. However, the radiation qualification is never placed at a level (i.e. life or accident condition) in excess of that proven by test. Accordingly, the validity of this allegation has no effect on qualification.

All radiation qualifications were found to be properly based in the random selection of qualification reports reviewed in detail and no discrepancies noted by ERCI.

ALLEGATION 9

Allegation: Humidity levels as documented in reports cannot be verified.

Answer: Nutherm affirms this allegation is valid. Nutherm does not monitor humidity levels in the thermal aging chambers.

Nutherm does not consider this a quality deficiency impairing qualification of safety related components based upon the explanation in Federal Register Volume 48, No. 15, Page 2732 of 10CFR50.49 which states "The Commission agrees --- it has not been demonstrated variation in humidity will produce any difference in degradation of electric equipment."

Accordingly, humidity is not considered in thermal aging calculations because it does not need to be considered.

ALLEGATION 10

Allegation: Based thermal aging duration on weak link activation energy methodology without determining what was the lowest activation energy.

Answer: Nutherm affirms this allegation is valid in part. Determination of weak link is based upon factors in addition to activation energy such as self temperature rise and materials function within the item.

Nutherm does not consider this a quality deficiency since proper determination of "weak link" must include factors besides activation energy to properly determine degradations effect upon functionality. ERCI's review (Reference ERCI Letter Attachments 4 and 6) of randomly selected qualifications disclosed no deficiencies in weak link methodology.

ALLEGATION 11

Allegation: Most devices were not sent out for TGA analysis.

Answer: Nutherm affirms this allegation is valid. Activation energies are not only obtained from TGA analysis. Most are obtained from commercially available data bases or from published referenced works.

Nutherm does not consider this a quality deficiency since the purpose of TGA is only to obtain activation energies and other methods of so obtaining are equally acceptable.

ERCI's review (Reference ERCI Letter Attachment 6) of randomly selected qualifications did not disclose any deficiencies in activation energy determination.

ALLEGATION 12

Allegation: Environmental engineering department did not properly determine thermal aging time.

Answer: Nutherm affirms this allegation is invalid. Thermal aging time is one input for determination of qualified life and will vary with types of materials, normal operating conditions, oven temperatures, etc. Accordingly, there is no "proper" thermal aging time but there is a qualified life determination made which considers thermal aging time.

ERCI's review (Reference ERCI Letter Attachment 6) of randomly selected qualifications did not disclose any improper determinations of qualified life.

ALLEGATION 13

Allegation: Devices were not mounted on stiff backs with the correct fasteners per field conditions.

Answer: Nutherm affirms this allegation is invalid. Mounting hardware is specified for testing. However, if the allegation were valid it would not impair the qualification of safety related items since mounting of parts is always specified to Nutherm's customers to be in accordance with manufacturers instructions forwarded by Nutherm with the installation manual. Since any case of hardware larger than specified would not fit in the prepared mountings it would only be possible to use mountings specified or smaller than specified. If smaller the seismic effect would be to make the test more conservative than one utilizing the prescribed hardware.

ALLEGATION 14

Allegation: Fasteners were not torqued on production units.

Answer: Nutherm affirms this allegation is invalid. The allegation utilizes "production" but in context seems directed at production units tested at seismic.

Seismic test units are torqued to procedure. However, if the allegation were valid it would not impair the qualification of safety related items since improper torquing would be either torqued too tightly or too loosely, both of which conditions would in almost all cases add conservatism to the actual seismic results.

ALLEGATION 15

Allegation: Devices were not loaded per field conditions.

Answer: Nutherm affirms this allegation is partially valid. Devices are electrically loaded during seismic only when specified by the customer or when engineering analysis determines the effect under loading is significant to the qualification conditions. Loading of most devices during seismic testing prevents determination of contact chatter. Contact chatter is monitored on all applicable seismic tests regardless of whether the item is loaded electrically. Only a few devices would be expected to have seismic reactions different under load and these devices are loaded.

ALLEGATION 16

Allegation: Nutherm's internal seismic expert is incompetent.

Answer: Nutherm affirms this allegation is invalid. Although competence is a subjective judgement, independently confirmed documentary evidence shows Nutherm's seismic expert, Dr. I. Gunin, is qualified by reasons of a doctorate degree in engineering and over 30 years of experience in dealing with vibration analysis in ship and rail car manufacturing.

ALLEGATION 17

Allegation: Generic heater qualification seismic conclusions were made without knowledge of structural support locations.

Answer: Nutherm affirms this allegation is partially valid. Although the construction and design of the heaters by Nutherm is documented by drawings and, Nutherm instructs as to mounting; it is not informed as to what field structure exists. However, we are either furnished with seismic response spectra for the mounting, which is then included in our report as a factor in seismic qualification or alternatively, an assumption is stated in the report that the seismic qualification is based upon attachment to a seismically rigid structure.

Since the basis of the seismic qualification is stated it is the customers responsibility to see that the mounting meets this qualification condition when mounted as specified by Nutherm. Accordingly, the allegation does not impair the qualification of the safety related equipment.

ALLEGATION 18

Allegation: Devices in DBE Test were not loaded per field conditions.

Answer: Nutherm affirms this allegation is invalid. The ERCI review (Reference ERCI Letter Attachment 5) of a randomly selected DBE test did not disclose any such condition.

ALLEGATION 19

Allegation: Duration of DBE test was not set properly.

Answer: Nutherm affirms this allegation is invalid. DBE duration is one input for determination of the accident qualified life and will vary with types of materials,

normal operating conditions, oven temperatures, etc. Accordingly, there is no "proper" DBE duration but there is an accident qualified life determination made which considers DBE duration.

ERCI's review (Reference ERCI Letter Attachment 6) of randomly selected qualifications did not disclose any improper determinations of qualified life.

ALLEGATION 20

Allegation: 100% of the early DBE testing had extremely poor documentation.

Answer: Nutherm affirms this allegation is invalid. The ERCI review (Reference ERCI Letter Attachment 4 and 5) of the randomly selected DBE test found all necessary supporting documentation to be available.

ALLEGATION 21

Allegation: Items are bought from distributors with no traceability back to the manufacturer specific lot no.

Answer: Nutherm affirms this allegation is partially valid. Manufacturer lot number is not always available or utilized in Nutherm's dedication process. Nutherm determines the "identical" nature of test items to dedicated items through engineering review of various objective criteria to determine the reasonableness of a conclusion as "identical". Failure to utilize manufacturer lot number does not impair the qualification of safety related equipment since neither Nutherm's dedication and qualification of commercial items process nor any industry standard requires manufacturers "specific lot number" to be utilized in the qualification process.

ERCI's review of selected qualification reports not only disclosed no deficiencies in Nutherm's method of relating tested parts to qualified parts, but stated that techniques which are employed are sound and reasonable, and the dedication procedure is an excellent concept.

ALLEGATION 22

Allegation: Material is purchased from different distributors and treated as one batch.

Answer: Nutherm affirms this allegation is invalid. Nutherm's method of qualification relates individual parts to tested parts utilizing various information for each part, and not through statistical evaluation.

ERCI's review of selected qualification reports not only disclosed no deficiencies in Nutherm's method of relating tested parts to qualified parts, but stated that techniques which are employed are sound and reasonable, and the dedication procedure is an excellent concept.

ALLEGATION 23

Allegation: Material is purchased at different times and treated as one batch.

Answer: Nutherm affirms this allegation is invalid. Nutherm's method of qualification relates individual parts to tested parts utilizing various information for each part, and not through statistical evaluation.

ERCI's review of selected qualification reports not only disclosed no deficiencies in Nutherm's method of relating tested parts to qualified parts, but stated that techniques which are employed are sound and reasonable, and the dedication procedure is an excellent concept.

ALLEGATION 24

Allegation: Distributors are requested to verify material as being the same or similar.

Answer: Nutherm affirms this allegation is partially valid. Occasional orders to distributors state the items purchased must be the same. However, this statement is imposed on the order not as a means of determining the identical nature for qualification but to allow returns of material found in detailed review not to be the same. The statement is imposed for commercial reasons and is not utilized in qualification. Nutherm's method of qualification relates individual parts to tested parts utilizing various objective data and any statement from a distributor is not utilized in this process. Accordingly, the validity of this allegation does not impair Nutherm's qualification of safety related equipment.

ERCI's review (Reference ERCI Letter Attachment 6) of selected qualification reports disclosed no deficiencies in Nutherm's method of relating tested parts to qualified parts.

ALLEGATION 25

Allegation: External audits done by the Quality Assurance Department are inadequate.

Answer: Nutherm affirms this allegation is invalid. Personnel files of all lead auditors were reviewed for verified documentation of their qualifications. Selected external audits were reviewed by senior management and found to be performed under direction of qualified lead auditors.

ALLEGATION 26

Allegation: They have imposed 10 CFR 21 on distributors who have no basis for understanding of this requirement.

Answer: Nutherm affirms this allegation is valid. Occasionally, due to inadequate instruction to typists Nutherm would type 10 CFR Part 21 requirements on orders to commercial vendors including distributors. The validity of this allegation does not impair the quality of Nutherm supplied safety related items. The imposition of 10 CFR Part 21 on vendors not in a position to understand and/or comply with the requirement would not impair the quality of these commercial grade purchases.

ALLEGATION 27

Allegation: Individuals with no technical background were given the responsibility to write technical testing procedures.

Answer: Nutherm affirms this allegation is partially valid. Certain technical procedures were written by personnel with inadequate backgrounds.

Corrective actions and steps to prevent recurrence are addressed in our response to Nonconformance B.2 and B.4.

Although this practice in itself does not create a quality concern if the procedures were properly reviewed and approved by qualified personnel, in some cases it was determined this review and approval did not take place.

ERCI reviewed (Reference ERCI Letter Attachments 3, 4, and 5) all test procedures utilized in their random sample of certain qualification projects. All test procedures therein were reviewed and found to be adequate to not impair Nutherm's qualification of safety related equipment.

ALLEGATION 28

Allegation: Individuals with no technical background were given the responsibility to write EQ Plans.

Answer: Nutherm affirms this allegation is partially valid. Certain individuals with only limited technical background wrote some test plans.

Corrective action and steps to prevent recurrence are addressed in our response to Nonconformance B.4.

The partial validity of this allegation does not impair Nutherm's qualification of safety related equipment since all such plans were reviewed and approved by qualified personnel.

ALLEGATION 29

Allegation: Individuals with no technical background were given the responsibility to write EQ Reports.

Answer: Nutherm affirms this allegation is partially valid. In certain cases individuals with limited technical background wrote EQ Reports.

Corrective action and steps to prevent recurrence are addressed in our response to Nonconformance B.2.

The partial validity of this allegation does not impair Nutherm's qualification of safety related equipment since all such reports were reviewed and approved by qualified personnel.

ERCI's review (Reference ERCI Letter Attachments 6 and 7) of randomly selected qualifications did not disclose any deficiencies in activation energy determination.

ALLEGATION 30

Allegation: If quality gets in the way of productivity employees are reprimanded or fired.

Answer: Nutherm affirms this allegation is invalid. During the period January, 1985 through December 31, 1987 Nutherm fired six employees. Of these, two were in non-quality related departments (sales, accounting or administrative) and none in Quality Assurance. The personnel records in all cases reveal documented causes for each discharge with none related to quality/productivity conflicts.

ALLEGATION 31

Allegation: Two quality assurance individuals are taking medication which impair their judgement.

Answer: Nutherm affirms this allegation is invalid. Although by documented survey several quality assurance individuals were found to be taking medication, all such medication was determined to not be judgement impairing for these individuals.

ATTACHMENT VI

RESUME: SVEN G. AKERMAN SR.

P.O. Box 636
Morris, IL 60450
Home Phone No.: (815) 942-4235
Permanent Locator No: (206) 823-2222

Experienced Quality Assurance/Quality Control Inspection Engineer/Supervisor with experience in nuclear power plant, petrochemical, fossil fuel power generating industry and pipelines. Certified Q.C. 1 Welding Inspector by the American Welding Society and National Board as Authorized Inspector ASME Code. Extensive knowledge and experience in construction, project inspection, inspection of manufactured/fabricated items and procurement for large scale projects. Practical experience in QA/QC program management, supervision, development, review, audit, documentation review, procedure writing and procurement verification.

EDUCATIONAL BACKGROUND:

Pacific Western University, Encino, CA B.S. Engineering, 1982
New York State University, Albany, NY A.A. Liberal Arts, 1980
Wright State University, Fairborn, OH
Engineering studies, 1/72 - 6/75
Parks College of Aeronautical Technology, East St. Louis, IL
Engineering studies, 9/69 - 12/70
Nathaniel Hawthorne College, Antrim NH
Business Administration studies, 9/68 - 5/69
Mahopac High School, Mahopac, NY Graduate, 1968

CERTIFICATIONS:

National Board of Boiler and Pressure Vessel Inspectors
Commissioned Inspector (ASME Code Authorized Inspector)
American Welding Society certified QC1 Welding Inspector
Nuclear Certifiable to Level III

PROFESSIONAL BACKGROUND/EXPERIENCE:

June 1985 to Dec. 1987
Science Application International Corp.

(July '87 to Dec. '87) Assigned to ERCI Systems Integration and Management Corp. Comanche Peak Nuclear Project, Texas, as Quality Assurance Engineer responsible for the safety significant evaluation of reported diviations of procured vendor supplied equipment.
(June '85 to June '87) Assigned to Phillips Getschow Co., mechanical piping contractor at Commonwealth Edison Nuclear Project, Braidwood, IL. Lead Technical QC Engineer, assigned to:
A. Technical Evaluation of previously closed non-conformance reports.
B. Braidwood Construction Assessment Program (BCAP). Evaluated and responded to BCAP observations.
C. ASME Section XI: Developed program and evaluated ongoing repair, replacement and spare parts work to Section XI requirements.
D. Non-conformance reports and deficiency reports: Reviewed inprocess NCR's and DR's for evaluation/concurrence and closure.
E. Hydro/Pneumatic test coordinator: Developed procedures and maintained punchlist for outstanding work of ASME Sec. III and safety related tests.

Science Application International Corp. (Contd)

F. Interogatories: Reviewed Documentation and responded to interogatories.

G. Verified procurement records of initial, repair, replacement and spare parts materials to purchase order, specification and Code requirements.

H. Supervised staff of technical QC Engineers.

January 1985 to June 1985

Butler Service Group

ITT Grinnell, Nine Mile Unit 2 Nuclear Project, Lycoming, NY. Final QC Document Reviewer, Level II responsible for the final documentation review and approval of ASME Sec. III, and safety CAT I, II and III document packages. Prepared NPP-1 data reports. Verified procurement records.

April 1984 to January 1985

Piping Design Services, Inc.

Assigned to Baldwin Assoc., Clinton Nuclear Power Station, Clinton, IL. Lead Nuclear Quality Assurance Engineer, Final Documentation Review, Level II responsible for the final review and quality acceptance of piping/mechanical, field fabrication and hanger travelers to applicable codes, standards and plant procedures. Provide final material take off and procurement record verification for N-5 process and installation certification to ASME Code Section III requirements.

February 1982 to May 1983

Ralph M. Parsons Co., Pasadena, CA

(June '82 to May '83) Sr. Project Q.A. Engineer/Supervisor, Yanbu, Saudi Arabia. Reviewed contractor/subcontractor quality programs. Responsible for procedure preparation and final rewrite. Monitored testing labs to NDE/NDT requirements. Performed welding and NDE surveillance of power boilers to ASME-1, pressure vessels to ASME VIII, piping to ANSI B31.1, storage tanks to API 650, and structural steel to AWS D1.1. Assisted audit teams by preparing audit checklists and conducting audits of welding and NDE/NDT. Responsible for procurement activities including requisitions, purchase orders, vendor compliance and site reciept and installation.

(Feb. '82 to June '82) Project Q.A. Engineer/Lead Auditor, Pasadena home office for Petromin/Shell Al-Jubail Refinery project in Saudi Arabia. Performed surveillance/review and verification of contractor conformance to client quality requirements; wrote procedures; implemented corrective action of discrepancies/deficiencies; reviewed procurement documentation for completeness, correctness, traceability; prepared project audit program/checklists, and performed audit as Lead Auditor of procurement/purchasing, engineering/design, QC/inspection and management. Prepared final audit report.

May 1981 to February 1982:

Ebasco Services, Inc., New York, NY

(Oct. '81 to Feb. '82) Level II Nuclear Vendor Quality Assurance Rep. for WPPSS 3 & 5. Performed inspections at vendor's facility, reviewed compliance to procurement purchase order requirements, ASME Code,

Ebasco Services, Inc. (Contd)
procedures and drawings. Reviewed documentation for correctness and authorized material release for shipment.
(May '81 to Oct. '81) Level II Nuclear Q. C. Receiving Inspector, WPPSS 3 & 5. Performed receiving inspection of nuclear parts, components and materials to procurement/purchase order Code standards and procedure requirements.

August 1977 to May 1981
Royal Globe Insurance Co., New York, NY
(July '80 to May '81) ASME Code Sec. I and VIII, Authorized Inspector/Boiler and Machinery Engineering Rep., Seattle, WA office. Performed ASME Code inspection of newly constructed boilers and pressure vessels including design, procurement, fabrication, welding testing and certification; repair inspection of in-service boilers, pressure vessels, piping, pumps, valves and industrial machinery; performed boiler internal/external State Certificate inspections; accident investigation. Reviewed and signed ASME Code Data reports. Performed audits. Prepared procedures. Verified compliance of procurement requirements.
(Jan. '78 to June '80) ASME Code Authorized Inspector in France: Monitored pressure vessel manufacturer's compliance to ASME Code Sec. VIII through detailed inspection. Performed audits. Prepared procedures. Verified compliance of procurement requirements.
(Aug. '77 to Dec. '77) ASME Code Authorized Inspector in England: Performed inspections at International Combustion, power boiler contractors. Monitored compliance to ASME Code and quality program. Performed audits. Prepared procedures. Verified compliance of procurement requirements.

March 1977 to August 1977
Valley Industries, Tallulah, LA
Quality Control Manager for ASME Sec. VIII pressure vessel and structural steel fabrication plant. Developed and implemented QC system; hired/trained personnel; developed policy/procedures; established schedules/work files; supervised fabrication operations and managed QC compliance requirements. Prepared audit program and performed audits as lead auditor. Prepared procedures and verified compliance of procurement requirements.

October 1976 to February 1977
Kemper Insurance Company, San Francisco, CA
ASME Code Authorized Inspector/Loss Control Representative. Performed same duties as described above for Royal Globe Insurance Company.

September 1975 to October 1976
Hartford Steam Boiler Insp. & Ins. Co., Hartford CT
ASME Code Authorized Inspector/Engineering Representative, Cincinnati, OH office. Performed same duties as described above for Royal Globe Insurance Company.

January 1975 to September 1975
Wright Patterson Air Force Base, Dayton, OH

Boiler Plant Operator (Civil Service Assignment) responsible for operation of low and high pressure steam and hot water boilers including auxiliary equipment, pumps, valves, pressure vessels, electrical motors, steam turbines, piping, coal, gas and oil fired systems, boiler water testing and chemical treatment as required. Performed boiler/machinery inspection. Maintained operator log.

MILITARY: December 1970 to December 1974, U.S. Air Force.
Duties: Boiler Plant Operator, Wright Patterson Air Force Base, Dayton, OH
Duties as described above for civil service assignment.
(May '71 to Dec. '74)

I hereby certify that the statements in this resume are true to the best of my knowledge and belief.

Sven G. Akerman Sr. DATE: 4-18-08

GARY J. TOMAN

Principal Engineer

EDUCATION

B.S., Electrical Engineering, New Jersey Institute of Technology, 1970
M.S., Engineering Management, Drexel University, 1975
Numerous continuing education courses in nuclear power, reliability, management, quality assurance, and qualification of Class 1E equipment.

PROFESSIONAL AFFILIATIONS

Registered Professional Engineer - Commonwealth of Pennsylvania

PROFESSIONAL EXPERIENCE

WESTEC Services, Inc.

October 1987

Chief Discipline Engineer. Mr. Toman is responsible for development and evaluation of equipment qualification documentation and supervision of qualification tests. He is also responsible for evaluation and resolution of complex problems relating to instrumentation, control and electrical engineering.

Franklin Research Center

1982 - 1987

Head, Nuclear Engineering Section. Mr. Toman was in charge of failure analysis, equipment qualification, safety system operation analysis, and plant aging analysis. He lead efforts for developing a nondestructive means for evaluating the level of mechanical deterioration of electrical cable insulation. Mr. Toman contributed to the NRC's Nuclear Plant Aging Research Program through evaluation of the effects of aging on electrical cable, relays, circuit breakers, solenoid valves, and pressure transmitters. He has evaluated control and monitoring failures of the Fort St. Vrain control rod drive system and evaluated the adequacy of corrective maintenance and monitoring techniques for verifying operability of the drive mechanisms.

Mr. Toman evaluated the reactor trip circuit breaker (RTCB) that caused the anticipated transients without scram (ATWS) events that occurred at Salem Nuclear Generating Station. He also investigated RTCB failures at the San Onofre, McGuire,

GARY J. TOMAN

North Anna plants and, more recently, the D.C. Cook plant.

He was in charge of the completion of the evaluation of all harsh environment safety-related electrical equipment for 71 operating U.S. nuclear power plants. The evaluation entailed preparation of an individual qualification data base for each power plant and evaluation of utility-supplied documentation against the requirements of IE Bulletin 79-01B and NUREG-0588 in conjunction with plant-specific requirements.

Mr. Toman was colecturer at FRC's equipment qualification seminars. He has supervised equipment qualification test programs and development of qualification research efforts.

Stone & Webster Engineering Corporation

1980 - 1982

Lead Engineer - Environmental Qualification in the Joint Project Equipment Qualification Section. Mr. Toman was responsible for adequacy and timely completion of the review of vendor environmental qualification submittals, including the vendor's methodology for aging and establishment of qualified life; determination of appropriate qualification requirements for inclusion in equipment specifications; and development of auditable documentation files for environmental qualification. The effort required development of strong interfaces with instrument and control, electrical, power, and radiation protection engineering and a firm understanding of basic design requirements and documents.

Control Systems Division. Mr. Toman's responsibilities included technical review of all material relating to qualification of Class 1E equipment for the Division and for preparation of licensing documents related to qualification. He also prepared a revision to the instrument and control section of the Peach Bottom plant FSAR based upon plant modifications and changes in licensing commitments. He also directed and performed a review of all River Bend and Nine Mile Point Unit 2 BOP control systems to verify that they would complete protective action upon initiation and that they would remain in the safety function mode upon reset of initiating signals. The review also verified proper interaction with NSSS reactor protection signals. Mr. Toman also analyzed the operation of the isolation valve system for the Enrico Fermi Unit 2 residual heat removal system.

Philadelphia Electric Company

1970 - 1980

Quality Assurance Division. He was responsible for review of administrative procedures and procurement documents. He also prepared an overall revision of the operations phase quality assurance plan.

GARY J. TOMAN

Maintenance Division. Mr. Toman was responsible for inspection and supervision of repairs of large generators and motors (60 to 1040 MW). He also supervised stress relieving of welds.

Nuclear Section. He prepared technical specification amendments for Peach Bottom Atomic Power Station. In addition, he prepared responses to information requests and notices of violation from the Nuclear Regulatory Commission.

System Operation Division. He provided liaison between the Electrical Engineering Division and the power dispatching group. Mr. Toman performed analyses of transmission system responses to fault conditions. He was responsible for control center emergency support systems including diesel generator and uninterruptible power supplies.

PUBLICATIONS

"Evaluation of McGuire Units 1 & 2 Undervoltage Trip Attachment Failure," FRC Final Report TER-C5506-417, July 13, 1983.

"Evaluation of Failure to Trip of Reactor Trip Circuit Breakers on February 22, and 25, 1983 - Salem Nuclear Generating Station Unit 1," FRC Final Report TER-C5506-413, May 9, 1983.

"Implementation Guidance for New and Corrective Equipment Environmental Qualification," FRC Final Report TER-C5257-532, April 22, 1983.

G. J. Toman, S. P. Carfagno, S. Ahmed, "Surveillance and Diagnostics of Electrical Equipment Inside Containment - Cable Monitoring," 12th Water Reactor Safety Research Information Meeting, Gaithersburg, MD, October 1984.

G. J. Toman, S. P. Carfagno, S. Ahmed, "Condition Monitoring of Electrical Cables Located Inside Containment," International Conference on Nuclear Power Plant Aging, Availability Factor and Reliability Analysis, San Diego, CA, July 1985.

S. Ahmed, S. P. Carfagno, and G. J. Toman, "Inspection, Surveillance, and Monitoring of Electrical Equipment Inside Containment of Nuclear Power Plants with Applications to Electrical Cables," NUREG/CR-4257, Oak Ridge National Laboratory for U.S. Nuclear Regulatory Commission, August 1985.

G. J. Toman, "The Measurement of Equipment Degradation," 13th Water Reactor Safety Research Information Meeting, Gaithersburg, MD, October 1985.

Attachment 1

Nutherm Technical Audit 3/23/88
Review of Project GPU-1900
Document: Similarity Comparisons.
Comparison by Similarity Forms, Comparison of GE THED-124070 and 124020 Circuit Breakers to NTI P/N 1194.

PURPOSE OF DOCUMENT

To establish, for purposes of qualification, the similarity between installed components and EQ tested components.

OBSERVATION

The forms describe only general differences such as a component weighs more than the tested component (e.g., 1500 gm vs 1610 gm), or the ratings are different (20 vs 50 amperes), or the component has different or extra leads. Forms do not consistently report the same type of data for similar components. The effect of the dissimilarities is not discussed. Note: Discussions with Nutherm personnel indicate that this inspection is followed by a review of the observed differences by Nutherm engineering personnel.

CONCLUSION

Strengthening the evaluation of similarity between components is necessary. External evaluation of many component types is not adequate. Development of rules to be used as the basis for generic types of components is suggested, so that key structural, electrical and mechanical differences are identified and evaluated. Similarity comparisons that identify differences should be uniform so that the appropriate parameters are consistently identified for evaluation.

Attachment 2

Nutherm Technical Audit 3/23/88
Review of Project GPU-1900
Document: Inspection/Test Results Reports.

PURPOSE OF DOCUMENT

To record results of tests and inspections required to be performed during production.

OBSERVATION

The data reported appear to be too limited. For measurements, no indication of the instrument used or its calibration date is given. No indication of acceptance criteria is provided, and it is not clear that the tests have been completed successfully (it is assumed that the initials and dates so indicate). For the high potential test, the results do not provide enough detail to know what happened (i.e., how the test was performed). Were any high potential tests done with the circuit breakers (CBs) closed? Only Ø to ground or across open CBs? With respect to the 3-point trip test, the tester's name is not on the data sheet; no data concerning the instruments are given and the units for the time readings are not given. (QA Procedure 11.3.44 requires no documentation whatsoever, nor does it describe the required test circuit. The QA procedure also states use approximate currents of 135, 200, and 300% without defining approximate (Is ±5, 10 or 20% OK?).

Review of the data for 20 Amp CBs #24 and 13 indicates that they may have tripped too soon at 135% load. At best, they are borderline. The charts as attached to the 1900-ET1, are difficult to work with. Acceptable limits should have been extracted from the charts for use in data evaluation.

Note: CB 3-point tests were done on a single phase. Customers Spec Page 11 of 35 states in 4.6.1.2, "All thermal trip elements in breakers shall be tested at a minimum of three points in the tripping curve..." (The NRC has

cited TVA for only testing one phase of three-phase CBs.) This item is a nonconformance with the specification.
(Note: Clarification received from Ron Heiffner: Phases were probably tested in series. This is still not acceptable to NRC.)

CONCLUSION

Test results were not documented well. The adequacy of the written test procedure and the legibility of the test curves from Engineering Instruction 1900-ET1 may have led to some actual specification infractions.

FOR INFORMATION ONLY

THREE POINT-THERMAL TRIP TEST

1.0 PURPOSE

1.1 To provide a test to insure proper operation of thermal protection upon three (3) points on its tripping curve.

2.0 SCOPE

2.1 Applies to breakers and overload relays having thermal protection.

3.0 REQUIRED MATERIAL

NOTE: M & TE shall be calibrated.

3.1 Applicable tripping curve.

3.2 Timing device for measuring time to trip.

3.3 Temperature measuring instrument.

3.4 Power Supply.

3.5 Calibrated current meter.

3.6 Variable load.

4.0 PREREQUISITIES

4.1 The test values shall be established from the time current curves as follows:

Breakers - Test Points *(Approximately)

135%	200%	300%

Overload Relays - 135% 200% 600%

4.2 Test shall be performed at a device temperature of approximately 40 Degrees C. (unless otherwise stated on the trip curves)

5.0 TEST PROCEDURE

5.1 Connect the proper load to the test device, ammeter, timing instrument (across the contacts to be monitored) and power supply. NOTE: The poles of the overload relay shall be connected in series to a single phase power supply.

5.2 Energize the test circuit and record the current, tripping elapsed time and temperature. NOTE: Immediately de-energize the overload relay test circuit once the contacts have tripped.

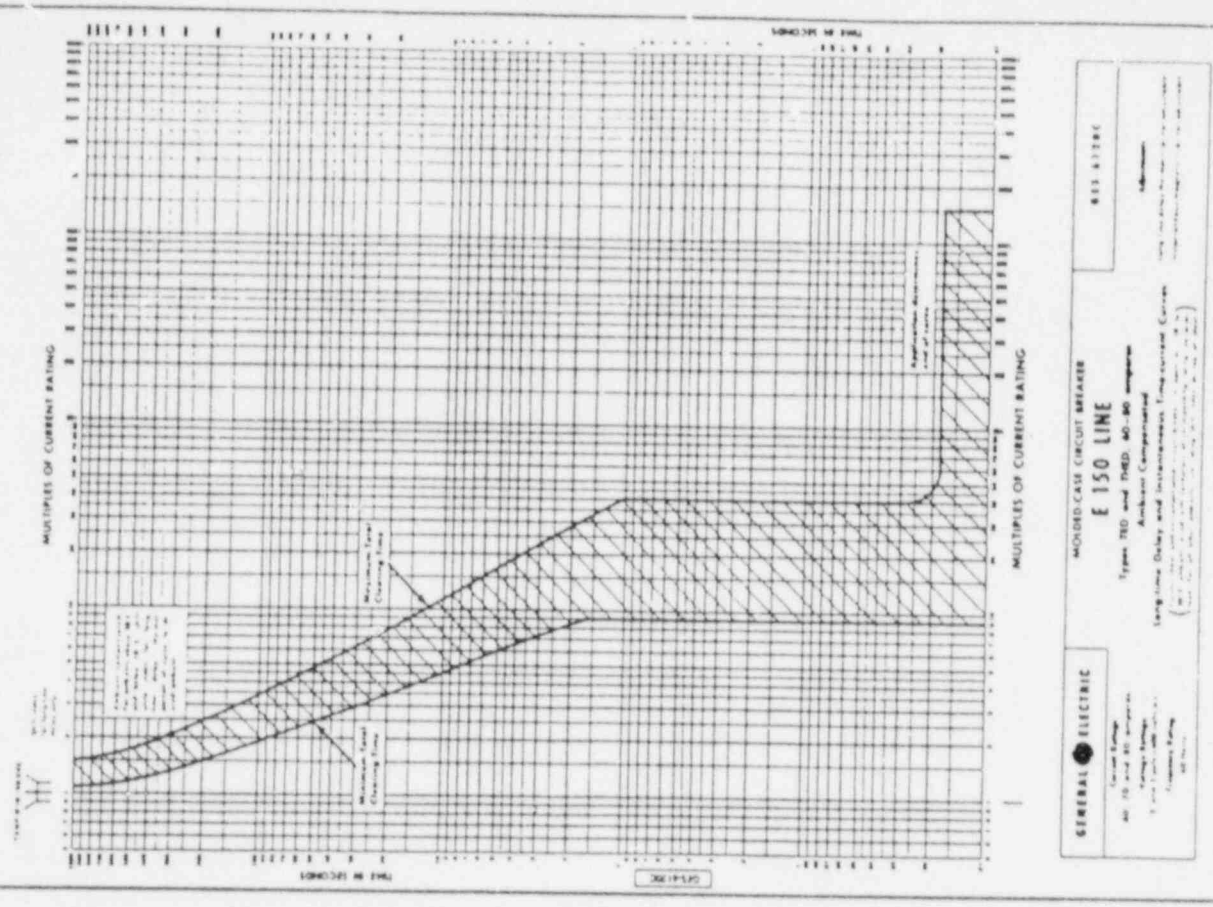
5.3 Allow the device to cool to approximately 40 Degrees C. and repeat Step 5.2 for the other two test points.

6.0 ACCEPTANCE CRITERIA

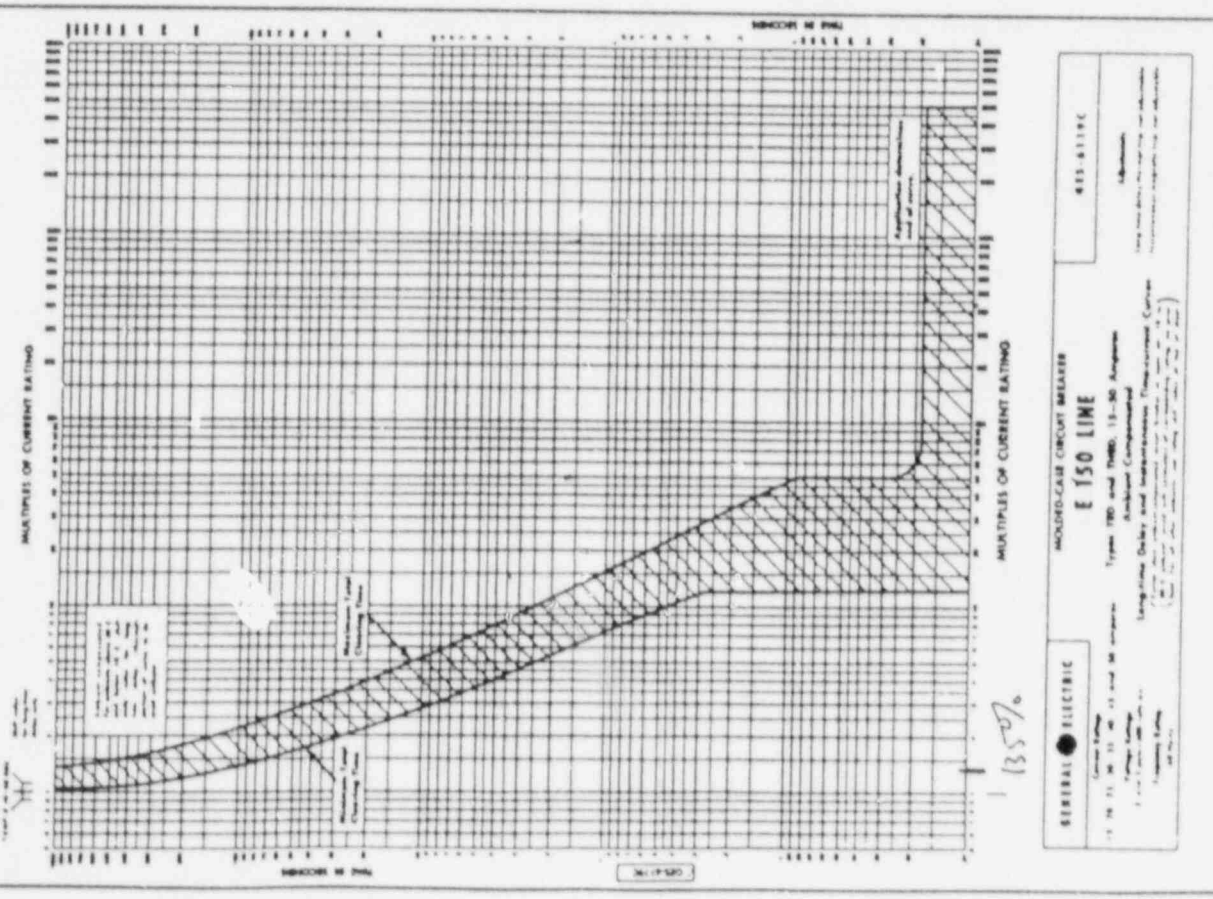
6.1 The device trips within its minimum and maximum values on the trip curve.

6.2 Overload relays shall trip in not more than eight (8) minutes at 200% of its heater element current rating. At 600% the device shall trip in not more than 10 seconds for a Class 10 relay, 20 seconds for a Class 20 relay and 30 seconds for a Class 30 relay.

E150 Line



E150 Line



ENGINEERING INSTRUCTION 1900-1
PAGE 2-2

G.P.U. - 1900-1
PANEL "D"
THREE - POINT
TRIP TEST
480V SINGLE PHASE
TESTED AT 25°C

135%	200%	300%	C.B. #
	70A		
95A	143A	205A	11
13:59	2:37	1:10	
	20A		
27.5	40	61	4
(1:47) LOW ?	39	11.8	
27.5	40	61.2	10
2:18	44.8	11.6	
27.5	40	61	14
2:04	39.3	12	
27.5	40	61	16
2:11	42.5	12.7	
27.5	40	61	24
(1:30) LOW ?	34.8	10.7	
27.5	40	61	26
2:38	47.8	14.7	
27.5	40	61	25
1:59	42	12.9	
27.5	40	61	23
2:05	42.6	13	
27.5	40	61	19
2:00	35.5	12.3	
27.5	40	61	17
2:36	44	14	
27.5	40	61	13
(1:29) LOW ?	34.3	11.2	
	OK	OK	

135%	200%	300%	C.B. #
	50A		
65.2	99	153A	1
20:28	1:27	21.3	
65.2	99	153A	3
19:12	1:17	21.5	
65.2	99	153A	5
11:30	1:09	19.5	
65.2	99	153A	7
14:08	1:18	21.4	
65.5	98.8	153A	9
29:24	1:27	22.5	
65.3	98.8	153A	15
16:53	1:21	22	
65.2	99.5	153A	8
18:17	1:17	21.5	
65.1	99.2	152.5	12
24:36	1:16	22.6	
	30A		
40	61.1	87.2	2
13:11	42	17	
40	61.0	87.1	6
9:14	41	16.5	
40	60.9	87.1	18
8:20	38.4	14.3	
40	60.9	86.5	20
32:49	55.4	21	
40	60.9	86.6	22
18:58	44	19.5	
40	60.5	86.6	21
4:40	33.7	15	

Attachment 3

Nutherm Technical Audit 3/23/88
Review of GPU-1900
Document: QAPs 7.1.04 Markings and Nameplates
10.3.00 Inspection of Finished Enclosures
10.3.10 Inspection of Mounting Hardware
11.1.20 Dielectric Hypot Procedure

OBSERVATION

None of the above procedures states the documentation requirements and none provides definitive guidance for acceptance criteria. It is assumed that assembly drawings are available to the inspector so that he knows what should be in the panel, but no directive is given to verify that all the equipment is there and in the right place. Review of these procedures indicates why the results sheets have so little data and lack desired information. The procedures also do not assign responsibility for performance and acceptance of results. Procedure 11.1.20 calls for multiple test points, but the data sheet for GPU-1900 records only one point (2100 V, 60 sec, 5 mA leakage). The procedure does not specify the duration of the test (1, 5, 10 minutes?). The acceptance criteria seem to assume use of a particular type of hypot set (i.e., it has leakage and breakdown lights), but it is not specified. 2100 Vdc was used for the test, although only 1250 Vdc was required. This is conservative, but no indication for the deviation was given.

CONCLUSION

These procedures do not provide sufficient guidance for performance of the test procedures and for evaluation of results. No requirements are given for documentation. No responsibility is assigned. The actual test appears to be fine, but the written procedures do not indicate this. It is recommended that the procedures be rewritten with sufficient guidance provided, responsibilities assigned and documentation requirements defined.

Attachment 4

Nutherm Technical Audit 3/23/88
Review of DBE Test Procedure
Document: N-261P. DBE Test Procedure

PURPOSE OF TEST

To provide a basis for DBE qualification of GE SB-1 switches, Dwyer airflow switches, Cutler Hammer starters, and a Siemens contactor.

OBSERVATION

The procedure lists the parameters to be maintained in the chamber (180°F, high humidity [not exactly specified, minimal direction to maintain humidity], 255 hrs +). While it is apparent that the Arrhenius analysis given in Table 2 is an example rather than the basis for the test, it is deficient in that the source of the activation energy is not described, temperature rise due to ohmic heating is not discussed, and temperature margin is not discussed. No tolerance is stated for temperature parameters (commercial labs often specify +5°F, -0°F). No cycling is indicated for the contactors and starters. It is not clear how the ability to function has been verified during the DBE exposure for the flow switch, starters and contactor. (It is understood that a hand switch will not change state during the DBE.) The procedure is also not explicit in defining the means of application of test voltage and current. (It appears to be left to the test technician.)

Responsibility for performing the test is not defined, and the documentation requirements are not explicit enough to assure appropriate recording of data. There is no direction with regard to dealing with anomalies or deviations from procedure. No direction is provided regarding provision of air flow to the Dwyer flow switch during testing.

CONCLUSION

1. Further definition of test parameters and functional requirements must be provided to the test laboratory. The test circuit arrangements must be specified so that proper functional testing of the required parameters is assured.

2. Cycling should have been defined for the contactors (see Attachment 5, Conclusion 1).

3. Tolerances on temperature should have been defined for the DBE test. It is customary to allow upwards deviations, but not downward ones.

4. The Arrhenius example provided in Table 2 indicates that temperature rise within components may not be properly considered, margin may not be appropriately considered, and the source of activation energy has not been documented. (It is understood this was an example, not a qualification basis.) Note: Reevaluation of the results provides assurance that the conclusion is sound for the sample even if exceptions to the method can be taken.

5. Control and monitoring of humidity conditions does not appear to be strong. (Evaluation of monitoring as done on March 24, 1988 shows a marked improvement over the 1986 programs.)

6. Some aspects of testing, such as air to the flow switch, are completely left to the test lab. Again, cycling of this switch was not discussed and ability to function may not be assured. If air pressure to the switch is required, it must be stated in the test procedure.

7. The transient rate should be specified for the test profile, otherwise an inappropriate rate of rise may be applied. It is understood that the desired transient rate may not be obtainable. Commercial laboratories often specify that the transient rate will be applied on a "best efforts" basis. Such a specification gives the technician a goal to aim for and tells him what type of monitoring is appropriate (e.g., highspeed stripchart vs a 7-day circular chart).

TABLE 2

DBE TEST CONDITIONS

SERVICE/ENVIRONMENT	TEST AT
TIME, HOURS	>255.0
TEMPERATURE, (MIN.) °F	180°F
HUMIDITY, %RH	high humidity, record steam in chamber observations
MECHANICAL CYCLING OFF/ON CYCLING,	N/A
PRESSURE, psig	ATM
ELECTRICAL LOAD	Applied continuously per Table 1

control? recording?

* Nutherm International applies Arrhenius analysis when performing DBE. Thermally induced deterioration of physical properties of thermoplastics, thermosetting, and elastomeric materials has been repeatedly shown to be predictable by accelerated thermal aging tests. Measurement of a property change after relatively short exposures at elevated temperatures an application of an Arrhenius model to the data can reliably predict the long term stability of a material at a lower temperature. Applied Arrhenius analysis indicates that 255.0 hours of DBE at ≥180°F envelope the customer DBE requirements presented below:

margin?

PEAK TEMPERATURE/ Steady State Temp.	Duration (hours)
178°F/127°F	4.0 min. (Peak)/ 2640 (steady state)

The "Weak-Link" in the construction of the General Electric SBM Switches is the acetal drive cams which exhibits an activation energy of .95 eV. Arrhenius analysis is based on an activation energy of .95 eV.

source? 127°F/2 weeks ≠ 180°F/255 hrs

Attachment 5

Nutherm Technical Audit 3/24/88
Review of DBE Test Report
Document: N-261 LR Rev. 0

PURPOSE

To describe results of the test performed under DBE Test Procedure N-261 P (see Attachment 4).

OBSERVATION

The results described are somewhat different that those required by the test procedure. A 204°F peak occurred for 15 minutes followed by a period at 180°F. The requirement was only 180°F. The requirements changed from 180°F for 255 hours to 180°F for 249 hours (procedure N-261-P to results N-261 LR). No reason for the change is provided. An anomaly is stated (8 hours below required temperature), but no corrective action is stated. However, Table 4 provides a tabulation of time and temperature from the test results.

Included in the file with the report were copies of the loading diagrams and the test currents. From these data, it is obvious that the Dwyer flow switch was pressurized. However, there was no procedural requirement to do so, nor was any information provided with regard to an acceptable pressurization level (i.e., was test representative of conditions at a plant?).

The actual data charts from the DBE were also reviewed (Chart A 420). The chart speed is not indicated, making interpretation difficult. The speed appears to be 1 inch per hour, indicating that the transient took about 15 minutes. The test appears to have been stopped at 48 hours and resumed. There is no discussion of this in the test report, and no requirements concerning continuity of the DBE test. Thermocouple 12 dips slightly below 180°F once per hour, but there is no discussion of the cause or why the results are acceptable. Midway into the test it appears that a second DBE was started on a separate chamber and recorded on the same chart. This makes interpretation of the charts difficult.

Discussion with D. Winder concerning the test loading revealed that the applied voltage was across the circuits shown on the diagrams. The circuits were ungrounded. Therefore, it appears that phase-to-phase or phase-to-ground, no voltage stress occurred in the test device. The bulk of the voltage drop was in the load resistor and lamp.

CONCLUSIONS

1. The results from test N-261 must be applied carefully. They are useful only for devices that are either continuously energized or continuously de-energized. However, most control circuits would be required to change state during the post-accident period, either as a "fail-safe" or to perform their accident function. Therefore, the usefulness of these test results is questionable. If they are to be used for verification of operability for periods greater than one half hour at 180°F, further analysis of operability is needed if the devices are required to transfer state.

2. There was no voltage drop across the insulation of the contacts of the switches and contactors. This causes concern for proving that the insulation system (air and barriers) functioned properly during the high humidity condition. High humidity testing with full voltage stress is appropriate.

One useful way of providing "synthetic" voltages and currents is to use independent voltage and current sources as was discussed during the exit meeting on March 25, 1988.

3. The actual documentation of the test is insufficient to answer some questions. The chart speed must now be a guess. It is not clear which test chamber was used. Humidity was not recorded. Voltages after the initial

reading were not recorded. The reason for shortening the test from 255 to 249 hours is not given. Addition of such details to charts and log books would take little time and would forestall such problems in the future.

4. More accurate specification of test parameters should be provided, including specification of allowable transient rates and tolerances.

Attachment 5

Nutherm Technical Audit 3/24/88
Review of Project AAF-1645
Document: Equipment Qualification Report AAF-1645R

PURPOSE OF DOCUMENT

To documents the results of qualification testing and analysis for 6-kW heaters and their remote control system.

OBSERVATIONS

1. The discussion of similarity of components is merely a statement. The Records of Anomaly are not specific enough to verify that an adequate evaluation of the differences in components has been performed. In particular, the materials are not listed for comparison, component diagrams and manufacturers' data are not provided, function during seismic and accident events is not discussed (Note: the similarity evaluations are better in this package than in GPU-1900). It is also recommended that Section 5 (Equipment Description) of the qualification reports reference the similarity reviews (Records of Anomalies).

2. Thermal Aging Analysis, Section 7.2.5.3, assumes:

97% of time at 100°F (non-operating)
3% of time at 120°F (operating) panel
3% of time at 128°F (operating) heater

The temperature rises (20 and 28°F) were determined by calculation. However, no calculation is provided or referenced. The controller contains contactors and transformers. Hot spots in the coils of these devices well exceed 20°F, but is not addressed (Note: this may be covered by device energization during thermal aging; however, there is no indication in the report that the devices were energized during thermal aging). It should be noted that hotspot temperatures are not critical for this application, but are of concern for systems and components with higher duty cycles.

3. Activation Energy

Section 8.98 states "Analysis by Nutherm scientists indicate the following..." The analysis is not referenced.

Section 8.7 develops activation energies for Zytel 101 (a DuPont nylon). The reference (No. 14 in the report, R #29 in file) relates to GE Lexan 101. It is not clear that these are similar materials and that the activation energy applies. None of the activation energies states the property they relate to or how the property relates to component function. (Note: This does not mean that all activation energies were chosen improperly; it denotes that information desired by many reviewers is not given.)

4. There is a minor discrepancy between Table 4 and page 66. One page gives the life of the GE disconnect switch as 26.3 years, and the other as 26.1 years.

5. ROA SEI-102 concerns failure of a Cutler Hammer contactor C 30CN3A during seismic testing. One model remained closed during seismic testing whether energized or not. The second failed after or at the end of seismic testing. The apparent reason was loosening of the support screws for the magnet during cycling and/or seismic testing. The fix was to tighten the screws of all field units and retighten those of the test devices prior to seismic. It is not clear from the ROA that retesting included repeating the mechanical cycling to assure that the problem had been fully rectified. The report also requires no periodic verification of tightness of the contactor screws.

6. ROA SEI-065 states that one of a master/slave pair failed during a second seismic test. No actual cause is determined. The controller apparently failed in a full on state.

The conclusion states "Because the units failed in an "on" condition during sine beat testing, the Solitech units are also considered acceptable for class IE applications requiring sine beat testing." This type of

reasoning is unacceptable. If one does not understand the failure, one cannot state that the failure will always occur in the same manner.

7. EQP AAF-1645P, page 13 has errors in the normal life radiation requirement for the heater and remote panel (10E7 rd and 10E5 rd). These are the accident doses. Also a 15°F margin is not needed on aging, but should be applied to the accident (however, because of the benign accident, a lower margin could be argued).

8. The Thermal Aging Summary Table is an analysis of the equivalence of the thermal aging to qualified thermal life. Evaluation of item NTL P/N 494, a GE THC-325 disc switch, indicates a qualified life of 26.1 years. Evaluation of paragraph 7.2.5.3 of the report indicates 3% of life is at 120°F and 97% at 100°F. Table 3 indicates that no margin should be added to the normal life temperature (this differs from Table 2 of the equipment qualification procedure which requires the 15°F margin). Evaluation of the qualified life result versus the stated calculation method indicates that the 15°F margin was in place during the calculation. The change from the plan to stated method is not discussed. The inclusion of the margin in the calculation does not agree with the stated method.

9. Section 8.9 references "Plastics for Electronics" for the source of activation energies. This reference does not provide activation energies, but rather data from which an activation energy could be calculated. Mr. Gunin provided memoranda that gave the methodology to be used to perform the calculation and stated that the calculation may be available, but he was not certain. The preferred method of referencing should have been to reference a formal calculation with the calculation referencing the source of input data. It should be noted that the activation energy of concern for micarta was consistent with data known to the reviewer and is considered adequate.

CONCLUSIONS

1. The similarity analysis should be strengthened and should focus more on: (a) components that could age and thereby affect seismic and DBE capabilities; (b) the function during seismic events (e.g., CB to remain closed, contactor to stay open (or closed) during event) and what characteristics of the component could affect the function (e.g., the trip latches should be the same, contact supports and mechanisms the same); and (c) testable characteristics that indicate similarity. Some useful items for inclusion in the report are the manufacturer's specification and dimension sheets, receipt inspection results, and pictures. It is highly likely that a disassembly of the EQ specimen versus the similar item may be necessary. Material lists are of high importance with a one-for-one correspondence for subcomponents.

2. For long-term continuously energized devices (i.e., [illegible]ized most of the time), ohmic heating and hot spot temperatures greatly shorten life. This is especially true for contactor and relay coils. The coil temperature rises should be considered in Arrhenius life calculations, because they will greatly affect the results.

3. Care must be taken in establishing linkages to activation energies. It is understood that an activation energy is not available for each compound or material. However, the assumption should be stated as well as the property of interest (e.g., Zytel 101 assumed similar to Celanese 147 with Ø of 1.17 eV for retention of 50% elongation at break).

4. Care must be taken to prevent errors in critical results and calculation methods from creeping into the reports. The reasons for differences between the test plant and the report should be described. It is suggested that the calculation for at least one of the components in the aging and DBE tables have a hand-performed calculation that presents the format of the calculation and shows the method. This would provide the

reviewer with the exact method used and would allow a verification that the stated method gives the same results as the computer (i.e., it verifies that the inputs result in the desired output).

5. Failure evaluations that result in continued use of the component must be more detailed and assure that the root cause was found and corrected, and that retesting was appropriately performed. The failure of the Cutler Hammer contactor indicates that it was induced by mechanical cycling; yet mechanical cycling was not reperformed and the client was not told to periodically check tightness of the screws. The failure of the master/slave controller does not appear to be well understood; yet an assumption is made that the failure mode will be consistent. This assumption appears to be unfounded.

6. When base reference material must be manipulated by calculation or evaluation, the calculation should be formally performed and the calculation referenced rather than the base data. The calculation should naturally contain the reference to the base material.

Attachment 7

Nutherm Technical Audit 3/25/88
Review of Project GPU-1900
Document: GPU-1900R EQ Report

PURPOSE OF DOCUMENT

To establish basic qualification to seismic and mild environment conditions.

OBSERVATIONS

1. The function of components does not appear to be fully considered. The verification of a similar function in the test vs the installed application does not always occur. An example is the Glastic standoff insulator. Its function in the test is to support an SCR. Its function in the application is to support a bus bar. It is not clear that the test envelops the application. It is also not clear that load conditions that could affect thermal trip circuit breakers have been considered during seismic testing.

2. Item 158-A, the Glastic standoff, is stated as being included in Wyle test 47809-1, but is not included in the list of components tested in the report. A reason for this should have been included in Nutherm's text.

3. The electrical interface with the power leads is not discussed from the standpoint of structural integrity of the bus (i.e., will weight and mass of the leads affect the seismic integrity?). No discussion of expected limits on interface connections is given (at least a limitation on Nutherm's liability should be given, i.e., the client is responsible for appropriate restraint of leads and connections to the box). While it does not appear critical to this project, such a discussion may be critical to others.

CONCLUSIONS

No significant omissions, errors or problems were noted. However, some additional attention to detail and smoothing of the report appears necessary. Verification that electrical and physical interfaces have appropriately considered is needed.