APPENDIX B

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

NRC Inspection Report: 50-313/88-05
50-368/88-05

Operating Licenses: DPR-51
NPF-6

Dockets: 50-313
50-368

Licensee: Arkansas Power & Light Company (AP&L)
P.O. Box 551
Little Rock, Arkansas 72203

Facility Name: Arkansas Nuclear One (ANO), Units 1 and 2

Inspection At: ANO, Russellville, Arkansas

Inspection Conducted: February 29 through March 4; March 21-25; April 4-8; and June 6-10, 1988

Inspector: J. R. Boardman
J. R. Boardman, Reactor Inspector, Operational Programs Section, Division of Reactor Safety — Date 7/5/88

Approved: D. H. Hunter
J. E. Gagliardo, Chief, Operational Programs Section, Division of Reactor Safety — Date 7/6/88

R. E. Ireland
R. E. Ireland, Acting Chief, Plant Systems Section, Division of Reactor Safety — Date 7/6/88

Inspection Summary

Inspection Conducted February 29 through March 4; March 21-25; April 4-8; and June 6-11 1988 (Report 50-313/88-05; 50-368/88-05)

Areas Inspected: Routine, announced inspection of followup to issues identified in NRC Inspection Report 50-313/87-23 and 50-368/87-23 and the licensee's response to NRC Generic Letter 83-28.

Results: Within the areas inspected, two violations (failure to maintain design control of installed seismic bolting and failure to take prompt corrective action for an Emergency Diesel Generator fuel line leak, paragraph 2.b.), and one potential violation (failure to have records of equipment qualification, paragraph 3.a.) were identified.

DETAILS

1. Persons Contacted

Licensee

°J. Levine, Executive Director Nuclear Operations
°+L. Humphrey, General Manager, Nuclear Quality
°+*D. Lomax, Plant Licensing Supervisor
°+*D. Howard, Special Projects Manager
°+*P. Michalk, Plant Licensing Engineer
*B. Baker, Plant Modifications Manager
°+*R. Lane, Engineering Manager Superintendent
+*J. Taylor-Brown, Quality Control Superintendent
*B. Converse, Operations Assessment Superintendent
+H. Greene, Quality Assurance Superintendent
°+*J. McWilliams, Manager, Maintenance
*R. Wewers, Work Control Center Manager
*B. Durst, Project Engineering Superintendent
*M. Snow, Licensing Engineer
*M. Tull, Licensing Specialist
°E. Ewing, General Manager, Plant Support
°S. Quennoz, General Manager, Plant
°R. Gillespie, Technical Analysis Superintendent
°D. Eichenberger, Maintenance Coordinator
°R. Turner, Plant Projects
°K. Wire, Plant Projects
°T. Baker, Technical Support Manager
°R. Tucker. Electrical Maintenance Superintendent
C. Halbert, Engineering Supervisor
D. Provencher, Quality Assurance Supervisor
C. Shively, Plant Engineeing Superintendent
B. McCord, Quality Control Supervisor
J. C. Garrett, Materials Management Superintendent

NRC

°+*W. D. Johnson, Senior Resident Inspector
°+*C. C. Harbuck, NRR Project Manager, ANO
*I. Barnes, Section Chief
*R. Haag, Regional Inspector
*L. Gilbert, Regional Inspector
*R. Taylor, Regional Inspector
°J. Gagliardo, Section Chief

*Denotes attendance at exit interview on March 4, 1988.
+Denotes attendance at exit interview on March 25, 1988.
°Denotes attendance at exit interview on June 10, 1988.

The NRC inspector also contacted other station and corporate personnel.

2. Followup of NRC Inspection Report 50-313/87-23; 50-368/87-23 (25578)

The subject inspection reviewed the licensee's quality verification activities. The quality verification organizations involved included Quality Assurance, Quality Control, and independent review groups such as the Independent Safety Evaluation Group. The purpose of the inspection was (a) to provide assurance that licensee quality verification organizations were effectively contributing to the identification, solution, and prevention of safety significant technical problems and deficiencies, and (b) to measure line management response to identified quality deficiencies. The subject inspection did not contain violations or deviations, but identified NRC inspector concerns and other findings. This followup inspection addresses the specific NRC inspector concerns and findings in the four areas (Plant Modifications, Maintenance, Plant Operations, and Corrective Actions) covered by the subject inspection.

a. Plant Modifications (two concerns)

The first concern related to the licensee's evaluation of a laminar indication in reactor coolant hot leg piping base metal as detected by ultrasonic inspection. This concern was resolved during the subject inspection, and no further followup was required.

The second concern related to a design calculation for the seismic support bracket of a high pressure injection pump recirculation line valve and motor operator. The concern was that one specified fastener could not be obtained. A substitution was made which deviated from the design calculation.

The original design calculation required mechanical properties (190,000 psi minimum tensile strength/ 170,000 psi minimum yield strength) which are not available, or practical, for seismic bolting applications. The design agent (Vogt) had modified a previous calculation, but had failed to modify the fastener mechanical properties.

The NRC inspector reviewed both the original and corrected calculations. The latter calculation specified equal to, or better than, ASTM A193, Grade B7. ASTM A193, Grade B7, in the subject size (1/4"-2 1/2"), specifies mechanical properties of 125,000 psi minimum tensile strength and 105,000 psi minimum yield strength, 16 percent minimum elongation, and 50 percent minimum reduction in area.

The licensee had installed "high strength" hexagon socket head cap screws (1960 series). The Industrial Fastener Institute book, Fastener Standards, Fifth Edition specifies (Page G-5, Note 17), surface hardness values of Rockwell C37 to C45 for the mechanical properties of the subject capscrews. The NRC inspector was not provided adequate data to determine the acceptability of these fasteners for this seismic design application. The equivalent tensile strengths for the above specified hardness values are 170,000

to 217,000 psi. Alloy steel materials of this range of mechanical properties are relatively nonductile. They would not meet the ASTM A193, Grade B7 requirements of 16 percent minimum elongation and 50 percent minimum reduction in area. The design mechanical properties (ASTM A193, Grade B7) should assure that the cap screws can meet required dynamic seismic loads.

The licensee stated that these installed capscrews were too small to be tested for mechanical properties. Failure to insure that installed socket head capscrews met the design requirements of ASTM A-193, Grade B7, is an apparent violation of 10 CFR Part 50, Appendix B, Criterion III, for design control, which requires licensees to establish measures to select and review for suitability of application materials, parts, and equipment that are essential to the safety-related functions of structures, systems, and components (313/8805-01).

b. Maintenance (two concerns)

(1) Concerns

The first maintenance concern related to the effectiveness of the licensee's corrective actions to prevent recurrence of Emergency Diesel Generator (EDG) fuel degradation reported by Licensee Event Report (LER) No. 50-368/86-014-00.

The licensee's corrective actions were effective to prevent recurrence of the exact failure mechanism. The NRC inspector identified, however, other related potential problems as follows:

- The Technical Specification (TS) for EDG fuel quality requirements does not address significant potential fuel degradation factors such as gum and oxidation products related to the duration of fuel storage.

- ANO Unit 1 EDGs each had a simplex (single in-line) filter, in lieu of duplex (double) filters. With duplex filters, either filter could be placed in service if one became clogged. This helps assure continuing EDG operability.

- Site fuel quality was not related to filter capacity to assure EDG operability. Specifically, the licensee could not provide data that site fuel quality would assure that Unit 1 EDGs could accomplish a design base run without clogging each unit's simplex filter. This could cause both units to stop. Failure of both EDGs is an unanalyzed condition.

The licensee had instituted an enhanced EDG fuel testing and a periodic refiltering program. Southwest Laboratory had completed a study of EDG fuel for the licensee.

This will remain an open item (50-313;368/8805-02) pending review of the licensee's final EDG fuel quality program and analysis of the Unit 1 simplex filter installation for its affect on EDG operability.

The generic aspects of the EDG fuel concern are included in a Memorandum from J. H. Milhoan to D. M. Crutchfield dated April 8, 1988; Subject: EMERGENCY DIESEL GENERATOR FUEL DEGRADATION DURING EXTENDED STORAGE.

The second maintenance concern related to a review of the licensee's corrective action in response to LER No. 50-368/86-012. This LER reported an inoperable Unit 2 pressurizer code safety valve which was found to have a set point considerably above the value permitted by TS.

Incident to the review, the NRC inspector identified that the code safety valves' body-to-bonnet stud bolt design was of a type previously identified as prone to failures during dynamic loading. Additionally the installed stud bolts were not in accordance with ANSI standard B16.5, "Stud Bolts for Pressure-Temperature Piping." The applicable American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code revision did not require analysis of this joint according to licensee personnel. This item is closed based on the Memorandum from J. W. Roe to C. E. Ross, dated December 2, 1987, that requested an NRR review of this concern as a generic issue.

(2) Additional Findings

In addition, the Maintenance Section of the report contained findings related to licensee actions with regard to Licensee Event Report (LER) No. 50-368/87-003 (Pressurizer Heater Rupture), QA-Audit designated QAP-11-86 (Loose and missing EDG turbo-charger bolts), Reports of Abnormal Conditions (RACs) 2-85-315 and 2-85-316 (EDG fuel line leak), and RAC 2-86-043 (stripped EDG fuel drain line fitting). Followup on these findings were as follows:

(a) Pressurizer Heater Rupture

As stated in Inspection Report 50-313;368/87-23, the root cause of the rupture was determined to be an apparent weakness in the licensee's vendor audit and surveillance program. The NRC inspector reviewed the 1988 printout of actual and scheduled vendor audits and surveillances, as

well as 1987 and 1988 manpower allocation for vendor audits and surveillances.

Site involvement has increased from 0.25 equivalent man-years to 3.1 equivalent man-years (4.1 by July 1988). Overall manning in 1987 and 1988 for vendor activities was identified to be as follows:

	1987	1988
AP&L personnel	2.75	7.1
Contract personnel	3.5	1.2
Total	6.25	8.3

During a subsequent inspection, the effectiveness of the licensee's vendor audit and surveillance will be reviewed. This review will include an analysis of licensee identified root causes of vendor responsible problems, and the root causes of receipt inspection rejections to verify that licensee vendor controls are effective.

(b) Loose or Missing EDG Turbo Charger Bolts

This finding related to loose or missing bolts. Based on interviews with licensee personnel, the NRC inspector found that only one bolt was affected. This finding is considered closed.

(c) EDG Fuel Line Leak

This finding related to licensee RAC Nos. 2-85-314 and 2-85-316, which identified a leak in a copper fuel oil supply line for EDG 2K4B. The leak was a potential fire hazard and an operability concern. The NRC inspector obtained the licensee's documentation of corrective actions taken.

The RACs had been closed without a determination of root cause, or actions to preclude recurrence. The silver braze repair of the hole through the tube wall base metal had no documentation of acceptability. Specifically, there was no brazing procedure, no brazer qualification, no approved brazing rod or documentation of the type rod used, and no acceptance criteria (except that the repair not leak).

Licensee proposed corrective actions at the time of the initial NRC inspection included replacing the repaired line with a new line supplied by the original manufacturer, or replacing it with a flexible line.

During the present inspection, licensee personnel confirmed that no additional action on this condition had apparently been accomplished since the August 1987 NRC inspection. The repaired line was still installed without documented acceptability, including seismic evaluation. The root cause of this metallurgical problem, its generic implications, and actions to prevent recurrence had not been determined. Failure to take prompt corrective action is an apparent violation of 10 CFR Part 50, Criterion XVI, which requires a licensee to establish measures to assure that significant conditions adverse to quality are not only promptly corrected, but that the cause of the condition is identified and that action is taken to preclude repetition (368/8805-03).

- Stripped EDG Fuel Drain Line Fitting

This finding involved a reportedly stripped fuel drain line fitting that was a possible fire hazard. Licensee personnel stated that the subject fitting did not have stripped threads, but slightly damaged threads. These were repaired by use of a thread chaser. This finding is closed.

c. Plant Operations

No significant concerns were identified. The two findings which were related to Unit 2 Plant Protection System Cabinets and the Nuclear Quality (NQ) organization operational oversight observation program, were reviewed and the following findings were noted:

Unit 2 Plant Protection System (PPS) Cabinets

The May 12, 1987, NQ Surveillance Finding Report (SFR) No. 461 identified that the PPS cabinet power supply cover was only secured by 1 of 14 screws. Several screws were missing and the remainder were loose. Plant Engineering Action Request (PEAR) 87-1857, dated June 10, 1987, requested determination of the minimum number of screws required to maintain seismic qualification. The screws that were in place, but loosened, were tightened on-or-about June 5, 1987. At the time of NRC Inspection 87-23, on August 20, 1978, the missing screws had not been replaced. PEAR 87-1857 response had not been completed (determination of seismic qualification), and reportability had not been determined. NRC Inspection Report 87-27 updated the status of this finding as follows: Temporary replacements for the missing screws were installed on August 24, 1987. Remaining actions (completion of PEAR 87-1987 and reportability determination) were made an unresolved item (368/8727-01). This item still remained open at the time of inspection.

NQ Operations Oversight Observation Program

The report included only favorable comments about the NQ operations observation program, except for an apparent reduction in frequency. Licensee personnel stated that the observation program had been restructured to meld the NQ Surveillance Program into the audit program. Audits of this type increased from 1 in 1986 (program initiation) to 25 in 1987, and 28 from January 1, 1988 to the date of this inspection. This finding is considered closed.

d. Corrective Actions

During NRC inspection 50-313;368/87-23, closures of corrective actions were examined to assess their effectiveness. No significant concerns were identified in the area of corrective actions. The inspection findings included:

- In certain cases root causes were not identified
- In certain cases there was a lack of timeliness of determination of reportability
- In some cases there was a lack of timeliness in completion of actions to prevent recurrence.

The above general areas were generically covered in NRC Inspection Report 50-313;368/87-26 and in the licensee's response thereto. This finding is considered closed.

Another finding was lack of identified effective corrective action in Nonconformance Reports (NCRs) dealing with inadequate material control. The licensee in February 1988 initiated a Standing Order on Material End Use Authorization (3000.004). This Standing Order presently has an indefinite expiration date. It is intended to assure that all issued safety-related components, parts, and material meet plant design and quality requirements. This finding is considered closed. The Material End Use Authorization Program will be reviewed for effectiveness during a subsequent inspection.

3. Near-Term Followup to NRC Generic Letter (GL) 83-28, Temporary Instruction (TI) 2515/64, Revision 1 - Licensee Response to the Generic Implications of ATWS Events at the Salem Nuclear Power Plant (25564B)

The purpose of TI 2515/64 is to provide guidance for performing near-term inspection follow-up to NRC Generic Letter (GL) 83-28 "Required Actions Based on Generic Implications of Salem ATWS Events," July 8, 1983. The objective of this TI is to provide near-term inspection of the equipment classification, vendor interface, and maintenance programs for selected safety-related components within safety-related systems.

The NRC inspector began a performance oriented review of the licensee's response to GL 83-28. When the inspection began, the licensee could not provide a definitive status of their overall responses to this generic letter.

The NRC inspector selected the following three safety-related components to sample the licensee's response to the generic letter:

- Reactor Containment Building Cooling Unit Fan Motors (containment cooling fan Reliance motors)
- Reactor Trip Breakers
- Limitorque Valve Operators

These components were selected because of their safety significance, wide use in the plant, potential generic implications, and their potential failure modes. The findings are detailed below:

a. Reactor Containment Building Cooling Fan Reliance Motors and other Reliance Motors Qualified by Joy Manufacturing Company Report X-604

The inspection covered both ANO-1 and -2 cooling fan motors. The NRC inspector reviewed the supplier's (Joy Manufacturing Co.) Environmental Qualification (EQ) Documentation, the motor manufacturer (Reliance Electric) maintenance instructions, selected licensee maintenance procedures and maintenance history, selected licensee material control and issue documentation, selected ANO Plant Engineering Action Requests (PEARs), and other licensee procedures and documentation. This included all applicable environmental qualification documentation for Reliance motors which was so identified in the licensee's document control system.

(1) Background of Environmental Qualification Requirements for Containment Cooling Fan Motors, and all other Reliance Motors, Except Motors Qualified by Limitorque

10 CFR 50.49(e) requires that environmental qualification for components such as the ANO-1 and -2 reactor containment building cooling fan motors include and be based on temperature, pressure, humidity, chemical effects, radiation, aging, and synergistic effects.

10 CFR 50.49(f) requires that equipment such as the subject fan motors ". . . be qualified by one of the following methods:

"(1) Testing an identical item of equipment under identical conditions or under similar conditions with a supporting analysis to show that the equipment to be qualified is acceptable.

"(2) Testing a similar item of equipment with a supporting analysis to show that the equipment to be qualified is acceptable.

"(3) Experience with identical or similar equipment under similar conditions with a supporting analysis to show that the equipment to be qualified is acceptable.

"(4) Analysis in combination with partial type test data that supports the analytical assumptions and conclusions."

10 CFR 50.49(k) requires that equipment such as the subject motors further be qualified ". . . in accordance with "Guidelines for Evaluating Environmental Qualification of Class 1E Electrical Equipment in Operating Reactors," dated November 1979 (DOR Guidelines), or NUREG-0588 (For Comment version), "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment."

DOR Guidelines, Section 8, require that complete and auditable records must be available for qualification. These records should describe the qualification method in sufficient detail to verify that all of the guidelines have been satisfied. A simple vendor certification of compliance with a design specification should not be considered adequate.

The licensee identified Joy Manufacturing Company Environmental Qualification (EQ) Report No. X-604, "Qualification Testing of Joy Axivane Fan and Reliance Electric Motor for Class I Service for Nuclear Containment per IEEE 334-1974," dated April 6, 1977, as being the basis for environmental qualification of the subject containment cooling fan motors. There is a 1980 Revision of X-604 which was basically a format change.

(2) Equipment Qualification Concerns With ANO Units 1 and 2, Containment Cooling Fan (Reliance) Motors

The NRC inspector identified the following areas of significant concerns relating to equipment qualification of the subject fan motors:

- Undocumented modification of the motor insulation system
- Unapproved bearing replacement
- Mixing of greases
- Use of modified bearings

Details of these concerns are provided in the following paragraphs:

a) Lack of Documentation of Licensee Modification of the Electrical Insulation System of Qualified Motors

Joy Manufacturing EQ Report X-604 states for the electrical insulation system of the qualified motor, that the specific definition of materials used in the insulation system is considered proprietary. This data is on file at both Joy Manufacturing and Reliance Electric Companies, and is available for audit at these facilities on request. Page 4 of Report X-604 further indicated that Dow Corning Type DC 997 varnish was a component of the subject insulation system. Licensee procedures have permitted tne repair (modification) of the insulation varnish with unspecified varnish without documentation and without QA/QC verification. Licensee personnel stated that repairs had been made using GE Glyptol 1201 varnish. The licensee identified no documentation meeting the requirements of 10 CFR 50.49 for the maintenance of motor qualification using GE Glyptol 1201 to repair the qualified insulation systems for ANO-1 and -2 fan motors. Further, the NRC inspector in communication with Joy Manufacturing Company personnel identified the following concerns:

- The Joy Manufacturing Company representative stated that he was not aware of the practice of accomplishing insulation system repairs to Reliance Motors, and that Reliance Electric indicated that Glyptol 1201 might not be suitable for high radiation environments.

- The Joy representative stated that Reliance indicated that they knew of no data, based on tests, showing the compatibility of their proprietary insulation system and Glyptol 1201.

- The Joy representative further stated that Reliance indicated there were no generic criteria for adequate evaluation of damage to the insulation of their qualified motors, that Reliance approved personnel must make this determination; and that, basically, proprietary warranted repairs required to maintain qualification using Report X-604 could only be made at the Reliance factory.

b) Lack of Documentation of Approval of Licensee Bearing Replacement For EQ (Reliance) Motors

Joy EQ Report X-604 identified a bearing failure during the EQ qualification test because of an unauthorized field repair/bearing replacement. The report stated that no field repairs (bearing replacement) were to be undertaken on the subject motors. The licensee had subsequently disassembled and reassembled all but one of the subject motors for both Units 1 and 2, for bearing replacement.

Licensee maintenance procedures for Units 1 and 2 containment cooling fan (Reliance) motor bearing replacement were based on a Reliance Motor Bearing Assembly Procedure obtained in February 1979 from Joy Manufacturing Company. Neither the procedure, nor accompanying documentation, indicated that this procedure was applicable for EQ, or safety-related, Reliance motors.

The NRC inspector contacted a Joy Manufacturing Company representative concerning the acceptability of this procedure for bearing replacement on Joy (Reliance) containment cooling fan (and other) motors covered by Report X-604. The Joy representative responded that the subject procedure used by ANO was a commercial procedure and did not contain the requirements for EQ fan motors.

A licensee telecon dated October 24, 1984, with a Joy Manufacturing representative stated (with reference to motor disassembly and required bolt torques for reassembly) "The reliance motors are qualified equipment and they [Joy] do not recommend disassembly, since any disassembly in the field will void the equipment qualification."

c) Lack of Documentation of Qualification of Gulf High Temp Grease for EQ (Reliance) Fan Motor Lubrication

Joy Report X-604 documents that the subject fan motors were environmentally qualified using Chevron SRI-2 grease. Licensee procedures such as 1403.08, Revision 0, Change 2, "Reactor Building Cooling Fan Motor Inspection," have permitted the use of "High Temp Grease (Gulf)" as an alternate to SRI-2, and admixed with SRI-2. The licensee could not document that SRI-2 grease was onsite at ANO prior to 1984, except for one 35 pound pail. The licensee did not identify that this pail would have met lubrication

quantity requirements, or that grease gun control (including any gun-filling pump system used with the pail) were controlled to preclude admixture with other greases used onsite.

The licensee identified no documentation meeting 10 CFR 50.49 substantiating maintenance of Reliance motor qualification using either Gulf High Temp grease, or an admixture of Gulf and SRI-2 greases.

d) Lack of Documentation for Qualification of Site Installed Bearings in EQ (Reliance) Motors

Background

Joy EQ Report X-604 identified the qualified (Reliance) motor opposite drive end bearing as being a 95BCOZXPP3H bearing. The symbols "PP" designate a double shielded bearing.

Licensee Design Control of Bearing Lubrication

The NRC inspector requested a printout of all ANO warehouse stock ball bearings. A review of this printout, and discussions with ANO personnel, identified that ANO had not specified, or controlled, bearing manufacturer lubrication of double sealed or double shielded bearings until February 1988 when PEAR 88-036 was issued for bearing Baseline Qualification Requirements (BQR). This PEAR was the result of the End Use Authorization Program (see report paragraph 2.d) identifying this problem. Previous BQR PEARs for bearings, such as generic PEAR 83-1905, failed to discuss lubrication.

Lack of Documentation of Bearing Manufacturer Installed Grease

As a result, the licensee could not document the lubricant packed by bearing manufacturers in double sealed/double shielded bearings at ANO. These bearings had been manufactured in several countries and by various manufacturers based on the NRC inspector's review of bearings in warehouse stock at ANO. Most safety-related replacement bearings at ANO appeared to have been purchased as commercial grade items from a distributor who was not in the licensee's supplier quality audit program.

Licensee Modification of Bearings

Licensee personnel stated that replacement opposite drive end bearings for EQ (Reliance) motors were modified on site prior to installation by removal of one shield and relubrication with SRI-2 grease.

Licensee Procedures for Bearing Replacement

A review of the following ANO procedures for EQ (Reliance) motor bearing replacement was accomplished:

- 1403.08, Revision 2, dated January 09, 1985, "Reactor Building Cooling Fan Motor
- 1403.008, Revision 4, dated December 18, 1987, Unit 1 Containment Cooling Fan Inspection and Repair
- 2403.005, Revision 4, dated June 4, 1988, Unit II Containment Cooling Fans

These procedures:

- Did not require the use of bearings having any shields. (Bearing designations in procedures do not include the shield designator.)
- Did not require steel bearing retainers for EQ applications. (The retainer designator was missing.)
- Did not specify motor bearing tolerance. (The tolerance designator was missing.)
- Did not require (1) determination of the lubricant in "as received" replacement bearings, (2) shield removal if lubricant is not SRI 2, or (3) specify how to degrease bearings of other than SRI 2 grease.
- Did not identify which bearing shield to remove, or how to remove the permanent shield without damage to the bearing. Shield removal modifies flow of grease in the motor lubrication system, and grease retention by the bearing assembly.

The licensee document "Evaluation of Lubricants Used in Safety-Related Equipment Installed at ANO Units 1 and II" states:

If the soap bases of the two greases are not the same, they MUST NOT BE MIXED TOGETHER IN THE EQUIPMENT. The original grease must be completely removed from all lubricated surfaces using the manufacturer's recommended practices [there were none provided or identified to the inspector] before the substitute grease is applied."

Licensee Technical Justification for Bearing Modifications

The licensee document control system (reel 3682, frame 4878) contained a letter to the licensee from Schneider Engineers dated March 23, 1988. This letter states (in part):

"Discussion: The ANO Units 1 and 2 Containment Fan Cooler Motor Environmental Qualification is based on the tests reported in Reference 1 [Joy Report X-604]. The NRC has reviewed and accepted this document as evidence of qualification for plants licensed to both 10 CFR 50.49 and IE Bulletin 79-01B, of which ANO Units 1 and 2 are the latter.

"Attachment 1, Appendix E of Reference 1 provides a detailed description of the test motor including the bearings AFBMA designation:

DRIVE END (INBOARD): 95RUO2M3B

OPPOSITE END (OUTBOARD): 95BCO2XPP3H

"Per Reference 2 [Anti Friction Bearing Manufacturers Association (AFBMA) Standard 20-1977], the AFBMA translation of each identification number is as follows:

"Drive End: 95mm bore; cylindrical roller bearing, a single row, non-locating type, inner ring without ribs, double ribbed outer ring, inner ring separable; dimension series 02, 32mm width; cage, bronze or brass not in sheet strip or wire form, centered by rolling elements; internal clearance

greater than normal; special lubricant (e.g., Chevron SRI#2).

"Opposite End: 95mm bore; single row radial contact ball bearing, non-filling slot assembly; dimension series 02, 32mm width; any type cage acceptable, spacer when a bearing requires supplementary coding of special cage; permanently fastened double shield; internal clearance greater than normal; special lubricant (e.g., Chevron SRI#2).

"The qualified configuration, therefore, consisted of both an unshielded thrust bearing and a double shielded radial bearing. The post-test inspection documented in Reference 1 showed that despite the shields the chemical spray entered the bearing, but did not affect its operation. The shield is not intended to seal the bearing. The reported bearing failure was attributed to over tightening of the locknut. AP&L EQ evaluations caution maintenance personnel to this problem.

"The installed bearings differ slightly from the tested bearings due to the size differences between the tested and installed motors. However, the vendor has certified that the test is applicable to the installed equipment. Reference 3 [a Reliance document on 1983 series motor design] indicates that the qualified series of motors supplied by Reliance use conservatively rated bearings in an open system (unshielded). Also, Reliance utilizes a "grease channeling passage" with minimum grease path entry ("metering plate") and two means of preventing over greasing - grease reliefs and relief along the shaft. Reliance provides additional information regarding bearings in References 7 and 8 [Reliance Summary Reports].

"According to Reference 4 [a Scheidner Engineering report], which evaluated the installed bearings and lubricants for suitability to their potential environment due to postulated accident conditions, the bearing lubrication combination in the ANO Containment Cooling Fan Motors is qualified. Use of the ANO maintenance procedures and Chevron SRI#2 grease will maintain the bearings in "like-new" condition.

"Based upon the EQ test, motor and bearing vendor data and industry standard information, the use of bearings

with zero, one or two shields is considered acceptable in the CCF Motor application provided that maintenance procedures for inspection and lubrication, in place at the current time, are strictly enforced. As such, the current bearing configuration is considered environmentally qualified in accordance with IE Bulletin 79-01B and 10 CFR 50.49."

Concerns Relating to Licensee Bearing Modification

The NRC inspector confirmed with a Joy Manufacturing Company representative that the different bearing configurations (one shield, two shields, no shields) are based on overall motor lubrication system design, and analysis has not been made to support substitutions. The Joy representative stated that use of single shielded bearing in lieu of a double shielded bearing, depending upon which shield was removed, might have negative affects on bearing lubrication, and relubrication periodicity.

The NRC inspector determined from Joy Manufacturing Company personnel that there have been three different lubrication systems for EQ Reliance motors (which includes the configuration of the motor frame and housing). This fact was apparently ignored in the Schneider Engineering Letter.

- The latest (open) Lubrication system, design (reference 3 of the Schneider Engineering letter) apparently post-dates the ANO motors, and uses unshielded bearings. The open system allows unlimited addition of grease without unacceptable introduction of grease into the motor cavity by migration down the motor shaft. Reference 3 states: "This bulletin is not intended to provide operational instructions. Appropriate Reliance Electric Instruction Manuals and warning tags attached to the apparatus should be read carefully prior to installation, operation and/or maintenance of equipment." Appropriate Reliance Electric instruction manuals do not support the conclusions of the Schneider Engineering letter for the motors reviewed by the NRC inspector.

- The second system, apparently applicable to ANO motors, was designed to use double shielded opposite drive end bearings. Relubrication is specified by appropriate Reliance manuals as a few cubic centimeters (or ounces) of grease. This is required to prevent over-lubrication.

- The earliest identified lubrication system design consisting of one shield and a metering plate, is found in "General Specifications for Nuclear Motors used with Joy Axial Fans in Containment Areas," FF-12642 (Sheet 1) Revision NBN 883, dated March 27, 1971, (this specification was provided to the NRC inspector by licensee personnel) which states in Sections (4) and (5):

"4) Bearings shall be anti-friction ball bearing regreasable type, single shielded (inside) with metering plate for each bearing. [Note that the required shield (on which side it is installed) is identified.] Bearings to operate in a nuclear environment and under emergency conditions. See motor bill of material for bearing loads and B-10 Life.

"5) Grease to be Chevron BRB#2 [Predecessor of SRI-2] or equivalent (radiation resistant). Grease entry and relief openings shall be located on Frame O.D., 180° apart, with removable pipe plugs."

Lack of Documentation of Design Control of Licensee Installed Bearings

For replacement bearings purchased as double shielded and installed in EQ (Reliance) motors, The licensee had no documentation to show:

- That the "as received" bearings with unknown grease were not installed in some cases.
- That shields were removed without distortion or damage.
- Which shield was removed.
- That all as-received grease was removed after shield removal.
- That the bearings, after shield removal, were properly relubricated with SRI-2 grease.

Summary of EQ Concerns

In the examples detailed above (lack of documentation of qualification of Glyptol 1201, acceptability of bearing replacement procedures to maintain qualification; qualification of Gulf High Temp Grease, and qualification of replacement bearings), the licensee apparently did not meet the requirement of 10 CFR 50.49(j) for records of the qualification of ANO Units 1 and 2 Reactor Containment Building Cooling unit fan (Reliance) motors and other Reliance motors at ANO whose qualification is based on Report X-604. Failure to meet 10 CFR 50.49(j) is an apparent violation (50-313;368/8805-04).

This apparent violation is not addressed in the Notice of Violation issued with this report. The licensee is requested to be prepared to discuss all aspects of this violation, including all affected equipment and corrective actions taken, during a subsequent meeting with Region IV staff covering the Equipment Qualification Inspection of ANO performed July 14-18, 1986 (NRC Inspection Report 50-313;368/86-24).

b. Reactor Trip Breakers

The inspection covered a review of the licensee's Reactor Trip Breaker In-Service Inspection and Maintenance Instructions (1405.18, Revision 2; and 2405.18, Revision 2). The procedures were well written and contained many helpful illustrations. The NRC inspector witnessed the performance of the maintenance procedure for Unit 1 on a spare breaker used for training. The licensee had been involved in the efforts of the B&W owners' group to improve the trip breaker maintenance procedure. Presently recommended improvements were scheduled for incorporation prior to the next accomplishment of breaker maintenance.

c. Limitorque Motor-Operated Valve Operators

The NRC inspector reviewed licensee procedures for disassembly, assembly, and maintenance of Limitorque Valve operators, Models SMB-000 through SMB-4. This included review of licensee procedures as 1403.160, Revision 8; 1403.161, Revision 5; and 1403.162, Revision 7. The procedures were detailed and had many meaningful illustrations. These procedures contain approximately 60 pages of instructions, (compared to 2 pages of instructions in the Limitorque Type SMB Instruction and Maintenance Manual, Bulletin SMB/-82B). These licensee procedures were developed from those used by Limitorque field engineers (Babcock and Wilcox).

The NRC inspector reviewed the licensee's training facility for Limitorque maintenance and the initial training film on Limitorque maintenance. Both the facility and the film appeared to be effective.

The NRC inspector reviewed the licensee's actions related to NRC IE Notice (IEN) 81-08 on failed Limitorque keys. The replacement keys were in the licensee's storeroom, but had never been installed. There was no site procedure controlling keys for any SMB models. This concern will be reviewed further during a subsequent inspection.

4. Seismic Qualification of ANO Unit One Containment Cooling Fan and Motor Units

During his search of the ANO document control system, the NRC inspector was unable to identify documentation of seismic qualification of the installed Unit 1 containment cooling fan motor assemblies. Based on the extent of the search, which could not be completed because of time, this is an unresolved item (50-313/8805-05) pending completion of this review during a subsequent inspection.

5. Potential Improper Lubrication of Qualified Safety-Related and Environmentally Qualified (EQ) Reliance Motors

The NRC inspector reviewed selected archive records of corrective maintenance for Reliance safety-related and environmentally qualified motors. Among these was Job Order (JO) #00755814 for Unit 2 containment cooling fan motor for 2VSF-1B.

The work description discussed installation of the wrong grease (brown versus green) and the purging of motors with the proper (green) SRI-2 grease. Licensee Report of Abnormal Condition (RAC) 0-88-008 (not reviewed by the NRC inspector) and nonconformance report (NCR) 88-076-2 addressed this anomaly. Based on discussions with licensee personnel, apparently the brown grease was nonconforming SRI-2, which was subsequently recalled by the grease manufacturer.

The grease purging procedure identified on Licensee Job Order (JO) 00755814 failed to comply with Reliance lubrication procedures of ANO safety-related motors (see ANO manual TD R165.0120, Reliance Manual B-3645-4, dated February 1985, page 7, Table 3).

The licensee's practice of purging can result in overgreasing the Reliance Safety-Related Electric motors at ANO. NRC Information Notice No. 88-12 discusses this generic concern and cites examples of failures of containment cooling fan motors from overgreasing.

Pending further review by the NRC inspector during a subsequent inspection of the generic implications of nonconforming SRI-2 grease and of the use of grease purges for Reliance motors, this will remain an unresolved item (313;368/8805-06).

6. Unresolved Item

Unresolved items are matters about which more information is required in order to ascertain whether or not the items are acceptable, violations, or deviations. The following unresolved items were discussed in this report:

Paragraph	Item	Subject
4	313/8805-05	Seismic qualification of ANO Unit 1 containment cooling fan motor units
5	313;368/8805-06	Lubrication practices for safety-related Reliance motors

7. Exit Interviews

The NRC inspector met with licensee representatives (denoted in paragraph 1) on March 4 and 25 and June 10, 1988, to summarize the scope and findings of the inspection activities.