ARKANSAS POWER & LIGHT COMPANY
CAPITOL TOWER BUILDING/P. O. BOX 551/LITTLE ROCK, ARKANSAS 72203/(501) 377-3525

T. GENE CAMPBELL
Vice President - Nuclear

August 19, 1988

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U. S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 1000
Arlington, TX 76011

ATTN: Mr. Robert D. Martin
Regional Administrator

SUBJECT: Arkansas Nuclear One - Units 1 & 2
Docket Nos. 50-313 and 50-368
License Nos. DPR-51 and NPF-6
August 15, 1988 Enforcement Conference
on Environmental Qualification of Equipment

Dear Gentlemen:

As requested by your office, the Arkansas Power and Light Company (AP&L) met with members of your staff and NRR on August 15, 1988, to discuss potential enforcement items relating to the environmental qualification (EQ) of equipment. These findings resulted from the "first round" EQ inspection conducted during July of 1986 and two (2) subsequent inspections in which EQ items were also reviewed.

During the meeting, AP&L indicated our intention to submit additional documentation relative to these issues. The attached information provides documentation of the information presented during the meeting and in many cases provides additional or more detailed information.

As discussed with your staff, I believe this information indicates AP&L's commitment to full compliance with environmental qualification requirements. In addition, specific information is provided relative to each item delineated in the inspection reports. I hope this information will be useful your review of the history of these items and in assessing their significance.

Very truly yours,

T. Gene Campbell

T. Gene Campbell

TGC:lg

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I. INTRODUCTION AND EQ PROGRAM OVERVIEW

A. Introduction

In the last two years the NRC has conducted several inspections of the equipment qualification (EQ) program at Arkansas Nuclear One (ANO), Units 1 and 2. The results of those inspections were summarized in three inspection reports:

- 50-313/86-23 and 50-368/86-24 (December 11, 1986)
- 50-313/86-32 and 50-368/86-32 (December 24, 1986)
- 50-313/88-05 and 50-368/88-05 (July 14, 1988)

In those inspection reports the NRC identified a total of five potential enforcement items (with several sub-issues) and five unresolved or open items. In addition, subsequent to the latest EQ inspection report, the NRC has requested information on a new item involving qualification of Rosemount transmitters.

On August 15, 1988, Arkansas Power and Light Company (AP&L) met with the NRC at Region IV headquarters to discuss each of these EQ issues. At the meeting, AP&L addressed the substance and significance of each potential enforcement item. AP&L also

presented information considered sufficient to resolve each unresolved issue, including an update on the Rosemount transmitter issue. The NRC requested that AP&L document that information and provide it to the NRC. This report serves that purpose.

In sum, AP&L does not believe that the EQ issues identified in the inspection reports and addressed below warrant escalated enforcement action under either the NRC's Modified Enforcement Policy (Generic Letter 88-07) for EQ violations or under the General Enforcement Policy (10CFR Part 2, Appendix C). AP&L has long been committed to aggressively addressing the environmental qualification issue in a professional, responsible, and proactive fashion. As is described below, and as was acknowledged by the special NRC inspection team for the July 1986 EQ inspection, AP&L has implemented a well-planned and thoroughly documented EQ program. AP&L does not believe that documentation deficiencies identified were significant from a safety perspective or representative of any programmatic or management weaknesses in this area. AP&L has concluded that all of the equipment highlighted in the inspection reports was either qualified or qualifiable, and operable. Further, in all cases where documentation deficiencies have been substantiated, AP&L has taken appropriate measures to address the underlying concerns and to ensure that qualification documentation is established and maintained. AP&L management remains committed to excellence in this area.

B. AP&L's Efforts to Comply with EQ Requirements

NRC's equipment qualification (EQ) requirements have significantly evolved since 1979. This evolution led to issuance by NRC of the final rule, 10 CFR 50.49, in January 1983. The deadline for licensee compliance with the rule was ultimately established as November 30, 1985. However, in many respects, interpretations of the provisions of the rule and of the dictates of good practice in the area of equipment qualification have continued to evolve since November 30, 1985. Throughout this long history, AP&L has taken an active role in industry efforts related to EQ and has exerted substantial efforts to meet applicable requirements.

To briefly summarize, prior to 1979, formal programs to address EQ were not required for ANO. By 1980, however, efforts were underway at ANO to address the early EQ guidance of IEEE-323, IE Circular 78-08, and NRC Regulatory Guide 1.89. Although no specific commitments were required regarding IEEE-323, some electrical equipment at ANO was in conformance with IEEE-323 1971. NRC Bulletin 79-01B was issued on January 14, 1980, requiring for the first time that electrical equipment at ANO Units 1 and 2 be qualified to the DOR Guidelines. AP&L thus began more extensive qualification efforts. When 10 CFR 50.49 became effective in 1983, these efforts were accelerated. (As discussed below,

existing electrical equipment at ANO was "grandfathered" to the previous standards, applicable under Bulletin 79-01B. Qualification upgrades were required only for replacement equipment.) Following the January 1985 refueling outage for Unit 1 and the February 1984 refueling outage at Unit 2, AP&L had completed significant design changes and upgrades well in advance of the November 30, 1985 deadline for compliance with the rule. By this time, AP&L had also implemented a new EQ maintenance or "preservation" program well in advance of most utilities. The program was not required by EQ regulations, but was a recognition by AP&L of the need to aggressively deal with the issues at hand.

AP&L's efforts with respect to equipment qualification are also evidenced by its interactions with the NRC Staff and the industry. These interactions enabled AP&L to responsibly address evolving issues and to implement a thorough EQ program. For example:

- In April 1984, AP&L and the NRC Staff met to discuss all deficiencies identified as a result of the Franklin qualification work and Technical Evaluation Report. The meeting was characterized as very positive and tentative resolutions for all items were agreed upon.

- AP&L initiated an independent audit/review of its EQ files by two separate EQ consultants (1984 and 1986) to ensure technical adequacy and auditability.

- Since its inception, AP&L has been a key participant in the Nuclear Utility Group on Equipment Qualification (NUGEQ). As a member of the Steering Group, this initiative has given AP&L a forum for addressing EQ issues and concerns and for interacting with the NRC Staff.

- AP&L has been actively involved in the EPRI Equipment Qualification Advisory Group, and is represented on the Steering Group.

- AP&L has participated in NRC EQ research as a peer review contact for the NRC subcontractor and by donating batteries for an NRC aging research project.

- AP&L implemented the special EQ maintenance (presentation) initiatives.

- AP&L initiated a Limitorque Actuator "Upgrade" Program. This was based on AP&L's decision to aggressively address IE Bulletin 85-03 and various Limitorque qualification and maintenance - related issues. This comprehensive inspection/upgrade/rework program was ongoing at the time of the NRC's 1986 special EQ inspection.

In total, AP&L has made far more than the minimum required effort in this area. AP&L devoted considerable resources to implementing its EQ program by the November 30, 1985 deadline and was extremely successful in achieving that goal. As noted by the NRC's special inspection team in Inspection Report Nos. 50-313/86-23 and 50-368/86-24 (at page 7), the "NRC inspectors concluded that the licensee has implemented a well planned and thoroughly documented EQ program meeting the requirements of 10 CFR 50.49." Similarly, the inspectors concluded (at page 12) that "the ANO EQ maintenance program appears well planned and implemented."

C. Overview of the EQ Program

As indicated above, the first major EQ requirements applicable to ANO were the DOR Guidelines established by Bulletin 79-01B. These guidelines remain the standards applied to assess and measure the qualification of the then-existing equipment for both ANO Units 1 and 2.

Implicit in the application of the DOR Guidelines to operating plants was the realization that more stringent qualification requirements were not warranted. In effect, Bulletin 79-01B made allowances for the older vintage equipment and plant design

without compromising the safety significance of the issue. For example, though type testing of all pertinent environmental parameters was preferred, material analysis was permitted to address radiation qualification. Aging qualification could also be addressed by material analysis. In short, the DOR Guidelines were intended to "screen" out the more apparent qualification problems.

10CFR50.49 subsequently codified EQ requirements for all plants. Though it contains more stringent qualification requirements than Bulletin 79-01B, it contains a grandfather clause for any equipment which was previously required to be qualified by another standard (i.e., the DOR Guidelines). However, the rule clearly indicates that any replacement equipment must be upgraded to the requirements of the rule. Therefore, the EQ-related equipment at ANO is a mixture, some of which is qualified to 10CFR50.49, the remainder being qualified to 79-01B.

The ANO EQ Program was formally documented in the AP&L EQ Program Manual. As described in the manual, the qualification process was implemented in two phases. Phase 1, Identification/Evaluation, involved identifying the required electrical components and

establishing the appropriate qualification documentation. It is important to understand that most of this existing equipment had been designed, procured, and installed before explicit EQ requirements existed, and in many cases even before there were explicit Appendix B QA requirements. For this reason also, qualification was established for components, and was not addressed to the piece part level. This was one reason for the flexibilities inherent in the DOR Guidelines. This was clearly recognized by NRC in its implementation of the new requirements since the vintage of the equipment precludes the existence of extensive documentation "pedigree". This point is particularly important with respect to several of the issues addressed below (e.g., motor lead crimp type connectors for Limitorque actuators). AP&L and the industry have taken the position that since in many cases, no traceability existed for piece parts included in existing components, piece part qualification was neither reasonably required nor practically achievable. The NRC clearly accepted this viewpoint during the EQ rulemaking process.

Phase 2 of the AP&L EQ Program, Maintenance/Preservation, involves preserving qualification and addressing qualification of replacement parts and components. AP&L created and implemented this comprehensive program for preserving qualification status through various plant activities well in advance of most utilities.

It is important to note, however, that equipment qualification maintenance must be distinguished from "good maintenance practice". Failures to completely address the latter should not be treated as violations of 10CFR50.49 requirements, and therefore should not result in escalated EQ enforcement action. This distinction is relevant to several of the specific issues addressed below (e.g., corroded terminal blocks, Reliance containment cooling fan motors). AP&L has included the essential EQ maintenance requirements and the good maintenance practice issues together in a comprehensive manner; therefore, AP&L believes it has implemented an excellent program to maintain reliable equipment.

In sum, AP&L's EQ program philosophy has been consistent with evolving regulatory requirements and the evolving state of NRC/industry knowledge with respect to the EQ issue. AP&L believes that this historical perspective is important in addressing the issues below. Consistent with the Modified Enforcement Policy, the NRC's first-round EQ inspections were intended to assess compliance with applicable regulatory requirements as of November 30, 1985. The issues of existence of a deficiency and application of the "clearly should have known" threshold of the policy can only be appropriately addressed by keeping in mind the time of the inspection and the state of then-available knowledge. In this regard, we believe that previous submittals, reviews and approvals by NRC and its

subcontractors and "final SERs" must be considered when determining a utility's responsiveness to any of the issues at hand. In light of these considerations, AP&L concludes that its program was fully adequate and that no significant deficiencies were identified.

II. Inspection Report Nos. 50-313/86-23 and 50-368/86-24

Potential Enforcement Items

1: Limtorque Motor Operated Valves

In 1985 and 1986, AP&L initiated a Limitorque actuator "upgrade" program. This comprehensive program was intended to address IE Bulletin 85-03 operability issues, evolving environmental qualification issues raised in IE Information Notice 86-03 (including those with respect to internal wiring), and various preventive maintenance concerns. The large number of then current issues regarding MOV operability and the lengthy history of other Limitorque issues prompted AP&L to aggressively undertake the program which extended well beyond efforts needed to meet the letter of regulatory requirements. This program included a licensee walkdown inspection of ANO EQ Limitorque operators. The licensee walkdown for ANO-2 was ongoing at the time of the July 1986 special NRC EQ inspection and was the source of many of the issues identified by the NRC Inspection Report with respect to the Limitorque actuators.

In the Inspection Report, the NRC specifically raised seven issues related to the qualification of Limitorque motor operated valves. The underlying concern in all cases related to the adequacy of file documentation to address apparent "deviations" between plant equipment and qualification test specimens. AP&L provided extensive documentation supporting the qualification of Limitorque actuators during and after the inspection.

AP&L separately addresses each of the seven issues below. Because these issues all relate to the same type of equipment, they have been appropriately grouped together. To the extent that the NRC Staff determines that enforcement action is indicated on this issue, AP&L believes that these items should not be considered for escalated enforcement either individually or collectively. The matters raised (entirely documentation deficiencies) either do not meet the NRC's "clearly should have known" test, are not safety significant, or in several cases are not violations at all.

Specifically, much of the equipment addressed below was addressed as part of the ongoing Limitorque actuator upgrade. Certain self-initiated actions were taken to further enhance the actuators which were already considered to be qualified; therefore, it is inappropriate to consider these items as evidence of violations.

One additional item is also noted. The inspection report covering this "First Round" inspection was not issued for nearly five months following the conclusion of the audit. Upon receipt of the report, AP&L noted a number of items which were different than reflected by AP&L personnel. Some of the differences are important to a fair and proper characterization of the inspection, especially considering that the current attention on enforcement is being brought forward two full years following the audit. The following is a list of the differences with a brief explanation. We recognize that the differences are most likely unintentional and are understandable in many cases. Our lack of immediate response to the discrepancies was largely due to two factors. First, the significance of the Limitorque issues was initially primarily attributed to the wiring questions and the discrepancies primarily refer to other issues. Second, AP&L was expecting a follow-up report from Region IV to be issued shortly thereafter.

Each of the items is stated below:

1. Failure to remove Grease Relief Shipping Caps is mentioned in the cover letter and in the report. AP&L acknowledges that the caps were not removed in some cases; however, this item was not mentioned as a concern during the audit. Therefore, AP&L was not given the opportunity to respond during the course of the subject audit.

2. P. 11, 5th paragraph - The write-up indicates "...JCO's had not been prepared for outside containment operators." The JCO previously written by AP&L did specifically address outside containment actuators though individual JCO's for these items were not created.

3. P. 11, 5th paragraph - In further reference to the inadequacy of the AP&L JCO, the writer status that the JCO did not consider a) wiring that may have been installed by third parties and b) other deficiencies identified during the walkdown such as absence of T-drains and unidentified terminal blocks. In the first instance, the sources of any unidentified wiring would not significantly alter the basis for the JCO. Second, at the time of the inspection, AP&L had justified the absence of T-drains and no unidentified terminal blocks had yet been discovered; therefore, no JCO was needed for these items. Upon discovery of unidentified splices, the existing JCO was judged adequate.

4. P 12 - Details of the report indicate that AP&L records confirmed (of 20 work packages reviewed) "(ii) 10 operators had questionable terminal blocks". This is potentially misleading. The terminal blocks were fully qualified and had not been replaced for qualification reasons.

5. P 12 - It is stated that operators which required T-drains did not have them installed. As explained elsewhere, it is AP&L's position that T-drains are not required.

6. P 12 - It is stated that mixing of grease types was evident. This resulted from ambiguous documentation. AP&L explained during the audit that mixing in fact did not occur.

7. P 12 - It is stated that terminal blocks were replaced due to being underrated. This is not accurate as explained later. It also states blocks were replaced due to corrosion. This is not true. Corrosion resulted in cleanup, not replacement.

8. P 13 - It is stated that T-drain installation was required by Test Report 600456. This test report in fact does not even mention T-drains, though it is now AP&L's understanding that T-drains were installed in the test specimen.

9. P 14 - Based on a walkdown, it was noted that "Many of the installed terminal blocks could not be identified." This is not accurate. The escort provided during the walkdown was not prepared to identify the blocks; however, AP&L was able to easily identify the blocks during the upgrade inspections.

10. P 14 - It is noted in the report that the qualification files do not specifically state that the effects of (limit switch compartment) heaters on qualified life have been addressed. AP&L acknowledges this fact, however, this issue was not brought to our attention during the course of the July 1986 inspection. It was raised during a follow-up inspection completed in October 1986. As stated before, inclusion of this item in the July inspection report is misleading especially in consideration of escalated enforcement since AP&L had no opportunity to address and resolve the issue during the first round inspection.

1.1: Unidentified Splices

A. Statement of the Issue

According to the Inspection Report, AP&L's files did not adequately document qualification of Limitorque valve operators because the plant equipment was not identical in design and material construction to the qualification test specimen, and deviations were not adequately evaluated as part of the qualification documentation. Specifically, under this issue, the report states that wiring and splices internal to the components were unidentified and/or unqualified.

B. AP&L's Position Regarding Existence Of A Violation

AP&L concludes that this issue does not represent a significant deficiency with respect to 10CFR50.49. AP&L acknowledges that at the time of the NRC inspection, licensee walkdowns indicated that several ANO Unit 2 Limitorque operators had unidentified internal wiring and/or splices. However, the inability to identify subcomponent parts upon inspection is not necessarily indication of an unqualified or inoperable component. As discussed further below, AP&L believes that the splices at issue were either qualified or qualifiable

In this case AP&L conservatively replaced all the splices it had identified as questionable, because confirmation of qualification could not be made on the spot. This action was not based on any conclusions with respect to qualification or operability but was a pre-determined course of action outlined in the work plan.

Moreover, it is important to note that any issues with respect to Limitorque internal wiring have been resolved as an enforcement matter since the December 1986 Inspection Report. This issue was essentially eliminated from potential enforcement action by virtue of SECY-87-32 (February 6, 1987) and EGM-87-02 (April 10, 1987). Because of the generic

nature of Limitorque internal wiring deficiencies, Mr. Stello discussed in SECY-87-32 the Staff's proposal to exercise its discretion to take "no enforcement action for certain violations involving unqualified valve motor operator internal wiring because of extenuating circumstances and the limited potential safety significance of the violations." This Staff proposal was approved by the Commission on March 23, 1987. Also, in EGM-87-02, Mr. Taylor of the Office of Inspection and Enforcement, wrote that "[v]iolations involving deficiencies in the qualification of internal wiring for Limitorque motor operated valves where licensees have taken reasonable corrective actions should not be cited unless programmatic." The unidentified splices and wiring at issue here did not represent programmatic problems. Therefore, AP&L concludes that no enforcement is appropriate with respect to this matter.

C. Safety Significance/Clearly Should Have Known Thresholds

AP&L believes that escalated enforcement action is also inappropriate with respect to this issue under the Modified Enforcement Policy (GL-88-07) because i) the potential violation is not safety significant and ii) the potential violation is not one which meets the "clearly should have known" test. Under the Modified Enforcement Policy, a

showing on the first of these two threshold tests warrants a conclusion that there should be no escalated enforcement action. A showing on the second threshold test warrants a conclusion that no enforcement action should be taken.

i) The potential deficiencies in the internal splices do not have safety significance. First, some of the unidentified splices at issue under this item were heat shrink splices. AP&L replaced these splices only because they could not be positively verified as Raychem WCSF or because they did not meet the detailed Raychem installation guide. There was no indication that the installed splices were not qualified or operable. Extensive Raychem splice testing supports the ruggedness and fidelity of numerous application variations.

Second, other unidentified splices at issue were identified as Scotch 33 tape splices. AP&L has concluded that these installed splices provided the necessary mechanical protection and, therefore, were most likely operable. Workmanship of the splices was judged excellent and confirmed to reflect the standard industry method for motor termination splicing prior to the advent of new "EQ splices" such as Raychems.

Specifically, Limitorque tests had qualified these actuators using "blind barrel crimp lugs." Blind barrel crimp lugs provide no moisture intrusion barrier. Therefore, it is reasonable to conclude that a moisture barrier would likewise not be necessary for the Scotch tape splices. To be acceptable, these tape splices needed to provide only mechanical protection.

In this light, AP&L engineering staff performed evaluations and concluded that the splices were operable. Informal examination by a Wyle Laboratories EQ testing expert also confirmed that the splices were qualifiable. The expert judged the splice capable of passing a qualification test for this functional application. He also noted that similar splices had been tested successfully in the past.

ii) The deficiencies identified with respect to internal splices do not meet the "clearly should have known" threshold that must be met for all EQ enforcement actions. The procedure for qualifying Limitorque operators in effect at the time of the 1986 licensee walkdowns and NRC inspection involved comparison of Limitorque records to the device identification number (shop order/serial number). Walkdowns were performed to

confirm nameplate data and any issues identified based on Limitorque records (e.g., proper torque switch material, terminal block, motor brake, etc.). AP&L had no prior indication of problems, concerns, or issues over internal connections for Limitorque operators.

Furthermore, as discussed above, at that time there was no indication of a requirement or need for internal piece part validation/verification in the absence of an identified problem. As also discussed above, the AP&L EQ Program was based on a philosophy of qualification to the component level for originally installed equipment. This approach was consistent with industry practice and well known to NRC and its subcontractor who had reviewed the qualification documentation in the past. Therefore, if a deficiency is determined to have existed in this area, it is not one which meets the "clearly should have known" test. No enforcement action would be appropriate under the Modified Enforcement Policy.

D. Root Cause

The source of the unidentified splices could not be determined. The source could have been the architect-engineer, valve manufacturer, or licensee

maintenance/contractor personnel. Splicing most likely was completed prior to or during plant start-up activities (pre-1978). Formal equipment qualification programs were neither in place nor required at that time.

E. Other Considerations

- AP&L identified the problem and took prompt and conservative corrective action.

- Existing JCOs for internal wiring issues were considered adequate to address this issue as well; therefore, no special JCOs were considered necessary.

1.2: Terminal Blocks

A. Statement Of The Issue

According to the Inspection Report, AP&L's files did not adequately document qualification of Limitorque operators because the operators were not identical in design and material construction to the qualification test specimen, and deviations were not adequately evaluated as part of qualification documentation. Specifically, under

this issue, the NRC inspector noted that certain terminal blocks had been replaced because (i) blocks were underrated, (ii) corroded or (iii) unidentifiable.

B. AP&L Position Regarding The Existence Of A Violation

i) AP&L agrees that four unidentified terminal blocks (out of over 300 inspected) could not be identified as qualified components. As discussed further below, this issue was not safety significant in that testing has verified that the blocks would have performed their intended function.

ii) AP&L agrees that several terminal blocks were noted to have exhibited the effects of corrosion. However, as discussed further below, AP&L believes that the discovery of minor corrosion on terminal blocks should be categorized as a preventive maintenance issue of low relative safety significance rather than as an equipment qualification concern. The installed blocks were fully qualified and operable for their intended use.

iii) AP&L does not agree with the NRC's assumption that certain terminal blocks were replaced because they were underrated. As discussed further below, certain terminal blocks were replaced as a result of AP&L's decision to use alternate lead point spacing, which often resulted in an inadequate number of termination points or because of issues related to Bulletin 85-03. Therefore, these replacements were not due to an EQ concern.

C. Basis For Denying That An Underrating Deficiency Existed

In 1981, certain terminal blocks provided by Limitorque were derated by UL due to implementation of a new standard requiring a minimum barrier height between terminal points. In response to this and other issues, Limitorque performed tests on the blocks in two configurations -- normal and alternate lead-point spacing. The test, (Report No.B0119) re-confirmed that the blocks would perform their intended function notwithstanding derating. Considering the above, AP&L had a reasonable basis for continuing to believe that the terminal blocks were qualified.

Nonetheless, AP&L conservatively decided to change its use of the terminal blocks to an alternate lead-point spacing (ALPS) configuration. If the blocks did not provide the required number of termination points with the new spacing scheme, the blocks were replaced. This replacement was not due to underrating concerns as it was characterized in the NRC inspection report.

D. Safety Significance/Clearly Should Have Known Thresholds

Regarding the unidentified terminal blocks (Issue B (i) and the "corroded" terminal blocks (Issue B (ii)), discussed above, AP&L believes that enforcement action should not be taken under the Modified Enforcement Policy (GL 88-07) because:

- The unidentified terminal blocks were not a safety significant deficiency. This conclusion was confirmed by subsequent confirmatory testing which verified that the terminal blocks were still capable of performing their required functions under accident conditions (Schneider Engineering Test Report #P805-06-8)

- Subsequent to implementation the Limitorque upgrade program in 1986, AP&L reviews and inspections did not provide any reason to suspect unqualified/unidentified terminal blocks had been used. Since AP&L inspected approximately 150 terminal blocks at the time of the 1986 NRC inspection and had discovered only 4 that could not be identified as qualified components, there was no indication of a programmatic breakdown. Furthermore, considering the upcoming ANO-1 inspections, AP&L was confident that all remaining terminal blocks could also be identified as qualified. Therefore, it should not be held that AP&L clearly knew or clearly should have known of the existence of unidentified terminal blocks prior to November 30, 1985. Under the Modified Enforcement Policy, this is a matter that should result in no enforcement action.

- Based on Limitorque records and communications in 1980-1983 timeframe, AP&L had already identified specific cases of actuators having improper terminal blocks and took actions to replace the devices. IE Notice 83-72, which noted cases of unqualified terminal blocks, was not considered different than these cases already addressed by AP&L.

- Corrosion of terminal blocks is a normally encountered preventive maintenance issue. The amount of corrosion found was considered minor and would not have adversely affected the ability of the terminal blocks to perform their intended function. The contacts were promptly cleaned. Therefore, this deficiency had little or no safety significance.

- In any event, corrosion on terminal blocks is a preventive maintenance issue only tangentially related to qualification. This should not be classified as a violation of 10CFR50.49. AP&L does not believe that plant preventive maintenance is a matter within the scope of the EQ requirements. Therefore, this matter does not meet the "clearly should have known" test.

E. Root Cause(s)

i) Unidentified Terminal Blocks

AP&L believes that it is likely that the unidentified terminal blocks were installed by the architect engineer (A-E), valve manufacturer, or AP&L maintenance/contractor personnel prior to plant start-up in 1978. AP&L's qualification inspection efforts, although extensive, did not discover the unidentified blocks until after November 30, 1985. Inspection of subcomponents to the piece part level was not considered necessary in the absence of an identified safety concern.

ii) Corroded Terminal Blocks

Terminal block corrosion can occur between preventive maintenance inspection due to ambient operating conditions. The inspection frequencies are still considered adequate in that the blocks had not significantly corroded to a point that operation or qualification was affected.

F. Corrective Actions

i) Unidentified Terminal Blocks

- All four unidentified terminal blocks were promptly replaced with qualified components.

- All remaining terminal blocks were positively identified as qualified [illegible]s.

- AP&L conducted analysis of Unit 1 implications resulting from this Unit 2 issue. It concluded that four unidentified terminal blocks at Unit 2 were not [illegible]tive of a systematic concern. Therefore, this issue did not suggest an immediate Unit 1 problem. In addition, JCOs prepared for Limitorque valves (in response to identification of wiring concerns) enveloped any terminal block concerns that might have arisen. AP&L's judgement was borne out by the results of the ANO-1 inspections in which no unqualified blocks were found.

ii) Corroded Terminal Blocks

- Terminal block corrosion is promptly detected and corrected as part of the preventive maintenance program.

G. Other Considerations

- The terminal block identification issue of is considered an isolated occurrence.

- AP&L identified the deficiencies. Moreover, the deficiencies were promptly corrected. Consistent with the Modified Enforcement Policy, a licensee identified and promptly corrected deficiency should be treated as one similar to a deficiency discovered and corrected during the NRC inspection. In both circumstances, the NRC should consider the deficiency to be "minor" and no escalated enforcement action should result.

1.3: Missing T-Drains

A. Statement Of The Issue

The Inspection Report states that, at the time of the inspection, AP&L's files did not adequately document qualification of Limitorque valve operators because the plant equipment was not identical in design and material construction to the qualification test specimen, and deviations were not adequately evaluated as part of the qualification documentation. Specifically, under this issue, the report states that T-drains required for qualification were not installed in Limitorque motors.

B. AP&L's Position Regarding The Existence Of A Violation

AP&L does not believe that a violation existed. The facts giving rise to this potential enforcement item do not represent a violation of the requirements of 10CFR50.49. Although both licensee and NRC walkdowns indicated T-drains were not installed in all MOVs, AP&L was aware of this condition, had analyzed its acceptability, and concluded (in 1984) that T-drain installation was not a qualification requirement.

As AP&L indicated during the NRC inspection, T-drain installation is not a qualification issue because Limitorque had successfully qualified inside containment motors both with and without T-drains. Conversations with Limitorque confirmed that although T-drains were advantageous from a maintenance perspective, successful EQ testing had been conducted on actuators without the T-drains. A review of the test report (#600198) confirmed that the motor had been pre-aged (thermal and radiation) prior to the LOCA exposure.

AP&L further confirmed this position by contacts with an EQ consultant. Documentation of this conclusion was provided by a letter to AP&L from the consultant dated April 3, 1985. (Letter, K. J. Iepson to C. Turk, "T-Drains on Limitorque Motorized Valve Actuators", April 3, 1985, Attachment 1.) This letter was included in the Limitorque EQ files at the time of the NRC audit. (However, AP&L is uncertain whether the Staff was aware of this evaluation during the inspection.) The consultant's evaluation was based in part on his discussions with a principle member of the NRC staff who concurred with this position.

C. Safety Significance/Clearly Should Have Known Threshold

Should the Staff decide that this issue is a violation, AP&L does not believe that enforcement action should be taken in that AP&L should not have clearly known that T-drains were required to establish qualification. As previously discussed, AP&L investigated the T-drain issue prior to November 30, 1985 and reached a reasonable conclusion, based on consultations with people that were knowledgeable in the area of concern. In addition, this issue does not warrant enforcement action under the Modified Enforcement Policy because the issue has no safety significance. AP&L's analyses conclude that the T-drains have no negative impact on qualification status or the ability of the Limitorque valves to perform their intended function.

AP&L also believes that enforcement action under the Modified Enforcement Policy is inappropriate where a matter is related only tangentially to 10CFR50.49. In summary, Limitorque recommended to AP&L that the actuators, if designed to accommodate T-drains, should be fitted with the T-drains as a good design feature. Therefore, in conjunction with the Limitorque inspection/upgrade program, AP&L determined that missing T-drains would be installed. However, as previously discussed, communications with Limitorque indicate that though T-drain installation is still recommended from a maintenance perspective, it is still acceptable to not install them if conditions are bounded by tests without T-drains.

D. Root Cause

The lack of T-drain installation is thought to have been a decision of the Architect Engineer during the 1970's; however, this could not be confirmed. Since the qualification tests do not stipulate the need for T-drains, and shipping p ocedures did not adequately flag them, the potential for not installing the devices is increased.

E. Other Factors That Should Be Considered

- AP&L had made a conservative decision prior to the inspection to install T-drains for maintenance considerations, not to establish qualification.

- The omission of T-drains was reviewed and dispositioned prior to November 30, 1985.

- Limitorque test reports do not identify T-drains as a qualification requirement.

- Limitorque maintenance manuals do not call out T-drains.

1.4: Mixing of Greases, Hardening and Contamination

A. Statement Of The Issue

According to the Inspection Report, AP&L files did not adequately document qualification of Limitorque operators because they were not identical in design and material construction to the qualification test specimen and deviations were not adequately evaluated as part of qualification documentation. Specifically, under this issue, the Report notes cases in which i) mixing of grease types was evident, ii) grease was found to be contaminated, or iii) grease was found to be hardened.

B. AP&L Position Regarding The Existence Of A Violation

AP&L disagrees with the Staff's conclusion that different types of greases were mixed and that "contaminated" or "hardened" grease adversely affected the components' qualification.

C. Basis For Concluding That A Violation Did Not Exist

As previously indicated to the EQ inspection team, the NRC has misinterpreted statements made in AP&L maintenance work packages. The AP&L maintenance sheets in some cases stated that "grease mixing" was one of the reasons that certain grease was replaced.

The "grease mixing" statement referred only to one of two conditions. The first case refers to removal of a qualified grease to avoid the potential for future mixing. The concern related to the potential incompatibility between Sun 50 EP (the grease contained in some early tested components) and Exxon Nebula, a later qualified grease presently recommended for use in Limitorque valve operators. AP&L inspected Limitorque operators for evidence of mixing of these greases and did not discover any examples where Exxon had been used without first cleaning out the Sun grease (ANO Memo ANO-86-16481).

The second use of the term referred to identification of mixture of constituent properties, i.e. mixture of liquid grease and "hardened" grease. Use of the term "mixing" by the AP&L inspection personnel was clearly inappropriate for this situation. Nonetheless, the important consideration is that it is not indicative of a qualification issue.

AP&L acknowledges that certain Limitorque operators were discovered with "contaminated" or "hardened" grease. These conditions are expected wherever a component of this type operates for a significant period of time. The existence of these conditions is not a violation of 10CFR50.49, or a violation of any other NRC regulation, plant procedure, or plant technical specification. This item represents an example where it is important to distinguish between those steps necessary to satisfy equipment qualification requirements and those matters that are separately addressed as a matter of good maintenance practice.

"Contamination" in this context merely refers to evidence of foreign matter (e.g. metal particles, etc.) in the grease as a by-product of normal operation. Similarly, wherever an actuator of this type operates over a period of time, "grease hardening" is expected. In fact, replacement of qualified Beacon 325 limit switch compartment grease with approved substitute Mobil 28 has been specifically recommended due to its tendency to harden after long exposure to elevated temperatures. These issues are addressed during routine preventive maintenance inspections and are corrected on an "as-needed" basis. Preventive maintenance procedures were effective, in that the contamination and grease hardening conditions were discovered by AP&L and corrected as necessary. The amount of contamination and hardening does not suggest that preventive maintenance frequencies should be increased or that components had operated in a condition that adversely affected their ability to perform intended safety functions.

1.5: Grease Relief Caps

A. Statement Of The Issue

According to the Inspection Report, AP&L files did not adequately document qualification of Limitorque operators because plant equipment was not identical to the qualification test specimens and deviations were not adequately evaluated as part of qualification documentation. Specifically, under this issue, the Report notes that shipping caps were not removed from grease relief valves.

B. AP&L Position Regarding The Existence Of A Violation

AP&L agrees that shipping caps were not always removed from Limitorque operators, but for reasons further discussed below, does not believe that this issue warrants enforcement or that qualification of the operator was adversely affected.

C. Safety Significance

The failure to remove grease relief shipping caps is not safety significant because:

- The grease relief valves provide relief from pressure buildup as a result of grease and air space thermal expansion due to prolonged elevated environmental temperatures (i.e., LOCA accident conditions). The soft plastic dust cap is slipped over the grease relief and would either melt before relief valve actuation or be blown off by pressure relief. It will not prevent relief of grease or gases from the gear case; therefore, removal is not required to establish qualification of the actuator.

- Grease reliefs are only required for inside containment actuators subject to prolonged high temperatures (i.e., above 250°F). Outside containment actuators are qualified to 250°F without grease reliefs. The specific environmental profiles for ANO-1 and ANO-2 are above 250°F for a short period of time only (~ 1000 seconds). Because of thermal gradients through the operator housing/casing, it is not likely that for inside or outside containment actuators, the grease reliefs would activate.

- AP&L does not believe that this issue is a significant matter and believes that no enforcement is appropriate. At most, however, this would be a Severity Level IV or V matter. The NRC previously cited a grease relief shipping cap issue at Portland General Electric's Trojan Plant as a Severity Level IV Violation (Notice of Violation dated October 16. 1987), thereby supporting AP&L's conclusion that this is not a safety significant issue.

D. Root Cause

Inattention to detail during actuator installation is the most likely cause for shipping caps not being removed from grease reliefs.

E. Other Considerations

- AP&L identified the shipping cap issued during a planned inspection of Limitorque operators.

- The existence of shipping components on installed equipment is considered a minor matter and not indicative of a programmatic failure.

- Shipping caps removal was identified as part of the AP&L inspection criteria.

1.6: Unidentified Motor Lead Crimp Type Connectors

A. Statement Of The Issue

The Inspection Report states that at the time of the inspection, AP&L's files did not adequately document qualification of Limitorque valve operators. Under this item, the report specifically states that "the motor leads are terminated with blind barrel crimp connectors. The installed connectors could not be identified as to manufacturer, model, etc. In addition, the referenced Limitorque Test Report B0119 only qualifies Thomas Betts RB-873, Burndy VAE-14N53, and Hollingsworth XSS-20826 terminal lugs. Limitorque stated that only blind barrel crimps of the same family were used during qualification testing.

Also, no mention is made concerning mounting configuration of the test specimen crimps, which would further complicate similarity analysis between the tested and the installed crimps. The inspectors could not verify that the installed crimps were original Limitorque-supplied equipment. Information concerning these crimps was not contained in the EQ file."

B. AP&L Position Regarding The Existence Of A Violation

AP&L does not believe that this item represents a violation of 10CFR50.49. Further, if a deficiency is determined to have existed, it is a deficiency that, considering the state of knowledge on November 30, 1985, is one that would not meet the "clearly should have known" test.

C. Basis for Concluding that a Violation Did Not Exist

Limitorque qualification test reports do not contain either detailed lists of internal parts or indication of the method used for motor lead termination. During the walkdown inspection, the NRC Inspector questioned the qualification of the blind barrel crimp connectors. AP&L, therefore, confirmed with existing documentation prepared through earlier discussion with Limitorque, that the blind barrel crimps were in fact qualified by Limitorque testing (e.g. Test Report B0119).

D. Safety Significance/Clearly Should Have Known Thresholds

Regardless of its conclusion on the existence of a violation, AP&L does not believe that escalated enforcement action is warranted for this item under the Modified Enforcement Policy because (i) there is little or no safety significance, and (ii) this issue does not meet the "clearly should have known" test.

(i) The blind barrel crimp connectors at issue under this item provide only a mechanical connection. In the November 30, 1985, timeframe, the Limitorque test report provided adequate qualification of Thomas & Betts blind barrel crimps. There is no requirement to seal against moisture intrusion since the tested crimps were clearly exposed to steam environment inside the limit switch compartment. Therefore, any method of connection that provides mechanical separation and mechanical protection through the harsh environment exposure would be adequate for the application.

The installed blind barrel crimp connectors were demonstrated by test to be adequate for this purpose. The deficiency had no safety significance .

As an indication of the safety significance of this issue, AP&L notes two NRC staff enforcement actions. First, in a March 17, 1988, action involving Arizona Nuclear Power Project's Palo Verde plant, the Staff cited unidentified crimp connectors. Second, in a June 10, 1987, action involving Rochester Gas and Electric's Ginna plant, the Staff cited an unqualified Raychem heat-shrink connector configuration. Both of these actions were categorized as Severity Level IV.

ii) AP&L should not have clearly known of the potential deficiencies identified in this item. Prior to the NRC's inspection and questioning regarding this issue, AP&L had no indication of any qualification concerns related to dual voltage motor connections. Morecver, as discussed above, equipment qualification practices do not typically require piece part validation/verification for originally installed equipment, in the absence of an identified problem.

At the time Limitorque confirmed adequacy of the connectors, AP&L had already chosen to re-make all motor lead winding connections with Raychem splice kits. This choice, however, was not made as an acknowledgement of any existing deficiencies. Raychem splices are clearly superior connections (through not essential for qualification, given that a mositure-proof connection method is not required for this motor splice application). Rather, the decision was made as part of the licensee's overall philosophy of upgrading the actuators.

E. Other Considerations

- AP&L took measures to upgrade the actuators by removing the blind barrel crimps and installing Raychem splice kits (a superior method). This conservative "corrective action" was taken at AP&L's initiative, notwithstanding the lack of any substantive qualification issue.

- AP&L had demonstrated that the Limitorque blind barrel crimps were qualified by Test Report B0119. The Inspection Report suggests, however, a possible issue regarding traceability. The NRC Staff states that the inspector could not verify that the installed crimps were original Limitorque supplied equipment. AP&L submits that this issue exceeds the reasonable scope of the requirements.

  This issue would involve piece part documentation of components manufactured and/or tested prior to current EQ standards. The blind barrel crimps were of a type included in original Limitorque supplied equipment. A reasonable inference should be made that these crimps were original equipment and were thus qualified by Test Report B0119. Moreover, as discussed above, any such device providing mechanical protection would have been similarly adequate.

1.7: Limit Switch Compartment Heaters -- Life of Components (Item 1.7.1) and Burnt Insulation (Item 1.7.2)

A. Statement Of The Issue

The Inspection Report states that at the time of the inspection, AP&L did not adequately document qualification of Limitorque operators. Under this item, the Report specifically states that at the time of the inspection, all limit switch compartment heaters were energized. AP&L's EQ files did not specifically state that the effects of energized heaters on qualified life of the operators had been addressed. In addition, two examples of wires in direct contact with limit switch area heaters were discovered.

B. AP&L Position Regarding The Existence Of A Violation

AP&L agrees that the alleged deficiencies existed. However, for reasons discussed below, AP&L denies that there is sufficient safety significance in these deficiencies to warrant escalated enforcement action. In addition, the deficiency involving the wires against the space heater should not be considered a Modified Enforcement Policy issue in that the wire was installed in its as-found condition subsequent to November 30, 1985.

C. Safety Significance

Although noted in the July 1986 inspection report, AP&L notes that this issue was not brought to AP&L's attention during the audit. Therefore, AP&L had no opportunity to address or resolve the issue during the inspection. Nonetheless the issue is addressed below and also as section III, open item 1.2 later in the report.

AP&L's position has always been that the energized limit switch compartment space heaters do not significantly alter qualified life of Limitorque motorized valve operators. Aging of these components was systematically addressed and considerable aging margins are documented in Limitorque test reports. Although, due to an oversight, the decrease in qualified life due to energized space heaters was not quantified and documented, AP&L was confident as of November 30, 1985 (and is still confident) that this effect was much less than the documented margins.

AP&L is also confident that any premature aging or deterioration would have been discovered through AP&L's qualification preservation program. This type of preventive action is specifically allowed per NRC Generic Letter 82-09. ANO has not experienced any Limitorque failures attributed to the presence of energized limit switch compartment space heaters in over 14 years of commercial operation.

The use of energized limit switch compartment space heaters was originally considered to be a good maintenance practice (such use controls condensation of moisture on internal parts and therefore minimizes corrosion). The energized heaters do not in themselves represent a safety problem.

With respect to the second sub-issue, AP&L acknowledges that two wires had been left in direct contact with the limit switch area heaters as a result of rewiring during the upgrade program. However, this condition was not safety significant. The wires discovered had not been damaged in any way that would have adversely affected operation of the actuator.

Subsequent to this discovery, all rewired actuators were re-opened and inspected for similar deficiencies; none were found. The situation is considered to be an isolated maintenance anomaly and was not representative of an EQ Program problem or maintenance breakdown.

D. Root Cause

AP&L did not adequately document its position regarding energized limit switch heaters for inclusion in EQ files. Because of the acknowledged imprecise nature of aging calculations (i.e. arrhenius methods), this calculation was not vigorously pursued in favor of more results - oriented maintenance and surveillance activities.

E. Other Considerations

- AP&L has subsequently decided to de-energize the Limitorque space heaters. This decision was not based on any conclusion that the energized heaters caused a qualification problem.

- Personnel have been counseled to fully document the bases for AP&L positions (such as the position on reduced qualified life) with calculations and/or analysis as required.

- Personnel have been counseled regarding the use/non-use of space heaters and the required level of care regarding wiring proximity. The Limitorque actuator maintenance data record sheets now contain a suitable caution.

2: Rockbestos Coaxial Cable to the GA RD 23 High Range Radiation Monitor

A. Statement of the Issue

According to the Inspection Report, AP&L's files did not adequately document qualification of Rockbestos coaxial cable to the GA RD 23 High Range Radiation Monitor. Documentation was based on testing a similar item, but supporting analysis addressing differences was not adequate. Specifically, similarity evaluation of the installed type "LD" cable and the tested type "LE" cable was not provided.

B. AP&L's Position Regarding Existence of a Violation

AP&L acknowledges that at the time of the NRC inspection, qualification documentation was not complete. The file required an acceptable similarity analysis between Rockbestos coaxial insulation types LD and LE. However, AP&L had determined that the Rockbestos coaxial cable was qualifiable at the time of the inspection. Therefore, under the Modified Enforcement Policy (GL 88-07), the documentation deficiency is not sufficiently significant for escalated enforcement action.

C. Basis for Concluding that Equipment was Qualifiable or that Deficiency had Low Safety Significance

This issue results from a well-known qualification issue concerning Rockbestos cables. The NRC originally identified concern over the validity of Rockbestos qualification reports in IE Notice 84-44. As a result of these concerns, Rockbestos initiated a program to requalify their existing lines of cable. However, the Rockbestos test qualified a newer version (type LE) of its nuclear-grade cable, due to changes in manufacturing techniques and material formulations. Therefore, the new qualification reports required a similarity analysis to tie the later version (LE) of the cable to older vintage cable (LD) installed at ANO.

The NRC EQ inspection was conducted on July 14-18, 1986. At the time, the similarity analysis was not included in the qualification files for Rockbestos coaxial cable. However, the evaluation by Rockbestos was well-known by NRC Staff personnel to be under preparation and soon to be transmitted. In fact, a letter from AP&L to Rockbestos (dated March 28, 1986) was included in the Rockbestos vendor file, V42. This letter requested a copy of the analysis report to document the similarity between LE and LD coaxial cables.

The Rockbestos evaluation of the similarity between type LD and LE cable was later provided to AP&L by a letter dated July 17, 1986. (The inspection ended on Friday, July 18. The letter was received by AP&L on Monday, July 21, 1986.) Therefore, AP&L concludes that the Rockbestos cable was qualifiable.

In any event, the similarity analysis is now included in the Rockbestos vendor file. The analysis confirms that the cable installed in the high range radiation monitors was qualified. If a qualification deficiency existed, it was a minor documentation deficiency, well known by the NRC to exist at other plants, with no safety significance. As reflected by NRC in the IE Notice, no significant safety concern over Rockbestos cable existed (for example, several types of Rockbestos cable had been successfully tested by an NRC research contractor). This issue consisted primarily of providing qualification documentation acceptable to the NRC and would not be appropriate for escalated enforcement

action. A copy of the applicable file revisions is enclosed as Attachment 2 for your review and closure of this item.

D. Root Cause

This documentation deficiency was the result of the concern raised in IE Notice 84-44. AP&L needed to question the vendor on the differences between installed and tested cable insulation, and to promptly obtain necessary similarity evaluations.

E. Other Considerations

- AP&L had identified the need for the similarity evaluation prior to the NRC inspection. AP&L had also requested a copy of the evaluation from the vendor prior to the NRC inspection.

- The circumstances surrounding this issue have been determined to be isolated. AP&L does not believe that there are any indications of programmatic weaknesses.

- AP&L's disposition of IE Notice 84-44 had been documented and was available for review by the NRC inspection team.

- This concern affected only the High Range Radiation Monitors.

3: Instrument Accuracy

A. Statement of the Issue

The Inspection Report concludes that EQ files and other information provided to the inspectors during the inspection failed to adequately address instrument accuracy because the evaluation did not compare instrument loop errors resulting from all applicable sources with plant accuracy requirements. Specifically, error contributions from cables and ancillary equipment were not included in instrument error analyses. The Staff considered the above requirements necessary to satisfy DOR Guidelines.

B. AP&L Position Regarding the Existence of a Violation

AP&L does not believe that the EQ file loop accuracy calculation in existence at the time of the inspection constituted a violation of DOR Guidelines. Should the Staff disagree with this conclusion, AP&L believes that the absence of an analysis of IR for cable and ancillary equipment should not result in escalated enforcement action in that i) based on DOR wording, AP&L should not have clearly known that the EQ files were deficient and ii) the alleged deficiency was not sufficiently significant.

C. Clearly Should Have Known Threshold

In order to determine whether AP&L should have clearly known that cable IR and ancillary equipment accuracy values needed to be specifically considered in loop accuracy calculations, a brief review of the state of industry (and Staff) knowledge in the November 30, 1985 timeframe is appropriate. DOR Guidelines required that system component evaluation worksheets (SCEWs) be prepared which included "accuracy", with a specified and demonstrated value. This value was to be provided for individual components such as transmitters, RTDs, etc. Industry and the Staff considered this accuracy value to be applicable to the design basis condition, through which the component had to perform its safety function. There was no implication in DOR Guidelines that instrument accuracy by system (loop accuracy) was required. In addition, explicit directions were not provided, nor did the Staff require insulation resistance values for cables or ancillary components in determination of instrument accuracy.

The ANO Franklin TERs dated February and April, 1983, and the Staff's subsequently issued SERs dated November and December, 1984, were considered the documents that provided the Staff's concerns regarding equipment qualification, including loop/component accuracy methodologies. These reports did not contest AP&L's methods for accuracy calculations. The Franklin TERs for example specifically detailed all components judged to have inadequate basis for addressing accuracy. Cable and ancillary components (penetrations, for example) were not listed. Therefore, AP&L had just cause to believe no deficiencies existed for

these components. Therefore based on the fact that (1) DOR Guidelines only required principle component accuracies and did not require loop accuracy considerations, (2) the Staff did not appear to have been concerned prior to 1985 with cable or ancillary component IR, and (3) the Staff did not raise cable or ancillary component IR as a concern in the Franklin TERs or the subsequent Staff SERs, AP&L does not believe that it should have clearly known that the additional information of IR impact on instrument loop accuracy should have been included in the subject EQ file.

D. Safety Significance

AP&L developed extensive and conservative calculations for instrument loop accuracy by November 1985 in advance of most utilities. Although not explicitly documented, IR impact from cable and ancillary devices (excluding exposed devices such as terminal blocks which were removed) on instrument loop accuracy was considered and regarded as insignificant. Nevertheless, prior to the NRC inspection of July 1986, AP&L did calculations of the IR impact on instrument accuracy. Worst case IR errors were calculated for types of instrument loops (e.g. transmitters and RTDs). The worst case IR error was combined with each existing component loop error. For each loop the revised instrument accuracy (with IR) thus demonstrated was deemed sufficient to allow accomplishment of the required safety function. This evaluation confirmed the relative insignificant IR errors have on total loop accuracy.

AP&L's previous generic loop accuracy assumptions have subsequently been substantiated by incorporation of component specific IR errors into each component's loop accuracy calculation. As previously stated, when considering the state of mind of the Staff and industry in 1985, this is not a clearly should have known issue. Moreover, it is not a matter with safety significance. Hence, in accordance with Generic Letter 88-07, escalated enforcement is not appropriate.

E. Other Considerations

- Incorporating IR into loop error analysis is an evolving issue. It is important to keep in mind that first round EQ inspection assessed qualification status as of November 30, 1985.

- AP&L has been proactive in assisting in the development of the industry's approach to related issues by providing input regarding IR in ISA Standard 67.04, "Nuclear Safety-Related Setpoint Determination." In addition, AP&L is working with NUGEQ in the development of a paper currently in draft form entitled "Determining IR of Equipment During LOCA Conditions."

- Once the Staff expressed concern regarding this issue, component specific cable/ancillary component IR calculations were performed to demonstrate that generic assumptions were conservative.

4: Amphenol/Bunker Ramo Electrical Penetration Assemblies

A. Statement of the Issue

The Inspection Report raised two issues of concern regarding the qualification of Amphenol (Bunker Ramo) electrical penetration assemblies. The Staff was concerned that the test report in the EQ file at the time of the inspection did not contain leakage current data taken during the transient portion of the LOCA test. The Staff concluded that an adequate similarity analysis had not been prepared comparing the Conax penetration assembly to the Bunker Ramo penetration (Conax test report was used to provide IR values). Secondly, the Staff was concerned that RTV silicone used for temporary repair of the Bunker Ramo penetrations was not referenced in the EQ files as a temporary fix. In addition, the RTV sealant EQ file was not specifically referenced in the Bunker Ramo EQ file.

B. AP&L Position Regarding the Existence of a Violation

AP&L believes that documentation in the EQ file at the time of the inspection was adequate to establish qualification of Bunker Ramo penetrations when considering the 1985 interpretation of ANO testing requirements. The absence of specific IR data was not considered significant since i) it was not considered a requirement for qualification considering the vintage of the equipment and the applicable regulation (DOR Guidelines), ii) NRC and their subcontractor reviewed the qualification documents and did not

indicate a deficiency in the category of accuracy evaluation, or functional requirements, and iii) IR effects had been judged nonsignificant for the penetrations (see previous item). Nonetheless, prior to the audit, worst case calculations were conducted which confirmed AP&L's conclusion that IR effects due to penetrations (considered dominated by cable pigtails) were not significant.

AP&L also disagrees with the Staff's assertion that it was necessary to specifically reference the RTV sealant EQ file in the Bunker Ramo EQ file to establish component qualification. As discussed further below, should the Staff maintain its position that at the time of the inspection the Bunker Ramo EQ file was inadequate to establish component qualification, AP&L believes i) that AP&L should not have clearly known that the information contained in the EQ file was inadequate, and ii) that the issue is not sufficiently significant.

C. Clearly Should Have Known/Sufficient Significance Thresholds

AP&L believes that even if the Staff determines that a documentation deficiency existed, enforcement action is not appropriate under the Modified Enforcement Policy (GL 88-07) because the potential violation does not meet the "clearly should have known" test and is not sufficiently significant.

i) AP&L should not have clearly known that a deficiency existed. Upon receipt of IE Bulletin 79-01B, AP&L reassessed qualification of the penetrations in accordance with DOR Guidelines. AP&L again concluded that the devices were qualified. The Staff and its consultants, Franklin Research Center (FRC) did not consider penetration IR data (or cable IR data) during the LOCA necessary to meet the DOR guidelines. This is evidenced by the review and subsequent issuance of the Franklin TER dated March 1983, for ANO-2 Bunker Ramo penetrations which identified no deficiency concerning either functional testing or instrument accuracy requirements. In addition, the subsequent SER issued in December 1984, identified no open items concerning IR data.

Furthermore, the Staff and its consultants have also previously reviewed similar Bunker Ramo penetrations and implicitly or explicitly accepted qualification. Specifically, in 1984, FRC reviewed the IR issue at Portland General Electric's (PGE) Trojan plant and concluded in a (TER) that once "termination faults" were cleared, the penetrations exhibited acceptable performance. In a letter dated December 4, 1984, the Staff concluded that proposed resolutions for each deficiency identified in the Trojan FRC TER were acceptable. The Staff again accepted qualification of the Bunker Ramo penetrations in a December 19, 1986, letter to the Toledo Edison Company for the Davis Besse Plant.

In summary, AP&L concludes that as of November 30, 1985, an adequate basis existed for concluding that the Bunker Ramo penetrations were qualified in accordance with the requirements of DOR Guidelines.

ii) This is not an issue with sufficient significance, such that escalated EQ enforcement would be warranted. During the audit AP&L presented to the reviewer its method for determining IR for incorporation into the generic IR error calculations. As identified in the Inspection Report this approach was considered "plausible" by the inspector. This characterization indicates that the Staff's frame of mind did not consider Bunker Ramo penetration IR issues at ANO to be a major concern. It is important to remember that the first round inspections were intended to assess qualification as of November 30, 1985.

As discussed in the previous item, IR errors (including penetration IR) were combined with the existing loop errors and determined to be acceptable.

Based on the above, AP&L concludes that the documentation deficiency which may have existed was not sufficiently significant.

The RTV sealant documentation issue is not sufficiently significant in that a minor editorial revision to the EQ file was all that was needed to remedy the Staff's concern. All qualification documentation for the sealant was in the file at the time of the inspection.

D. Other Considerations

The basis for IR values utilized was subsequently formally documented and placed in the files in February, 1987 to close this item.

Recently a new concern has arisen over Amphenol/Bunker Ramo qualification. This concern surfaced during an EQ inspection at Braidwood-2. IE Notice 88-29 recently issued May 24 of this year, identified that sufficient IR data during the LOCA was not taken to demonstrate qualification of the penetrations.

AP&L is working with the NRC (NRR) through the NUGEQ to resolve this concern. In brief, the concern is that the Midland test report for Bunker Ramo penetrations did not publish IR values that were taken during the test. However, Mr. Ray Perez, a former Amphenol employee directly involved with the test, has provided an affidavit to the Nuclear Utility Group on Equipment Qualification confirming the existence of "acceptable" IR test results. Subsequently, the affidavit was provided to the Staff at an August 4, 1988 Group/Staff meeting.

Additional concerns from the Staff originated from the SNUPPS Bunker Ramo test which noted IR degradation due to penetration configurations. The tested configuration, unlike ANO-2 installations, contained terminal blocks in circuits, an obvious IR loss pathway. Secondly, penetration pigtails were either submerged or directly sprayed during the test. The modules using the terminal blocks ultimately regained adequate IR, indicating a "dryout" of the terminal blocks and indicative of the terminal blocks being the source of IR losses. The ANO-2 installed configuration is not susceptible to submerged or direct chemical spray conditions. In addition, the temperatures postulated during the SNUPPS test (340°F) far exceed ANO's actual LOCA environment (280°F).

Additional test data, which was discussed in full at a meeting between NRC Headquarters Staff and NUGEQ on August 4, 1988, further supports AP&L's position. AP&L believes that this additional data which has been provided in response to Staff inquiries (e.g., applicability of representative test IR values) was not a requirement at ANO, but an enhancement to the ANO Bunker Ramo EQ file.

In a letter dated May 13, 1988 (Crutchfield to Campbell), the NRC Staff requested that AP&L provide its EQ file on Bunker Ramo penetrations. AP&L has also performed extensive operability analyses and has concluded that the Bunker Ramo penetrations are operable and will perform intended safety functions. Apparently the Staff concurs with this operability conclusion in that it has been in close contact with industry, has requested significant analyses from other utilities with Bunker Ramo penetrations, and has indicated that this issue is not a safety concern.

Open Items

1: Eaton Cable

A. Statement of the Issue

This open item addresses two issues regarding qualification of Eaton cable. First, the NRC inspector stated that the basis for claiming a 40 year qualified life was not presented in the file. However, the Inspection Report acknowledged that "the necessary information was present." AP&L stated that it would revise the file "to clarify that life is determined based on a data point on the curve used to establish an activation energy value, corresponding to retention of 40 percent elongation after 40 years at 90°C."

Second, the Inspection Report stated that the qualification package contained "conflicting identification of the jacket material." At the time of the inspection the licensee determined from purchase orders that the material is Hypalon. The open item was for AP&L to revise the file accordingly.

B. Resolution of Item

Eaton cable was clearly qualified or qualifiable prior to November 30, 1985. The proper documentation and information was always available in the EQ file. Resolution of the open item

required only editorial revisions the ESP-211 evaluation to 1) reference the proper aging calculation and 2) remove the conflict to show the jacket material as Hypalon, as demonstrated to the inspector. AP&L revised the files on August 19, 1986, as required. The pertinent documentation is included as Attachment 3 to this submittal.

2. Boston Insulated Wire Cable

A. Statement of Issue

This open item addresses revisions to the qualification file for Boston Insulated Wire (BIW) cable. The Inspection Report stated that qualification was not fully established "because the 211 form failed to reference information contained in the file that showed qualification for the required 110 hours post-LOCA operation. The licensee agreed to revise the file to reference the proper supporting material."

B. Resolution

As with the open item addressed above, this open item only required revisions to the file summary material to specifically reference information otherwise contained in the file. This was not a issue that rendered the unqualified or an issue for which the licensee clearly should have known of a deficiency. The requested revision was made on August 19, 1986. In this case, portions of Item 19

in the BIW Vendor File, V10, were attached to the 211 form and referenced as documentation supporting the 110 hours post-LOCA operating time. The pertinent documentation is included as Attachment 4 to this submittal.

3. Rotork Motor Operator

A. Statement of the Issue

This open item addresses revisions to the qualification file for Rotork Valve Operator Model 11NA1. In the Inspection Report, the inspector observed that the "Rotork qualification report TR 116 dated October 12, 1973 describes four test anomalies. Both the Rotork report and the AP&L file are ambiguous concerning the resolution of the test anomalies."

B. Resolution

As with the above open items, this item does not represent a significant qualification deficiency or a case in which the licensee clearly should have known of a deficiency. The Rotork valve operator model 11NA1 was qualified or qualifiable prior to November 30, 1985. This open item refers only to perceived ambiguity in the resolution of test anomalies.

Subsequent discussions between Rotork and AP&L have been conducted to clarify the resolution of the test anomalies. The EQ files have since been revised to reflect the information gathered to address the NRC concern. The pertinent documentation is included as Attachment 5 to this submittal.

C. Supplemental Information

Rotork Qualification Report, TR116, described four test anomalies. This open item involved the need to properly address the resolution of these anomalies.

The first two anomalies were torque switch mechanism malfunction and auxiliary switch malfunction. Both anomalies occurred on the same switches due to dimensional changes (i.e., softening) of various nylon parts. The retest, described in report TR222, was run to check the dimensional stability of the new material, Ryton R4, at high temperature. The retest was based on a material design change to improve the device. The device was not pre-aged because it was being tested to very high temperature only to check for dimensional changes. It should also be noted that the failure caused by the pin obstructing the plate movement was addressed and corrected in TR116 by removal of the unnecessary and redundant pins.

The third anomaly was failure of the Add-on-Pak switches due to material and design problems. The drive shaft was changed to brass and the end stop changed from a plate to a pin type design. ANO-1 does not use this optional equipment; however, ANO-2 does. The material change from a degradable to a nondegradable metallic material with identical form, fit, and function did not require retesting. The design change is an equipment improvement, again using metallic components. The metallic components are not affected by environmental conditions and therefore do not require qualification testing. Thus Add-on-Paks are qualified.

The fourth anomaly was a material change from Nitrile to Viton before LOCA testing and without aging. DOR Guidelines do not require retesting of the Viton. Further, fourteen years of experience since the test has affirmed that Viton is not susceptible to significant thermal aging in this application.

III. SUBSEQUENT NRC INSPECTIONS

The following potential enforcement items and open items were based on NRC inspections subsequent to the initial July 1986 special EQ inspection. Specifically, these issues were raised in Inspection Report Nos. 50-313/86-32 and 50-368/86-32 and Inspection Report Nos. 50-313/88-05 and 50-368/88-05. As with the above issues, to the extent that these deficiencies did not exist prior to November 30, 1985, enforcement under the Modified Enforcement Policy (GL 88-07) is not

appropriate. In addition, to the extent that these two subsequent inspections address new issues (i.e., they do not represent followup inspections with respect to items raised in the first-round inspection), enforcement under the Modified Enforcement Policy would not be appropriate. Rather, these issues would be addressed in the context of the NRC's General Enforcement Policy of 10 CFR Part 2, Appendix C. AP&L has attempted below to address all relevant factors under both the modified and the general enforcement policies.

Potential Violation

1: Reliance Containment Cooling Fan Motors

1.2.1 Reliance Containment Cooling Fan Motors (Fans by Joy Manufacturers)

A. Statement of the Issue

As a result of several NRC inspections from March through June 1988, the Staff concluded that several deficiencies existed regarding Reliance Containment Cooling Fan Motors and Joy Fans. Specifically, the Staff was concerned that i) unqualified Gulf high temperature grease for which qualification had not been established could have been used in the Joy fan motors and may have been mixed with qualified Chevron SRI-2 grease; ii) lack of qualification for

single shielded bearings which were installed by AP&L during maintenance activities; iii) inadequate bearing replacement procedures to maintain a qualified component; and iv) inadequate documentation of maintenance using GE Glyptol 1291 to repair qualified insulation systems on ANO-1 and ANO-2 containment cooling fan motors. The above issues were characterized by the Staff in Inspection Report Nos. 50-313/88-05 and 50-368/88-05 as an apparent violation.

B. AP&L Position Regarding the Existence of a Violation

i) AP&L agrees that a documented evaluation of qualification did not exist at the time of the NRC inspections for Gulf High Temp grease, or the mixing of Gulf High Temp grease with qualified Chevron SRI-2 grease. AP&L also agrees that procedures in effect at that time did not prevent the use of Gulf grease in the motor. However, AP&L believes that the installed configuration was qualifiable -- regardless of whether Gulf High Temp grease, or a mixture of Gulf and SRI-2 grease was used. AP&L does not believe that this documentation deficiency was safety significant

and concludes that escalated enforcement action is not warranted.

ii) AP&L agrees that a similarity analysis was not in the EQ file at the time of the NRC's inspection that compared the use of a single shielded bearing to the tested double shielded bearing. However, for reasons further discussed below, AP&L believes that the installed configuration was qualified and operable and does not believe that the deficiencies were safety significant.

iii) AP&L agrees that maintenance procedures in effect at the time the fan motor bearing replacements were made did not prevent the use of the modified bearing. However, as further discussed below, subsequent analysis has concluded that the deficiency did not result in a safety significant issue in that the motors were qualifiable.

In addition, AP&L considers this issue to be of minimal safety significance and an isolated example of a failure to comply with 10 CFR Part 50, Appendix B, Criterion III, Design Control and Criterion VIII, "Identification

and Control of Materials, Parts and Components." AP&L does not believe that this plant maintenance issue is properly addressed as a violation of the EQ requirements of 10 CFR 50.49. (Even if addressed in that context, this is not a violation that would meet the "clearly should have known" test.)

iv) AP&L agrees that EQ documentation was not provided regarding the use of GE Glyptol 1291 to repair qualified insulation systems for ANO-1 and ANO-2 containment cooling fan motors. However, AP&L used Glyptol only as a cosmetic or touch up agent and does not consider that such use affects the environmental capability of the motor winding insulation system. Any damage which was sufficient to compromise the insulation system integrity (and therefore qualification) would have required by procedure a documented evaluation of a suitable repair method.

In addition, AP&L does not believe that these plant maintenance issues should be considered a first-round EQ inspection issue under the Modified Enforcement Policy (GL 88-07). This inspection took place in March and April of

1988 and did not constitute a followup of any issues raised in either the July 1986 EQ inspection or its October 1986 followup.

C. Safety Significance

i) Gulf High Temperature Grease

- AP&L has confirmed the suitability of Gulf High Temp grease, and a mixture of Gulf High Temp and Chevron SRI-2 grease in this application. Schneider Report #SCE-ANO-17, dated December, 1985, and EPRI Report NP-4916, dated January, 1987, provided sufficient data to conclude that the procedurally allowable greases were qualifiable either in exclusive use or in mixture with the tested Chevron grease.

- The subject motors had operated for nine years with the grease/potential grease mixture. No grease related failures of the motors have occurred, thereby supporting the consultant's conclusion that operability of the motors has not been adversely affected.

ii) Single-Shielded vs. Double-Shielded Bearing

- The use of a single-shielded (or unshielded) bearing assembly should not affect qualification or operability of the fan motors in that the tested configuration included both an unshielded thrust bearing and a double-shielded radial bearing.

- Reliance has verbally confirmed that their current designs do not use shields or metering plates (the so-called open or PLS system) due to their previous determination that they are unnecessary.

- A review by Schneider Engineering also concludes that the as-found configuration should not affect motor operability.

- The absence of any bearing failures on these continuously operated motors since 1979 confirms that the as-found configuration did not adversely affect motor operability.

- AP&L preventive maintenance activities have found no evidence of unqualified grease, no evidence of incompatible grease mixing, no evidence of bearing damage from shield removal, and no cases involving incorrect shield removal.

iii) Inadequate Bearing Replacement Procedures

- Based on the above discussions, AP&L believes that deficient procedural guidance did not result in a safety significant configuration. Moreover, AP&L does not view this as an EQ issue.

iv) Inadequate Documentation of Insulation Repair Using Glyptol 1291

- Per Joy Report X-604, Dow Corning Type DC 997 varnish was to be used in the subject motors. Per a Schneider telecon with Glyptol Inc., dated August 10, 1988, no compatibility problems would be expected between Glyptol and any silicone based varnish (such as Dow Corning DC 997). At worst, Glyptol may not adhere perfectly

which may increase maintenance frequency but does not affect qualification.

- AP&L does not consider adherence to be a concern during normal operation. The adherence issue could become a concern under LOCA conditions in that moisture could promote separation of the Glyptol and Dow Corning varnish. The potential for this effect is minimal in that moisture intrusion into the motor is limited. The motor is totally enclosed. Breather ports, the most likely pathway, will introduce minimal amounts of moist air into the motor, none of which will condense on the already hot motor windings.

D. Other Considerations

In the course of periodically upgrading its procedures regarding maintenance of these motors, AP&L accomplished the following prior to the inspection of March-April, 1988:

- Correctly specified necessary information (AFBMA numbers) for replacement bearings including shield configuration and lubricant.

- Eliminated procedure references in both units to alternate lubricants.

- Eliminated procedure references to Glyptol use in both units.

It is AP&L's position that these activities indicate no programmatic weakness in AP&L's maintenance program and in fact, support the conclusion that the current program proactively considers environmental and mechanical requirements in its periodic procedure reviews and upgrades.

Open Items

1: Limitorque Motor Operators

In the Inspection Report based on the October 1986 inspection, the NRC raised two open items with respect to Limitorque motor operators. Each of these items is addressed below.

1.1 Okonite T95/35 Tape Splices on Braided Field Cable

A. Statement of the Issue

During routine inspection of Unit 1, an NRC inspector observed a taped splice in a Limitorque operator motor lead which was later identified as an Okonite splice (NRC Inspection Report 313/86-33). While at the corporate office, the NRC inspector reviewed data which provided the basis for the Okonite splice qualification. Splice model T95 had been qualified for a harsh environment by Okonite test report NQRN-3, Revision 1, June 30, 1982, and Revision 2, February 16, 1984. AP&L stated that the splice was used to replace blind barrel crimp lugs provided in Limitorque operator motor leads which had braided jackets (which was also a previous Staff concern (see discussion in Section II.1.6 of this submittal).

According to the Inspection Report, the AP&L referenced Okonite test report qualified the splice on cables without braided jackets. The Inspection Report concludes that AP&L's Okonite splice qualification file does not comply with provisions of 10CFR50.49(f)(1) which requires either testing an identified item under identical conditions or testing under similar conditions with a supporting analysis to show that the equipment is

acceptable. Because of the differences in the type of cable on which the splice was tested and installed (unjacketed vs. braided jacket), it was requested that the licensee provide supporting analysis to show that the splice is qualified in the installed configuration. Of concern is the possibility of an electrical short circuit in the event the jacket absorbs moisture. This was classified in the Inspection Report as an open item.

B. AP&L Resolution and Position Regarding the Existence of a Violation

In that the subject splice was not required to prevent moisture intrusion, AP&L does not believe that this open item represents an equipment qualification deficiency. AP&L believes that the Okonite T95 tape provides a fully qualified connection for Limitorque motor leads.

Although documentation was not complete, DOR guideline (Bulletin 79-01B) applicable to this tape would require only a brief functional analysis. AP&L believes that, as discussed below, the tape splices were either qualified or qualifiable under this standard.

This issue was classified only as an unresolved item. Nonetheless, given that these leads were taped subsequent to November 30, 1985, this open item does not fall under the Modified Enforcement Policy of GL 88-07.

C. Background

The Limitorque test reports, plus analysis, specifically qualify the motor operator using non-sealed Thomas & Betts lugs. AP&L's position on qualification of blind barrel crimps is addressed above under Item II.1.6. As addressed above, Limitorque qualification tests showed that moisture intrusion is not a significant concern for this connection. AP&L believes that the T95 tape provides a fully qualified connection for the Limitorque.

D. Basis for AP&L Position on Qualification

The application of T95 tape in Limitorque operators at ANO is for splicing motor lead extension wires to field power cables and splicing of series connected winding leads on dual voltage motors. In the motors of concern, the wire insulation was composed of glass braid over Nomex tape. The concern is whether Okonite tape used over braided insulation would be environmentally

qualified, because the tested configuration for Okonite tape shows the cable jacketing peeled back.

AP&L believes that the following points support qualification:

- The glass braided Nomex tape over insulation motor lead wire is qualified for in-containment use by Reliance and Limitorque.

- Limitorque has tested single and dual voltage AC motors for nuclear accident conditions. Documentation shows that Limitorque used nylon-insulated Thomas & Betts blind barrel crimp splices on the dual voltage motor lead wire extensions and qualified terminal blocks for field power cable connections to the motor leads.

- Okonite T95 tape has been tested under nuclear accident conditions and its tested insulation and aging properties are superior to nylon and at least equivalent to the phenolics used in qualified terminal blocks.

In judging acceptability of the Okonite tape, a comparison must be made between the nylon-insulated Thomas & Betts blind barrel crimp joint and various power terminal blocks successfully tested by Limitorque, and the Okonite tape-over-bolted-splice configuration. The comparison would be made in the categories of moisture intrusion, electrical insulation, and mechanical protection to the conductor joints. With regard to moisture intrusion, this is obviously not a significant qualification concern for this application, since the successfully tested configurations used open Thomas & Betts crimp splices and various designs of open power terminal blocks. Such connections will not prevent moisture ingress. Further, based on the points noted above, it is evident that the Okonite tape configuration would offer equivalent, if not superior, protection to the conductor joint in terms of mechanical protection and electrical insulation.

E. Other Considerations

- As discussed above, the detailed equipment qualification requirements applicable to originally installed equipment at ANO do not extend to the piece part level. Specifically, upgrading to the requirements of 10 CFR 50.49 is necessary only for replacement of components. AP&L's assurance of at least an "equivalent" connection

method using separately qualified parts was adequate for overall component qualification.

- A total of nine inside containment actuators in ANO-1 presently contain Okonite tape insulated splices of motor power connections. Of these nine, four sample isolation valves do not require actuator motor energization to perform their safety function due to the fact that they are normally closed except for infrequent sampling. They do not receive any automatic (ES) closure signals. Four RCP seal return isolation valves receive low RCS pressure/containment isolation signals to close and complete their safety function early in a DBE prior to significant exposure to high temperatures and/or radiation. Thus, the extent of any postulated effect due to splice failure is not significant.

- Outside containment, fifteen EQ actuators have Okonite splices on their motor power leads and one of these fifteen has Okonite splices used for its series winding connections. Fourteen of the affected actuators:

  1) Complete their function prior to exposure to radiation from the recirculation phase of an inside containment LOCA/HELB and

2) Are not required to function to mitigate an outside containment HELB. These actuators are contained in the service water, high pressure injection, makeup and purification, containment spray, and main steam systems.

The remaining actuator is on the feedwater isolation valve whose function during an outside containment HELB would be to close to isolate main feedwater from a postulated critical crack in the short piping section between this valve and the containment penetration. This function is capable of being performed by components upstream of this valve which are not exposed to the consequences of the postulated HELB.

Again, the postulated effect due to a splice failure is not significant.

- For all the reasons discussed above, this item does not raise a significant safety issue. Moreover, if addressed under the Modified Enforcement Policy, this is not a case where the licensee "clearly should have known" of a qualification deficiency. AP&L took reasonable measures to meet applicable requirements and to satisfy the NRC inspector. It should be noted that all Okonite connections were installed with a standard detail specifically approved for this application.

- In order to reinforce the conclusions reached in AP&L's original disposition of this issue AP&L has recently completed a more detailed evaluation of the suitability of the approved Okonite splicing system in these applications. This evaluation is enclosed as Attachment 6. This evaluation fully supports the information provided to the inspector during the 1986 followup audit and concludes that the approved Okonite configurations are and have been fully qualified in accordance with the DOR guidelines.

1.2: Thermal Aging of Components Due to Switch Compartment Space Heaters

A. Statement of the Issue

During the Staff's inspection, it was determined that limit switch compartment heaters at ANO were apparently energized during plant operation. Since any temperature rise in the compartments could accelerate aging of heat sensitive components, AP&L was requested to provide any information which showed that the heaters had been considered in aging analyses. This information was not provided during the inspection; therefore, AP&L was requested to provide test data or analysis which would show the effects of torque switch compartment heaters

on aging of valve operator heat sensitive materials. Pending submittal of the requested information, this issue was categorized as an unresolved item.

B. AP&L Resolution and Position Regarding the Existence of a Violation

AP&L agrees that compartment temperature rise as a result of limit switch compartment space heaters was not considered in aging calculations. However, based on the information provided below, AP&L believes that this open item can be resolved. AP&L also believes that enforcement action is inappropriate in that the documentation deficiency was not safety significant.

In order to resolve the issue, AP&L (1) performed preliminary calculations to ensure that significant qualified life remained for the affected components, (2) subsequently performed extensive analysis plus testing that confirmed that aging would not be adversely affected, and (3) conservatively decided to deenergize the space heaters.

C. Basis for Resolution/Safety Significance Determination

The following facts warrant consideration in assessing the significance of temperature rise on component aging. These facts support AP&L's conclusion that if a 20°C component environment temperature rise is assumed due to space heater operation, a 40 year qualified life of affected operators and components is still assured.

- Assumed worst cast average service temperature in containment is 120°F (approximately 50°C) with a few exceptions. Outside containment, the value is 105°F (approximately 40°C).

- Thermal life of Limitorque class "B" motors is approximately 440 years at 70°C (File V33 Item 26). Thermal life of class "H" motors is higher.

- Thermal life of switch materials in Limitorque operators is approximately 1362 years at 70°C (File V33 Item 26).

- Thermal life of different kinds of insulation used on Limitorque wiring is much greater than 40 years at 70°C (File MISCEQ Item 18).

- Tested temperatures under DBE conditions envelope required temperatures by at least 20°C for Limitorque operators.

D. Root Cause

As previously discussed in AP&L's response to Issue 1.7.1, DOR Guidelines and NRC Generic Letter 82-09, allow significant flexibility in aging assessments. In hindsight, AP&L agrees that it should have more explicitly addressed heater aging effects; however, due to an understandable and isolated oversight, this factor was not considered.

E. Other Considerations

- Though originally designed by the ANO architect-engineer to be energized for moisture control, competing interests at stake are the good maintenance practice of controlling internal condensation and corrosion vs. the reduction in qualified life which was difficult to accurately quantify. AP&L has subsequently decided to deenergize Limitorque space heaters due to the understatement of potential for heat stress apparent in the original decision, particularly in light of the higher than expected operating

temperatures in the ANO-1 Reactor Containment Building.

- AP&L documented via analysis and confirmatory experimental data (actual measurements of temperature rise due to space heater energization) that most actuators had qualified subcomponent lives of much greater than 40 years. Those with limited lives (less than 40 years) were provided with procedurally required replacement intervals designed not to exceed the documented qualified life of the most limiting subcomponents. In no case was a device shown to be unqualified or a modification required to restore qualified status as a result of this process.

IV. ROSEMOUNT TRANSMITTERS

A. Background

The Staff's July 27, 1988 letter confirming August 15, 1988 as the enforcement conference date, provided a proposed agenda for the conference. Listed as Item IV.3 were two issues involving Rosemount transmitters. The issues, based on conditions recently identified by AP&L, involve the apparent loss of environmental seal integrity and sensor orientation requirements. The Staff's concerns regarding

this issue have not to date been documented in an inspection report.

July 29, 1988 conversations between Dan Howard (AP&L) and Region IV personnel concluded that AP&L should provide information on Rosemount seal integrity issues at the August 15, 1988 Enforcement Conference. AP&L agreed to address the effect and extent of electrical housing rotation findings. It was also agreed that should the Staff consider this issue significant enough to warrant considerations for enforcement, the Staff would document its concerns and a separate enforcement conference would be scheduled. The following discussion briefly describes AP&L's inspections, analyses, and corrective actions regarding the Rosemount transmitter seal integrity issue.

B. Installation Requirements

As a result of AP&L's review of Rosemount's revised procedure for transmitter reassembly (while performing maintenance on the electrical housing and sensor module for SIT Level Transmitter 2LT-5070), AP&L discovered that Loctite sealant should be applied to sensor module threads and baked for 12 hours at 200°F to provide an environmental boundary seal. The procedure also stated that rotation of the sensor could break the environmental seal. Rosemount has subsequently accepted the use of Locite PST-580 without baking since this configuration conformed to the Rosemount LOCA test configuration.

C. Unit 2 Walkdown Results

All Unit 2 environmentally qualified transmitters were walked down to determine if electrical housings had been rotated on sensor module neck threads. Out of 42 modules inspected, 26 were not rotated. Sixteen modules appeared to have been rotated to varying degrees. A maximum rotation limit of 2.5° was initially used as a pass/fail criteria. Three of the sixteen transmitters exceeded the maximum allowable value (4°, 9° and 5° rotation).

D. Testing Program

A pressure test was developed to determine if seal integrity had actually been lost due to excessive rotation. The test consisted of pressurizing the electronics housing for 30 minutes at 60 psig and observing a test gauge for pressure decay. Of the three transmitters discussed above, one exhibited seal degradation (5° rotation). The transmitters with 4° and 9° rotation passed the seal test.

AP&L also developed a work plan to pressure test a new Rosemount transmitter at varying degrees of rotation to further define allowable deviations from 0° rotation. The transmitter passed the pressure test at 0° and 2.5°, but failed at 5°. Based on these results, AP&L conservatively decided to test the 13 remaining Unit 2 transmitters. Only one of the 13 transmitters failed the pressure test (1.5° rotation). This transmitter was promptly repaired. As a conservative step, AP&L also decided to test all remaining Unit 2 Rosemount transmitters,

notwithstanding the lack of rotation. All of the nonrotated transmitters passed the pressure test.

E. Unit 1 Walkdown Results

As a result of the Unit 2 findings, Unit 1 transmitters were also walked down. A walkdown was performed on 22 accessible transmitters in the Reactor Building. Fourteen were found to be rotated. Five of the fourteen were pressure tested. All passed. JCOs were prepared for the nine remaining transmitters to address the interim until test could be performed and necessary repairs could be made. A walkdown was also performed on nine transmitters located in the Unit 1 Auxiliary Building. Five of the nine Auxiliary Building transmitters were rotated. All nine were tested and only one leaked. A Job Order was promptly issued to repair the deficiency. Also, Job Orders have been written to address testing of the remaining transmitters in the Reactor Building.

F. Other Considerations

- AP&L either tested the transmitter seal or wrote JCOs for all potentially affected transmitters, including those that were not rotated, both inside and outside containment.

- AP&L promptly reported the condition to the NRC via 10CFR50.72 and also notified the industry.

- Results indicated only three of approximately 75 potentially affected transmitters were rotated sufficiently to lose their environmental seal (two on Unit 2 and one on Unit 1).

- Based on the actual number of test failures the 50.72 report was not required.

- Leak tests included significant margin (overpressure).

- The potential for loss of EQ boundary at the transmitter neck seal was not addressed in EQ test reports and found only through AP&L's review of a recent revision of vendor installation instructions. Until AP&L personnel discovered the rotated installation concern in modified Rosemount installation procedures, there were no indications of this condition being a concern from Rosemount, the NRC, or the industry.

- AP&L's prompt and extensive response once the deficiency was identified is indicative of a proactive licensee philosophy. This is reflected in both the scope of the response and the ultimate corrective actions.

ATTACHMENT C

REV. 2 AUDIT CHGS

SYSTEM COMPONENT EVALUATION WORKSHEET	QUALIFICATION CRITERIA: 79-01B	SYSTEM: VARIOUS UNIT: ANC-1 P&ID: VARIOUS	ID (TAG) NO.: GEN 1002 COMPONENT: ELECTRICAL CABLE LOCATION: RB
	ESP-211F1 EVAL.: ATTACHED		

DESCRIPTION	ENVIRONMENT			DOCUMENTATION REFERENCES		QUAL. METHOD	OPEN ITEM
MANUFACTURER: BOSTON INS WIRE NPRDS CODE:B365 MODEL NO.: BOSTRAD 7 600V CONTROL/POWER FUNCTION: ELECTRICAL DISTRIBUTION SERVICE: VARIOUS FLOOD LEVEL: ABOVE ACCURACY REQ'D: N/A DEMO: N/A	PARAMETER	REQ'D LEVEL	QUAL. LEVEL	REQUIRED	QUALIFICATION		
	OPERATING TIME (HRS)	720	24	ESMP #71	V10 ITEM 19	TEST	NONE NOTE 1
	TEMP (F)	280	316	FSAR FIG. NO. 14.62	V10 ITEM 19	TEST	NONE
	PRESSURE (PSIG)	53.1	90	FSAR FIG. NO. 14.61	V10 ITEM 19	TEST	NONE
	RELATIVE HUMIDITY %	100	100	ESMP #71	V10 ITEM 19	TEST	NONE
	CHEMICAL SPRAY (pH AND COMP)	2670 ppm BORON pH 10.5 @ 77F	BORIC ACID pH 10	ESMP #71	V10 ITEM 22	TEST	NONE
	RADIATION (RADS)	5.0 E+7	1.0 E+8	ESMP #71	V10 ITEM 21	TEST	NONE
	AGING	40 YRS NOTE 2 (3)	40 YEARS	ESMP #71	V10 ITEM 19 MIS EQ ITEM 18 87-EQ-0002-33 (3)	SEQUENT TEST & ANALYSIS	NONE NOTE 1
	SUBMERG.	N/A	N/A	N/A	N/A	N/A	NONE

NOTES: 1. SEE ATTACHED ESP-211F1 FOR DISCUSSION OF TIME OF LOCA TEST AND AGING. (3) 2. REQUIRED AT AN AMBIENT TEMPERATURE OF 180 F.

PREPARED BY: Dean Williams
DATE: 2/17/88
REVIEWED BY: Buck Frei
DATE: 2/24/88
SCEW SHEET NO.: A099
REVISION NO.: 3

IV. Environmental Qualification Documentation

A. Qualification References

1. File V10, ITEM 13, BIW REPORT B901
2. File V10, ITEM 23, BIW REPORT B905
3. File V10, ITEM 21, BIW Report B903A
4. File V10, ITEM 22, BIW Report B904
5. File MISCEQ, ITEM 18, SCE-ANO-6

6. CALC. NO 87-EQ-0002-31
7. CALC NO. 87-EQ-0002-33

B. Qualification Methods (check all that apply)

8. CALC NO. 87-EQ-0002-25

[X] 1. Type Tests

[ ] 2. Experience

[X] 3. Analysis - indicate type and the parameters addressed

Analysis (see ref 5) (SEE REFS 6, 7)

C. Test Specimen Description

1. Device Electrical Cable
2. Vendor BIW
3. Model #/ID # See Below
4. Range/Size/Options, etc. See Below
5. Qualified interfaces NONE

B/W Part No. 7244-H-002 — Single Pair Inside Containment Cable — BOSTRAD®
B/W Part No. 87244-H-002 — Single Pair Inside Containment Cable — BOSTRAD®
Results are plotted on a curve in which temperature, pressure and time are indicated. See pages 13 and 14.

Effect of Irradiation

In order to provide information with respect to the effect of exposure of radiation on the behavior of the cable under this containment environmental condition, a sample of the two-pair instrument cable, B/W Part No. 7245-H-004, was submitted to the containment environmental test after exposure of 5.5 X 10^8 integrated rads dose of radiation.

REF. 1

Two 15 foot samples of seven conductor #18 AWG cable having both insulation and jacket of Bostrad 7 were used in this evaluation. The cable was BIW 8545-H-007.

REF. 2

C. Is each required qualification parameter listed in section III.D. enveloped by the corresponding qualified value in section IV.D. plus appropriate margin?

___ Yes (see SCEW for summary)

X No (list any discrepancies and justify)

The LOCA test lasted 24 hours rather than the "typical" test of 30 days used after IEEE Standard 323 was issued. However, the LOCA test did envelope (with margin) the actual accident profile anticipated to occur at ANO. The final post-LOCA IR reading (> 1,000 Megohms) indicates that the cable specimens were in good condition and that no failures would have been anticipated if the test had continued at a low temperature (≥ 140°F) typical of LOCA simulations.

2 See attached sheets for a comparison of tested and accident profiles

D. Can any non-enveloped environmental parameter identified above be reduced to show compliance (i.e., location-specific dose reduction, thermal lag analysis, shielding, relocation, etc.)?

___ Yes (list parameter, method, and attach supporting justification)

X No (justified in C. above)

___ NA

V10 Item 19

VII. UNIQUE TESTS PROPOSED BY UTILITY ENGINEERS

This specification is intentionally prepared to provide a complete presentation of the tests and performance characteristics of cables intended for installation in nuclear power plants.

Utility engineers and consulting engineering firms who have made a specialty of preparing specifications over the past few years have proposed a variety of test procedures. Wire and cable engineers have been confronted with conducting tests under the various methods and have had an opportunity of evaluating the merits of the different methods and materials.

As a result of the San Onofre fire, all engineers involved in design and manufacture of electrical components have been awakened to the realization that new standards and more severe testing have to be adopted if a nuclear power plant is to be finally accepted and approved by the Atomic Energy Commission.

Several committees have been appointed and have conferred with the objective of preparing specifications having the degree of severity and comprehensive performance requirements which will provide a degree of safety and reliability under the variety of conditions which may be imposed within a nuclear power plant over its expected life during the next forty years.

Boston Insulated Wire & Cable Co. has studied the numerous specifications for cables for nuclear power plants for both inside and outside containment areas. Specific requirements and procedures are presented for the following four environmental conditions:

A. Inside Containment Environmental Test
B. Vertical Laboratory Flame Test
C. Bonfire Tests with Burning Oil as a Source of Flame
D. Nuclear Radiation Exposure Tests

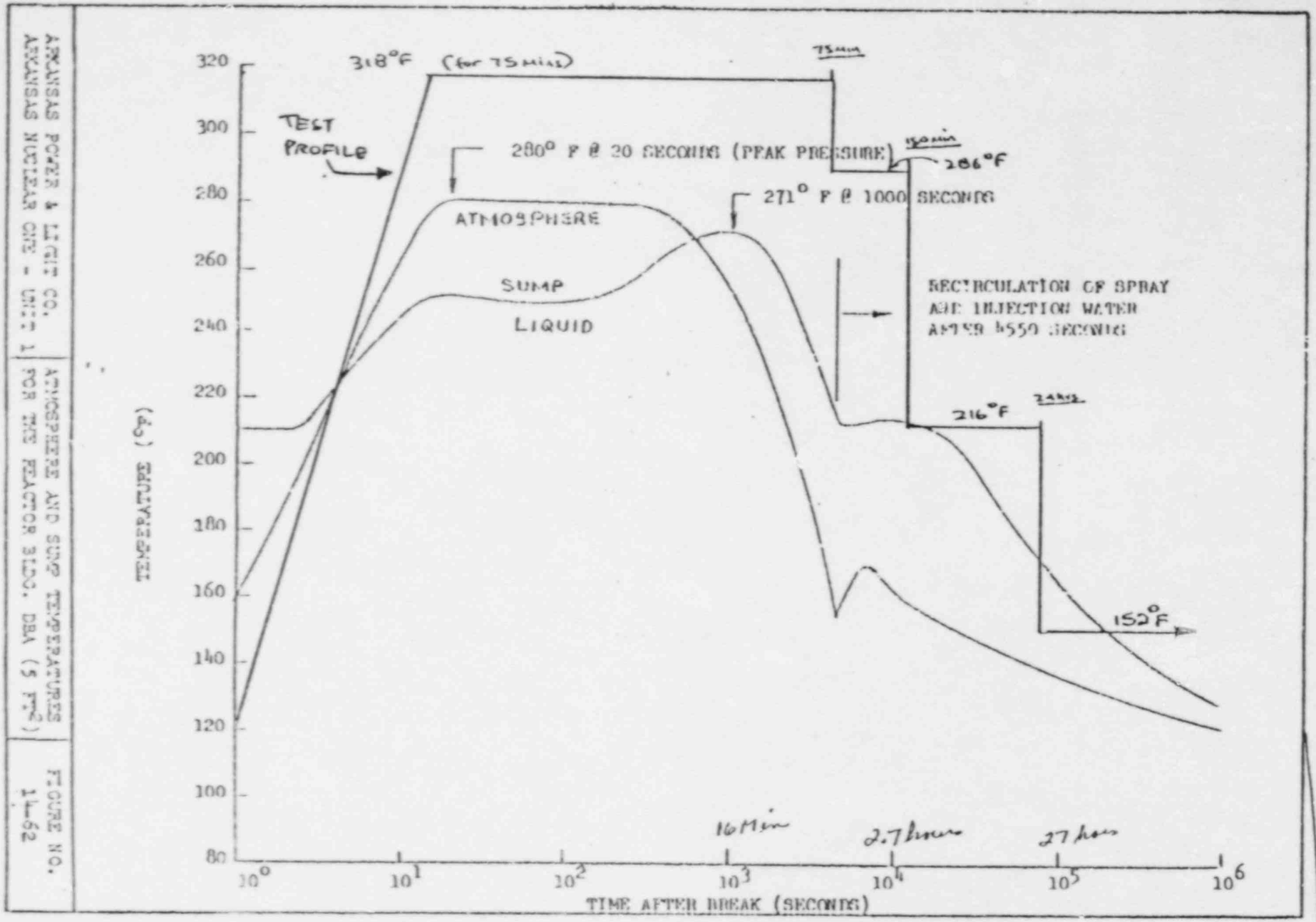
A. Inside Containment Environmental Test

Requirement

Cables are designed to withstand without failure, once in their lifetime, the coincident pressure and temperature transients which are likely to occur within the containment areas of a nuclear reactor in the event of a Loss of Coolant Accident (L.O.C.A.). The particular pressure and temperatures estimated by nuclear engineers have differed. The more severe conditions have been adopted for test purposes as follows:

Time After L.O.C.A.	*Temperature Degrees F.*	*Pressure PSI*	*R.H. %*
Within 10 secs.	318°	60–70	100
15–75 min.	318°	90	100
75–150 min.	286°	60	100
150 min.–24 hrs.	216°	20	100
After 24 hrs.	152°	10	100

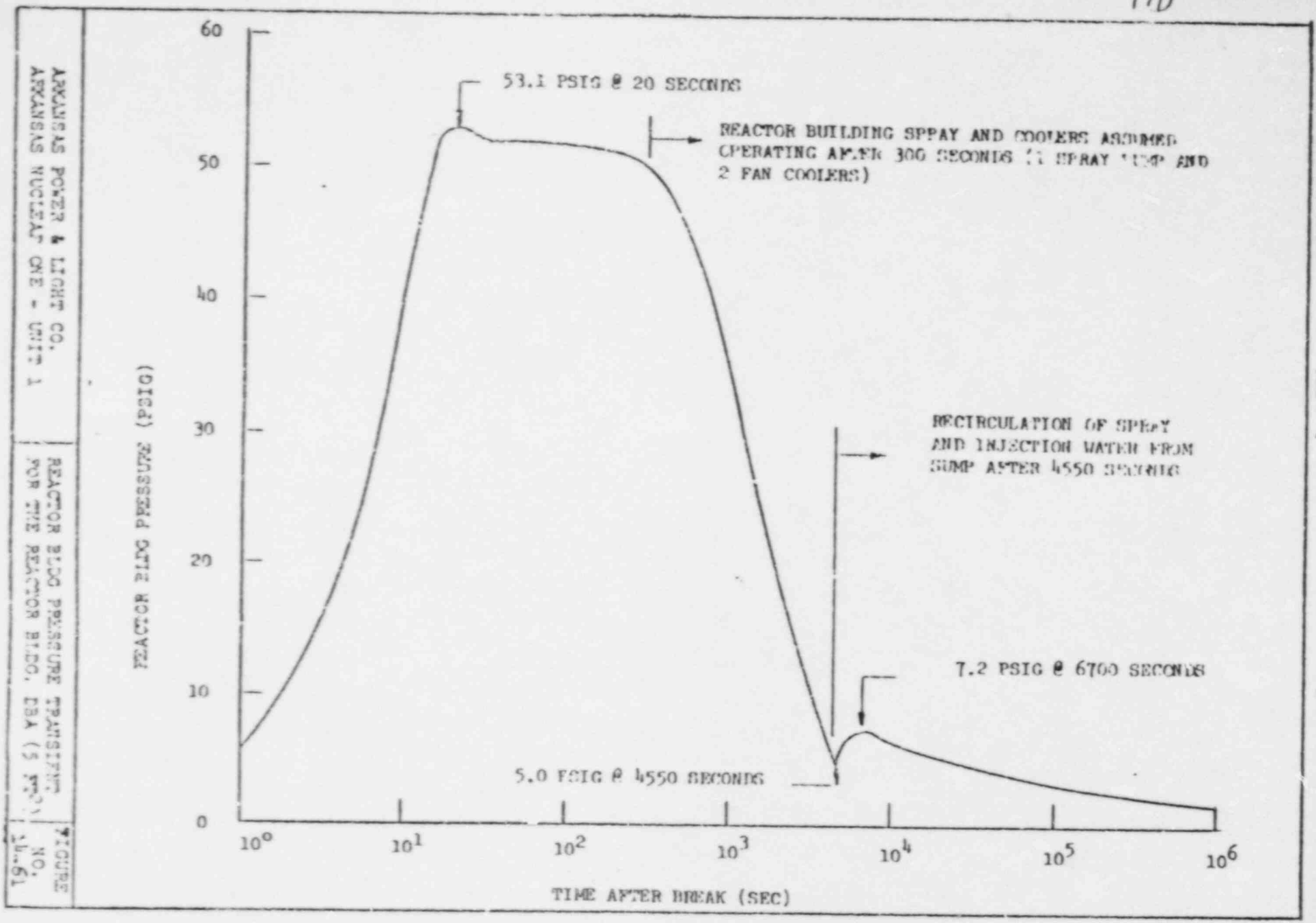
AH-1
SCEW # A099
Rev. 2



ARKANSAS POWER & LIGHT CO. ARKANSAS NUCLEAR ONE - UNIT 1	ATMOSPHERE AND SUMP TEMPERATURES FOR THE REACTOR BLDG. DBA (5 FT²)	FIGURE NO. 14-62

page 2 of 3

RAD 5X10 RAD
40 YR
TID



ARKANSAS POWER & LIGHT CO.
ARKANSAS NUCLEAR ONE - UNIT 1

REACTOR BLDG PRESSURE TRANSIENT
FOR THE REACTOR BLDG. ESA (5 FT²)

FIGURE NO. 14.61

AH.1 SCE# 4099 Rev. 2

ATTACHMENT 5

SYSTEM COMPONENT EVALUATION WORKSHEET	QUALIFICATION CRITERIA: 79-01B	SYSTEM: BORON MANAGEMENT UNIT: ANO-2 P&ID: M-2214 ESP-211F1 EVAL.: ATTACHED (1)	ID (TAG) NO.: 2CV2202-1;2ZS2202-1 COMPONENT: MVO & POS SW LOCATION: RB

DESCRIPTION	ENVIRONMENT			DOCUMENTATION REFERENCES		QUAL.	OPEN
	PARAMETER	REQ'D LEVEL	QUAL. LEVEL	REQUIRED	QUALIFICATION	METHOD	ITEM
MANUFACTURER: ROTORK NPRDS CODE:R378 MODEL NO.: 11NA1 SN:B2387/K 2 FUNCTION: VALVE OPERATION SERVICE: BMS RDT 2T68 DI SCH PENETR. ISO L FLOOD LEVEL: ABOVE ACCURACY REQ'D: N/A DEMO: N/A	OPERATING TIME (HRS)	720	36 DAYS	NOTE 1	V44 ITEM 7	SIMULT TEST	NONE
	TEMP (F)	289	375	FSAR TABLE 3.11 .1	V44 ITEM 7	SIMULT TEST	NONE
	PRESSURE (PSIG)	54	80	FSAR TABLE 3.11 .2	V44 ITEM 7	SIMULT TEST	NONE
	RELATIVE HUMIDITY %	100	100	FSAR TABLE 3.11 .2	V44 ITEM 7	SIMULT TEST	NONE
	CHEMICAL SPRAY (pH AND COMP)	15000 PPM BA PH10.5 @77F	DEMIN WTR (NOTE2)	ESMP #71 R1	V44 ITEM 15F,7	SIMULT TEST	NONE (NOTE2)
	RADIATION (RADS)	3.3 E+7	2.0 E+8	FSAR TABLE 3.11 .2	V44 ITEM 7	SEQUENT TEST	NONE (NOTE 3
	AGING	40 YEARS	40 YEARS	FSAR	V44 ITEM 7	SEQUENT TEST	NONE
	SUBMERG.	N/A	N/A	N/A	N/A	N/A	NONE

NOTES: 1. SEE REFERENCE ESMP #71 2. ROTORK SUMMARY OF ENVIRONMENTAL TESTS INDICATE VARIOUS CHEMICAL PH WITHOUT DEGRADATION. REFER TO ESP-211 EVAL. V44 ITEM 16. 3. GIL SEALS AND O'RINGS QUALIFIED TO 6E7 RADS 4. REFER TO ESP-211 EVAL. V44 ITEM 16 FOR DISCUSSION. 5. ESP-211 EVALUATION ATTACHED PER REV. 1 (1)

PREPARED BY: JWK
DATE: 2/10/87
REVIEWED BY: DU
DATE: 2/10/87
SCEW SHEET NO.: 2A018
REVISION NO.: 1

REVISED (1)

IV. Qualification Documentation (Continued)

E. Aging (LIMIT SWITCH WAS NOT AGED - SEE ATTACH. A)

1. Were all significant aging mechanisms considered (radiation, thermal, electrical cycles, mechanical cycles, etc., - see section III.C.6)

✓ Yes* - (identify each significant aging mechanism below)

___ No - (justify any exceptions)

Aging Mechanism	Methodology	Ref
THERMAL	TEST	(1)
RADIATION		
CYCLING		
SEISMIC		

2. Was the Aging mechanism addressed by artificial aging (preconditioning) prior to accident test?

X Yes* - (required by 10CFR50.49)

___ No - (79-01B device)

THE THERMAL & RADIATION AGING WERE PERFORMED AS SEPARATE EFFECTS TEST. THIS CASE IS CONSIDERED ACCEPTABLE AND NO SYNERGISTIC EFFECTS BETWEEN LOADED & UNLOADED SPECIMENS ARE KNOWN.

3. Did evaluation of any Aging mechanisms indicate a lifetime less than plant life?

X Yes - (identify mechanisms and limitation)

___ No

1 { OIL SEALS & O-RINGS - THERMAL AGING - 110°C, 7 DAYS
RADIATION AGING - 60 MRAD

2 { OIL, SWITCH ASSEMBLY - THERMAL AGING - 120°C 30 DAY
RADIATION AGING - 200 MRAD

3 { RESULT - MEDIUM NITRILE NOT SUITABLE - MUST USE VITON
VITON WAS NOT AGED BUT IS SUITABLE FOR VALUES GIVEN

4. If the Aging test results in limited life components, can credit be taken for less severe plant conditions to increase lifetime (Arrhenius extrapolation).

___ Yes (explain basis and attached approved calculations)

___ No

X NA

* EXCLUDES LIMIT SWITCH - SEE ATTACHMENT A FOR DISCUSSION

V. Qualification Assessment

A. Is the installed equipment (or that being considered for installation) identical to the tested equipment?

___ Yes

X No (justify any difference by similarity analysis, etc.)

1) REF. (1) PG. 77 PROVIDES ROTORKS JUSTIFICATION FOR EXTRAPOLATION TO SIMILAR UNITS AS THE TESTED SPECIMEN, ALSO, FILE V44 CONTAINS CORRESPONDENCE IN WHICH ROTORK IDENTIFIES THIS REPORT AS APPLICABLE TO THE INSTALLED DEVICES AT ANO (ITEM 15, VARIOUS)

2) THE PRIMARY DIFFERENCE BETWEEN THE TESTED & INSTALLED EQUIPMENT (NAO - BWR & NA1 PWR) IS THE HOUSING MATERIAL IS CHANGED FROM ALUMINUM TO CAST IRON & STEEL TO PROVIDE CHEMICAL SPRAY QUALIFICATION (BASED ON ITS SUBMERSIBLE DESIGN & PREVIOUS DI WATER SPRAY QUALIFICATION)

B. Were any test failures or anomalies encountered during the test program?

X Yes (list below and justify each)

___ No

Failure/Anomaly	Resolution
1) TORQUE SWITCH MECHANISM MOD. STD. "0" FAILED AFTER 3 HRS. OF DBE TEST	SWITCH MECHANISM MOD STD. "1" INSTALLED. REF. ATTACHMENT A FOR DISCUSSION.
2) AUX SWITCH MALFUNCTION	
3) ADD-ON-PACK SWITCH MECH. DRIVE LOST	ALL FAULTS ADDRESSED IN SECTION 8.5 OF (1). THE JUSTIFICATIONS GIVEN ARE ACCEPTABLE BASED ON THE DEVICE, THE MATERIALS INVOLVED & THE DATA GIVEN
4) VITON SEALS REPLACED NITRILE SEALS (NO PRE-AGING) PRIOR TO LOCA	

ARKANSAS POWER & LIGHT

CALCULATION NO.

ATTACHMENT A

CALCULATION SHEET

LIMIT/TORQUE Switch Testing and Modification

(File V44, Item 7)

The ROTORK MOV tested in TR116, exhibited several anomalies during the testing. In particular, the Nuclear Switch Mechanism (NSM), which incorporates both the torque switch and limit (auxiliary) switch functions, had an anomaly in which the closed torque switch malfunctioned on one valve operation and the open limit switch malfunctioned on one operation. The latter failure was a direct result of the former. The cause of the failure was determined to be the obstruction of the torque plate movement by the anertrawl pins. For the NA series MOVs, these pins are unnecessary and redundant. However, it was also noted that dimensional changes at high temperature of the glass-filled Nylon (in place of the Nylon 6/6) had contributed to the failure mode. It was the intent of TR222 (File V44, Item 10) to establish

REV.	0							
BY	K Gibson 2-3-87							
CHK'D								
APP'D								

the ability of components made from Ryton R4 to perform satisfactorily in place the nylon parts (except the nylon 6/6 cams) with respect to dimensional stability at high temperatures (File V44, Items 15s and 15v). The NSM with Ryton R4 parts was subjected to a high temperature for 30 days according to the LOCA profile of TR116 without the pressure, steam, and chemical spray. This procedure is in accordance with IEEE 323-1974, Section 6.8, "Modifications" (Appendix 1) and the DOR Guidelines. The evaluation of the effect of this material change is based on the documented mechanical, thermal, and electrical properties of the only material changed; namely, Ryton R4.

File V44, Item 15u. provide data on Ryton R4, a polyphenylene Sulfide (PPS) material, which shows that its mechanical and electrical properties are virtually unaffected by temperature,

REV.	0							
BY	~~Dolpson~~	2-3-87						
CHK'D								
APP'D								

radiation, or moisture. It has a UL 94 temperature index rating of 338°F which is higher than the LOCA conditions of ANO. This material change will only enhance equipment performance as demonstrated in TR222 and, as such, does not require complete requalification.

REV.	0							
BY	Folgson	2-3-87						
CHK'D								
APP'D								

Appendix 1

the basis for extrapolation, equipment or components shall be subjected to a comparable environment for a time or level necessary to justify the extrapolation of the test results to the total time or level to be qualified.

6.5.4 *Determination of Qualification.* The electric equipment type shall be considered to be qualified by demonstrating that the equipment performance will meet or exceed its specified values for the most severe environment or sequence of environments in the equipment specification during its qualified life. The severity of the environmental parameters shall be based upon knowledge of the failure modes and failure mechanisms of the equipment which may be determined by test. The qualified life shall be based upon the known limits of extrapolation of the time dependent environmental effects if an accelerated aging test was used to determine the mathematical model.

6.6 On-Going Qualification. Some equipment may have a qualified life less than the required design life of a nuclear power generating station. There are two recommended methods of long term qualification (see Section 5.5):

(1) Equipment of the same type as that which has been type tested and installed in a station shall be placed in an environment that accelerates the aging under controlled conditions. When it is determined that the equipment has reached the required design life of the station, it shall be removed from the accelerated life environment and type tested. The installed equipment may be considered adequate for the design life of the station if the equipment that was subjected to the accelerated life environment passes the type test.

(2) Additional identical equipment shall be installed in a nuclear generating station in locations where service conditions equal or exceed those of the equipment to be qualified. This equipment shall be removed after a planned period less than the previously qualified life and subjected to a qualification test similar to that performed prior to its installation. This test must include additional accelerated aging. Successful completion of this type test extends the qualified life of the installed equipment. This procedure shall be repeated until the qualified life equals the required installed life of the equipment.

Should the above methods demonstrate that the qualified life is less than the required life, a periodic replacement plan shall be instituted.

6.7 Criteria of Failure. In the evaluation of the qualification test results, any sample equipment is considered to have failed when the equipment does not perform the Class IE functions required by the equipment specifications.

6.8 Modifications. Modifications should not be made to the equipment, or to the equipment or test specifications, after the start of the type test or beginning of the operating experience reporting period since such modification will normally render the test and experience results inconclusive. Modifications may be made only if full justification is documented on the basis that such modifications have no bearing on the validity of the test.

Each modification to the equipment or to the equipment specification made after the type test or beginning of the operating experience reporting period shall be evaluated to determine its effect on the equipment qualification. This evaluation shall indicate whether or not complete requalification is required. If not, the analysis or data and evaluation that demonstrates the effect of the modification on equipment performance shall be added to the original qualification documentation.

Components of the equipment which can be shown to be unaffected by the change need not be type tested again, as previous operating experience and type test data along with complete qualifications for portions affected by the modification shall constitute qualification of the entire equipment.

Any changes in qualification basis, materials of construction, lubricant, mechanical stresses, clearances, manufacturing process, dielectric stress levels, etc, shall be identified and the equipment requalified if necessary. Necessity shall be based on effect of the change on the equipment's Class IE functions.

6.9 Documentation. Files which provide documentation of the qualification procedures, methods, and results shall be maintained to provide a current basis for qualification and permit comparisons if future tests are conducted.

7. Simulated Service Condition Test Profile

The user shall furnish sufficient environmental data to allow the simulation of the

IV. Qualification Documentation

A. Qualification References

(1) FILE V44 ITEM 7 ROTORK REPORT TR-116, REV. 1 DATE 11/78
(2) FILE V44 ITEM 15c, LETTER FROM ROTORK ON NA1 QUAL.
(3) FILE V44 ITEM 15f, ROTORK SUMMARY OF QUAL. REPORTS
(4) FILE V44 ITEMS 15 b & 15 l, LIST OF ROTORK TEST REPORTS & LIST OF ROTORK ACTUATORS IN ANO 1 & 2
(5) FILE V44 ITEM 10 ROTORK REPORT TR-222, REV 0
(6) FILE V44 ITEMS 15s, 15t, 15u, & 15v DEALING WITH SWITCH TESTING

B. Qualification Methods (check all that apply)

X 1. Type Tests

___ 2. Experience

___ 3. Analysis - indicate type and the parameters addressed

C. Test Specimen Description

1. Device MOTORIZED VALVE ACTUATOR
2. Vendor ROTORK
3. Model #/ID # 16NAO
4. * Range/Size/Options, etc. - BASED ON TABLE (PG. 19) IN REF. (1) 10 ft-#, 15000 # THRUST, TORQUE SETTING 150 ft-# IN BOTH DIRECTIONS, 57 RPM, 60:1 GEAR RATIO.
5. Qualified Interfaces NONE

* EXTERNAL JOINTS ARE SLEEVE & O-RING
DYNAMIC SEALS ARE "LIP" OR DOUBLE O-RING
MOTOR & SWITCH ENCLOSURES ARE COMPLETELY SEALED
DYNAMIC SEALS (OIL RETENTION) FOR ELECTRIC ENCLOSURE ARE VITON
GEARBOX BASE SEALS ARE VITON
ALL OTHER SEALS & O-RINGS ARE MEDIUM NITRILE
HOUSING-ALUMINUM, TERMINAL BOX - CAST IRON
NEMA 6 ENCLOSURE (WATERTIGHT)
GEARBOX - OIL BATH LUBRICATED
EXTERNAL LIMIT/POSITION SWITCHES - USER SCOPE OF SUPPLY
MOTOR - 3Ø, 15 MIN DUTY CYCLE, 40°C RISE, CLASS H, 60 HZ, 460 VOLT, PROVIDE FULL OUTPUT @ -10% RATED VOLTAGE

revision 1 NOV. . . 1

title

TR116 R378 A1 2

QUALIFICATION RECORDS FOR TYPE NAO VALVE ACTUATORS (NUCLEAR CLASS 1E)

QUALITY ASSURANCE RECORD

E.Q. DOCUMENTATION
File No. V44
Item No. 7

revisions	prepared	checked	approved
1			
2			
3			

notes

REVIEWED BY
GTM 10/17/73

INITIAL ISSUE:

Prepared by: BRIAN GREGORY
Status: CHIEF ENGINEER
Date: 12 Oct 1973
Signature:

Checked by: D.L. HOKE
Status: TECHNICAL DIRECTOR
Date: 12 Oct 73
Signature:

Approved by: R.J. MATTHEWS
Status: QUALITY CONTROL MANAGER
Date: 12th Oct 73
Signature:

MAR 18 1976

BECHTEL SAN FRANCISCO | JOB NO. 6600

QUALITY DOCUMENTATION REVIEW

1 [X] ACCEPT - Manufacturing may proceed.
2 [ ] ACCEPT - Please resubmit on reproducible
3 [ ] ACCEPT WITH COMMENTS - Make changes and submit corrected documentation. Manufacturing may proceed.
4 [ ] NOT ACCEPTABLE - See comments.
5 [ ] REMARKS:

By: Date: 5-6-76

BECHTEL

	MEQS	QC	C	E	A	M

FEV TO EHS HM DTD 5-5-76
SG 76-128

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8.5 Modifications

It is required that each modification to the actuator or to its specification made after the start of the type test shall be evaluated to determine its effect on the actuator qualification. The following provides that evaluation.

8.5.1 Faults reported

1) Close torque switch malfunction on front seating.
2) Auxiliary switch malfunction in open position.
3) Add-on-Pak switch mechanism drive lost.
4) Viton seals added in place of nitrile in places.

8.5.2 Time of Occurence

Thirty five minutes into first LOCA exposure
Fault 4) Prior to first LOCA.

8.5.3 Modification Standard of Equipment

1) At time of fault - Modification Standard '0'.
2) When modified - Modification Standard '1'.

8.5.4 Evaluation of Fault

1) Close torque switch malfunction resulted from the torque plate movement being obstructed by overtravel pins. The plate is directly involved in operation of the torque switch and its failure to move produced a switch malfunction. The fault can be directly attributed to no allowance being made for the dimensional change in this component by the use of glass filled nylon in place of nylon 6/6
2) Auxiliary switch malfunction in open position resulted from reduction in striker plate reset force due to combined effect of increase in friction between this plate and its pivot shaft and increase in friction in spring reset system which is part of the switch. At the close position immediately prior to the malfunction the striker plate and its operating piece are mutually disengaged. (This is intentional in

Due to the fault described above re-engagement was not achieved when the actuator was driven open and consequently the striker plate was not operated at the open limit position.

3) Add-on-Pak switch mechanism drive is derived from a slotted coupling connected to the main switch mechanism. The Add-on-Pak local position indicator system is not required for NAO duty but a portion of that system remains to act as an end-stop. The mechanism front support plate obstructed the indicator piece causing the device to jam. The resultant factors transmitted through the slotted coupling caused breakage of this component.

4) Production documentation calls up Viton seals for critical locations in the actuator. Due to the extended lead time of these seals the test was launched with lower specification medium nitrile. Had this material proved successful the use of the specified Viton would provide increased margin on future production units.
However, following aging and irradiation it was evident that seals in nitrile material are unsuitable for dynamic applications with any reliability.

8.5.5 Evaluation of Solution

1) The solution to the close torque switch problems centres around the removal of the overtravel pins and thus the elimination of the potential obstruction. These pins are directly associated with the switch removal facility on standard actuators. This facility is not provided on NA units and the pins are redundant.

Since the modification involves the removal of an item which is non-complex in construction and function, retesting to involve aging and seismic is considered unnecessary.

2) The solution to the open auxiliary limit switch problem centres around the provision of a striker plate reset spring. The function of this spring is to provide re-engagement of the striker plate and operating piece and since it does not act directly in switch operation a retest is considered unnecessary.

3) The solution to the Add-on-Pak drive involves redesign of two pieces. The end stop piece which remained from the indicator mechanism is replaced by a pin specially for end stop use; the drive component is produced in brass instead of glass filled nylon.

Since the additional pieces are constructed of metal and are non-complex in construction and function, retesting is considered unnecessary.

4) Viton seals as specified by production documentation were built into the unit before LOCA exposure. These seals were not aged or irradiated since seals of this material previously subjected to the specified conditions should show no detrimental change.

8.6 Summary

The 1GNAO actuator completed 36 days of LOCA exposure following aging, radiation cycle test and vibration subject to the fault report in Section 8.5 plus an extra transient of 3 hours.
In addition, this actuator completed a short duration at each of three additional LOCA transients during the evaluation of the solution to the fault reported in Section 8.5.

An the end of 24 day exposure, and following a period of 10 days during which no operations were performed, a close torque switch failure was reported on the second operation. The preceding operation and following operation on that day were succensful. A

ATTACHMENT 6

ATTACHMENT 6

EVALUATION OF THE OKONITE
T-95/35 SPLICING SYSTEM IN
LIMITORQUE MOTOR OPERATOR APPLICATIONS

References

1. Okonite Qualification Report NQRN-3 Rev. 3 dated 3/31/87 (Vendor file V38 Item 17)

2. Limitorque Qualification Report B0058 dated 1/11/80 (Vendor file V33 Item 26)

3. Nuclear Environmental Qualification Test Report (Wyle) 17859-02P dated 3/11/87

Purpose

To justify the variation from the qualified configuration of terminations in E.Q. Limitorque actuators (terminal blocks) with Okonite T-95 tape splices.

Description of Variation

The Limitorque valve operators used in environmentally qualified applications are purchased certified to qualification reports (Ref. 2). This report describes a tested configuration which utilizes a terminal block for connection of the power supply cables to the motor leads. In order to accommodate operational requirement it may be necessary to remove the terminal block and splice the field cables directly to the motor leads. This represents a deviation from the referenced test report and therefore must be evaluated. It has been concluded that a splicing method, if environmentally qualified separately, is equal to or better than the Limitorque tested configuration and can therefore be acceptably substituted. This means that the splice qualification evaluation can be used to satisfy the similarity concern and serve as the evaluation of the variation from the Limitorque test report.

The Okonite T-95/35 splicing system has been environmentally qualified per Reference 1. The referenced test report documents an acceptable qualification test to environmental parameters which envelope the worst case parameters at ANO including temperature, pressure, relative humidity, chemical spray, radiation, and aging. For purposes of this evaluation, the environment inside the valve actuator limit switch enclosure is assumed to be identical to the environment outside although chemical spray is not present inside the enclosure, the radiation dose is reduced due to the enclosure, and moisture intrusion is inhibited. These factors tend to make the splice environment less harsh than the tested environment. The installed configuration of the splice deviates from the tested configuration in two areas. The following engineering evaluation demonstrates that these variations are acceptable.

Description of Variation

The Limitorque valve operators used in environmentally qualified applications are purchased certified to qualification reports (Ref. 2). This report describes a tested configuration which utilizes a T&B nylon blind barrel crimp for connection of the dual voltage series motor leads. Due to maintenance reasons the T&B crimps were removed and replaced with a tape splice on the dual voltage motor leads. This represents a deviation from the referenced test report and therefore must be evaluated. It has been concluded that a splicing method, if environmentally qualified separately, is equal to or better than the Limitorque tested configuration and can therefore be acceptably substituted. This means that the splice qualification evaluation can be used to satisfy the similarity concern and serve as the evaluation of the variation from the Limitorque test report.

The Okonite T-95/35 splicing system has been environmentally qualified per Reference 1. The referenced test report documents an acceptable qualification test to environmental parameters which envelope the worst case parameters at ANO including temperature, pressure, relative humidity, chemical spray, radiation, and aging. For purposes of this evaluation, the environment inside the valve actuator enclosure is assumed to be identical to the environment outside although chemical spray is not present inside the enclosure, the radiation dose is reduced due to the enclosure, and moisture intrusion is inhibited. These factors tend to make the splice environment less harsh than the tested environment. The installed configuration of the splice deviates from the tested configuration in two areas. The following engineering evaluation demonstrates that these variations are acceptable.

Evaluation of Configuration

The Okonite test configuration consisted of a splice between Okonite cables (trade name Okoguard). The installed splice within the limit switch compartment is between field cable and the motor lead which is a glass braid over Nomex insulation tape. The field power cable currently used at ANO is ethylene-propylene rubber (EPR). EPR is also the insulation used in the Okoguard cable manufactured by Okonite. Therefore one side of the splice is considered identical to the tested configuration leaving the glass braid/Nomex portion of the splice as the significant configuration variation. The primary concern being moisture intrusion causing short circuits between phases and/or ground where the glass braid acts as a wick.

This variation will not affect the mechanical protection or electrical insulation properties of the splice as demonstrated by the Okonite test report. The wicking process relies on the presence of moisture in sufficient quantities to condense and occupy the spaces between the glass braid. The wicking process is independent of orientation. Based upon the Limitorque test report (Ref. 2) and the use of unencapsulated terminal blocks which offer no moisture protection, it can be concluded that moisture within the operator enclosure of sufficient quantities to cause short circuits does not result from exposure to the post accident environment. Therefore it can also be concluded that sufficient moisture will not be present to cause the wicking phenomenon through the glass braid and the splice offers superior moisture protection over the open terminal blocks regardless of the physical orientation of the spliced conductors.

Conclusion

As the installed configuration is considered highly similar to the Okonite tested configuration (Ref. 1) the environmental qualification of Okonite T-95/35 splicing system has been proven. Therefore, the variation from the Limitorque tested configuration is also acceptable as an environmentally qualified method of electrical connection superior to an open terminal block.

In addition to the above evaluation, an N.E.Q. test report (Ref. 3) was reviewed and found acceptable. This report further substantiates the qualification of the T-95/35 splicing method. One of the tested configurations is highly similar although less restrictive than the one currently specified at ANO.

ATTACHMENT 6

EVALUATION OF THE OKONITE T-95/35 SPLICING SYSTEM IN LIMITORQUE MOTOR OPERATOR APPLICATIONS

References

1. Okonite Qualification Report NQRN-3 Rev. 3 dated 3/31/87 (Vendor file V38 Item 17)

2. Limitorque Qualification Report B0058 dated 1/11/80 (Vendor file V33 Item 26)

3. Limitorque Qualification Report 600198 dated 1/2/69 (Vendor file V38 Item 22)

4. Nuclear Environmental Qualification Test Report (Wyle 17859-02P dated 3/11/87

Purpose

To justify the variation from the qualified configuration of terminations in E.Q. Limitorque actuators (T&B blind barrel crimps) with Okonite T-95 tape splices.

Evaluation of Configuration

The Okonite test configuration consisted of a splice between Okonite cables (trade name Okoguard). The installed splice within the limit switch compartment is between two motor lead wires which consist of a glass braid over Nomex insulation tape. The primary concern being moisture intrusion causing short circuits between phases and/or ground where the glass braid acts as a wick.

This variation will not affect the mechanical protection or electrical insulation properties of the splice as demonstrated by the Okonite test report. The wicking process relies on the presence of moisture in sufficient quantities to condense and occupy the spaces between the glass braid. The wicking process is independent of orientation. Based upon the Limitorque test report (Ref. 3) and the use of nylon crimp connectors which offer no moisture protection, it can be concluded that moisture within the operator enclosure of sufficient quantities to cause short circuits does not result from exposure to the post accident environment. Therefore it can also be concluded that sufficient moisture will not be present to cause the wicking phenomenon through the glass braid and the splice offers superior moisture protection regardless of the physical orientation of the spliced conductors.

Conclusion

As the installed configuration is considered highly similar to the Okonite tested configuration (Ref. 1) the environmental qualification of Okonite T-95/35 splicing system has been proven. Therefore, the variation from the Limitorque tested configuration is also acceptable as an environmentally qualified method of electrical connection.

In addition to the above evaluation, an N.E.Q. test report (Ref. 4) was reviewed and found acceptable. This report further substantiates the qualification of the T-95/35 splicing method. One of the tested configurations is highly similar although less restrictive than the one currently specified at ANO.

ATTACHMENT 3

SYSTEM COMPONENT EVALUATION WORKSHEET	QUALIFICATION CRITERIA: 10CFR 50.49	SYSTEM: ELECTRICAL DISTRIBUTION UNIT: ANO-2 P&ID: ESP-211F1 EVAL.: ATTACHED	ID (TAG) NO.: 2GEN-1013 COMPONENT: ELECTRICAL CABLE LOCATION: RB

DESCRIPTION	ENVIRONMENT			DOCUMENTATION REFERENCES		QUAL. METHOD	OPEN ITEM
	PARAMETER	REQ'D LEVEL	QUAL. LEVEL	REQUIRED	QUALIFICATION		
MANUFACTURER: EATON (SAMUEL MOORE) NPRDS CODE:E059 MODEL NO.: 2C#16AWG FR/EPDM INSUL WITH HYPALON JACKET FUNCTION: ELECTRICAL DISTRIBUTION SERVICE: VARIOUS INSTRUMENTATION FLOOD LEVEL: ABOVE ACCURACY REQ'D: N/A DEMO: N/A	OPERATING TIME (HRS)	720	2400	ESMP #71	V19 ITEM 2	SIMULT TEST	NONE
	TEMP (F)	288	350	FSAR FIGURE 6.2-13	V19 ITEM 2	SIMULT TEST	NONE
	PRESSURE (PSIG)	53.4	68	FSAR FIGURE 6.2-8	V19 ITEM 2	SIMULT TEST	NONE
	RELATIVE HUMIDITY %	100	100	FSAR	V19 ITEM 2	SIMULT TEST	NONE
	CHEMICAL SPRAY (pH AND COMP)	2250 PPM BORON PH 11.0 @ 77F	3000 PPM BORON PH 9.5-11.5	ESMP #71	V19 ITEM 2	SIMULT TEST	NONE NOTE 1
	RADIATION (RADS)	3.3 E+7	1.65 E+8	ANO 2 FSAR TABLE 3.11.1	V19 ITEM 2	SEQUENT TEST	NONE
	AGING	40 YEARS	40 YEARS	FSAR	V19 ITEM 2 MISC EQ ITEM 18 (2)	SEQUENT TEST	NONE
	SUBMERG.	N/A	N/A	N/A	N/A	N/A	NONE

NOTES: (1) REFER TO ESP-211 EVALUATION FOR DISCUSSION

PREPARED BY: JWK
DATE: 8/19/86
REVIEWED BY: VB
DATE: 8/19/86
SCEW SHEET NO.: 2A164
REVISION NO.: 2

DEV 7 AUDIT CHEC

ARKANSAS NUCLEAR ONE
UNITS 1 AND 2
EQUIPMENT ENVIRONMENTAL QUALIFICATION DOCUMENTATION
EVALUATION FORM

Rev. 1-25-85
Page 1 of 14

2V19-A164, Rev

DCP No. _____

I. EQUIPMENT DESCRIPTION

A. Device ELECTRICAL CABLE

B. Tag # 2GEN-1013

C. SCEW sheet 2A164

D. System/P&ID VARIOUS - ELECTRICAL DISTRIBUTION

E. Safety Function ELECTRICAL DISTRIBUTION

F. Service INSTRUMENTATION CABLE

G. Vendor EATON

H. Model #/ID # 2C-#16 AWG FR-EPDM Insulation Hypalon ~~CPE~~ JACKET

I. Range/Size/Options, etc. As described in IV.C

J. Specification No. 6600-E-026

Purchase Order No/Date —

See attachment 1 for cables for which applies.

NCO 6/26/86

ARKANSAS NUCLEAR ONE
UNITS 1 AND 2

2V19-A164, Rev. 0

EQUIPMENT ENVIRONMENTAL QUALIFICATION DOCUMENTATION
EVALUATION FORM

DCP No. _____

I. EQUIPMENT DESCRIPTION

A. Device ELECTRICAL CABLE

B. Tag # 2GEN-1013

C. SCEW sheet 2A164

D. System/P&ID VARIOUS - ELECTRICAL DISTRIBUTION

E. Safety Function ELECTRICAL DISTRIBUTION

F. Service INSTRUMENTATION CABLE

G. Vendor EATON

H. Model #/ID # 2C-#16AWG FR-EPDM Insulation
(2) ~~Hypalon~~ ~~XLPO~~ JACKET

I. Range/Size/Options, etc. As described in IV.C

J. Specification No. 6600-E-026

K. Purchase Order No/Date —

See attachment 1 for cables for which applies.

NCS 6/26/86

III. Qualification Requirements

A. Check the applicable qualification guidelines.

___ 1. 79-01B (DOR Guidelines) - applies to all equipment purchased prior to May 23, 1980.

_X_ 2. 10CFR50.49 (EQ Rule) - applies to all equipment purchased after May 23, 1980, unless there are sound reasons to the contrary.

B. Categorize this device in the following areas requiring qualification (more than one may apply).

_X_ 1. Safety-related

___ 2. Non-safety related whose failure could adversely affect a safety-related device.

___ 3. Post accident monitoring (R.G. 1.97 category 1 and 2 equipment).

C. Normal Service Conditions Range/Durations

1. Temperature 120°F assumed worst case ambient/40 yrs.

2. Pressure 0m 14psia/40years; with 2 40 pressurization to 60psig during ILRT

3. Relative Humidity ~~100% assumed worst case~~ 20-40% — 40yrs.

4. Radiation (zone & total integrated dose) 1.0 x 10^7 rads/Zone I/40yrs.

5. Cycles (electrical or mechanical) Energized

6. Others (if significant - vibration, dust, process conditions) None

D. Design Basis Accident Conditions (check all applicable blocks)

_X_ LOCA Inside Containment

_X_ High Energy Line Break (HELB) Inside Containment

_X_ HELB Outside Containment

8002846047

X Emergency Core Cooling System (ECCS) Recirculation Outside Containment

___ Mild environment (explain if location is potentially harsh)

0002346048

Indicate Maximum (worst) condition for the specific location from the applicable breaks indicated above (here and on SCEW sheet) with references listed in section E below.

	Parameter	Specification	Ref	Comments
1.	Operating Time	720 hrs.	~~(5)~~ (6) BBC 7-11-86	
2.	Temperature (peak)	288 °F ~~289°F~~ NCB 6/26/86	(2)	
3.	Pressure (peak)	53.4 psig ~~54psig~~	(2)	
4.	Relative Humidity	100%	(2)(3)	assumed worst case - saturated conditions
5.	Chemical Spray (Composition & pH)	2250 ppm Boron ~~1500 ppm B~~ pH 10.5 @ 77°F	NCB 6/26/86 (4)	This is equivalent to ~~2600 ppm Boron~~
6.	Radiation - accident TID - accident & normal	2.3×10^7 rads 3.3×10^7 rads	(5)(7) 1	
7.	Submergence	None	—	For this equipment
8.	Acceptance Criteria			
	a. Accuracy	N/A		
	b. Other?	Continuous Operation (Carry current & Voltage) during normal and accident conditions		

E. Specification References

(1) ESMP #71 Rev. 1, ~~Section VI H.1~~
(2) FSAR Fig 6.2-13
(3) FSAR Fig 6.2-8
(4) ESMP #71, Rev. 1, ~~Section VI.D~~
(5) " " " ~~VI.C~~
(7) ANO-2 FSAR TABLE 3.11.1

2. Was the Aging mechanism addressed by artifical aging (preconditioning) prior to accident test?

_X_ Yes - (required by 10CFR50.49)

___ No - (79-01B device)

3. Did evaluation of any Aging mechanisms indicate a lifetime less than plant life?

___ Yes (identify mechanisms and limitation)

_X_ No

4. If the Aging test results in limited life components, can credit be taken for less severe plant conditions to increase lifetime (Arrhenius extrapolation).

___ Yes (explain basis and attach approved calculations)

___ No

_X_ NA

IV. Environmental Qualification Documentation

A. Qualification References

1. File V19, ~~which contains (see next page 5a~~ Item 2 NTS Report 554-1088 dated 8-9-81 KJD 9-19-85
2. File V19, Item 3 Thermal Life Curve
3. File V19, Item 4 " " "
4. File V19, Item 5 " " " KJD 9.19.85
5. File MISCEQ, Item 18 Aging of Electrical Cable, Analysis

B. Qualification Methods (check all that apply)

X 1. Type Tests

___ 2. Experience

X 3. Analysis - indicate type and the parameters addressed

AGING (See Ref. 5) 2

C. Test Specimen Description

1. Device Instrument Cable
2. Vendor EATON Corp.
3. Model #/ID # see below.
4. Range/Size/Options, etc. see below

5. Qualified interfaces None

Sample Description	Sample Number
2/c 16 ga. 7 strand tinned copper, 25 mil FR-EPDM Sch. 3P-6, 16 ga. drain and shield, 45 mil Hypalon Sch. 1J jacket	1
2/c 16 ga. 7 strand tinned copper, 25 mil FR-EPDM Sch. 3P-6, 16 ga. drain and shield, 45 mil Hypalon Sch. 1J jacket	2
2/c 16 ga. 7 strand tinned copper, 25 mil XLPO Sch. 8E-8, 16 ga. drain and shield, 45 mil Hypalon Sch. 1J jacket	3
1/c 16 ga. 7 strand tinned copper, 30 mil EPDM Sch. 3J primary insulation with 10 mils Hypalon Sch. 1M primary jacket	4

D. Tested or analyzed conditions (enter below and on SCEW sheet). The references correspond to the qualification documents listed in Section IV.A. above.

Parameter	Specification	Ref	Comments
Operating Time	2400 hours (100 days)	(1) pgs. 6, 12	- 2 peak transients - values shown are maximum sustained values. - Actual ~~test~~ peaked at 375°F / 72 psig
Temperature REC 7-11-86	350 ~~345~~°F	(1) pg 6, 12	
Pressure REC 7-11-86	68 ~~70~~ psig	(1) pg 6, 12	
Relative Humidity	100%	(1) pg 6, 12	
Chemical Spray (composition and pH)	3000 PPM Boron with $Na_2S_2O_3$ to pH 9.5 - 11.5. Flow rate 1.9 GPM	(1) pg. 7	
Radiation (Total Dose)	1.65 REC 7-11-86 ~~2.0~~ x 10^8 rads	(1) pgs 4, 5 and App. A	Co-60 Source 0.54 Mrad/hr. (Max.)
Submergence	None	—	

Acceptance Criteria

a. Accuracy —

b. Other MAINTAIN VOLTAGE AND CURRENT. PASS Hi-POT TEST.
⇒ No Synergisms were noted during the ~~test~~.

E. Aging

1. Were all significant aging mechanisms considered (radiation, thermal, electrical cycles, mechanical cycles, etc., - see section III.C.6)

X Yes - (identify each significant aging mechanism below)

___ No - (justify any exceptions)

Aging Mechanism	Methodology	Ref
RADIATION	TEST	(1)
THERMAL	TEST	(1) ~~thru 5~~, (5)

(2)

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5. Based on all applicable Aging mechanisms list the expected life of the component and periodic parts replacements necessary, if any, (also on SCEW sheet).

Component Expected Life: > 40 YEARS See Ref. 5 (2)

Part	Replacement Interval	Ref (Section IV.A)

6. List any other qualification limitations or contingencies based on test report review or vendor requirements (maintenance, surveillance, etc.).

Surveillance tests should Be in accordance with Report SCE AN0-C Ref (5)