UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W.
ATLANTA, GEORGIA 30323

Report Nos.: 50-413/88-07 and 50-414/88-07

Licensee: Duke Power Company
422 South Church Street
Charlotte, NC 28242

Docket Nos.: 50-413 and 50-414 License Nos.: NPF-35 and NPF-52

Facility Name: Catawba 1 and 2

Inspection Conducted: February 1-5, 1988

Inspector: T E Conlon for 4/26/88
N. Merriweather, Team Leader Date Signed

Team Members: S. A. Alexander, Equipment Qualification and Test Engineer, NRR
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Approved by: T E Conlon 4/26/88
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Plant Systems Section
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SUMMARY

Scope: This special, announced inspection was in the area of Environmental Qualification (EQ) of Electrical Equipment and included a review of Duke Power Company's (DPC) implementation of the requirements of 10 CFR 50.49; plant walkdown inspections of electrical equipment within the scope of 10 CFR 50.49; a review of the circumstances and corrective actions relating to previously identified EQ deficiencies and a review of their evaluations of inspection findings on how they effect restart of Unit 2 and continued operation of Unit 1.

Results: Seven violations were identified and are discussed in Paragraphs 2, 3, and 6.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*D. Collings, Senior Engineer, Design Engineering Department
*M. Cote', Production Specialist II, Nuclear Production Department
*J. Cox, Catawba Training Manager, Production Training Services
*J. Crenshaw, Senior Engineer, Design Engineering Department
*C. Driggers, Supervisor, Design Engineering Department
*G. Gardner, Supervisor, Design Engineering Department
*G. Grier, Corporate Quality Assurance Manager
*S. Grier, Nuclear Production Engineer, Nuclear Production Department
*J. Hampton, Manager of Catawba Nuclear Station
*C. Hartzell, Catawba Compliance Engineer, Nuclear Production Department
*E. Hite, Maintenance Engineer
*R. Kovacs, Design Engineer - Instrumentation, Design Engineering Department
*J. Lanier, QA Engineer, QA Technical Services
*C. Little, System Technical Manager - Instrumentation and Electrical
*T. McMeckin, Chief Engineer, Design Engineering Department
*D. Owen, Principal Engineer, Design Engineering Department
*R. Prior, Vice President Design Engineering
*G. Smith, Superintendent of Maintenance, Catawba Nuclear Station
*R. Sokal, Technical Assistant, Design Engineering Department
*J. Stackley, Instrumentation and Electrical Engineer, Catawba Nuclear Station
*J. Thomas, Senior Engineer - Electrical, Design Engineering Department
*P. Voglewede, Supervisor, Design Engineering Department
*R. Weidler, Senior Engineer - Mechanical, Design Engineering Department
*M. Wilken Shoff, QA Engineer, QA Technical Services

Other Organizations

*J. Styslinger, EQ Engineering Supervisor, Georgia Power Company
*H. Vaught, Maintenance Engineer, Georgia Power Company

NRC

*K. Jabbour, Licensing Project Manager - Catawba, NRC, NRR
*T. Peebles, Section Chief, NRC, RII
*P. K. Van Doorn, Senior Resident Inspector, NRC, RII

*Attended exit interview

2. Exit Interview

The inspection scope and findings were summarized on February 5, 1988, with those persons indicated in paragraph 1. The inspector described the

areas inspected and discussed in detail the inspection findings listed below. No dissenting comments were received from the licensee. Subsequent to the inspection, two previously identified unresolved items have been determined to be violations of 10 CFR 50.49 (Item Nos. 50-413, 414/88-07-05) for failure to establish qualification of the MINCO Type RTDs for submergence and (Item Nos. 50-413, 414/88-07-07) for T-drains painted over or lack of T-drains on some inside containment Limitorque operators. In addition, one unresolved item concerning lack of traceability for tested versus installed Rosemount transmitters is now considered closed.

The following is a list of new items identified during this inspection.

Item Number	Description/Reference Paragraph
50-413/88-07-01	Violation, Licensee's EQ files did not support qualification of the four-to-one electrical tape splice used on the hydrogen recombiners in the Unit 1 containment. The installed configuration was not similar to the tested configuration in that the files demonstrated qualification for an in line one-to-one tape splice versus a four-to-one V-configuration tape splice, Paragraph 6.i.(19).
50-413, 414/88-07-02	Violation, The RCS wide range (hot and cold leg) resistance temperature detectors (RTDs) (model RdF) were not installed in accordance with the tested configuration. The bellows or hydrostatic hose assembly which encapsulated the RTD pigtail lead wires from moisture egress was removed during installation. Furthermore, the junction box where the RTD pigtail wires terminated was not qualified for submergence, Paragraph 6.i.(2).
50-413/88-07-03	Violation, The licensee had unqualified limitorque motor operated valves installed on both units in the Containment Air Return and Hydrogen Skimmer System (valve Nos. 1VX1A, 1VX2B, 2VX1A, and 2VX2B). The licensee had previously claimed that these valves were qualified for outside containment. However, the licensee could not support qualification for the use of these limitorque operators for either inside or outside containment because the operators were procured as non-safety, Paragraph 3.

50-414/88-07-04	Violation, The Joy Reliance fan motors used inside containment on the Hydrogen Skimmer fans did not have the breather-drains installed. This ~~appears not to be~~ is in accordance with the tested configuration and the licensee did not have an adequate evaluation in the file, Paragraph 6.i.(1).
50-413, 414/88-07-05	Violation, Licensee's EQ files did not support qualification for the Minco type RTDs in that the RTDs and associated junction boxes were located below the flood level inside containment. The file did not address submergence at the time of the inspection, Paragraph 6.i.(3).
50-414/88-07-06	Violation, The cover gasket on a Namco Limit switch (tag no. 2NCLL0251) was missing at one end. This configuration is not considered qualified, Paragraph 6.i.(18).
50-413, 414/88-07-07	Violation, Limitorque valves on Unit 2 were observed to have their T-drains painted over. Two out of the three limitorques inspected exhibited some kind of obstruction. A walkdown by the licensee identified further examples of T-drains obstructed or their ability to properly drain was uncertain. In addition, some limitorque operators located inside containment on Units 1 and 2 were discovered without any T-drains installed, Paragraph 6.i.(15).
50-414/88-07-08	Unresolved Item, T-drains on limitorque valve No. 2NI-122B were not installed at the low point. This configuration does not appear to be qualified, Paragraph 6.i.(15).

3. Licensee Action on Previous Enforcement Matters

(Closed) Violation 50-413/86-05-05, Use of Unqualified Limitorque Motor Operated Valves Inside Unit 1 Containment

The inspectors followed up on a previously identified Violation 413/86-05-05 which identified the lack of proper documentation for the environmental qualification of 1VX1A and 1VX2B, hydrogen skimmer fan isolation valves. The initial concern was that these motors operated

valves were intended for outside containment applications but were actually used inside containment. Duke Power Company Report No. SES-JR-45 dated June 15, 1984, discussed the variations between these outside containment motor operated valves and those intended for inside containment applications. The report concluded that the Class B motor insulation system was acceptable for inside containment use at Catawba based on previous testing conducted by limitorque on MOV's with Class B motors since the environmental parameters experienced by the Catawba actuators was less severe than that in the limitorque outside containment test. The following weaknesses were noted this methodology:

- Evaluation considered only the motor and did not include other electrical components such as torque switch, limit switch and termination means

- Effects of chemical spray not evaluated. Limitorque tests have shown that some outside containment materials are not acceptable in chemical spray environments

In addition, when the licensee was asked to verify that the MOV was indeed qualified for outside containment harsh environments he discovered the MOV's were procured commercial grade and that no documentation existed to justify their use in outside containment EQ applications. These MOV's were replaced in February 1986. As stated in previous Inspection Report No. 50-413/86-05 the use of these unqualified motor operated valves constitutes a violation of 10 CFR 50.49. However, Violation 413/86-05-05 will be closed out and a new number will be assigned to this violation, 413/88-07-03, Use of Unqualified Limitorque Motor Operated Valves Inside Unit 1 Containment. This problem also existed on Unit 2 Valve Nos. 2VX1A and 2VX2B.

4. Unresolved Items

Unresolved items are matters about which more information is required to determine whether they are acceptable or may involve violations or deviations. One unresolved item identified during this inspection is discussed in paragraph 6.i.(15).

5. Background

NUREG-0588 was issued in December 1979 to promote a more orderly and systematic implementation of equipment qualification programs by industry and to provide guidance to the NRC staff for its use in ongoing licensing reviews. The positions contained in that report provide guidance on (1) how to establish environmental service conditions, (2) how to select methods that are considered appropriate for qualifying equipment in different areas of the plant, and (3) other areas such as margin, aging, and documentation. In February 1980, the NRC asked certain near-term OL

applicants to review and evaluate the environmental qualification documentation for each item of safety-related electrical equipment and to identify the degree to which their qualification programs were in compliance with the staff positions discussed in NUREG-0588. The applicable requirements for Catawba Units 1 and 2 are - NUREG 0588, Category II.

A final rule on environmental qualification of electrical equipment important to safety for nuclear power plants became effective on February 22, 1983. This rule, 10 CFR 50.49, specifies the requirements to be met for demonstrating the environmental qualification of electrical equipment important to safety that is located in a potentially harsh environment. This rule also states that equipment which was previously qualified in accordance with NUREG 0588, Category II need not be requalified to 10 CFR 50.49.

To document the degree to which the environmental qualification program at Catawba complies with the NRC environmental qualification requirements and criteria, the licensee provided equipment qualification information by letters dated June 17, 1982, and February 7, February 8, April 25, May 14, and June 6, 1984, to supplement the information in FSAR Section 3.11.

The three categories of electrical equipment that must be qualified in accordance with the provisions of 10 CFR 50.49 are:

a. safety-related electrical (equipment relied to remain functional during and following design-basis events),

b. non-safety-related electrical equipment whose failure under the postulated environmental conditions could prevent satisfactory accomplishment of the safety functions by the safety-related equipment, and

c. certain post accident monitoring equipment (RG 1.97, Categories 1 and 2 post-accident monitoring equipment).

The staff reviewed the adequacy of the Catawba environmental qualification program for electrical equipment important to safety as defined above. The results of the staff's evaluations were documented in Safety Evaluation Report, NUREG-0954, Supplements 3, 4, 5 and 6 in Section 3.11. The status of the licensee's compliance to Regulatory Guide 1.97 for post-accident monitoring equipment is addressed in Supplements 4 and 5 of the Safety Evaluation Report for Units 1 and 2.

This inspection reviewed the licensee's implementation of a program to meet the requirements of 10 CFR 50.49 and corrective actions on previously identified EQ issues.

6. Findings

The NRC inspectors examined the licensee's program for establishing the environmental qualification of electric equipment within the scope of 10 CFR 50.49. The program was evaluated by physical inspection of EQ equipment, examination of the EQ files, interviews of personnel involved in EQ activities, review of procedures for controlling the EQ Master List, and examination of the licensee's maintenance program for maintaining the qualified status of the covered electrical equipment.

Although some significant EQ deficiencies were identified and are being considered for enforcement, the inspection team determined that Duke has implemented a program to meet the requirements of 10 CFR 50.49 for the Catawba Nuclear Station. The root cause of the deficiencies identified may be related to the lack of adequate EQ training for Catawba plant personnel. The area of EQ training is discussed further in paragraph 6.h.

A more detail review of maintenance; IE Notices and Bulletins; EQ procurement; EQ master list; EQ files and walkdown results are discussed in the paragraph's that follows:

a. EQ maintenance Program

The EQ maintenance program review was conducted by reviewing maintenance procedures, EQ maintenance requirements, equipment histories, and preventative maintenance schedules. The sampling also included work requests and replacement of equipment at the end of qualified life.

During the plant walkdown portion of the inspection, several EQ discrepancies were identified that could be attributed to inadequate maintenance practices. One maintenance related item was found on a NAMCO limit switch and is discussed in paragraph 6.i.(18). Another maintenance related item involved Limitorque actuators with T drains plugged with paint. This is discussed further in paragraph 6.i.(15). The cause for these and other maintenance EQ deficiencies appear to be the result of inadequate or lack of training provided to site personnel.

With the exception of the above discrepancies, the licensee has implemented an acceptable EQ maintenance program and, by strict procedure compliance, is maintaining equipment in a qualified state.

b. Inspection and Enforcement Notices (IENs) and Bulletins (IEBs)

IE Notices are handled by the Nuclear Production Department in accordance with Directive No. 4.8.1(s), Revision 0, "Operating Experience Program Description." The General Office Licensing section is responsible for any other NRC generated documents (i.e., Bulletins, Generic Letters, and etc.). Prior to 1987, the licensing section handled all NRC documents.

A walkthrough of the directive provided assurance that notices affecting EQ would be addressed properly. It also included discussions of how the various organizations and sections would interface to resolve any EQ issue.

Based on the review and walkthrough of the directive, it is concluded that the licensee has a program for distributing, reviewing, and evaluating IENs and IEBs relative to equipment within the scope of 10 CFR 50.49.

Specific IENs examined were: IEN 86-03, 86-53, and 84-90.

c. Environmental Qualification Master Equipment List

The methodology used by the licensee to determine which equipment items require qualification is detailed in Section II.4.5, Paragraph 4.1 of Design Engineering Department Manual, latest revision dated January 31, 1986. This procedure requires that safety-related equipment located in a harsh environment, as defined in the Environmental Qualification Criteria Manual, and required to mitigate the consequences of the accident causing the harsh environment be environmentally qualified. In addition, any safety-related or non-safety-related electrical equipment whose failure under the harsh environmental parameters experienced during design basis accidents, would degrade safety systems or mislead the operators are also required to be environmentally qualified. Post accident monitoring equipment located in a harsh environment is also covered as shown in Duke Power Company's response to Regulatory Guide 1.97.

The list of environmentally qualified equipment is contained in Duke Power Company, Catawba Nuclear Station response to NUREG 0588, document CNLT-1780-03.02. This document identifies the safety-related electrical equipment located in a harsh environment by generic type, manufacturer, and model number along with its worst case qualification requirements. Equipment specific tag numbers are listed in Tabs A through C of the Equipment Qualification Reference Index, document CNLT1780.03-1 (Rev 6).

Both documents are controlled and updated in accordance with the normal design control process.

To assess the completeness of the list, the Safety Injection System was selected for review. The following flow diagrams and the FSAR were reviewed to determine the system components such as Motor Operated Valves (MOVs), Solenoid Valves (SOVs), motors and instrumentation that are required to bring the plant to a safe shutdown condition:

CN-1562-1.1 Rev. 5
CN-1562-1.2 Rev. 5
CN-1562-1.3 Rev. 4

All items noted as requiring qualification were included on the licensee's equipment list. The only deficiency identified with the EQ master list related to a failure to identify some EQ equipment that becomes submerged during design basis accidents. This item is discussed further in paragraphs 6.i.(2) and 6.i.(3).

d. Cable Identification

During the plant walkdown the inspectors identified cable ID numbers from cable connected to EQ devices to the licensee so that traceability could be established to the cables identified on the EQ list. In all cases the licensee was able to identify the cable by manufacturer, cable type, manufacturer order number and cable reel number and could show the applicable test report for that cable type was included in their qualification files. No further questions were asked in this area.

e. EQ Equipment Replacement and Spare Parts Procurement

The Environmental Qualification Reference Index (EQRI) procurement section specifies the administrative controls applicable to the procurement of equipment within the scope of 10 CFR 50.49. It provides for the procurement of new equipment, direct replacement parts and components, and upgraded procurement in accordance with the requirements of 10 CFR 50.49(1). In addition, it provides administrative controls applicable to the procurement of commercial grade items and establishes limitations on their use.

Station Directive 2.4.1, "Purchasing of Materials, Labor, and Services" describes the procurement process and establishes requirements for performance of EQ Reviews of QA Condition 1 procurement documents. EQ equipment is procured as QA Condition 1 to ensure that quality requirements such as applicable tests and vendor-supplied quality records are specified on the purchase requisition. The QA organization reviews all QA Condition 1 procurement documents to verify inclusion of quality requirements on the procurement documents. Additionally, the requirements of 10 CFR 21 are imposed on these procurement activities.

Technical requirements for new procurements are defined during the design-engineering process. Information such as applicable specifications, drawings, codes and standards and EQ requirements are documented on the purchase requisition.

Upgraded procurement in accordance with the requirements of 10 CFR 50.49(1) are performed within the controls of the design-engineering program. Design Engineering Department Manual, Section II.4.9, "Equipment Replacement Summary Form", provides specific

guidance for documenting the process by which a determination is reached to upgrade EQ equipment. Additional guidance is provided in the EQRI, "Guidelines for Completing Spares Evaluation and Equipment Replacement Summary", for performing an annual evaluation to assess the need for upgrading spares and replacement parts. Reasons to the contrary are required to be documented on the form for procurement activities not in compliance with 10 CFR 50.49(1).

The procurement of commercial grade items for use in EQ applications is controlled by the nuclear station modification program. Specific guidance on the procurement of commercial grade items for use in QA Condition 1 applications is provided in Design Engineering Department Manual, Section II.4.1, "Nuclear Station Commercial Grade Evaluation." A Commercial Grade Items List consisting of a computer data base with three categories of commercial grade items have been established by licensee management. Responsibilities have been assigned to the Design Engineering organization for performing commercial grade item evaluations. Additional requirements for conditioning (i.e., dedication) prior to use and restriction in use of the various categories have been established.

The inspector reviewed purchase requisitions and/or purchase orders for various equipment types within the scope of 10 CFR 50.49. No EQ related deficiencies were identified.

f. QA/QC Interface

Pursuant to discussions with on-site QA organization personnel, the inspector determined that surveillances had been performed on plant activities with a potential for degradation of the environmental qualification of plant equipment. Typical of these surveillance is surveillance No. CN-87-16, Electrical Enclosures - Environmental Qualification. This surveillance was conducted from March 23 to April 3, 1987, and involved an assessment of the problem of improperly secured NEMA 4 electrical enclosures documented on Problem Investigation Report (PIR) No. PIR-1-C86-0061. Other PIR's and surveillance reports prepared by site QA personnel and/or Nuclear Production Department (NPD) personnel were reviewed to assess the adequacy of the corrective actions developed for EQ related problems. No deficiencies were identified during this review.

The Corporate QA organization performs audits of the Operational QA program in accordance with the requirements of the Technical Specifications. Interviews with staff members revealed that the following audit of the environmental qualification program were performed from July 22 - September 20, 1985, Audit No. SP-85-2 (GO), Environmental Qualification of Electrical Equipment. The scope of the audit included EQ records, station maintenance, personnel

qualification and training, procurement activities, station modification, document control and records management, and QA and QC inspections. Deficiencies identified and documented in the audit report for Catawba were discussed with licensee management. The inspector performed a review of selected developed corrective action plans for the identified deficiencies. No EQ related problems were identified during this review.

The inspector determined from additional discussions with licensee management that the audit schedule does not specifically provide for audit of the EQ program. Instead, EQ related activities and/or EQ program requirements are included within the scope of the audit if they fall within the performance area being audited. The following audits were reviewed by the inspector pursuant to this discussion; Departmental Audit SP-86-1 (MM), Material Control, and Departmental Audit DE-87-03 (ALL), Design Engineering. No violations or deviations were identified in this area.

g. EQ Modification Program

Station Directive 3.3.12, "Equipment Qualification Program," specifies the program established to ensure equipment within the scope of 10 CFR 50.49 is qualified, and assigns responsibilities to the Design Engineering organization for maintaining the EQRI (CNLT-1780-03.01 and CNLT-2780-03.01) through the station problem report (SPR) program.

Station problem reports may be dispositioned within the controls of the nuclear station modification program. The Nuclear Station Modification Manual, revision 5, is the controlling procedure for the preparation and implementation of Design Change Packages (DCPs) prepared by either the site engineering organization or the corporate engineering office. This manual specifies the design controls that ensure applicable regulatory requirements and design bases are correctly translated into specifications, drawings, procedures, and instructions to form a DCP. Considerations of the environmental qualification requirements of equipment to be installed via a design change is included as a design input to the design process.

The Design Engineering Department Manual, Section 11.4.5, "Environmental Qualification of Electrical Equipment", and Catawba's Environmental Qualification Criteria Manual provide specific guidance to the responsible engineer regarding environmental qualification considerations such as equipment location and environmental parameters. The design process further provides for the update of vendor technical manuals and shop drawings upon implementation of a DCP. The Environmental Qualification Reference Index (EQRI) which specifies maintenance requirements, replacement schedules, and other controls necessary to ensure continued EQ status is also updated to reflect equipment changes caused by plant modifications.

The inspector reviewed two design changes (Variation Notices Serial No. CE-1564, and CE-1237) prepared by the site engineering organization that involved EQ equipment. No EQ related deficiencies were identified during this review.

h. EQ Personnel Training

The Employee Training, Qualification, and Safety, (ETQS) program provides for training of craft personnel in specific task. The employee is trained to a procedure which is written to be task specific. Discussions with the Training Manager and other licensee personnel revealed that training in the requirements of Catawba EQ Program had not been provided to Nuclear Maintenance I&E, or site QA/QC staff members. The NRC EQ inspection at McGuire in July 1986 identified similar training deficiencies. Licensee management, as part of their corrective action, reviewed this inspection finding for generic application to other operating facilities. They determined that similar EQ training deficiencies existed at Catawba.

Review of an I&E working group meeting minutes dated November 4, 1987, showed that the EQ lesson plan developed for McGuire had been transmitted to Catawba for review by site personnel who would determine its applicability at their location. Additionally, from discussions with site personnel it was determined that the Catawba EQ lesson plan is scheduled to be completed by March 15, 1988.

The issue of providing EQ training to Nuclear Maintenance I&E and site QA/QC personnel was addressed at the exit interview and the need for timely corrective action was emphasized.

The Corporate QA organization performed an audit of the EQ program for electrical equipment during July 22, 1985 to September 20, 1985. The results of this audit are documented in Departmental Audit No. SP-85-2(GO) dated September 24, 1985. Audit finding SP-85-2(GO)(3) identified a deficiency in training of design engineering personnel. In response, the Design Engineering Organization committed to develop and implement a formal training class on the requirements of the EQ program. The inspector reviewed various correspondence on this subject and conducted interviews with engineering personnel. It was determined that engineering personnel had participated in Electrical Power Research Institute (EPRI) training sessions on environmental qualification of equipment. However, objective evidence was not presented to document implementation of the EQ training to which the Design Engineering organization had committed. A memo-to-file dated April 8, 1987, from R. J. Smith, Design Engineer, documents plans to establish an annual training program beginning in 1988.

Discussions with the Corporate QA organization personnel revealed that training in the requirements of the EQ program for McGuire, Oconee, and Catawba had been given by an outside consultant. This

training session titled, "Training Seminar on Equipment Qualification and Replacement Parts and Equipment," was given on December 7 and 8, 1987. Review of objective evidence further showed that select staff members from the Catawba site had also been trained in the requirements of the EQ program on August 26, 1986.

In summary, the licensee was aware of the weaknesses in the EQ training program for selective personnel and is now vigorously taking steps to improve their overall EQ Training Program to be more in-line with industry standards and NRC requirements.

i. EQ Documentation Files and Walkdown Items

The required qualification level for Catawba Units 1 and 2 original 10 CFR 50.49 scope equipment is NUREG 0588, Category II, "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment." The replacement equipment is required to meet the requirements of 10 CFR 50.49 or reasons to the contrary must be documented. The EQ documentation is composed of Master Equipment List (0588 Submittal), Environmental Profiles and the Central file. The Central File contains EQ Test Reports; Report Evaluation Checklists and Summaries; System Component Evaluation Worksheets (SCEW); EQ Component Lists with Maintenance and Procurement Requirements (EQRI); and other supporting documentation.

The licensee's generic EQ files were reviewed in detail against the requirements of the rule to determine if qualification had adequately been established and to determine if records were maintained in an auditable fashion. Some of the EQ files were found to be deficient requiring additional analysis to establish qualification. These deficiencies are identified as Violations 413/88-07-01 and 413, 414/88-07-05 and are discussed in Paragraphs 6.i.(19) and 6.i.(3), respectively. The inspection team considered item 01 to be fully qualifiable with the information developed during the inspection. Thelicensee provided supplemental information on item 05 subsequent to the inspection which indicated that this item may also be qualifiable. For more details on this item, see Paragraph 6.i.3.

The NRC inspectors examined files for approximately 20 equipment items, where an item is defined as a specific type of electrical equipment, designated by manufacturer and model, which is representative of all identical equipment in a plant area exposed to the same environmental service conditions. In addition to comparing plant service conditions with qualification test conditions and verifying the bases for these conditions, the inspectors selectively reviewed areas such as (1) required post-accident operating time compared to the duration of time the equipment has been demonstrated to be qualified, (2) similarity of tested equipment to that installed in the plant (e.g., insulation class, materials of components of the equipment, test configuration compared to installed configuration,

and documentation of both), (3) evaluation of adequacy of test conditions, (4) aging calculations for qualified life and replacement interval determination, (5) effects of decreases in insulation resistance on equipment performance, (6) adequacy of demonstrated accuracy, (7) evaluation of test anomalies, and (8) applicability of EQ problems reported in IEBs/IENs and their resolution. Although deficiencies were identified with the EQ Master List and EQ component qualification files, overall, a majority of the EQ files were auditable and documented qualification of the equipment. The following comments on both EQ records and walkdown items are considered the most significant findings.

(1) Joy/Reliance Fan Motors

During the review of the qualification file for Joy/Reliance fan motors, file CNM-1211.00-1009, the inspector noted in Section I.1.1 Part 5, Rev. 1 dated August 29, 1986 of the Equipment Qualification Reference Index that the installation/mounting of the Joy/Reliance Fan Motors be accomplished per reference document CNM-1211.00-1065. This technical manual, supplied by the vendor, requires the use of breather drains on the bottom of the main conduit box and the low point of the motor. During the walkdown of this equipment the inspectors noted that there were no breather drains installed on the Hydrogen Skimmer Fans for Unit 2 (Tag Numbers HSF 2A and HSF 2B). Further conversation between the licensee and the vendor on February 4, 1988, File No. CN-1211.00-19, show that the Reliance Fan Motors were qualified with the drain breathers installed and that in containment applications should have them. Normally, these devices are installed by the vendor prior to shipment. However, the licensee had to replace both motors after initial installation. Apparently, when the new motors were installed, the drain breathers were not removed from the old motors and put into the new motors as required. The failure to have adequate documentation in the file, at the time of the inspection, to support qualification of the fan motors without the drain breathers installed is a violation of 10 CFR 50.49 (K) and NUREG 0588, Category II, Section 5.(1). This item will be identified as Violation 50-414/88-07-04, Joy/Reliance Fan Motors not installed in accordance with the tested configuration.

(2) RDF Corporation Wide Range Resistance Temperature Detectors EQ File No. CNM 1399.03-0328

The qualification basis for these RTDs was NUREG-0588 Category II. Westinghouse's WCAP 8587 was used to qualify the RTDs.

The test conditions enveloped the plant requirements and the test specimens was similar to the equipment to be installed. The functional test did indicate that the insulation resistance

of the splice was on the order of 10 K-ohms (worst case). This insulation resistance resulted in a 8.57% error on the high temperature range (Duke Power calculations). The test specimens did not have a protective casing and were directly sprayed with water. This was the major cause of 10K-ohm reading. The RTDs installed at Catawba were supposed to have a protective casing consisting of a stainless steel bellows hose with a stainless steel overbraid which was to be terminated in a sealed enclosure. During the installation, however, the installer cut the steel bellows hose off and connected the uncovered RTD cables into the vapor tight box, thus, leaving an unsealed connection at the box. On November 5, 1987, it was discovered by a Duke Power engineer that Catawba Unit 1 Reactor Coolant System W/R RTD's cable termination junction boxes were not sealed. On November 13, 1987, following a review of the problem, the station management was notified of the possible inoperability of both units hot and cold leg W/R RTDs. Both Catawba units have operated in all modes of operation with the affected W/R RTDs being technically inoperable before corrective measures were implemented. This was reported to the NRC since the affected Units 1 and 2 W/R RTDs had been unknowingly technically inoperable in excess of the time limit specified in the technical specification (see LER 413/87-43).

In response to NUREG-0588 dated March 1984, Duke Power stated that the RTDs were hermatically sealed units with Flexonics Type 401 H stainless steel hydrostatic hose covering the RTD leads. Additionally, the RTD leads terminate to the field cables above the maximum post accident flood level thereby precluding a submergence problem with the RTD terminators.

A walkdown verified that the RTDs were not installed in accordance with the design drawings nor in accordance with the tested configuration in that the sealed bellows hose had been removed, the junction box was below submergence level, and the junction box was not adequately sealed. The failure to install the RCS wide range RTDs in accordance with the qualified tested configuration is considered a violation of 10 CFR 50.49. This item is being identified as Violation 50-413, 414/88-07-02, RCS Wide Range RTDs Installed in an Unqualified Configuration.

The problem that existed in Unit 1 RTD junction boxes has been corrected by completely filling the boxes with qualified epoxy (Scotchcast 9) and replacing the RTDs with new RTDs that have the leads covered with stainless steel bellows hose with a stainless steel overbraid. The epoxy filled boxes now completely cover the Raychem splices, thus reducing the possibility of any leakage current. The affected Unit 2 RTD junction boxes will be sealed with epoxy or replaced with environmentally qualified (sealed) junction boxes. It was

determined that the fix for these RTD junction boxes is fully qualified for their application at Catawba, after reviewing qualification documents supplied by Duke Power Company.

No findings were identified with the file for the W/R RTDs.

(3) Minco Resistance Temperature Detectors (RTDs), EQ File No. 1399.03-0357

The inspector reviewed the file for the Minco RTDs Numbers S8809 and S8810. The qualification basis was NUREG-0588 Category II. The Westinghouse WCAP Report 8587 was used to qualify these units. The test specimen was identical to the installed equipment and the plant profile was enveloped by the test. The minimum allowable insulation resistance measurements were within the range to guarantee a functional accuracy of 1.0°F.

Minco Model S8809 and S8810 Resistance Temperature Detectors (RTDs) are used for temperature/density compensation for the impulse lines of the reference and variable legs of the reactor vessel level indication system (RVLIS). The inspector was not able to physically examine the termination ends of these RTDs as desired due to time constraints. Therefore, the inspector requested Duke to provide documentation as to the location of the RTD junction boxes with respect to the DBE submergence level in their vicinity. Duke was unable to provide such documentation stating that there were no drawings that showed the exact installed location of the junction boxes for the Minco RTDs. Duke further stated that since the EQ documentation contained a letter from Westinghouse stating that the termination ends of these RTDs should be above flood level, Duke had purchased them with extra length of stainless steel sheathed mineral insulated cable to accommodate their installation above flood level. They also stated that a site engineer had personally supervised the installation of the junction boxes and routing of the RTD cable and termination ends to ensure they were installed above flood level.

Nevertheless, Duke reported subsequent to the inspection that they had walked down the RTDs and had found some junction boxes and termination ends below DBE submergence level. Duke also developed and provided to the NRC shortly after the inspection information that indicated that the Minco RTDs were qualifiable for submergence. After review of the information developed, the NRC inspector received verbal confirmation from Duke as to the results of the evaluation of the EQ test parameters being used with respect to Catawba DBE conditions including submergence and evaluation of EQ test performance data with respect to the functional performance requirements of the specific Catawba application of the RTDs. Duke determined that the tests were usable to support qualification of the RTDs for

submergence in that test performance data was acceptable for the plant specific applications and test environmental parameters enveloped Catawba DBE environmental parameters with sufficient margin with the exception that the temperature of the water in the long term water absorption tests at 160°F did not envelope the peak Catawba submergence water temperature of 190°F.

The overall approach to this qualification was a combination of type testing and analysis based on similarity of the RTD termination end to a submergence qualified conduit seal and on loss-of-coolant-accident (LOCA) and long term water absorption data on the wire of which the RTD external lead wires were made. Duke had compiled data that indicated that the predominant factor in determining the degradation of the wire's insulation resistance (IR) (the functional performance variable of interest) was temperature. The data indicated that identical and similar insulation materials of the same and different manufacturers consistently behaved similarly in terms of IR and variation of IR with temperature was consistent with that expected with the materials in question. The effects of submergence and water absorption were observed to be no more significant than LOCA effects except for temperature. Since the variation of IR with temperature was relatively predictable and there was consistent and bounding data from the RTD LOCA test, Duke determined the IR at 190°F analytically by interpolation between the data at 160°F and LOCA temperatures and noted that the IRs had been acceptable at LOCA temperatures for the application. This method of qualification provided reasonable assurance of satisfactory post-DBE submerged performance of the RTDs and after consultation with other knowledgeable NRC staff as well as NRC technical consultants, the inspector found it to be an acceptable approach.

However, the EQ documentation files at the time of the inspection did not have such additional data and analyses as it was not originally intended to show submergence qualification for the termination ends and external lead wires of the RTDs because they had been designed to be terminated in junction boxes above flood level. Having some RTDs terminated below flood level rendered the EQ documentation deficient in that qualification for submergence had not been demonstrated. This constitutes a violation of NRC regulations pertaining to EQ as specified below and is identified as Violation 50-413, 414/88-07-05, Inadequate Documentation for Qualification of Minco RTDs.

(4) Rockbestos Firewall III Coaxial Cable EQ File No. CNM-1354.00-0077

The qualification basis for this cable was NUREG-0588, Category II. The cables inside the Reactor Containment were second and third generation, with the third generation

qualification test report and the Rockbestos similarity analysis for second generation cables used for qualification. The plant profile was enveloped by the test conditions. No findings were identified.

(5) Brand-Rex Instrument Cable EQ File No. CNM-1354.00-0070

The qualification basis for this cable was NUREG-0588, Category II. The cables are used inside and outside the containment for power, control, and instrumentation. The file contained Franklin Test report F-C5120-4 dated January 11, 1982. The tested specimens had the same materials as the installed cable with an analysis to qualify other sizes of cable. The test conditions enveloped the plant profile. No findings were identified.

(6) Rockbestos Firewall (FW) III Chemically Cross-Linked Polyethylene (XLPE) Cable, EQ File No. CNM-1354.00-0069

The qualification basis for this cable was NUREG-0588, Category II. The cable specimens tested used the same insulation as the installed cables. The test conditions enveloped the plant requirements and the cable passed mandrel bend and high potential testing following the DBA. The package included the current Rockbestos test report. No findings were identified.

(7) Okonite Flame Retardant, Cross-Linked Polyethylene (XLPE) Cable EQ File No. CNM-1354.00-0063

The qualification basis for this cable was NUREG-0588, Category II. A number of different sizes are installed inside and outside containment. All cables installed inside containment are run in conduit. The installed cables are identical to the test specimens with the exception of sizes. The test environments enveloped the plant accident profile and the cables had satisfactory insulation resistance and all passed the withstand test. No findings were identified.

(8) Rockbestos Firewall III Irradiation Cross-Linked Polyethylene (XLPE) Insulated Low Voltage Power, Control, and Instrumentation Cable EQ File No. CNM-1354.00-0072

The qualification basis was NUREG-0588, Category II. One concern was identified with this cable file. The cable was listed as above flood level. However, during the review it was learned that the cable would be submerged. This issue was resolved before the end of the inspection changing the qualification documents to show that the cable would be submerged and placing submergence qualification documents in the file for this cable.

The current Rockbestos report on radiation XLPE cable was included in the file.

The plant conditions are easily enveloped by the test. The installed cables were identical to the tested cable. No findings were identified.

(9) Rotork Motor Operated Valve Actuator (Model NA-1, Pre-1978), File No. CNM-1205.19-65

The actuators covered by this file are qualified by a combination of type tests and similarity analyses in accordance with the requirements of NUREG-0588, Category II. The actuators are required to be operational for 10 days post-accident. The qualified life is 40 years with periodic surveillance of the oil.

Several concerns were discussed with the licensee and were adequately resolved. First, the EQ file was comprised of many individual test reports, rather than a single qualification document. It was not clear that the licensee had reviewed and approved all of these reports as the basis for qualification of the NA-1 actuators. The licensee explained that in order to comply with the requirements of IEEE 382-1972, Rotork undertook a complete qualification test program for a model 16NA actuator. The results were documented in TR-116 which became the parent document for various other test reports (43152-1, TR-334, TR-408, TR-222, TR-404, and TR-178). The combination of these test reports applies to the Rotork NA-1 actuators shipped to Catawba before 1987. The letters of correspondence between the licensee and manufacturer were included in the EQ file. The 3-tier signature approval sheet verified that the EQ file was complete. This was acceptable.

Second, the basis for qualification by similarity was not readily apparent. The licensee explained that all of the "A" range actuators are constructed of the same materials and are based on the same design. The electrical properties, stress levels, clearances, etc. for the 7NA through 90NA actuators are similar to the 16NA actuator that was tested. Applicability of the test reports as the basis for similarity was addressed in documents AE1/4 and NA1. These documents were briefly reviewed and found to be acceptable.

The walkdown inspection was performed on equipment tag number 2ND0002A. The actuator assembly was found to be partially disassembled; the covers were removed from the terminal box and switch enclosure, the motor was laying on its side on top of some adjacent pipes, and oil was spread everywhere. There were

no tags visible to indicate that work was in progress, although tools were found next to the valve. The manufacturer nameplate was read and found to match the master equipment list description except for the lubricant Nucleol 528.

The nameplate identified Nucleol 528 as the lubricant, although the electricians stated that Spartan EP150 was used for all Rotork actuators regardless of the nameplate. During the file review, the licensee provided the Rotork maintenance manual and Catawba preventive maintenance procedure for review. The review confirmed that Rotork recommends either Spartan EP150 or Castrol Nucleol 528 and that Catawba uses EP150 only. This was acceptable.

Internal inspection of the terminal box identified a concern that was resolved during the audit. There were six wires from field cable 2ND20 that were found to be cut off inside the terminal box. The cut ends of the wires were not taped over and the conductors were visible. The licensee performed an investigation and verified that the other end of the cable was grounded, and did not carry any load. This was acceptable.

The partial disassembly of the Rotork actuator for Valve 2ND2A was discussed with the licensee during the EQ audit. The licensee performed an investigation of this matter and issued a Problem Investigation Report (PIR 2-C88-0048). The progress of the investigation is summarized below.

The Rotork actuator was found with its motor completely separated from the actuator gearcase. The separation occurred at the bolted flange connection between the motor and gearcase. The bolt holes in the replacement motor flange are larger than the original motor. There was insufficient load bearing surface on the flange which allowed the motor operator to separate from the valve gear box when an extremely high (stall) torque was applied. The stall torque condition occurred after the torque switch had been jumpered out (personnel judgement error). All work on the valve was stopped at that time pending an investigation.

The licensee determined that the failure mechanism occurs if the valve is taken to stall conditions. The licensee evaluated the various valves using Rotork actuators and determined that the two valves (NV9 and NV10) with the highest potential torque are not vulnerable to this problem because they do not have the subject replacement motors. The investigation reduced the population of valves with the subject motor to two (1WL805A and 2NV89A). Both valves go to the closed position in an accident and are not required to reposition.

The investigation was still in progress at the conclusion of the EQ audit. The licensee will assess adequacy of the bolted flange connection and training of maintenance personnel. The licensee has discussed the matter with the NRC Resident Inspector, who will track the investigation. This issue has been transferred to the NRC Resident Inspector for tracking and closure.

No unresolved/open items were identified during the file review or walkdown.

(10) Rotork Motor Operated Valve Actuator (Model NA-1, Post 1978), File No. CNM-1205.66

The actuators covered by this file are qualified by a combination of type tests and similarity analyses in accordance with the requirements of NUREG 0588, Category II. The actuators are required to be operational for 10 days post-accident. The qualified life is 40 years with periodic oil checks.

The post-1978 actuators are nearly identical to the products shipped prior to 1978 except for the switch mechanism. The post-1978 design uses an electronic latching mechanism on the torque switch while the pre-1978 design uses a mechanical latch. Both switch mechanisms are made from the same material. Both switches have been tested to meet the required parameters.

The basis of qualification of the post-1978 actuators was a general test plan to meet the intent of the October 1978 draft of IEEE 382. Rotork undertook a complete qualification test program for actuator models 11NAZT1 and 90NAZT1. The results were documented in TR-4379-1, 43979-3, and 58364 for actuators shipped to Catawba after 1978. Additional test reports were included to address steam impingement and confirmation of operability for specified seismic loads. The qualified life (41.5 years) was determined by accelerated thermal aging tests (140°F and .8 ev activation energy).

The walkdown was performed on valve number 2NDO0037A. The nameplate was consistent with the EQ file data. Visual inspection of the terminal box and switch enclosure did not identify any concerns. The connections were secure, wires were labelled and in good condition; Rockbestos jumper wires were used, and the electrical cable connection appeared to be properly installed.

No violations or unresolved items were discovered during the file review or component walkdown.

(11) Rosemount Transmitter 1153 Series B, File No. CNM-1210.04-0262

The transmitters covered by this EQ file are qualified by a combination of type tests and similarity analyses in accordance with the requirements of NUREG-0588 Category II. The transmitters are required to be operational for 1/2-hour post-accident.

The 10-year qualified life was based on the results of thermal aging tests using 125°C internal temperature for 38 days and an activation energy of .78 ev. The Equipment Qualification Reference Index (EQRI) was reviewed and verified that the replacement and maintenance activities were consistent with the results of the qualification report. Several concerns were discussed with the licensee and adequately addressed. First, the licensee was asked to verify that the spare cable entrance is properly environmentally sealed. The Duke Power specification CNS-1390.01-0167 required the spare cable entrance to be sealed. The specification references the Rosemount instruction manual CNM-1210.04-0245 which includes the same sealing requirements. Second, Rosemount Report 108026 paragraph 15.4.1 describes a failure of the fill tube closure solder for the high static pressure housing. The recommended fix was to spot weld the fill tube. The licensee contacted Rosemount, who stated that the fill tube qualification fix was implemented prior to the sale of any high static pressure design units. The supplemental tests were completed and referenced in Rosemount reports 108025, Revision D, paragraph 7.1.9 and Report 88114. Due to limited review time these latter reports were not reviewed. However, the record of conversation between the licensee and the vendor, was reviewed and was acceptable.

The licensee's response to IE Notice 85-100 was reviewed. In it, the licensee stated that corrective action has been taken to compensate for the zero shift in transmitter output due to high static pressure. The new Rosemount instruction manual has already been issued for Catawba.

(12) Rosemount Transmitter Model 1153DB

A walkdown inspection was performed on two Rosemount 1153DB transmitters, namely tag numbers 2NVLT5740 and 2NVLT6070. The Catawba tag numbers were verified by the embossed metal labels attached to each transmitter. However, both manufacturer nameplates were missing. There were no marking to positively identify the model type as 1153DB. This concern was brought to the licensee's attention.

The licensee explained that the equipment tag number is a unique identification used for tracking all document records. Due to the limited audit time, the licensee was unable to present a review copy of the receipt inspection records which tie the manufacturer nameplate to the Catawba tag number. The licensee committed to perform a field inspection of the two transmitters to confirm the model type, to restore their nameplate data, and to survey a representative sample of all models of Rosemount transmitters to ensure that the missing nameplate concern is an isolated case. Subsequent to the inspection the licensee provided a copy of a Receiving Inspection Report which shows that the transmitters are model 1153DB4 which are qualified by their Master EQ List.

(13) Barton Transmitter Model 764 (BOP), File CNM-1210.04-0261

The transmitters covered by this file are qualified by a combination of type tests and similarity analyses in accordance with the requirements of NUREG 0588, Category II. The transmitters are required to be operational for 1/2 hour post accident. They are located in various harsh environments inside the auxiliary building, reactor building, and dog house.

The review of the EQ files included the following reports:

ITT Barton Report R3-764-9, "Class 1E Qualification Test Program and Results for ITT Barton Differential Pressure Electronic Transmitter Model 764," October 1982.

R3-764-11, "Investigation of 763 and 764 DBE Anomalies."

R3-764-16, "Investigation of Post-LOCA Long Term Severe Environmental Anomalies of Model 764, Class 1E Nuclear Grade Transmitters."

R1-764-57, "Post LOCA Severe Environment Test of Model 764," August 1, 1983.

R3-764-17, "Effects of Temperature on Model 764 during DBE (LOCA/HELB)."

R1-764-H2, "Accelerated Aging of Model 764," August 2, 1982.

Addendum to R3-764-9, December 9, 1983.

Several concerns were discussed with the licensee and were adequately addressed. First, as reported in Test Report FR-032175, the lead wire separated at the gland seal of the housing during the post-test examination of the transmitter. The recommended fix was to replace the 8-foot copper wire with stainless steel for added tensile strength and corrosion resistance. The licensee was asked to determine how these suggestions were incorporated into the qualification of the transmitters. The licensee determined that the test set-up method caused an unwanted pressure differential across the wire, forcing steam and water into the pin area of the gland seal and along the entire length of the wire. The installation at Catawba utilizes a physical discontinuity at the vessel pressure boundary, resulting in zero differential pressure along the wire. Therefore, the licensee considers that the stainless steel wire does not need to be incorporated into the transmitter design, qualification, or loop accuracy calculations.

Second, the test report R3-764-9 and Addendum showed that the ±5% error test acceptance criteria for the DBE 5-minute condition was not met. The licensee was asked to provide technical justification for acceptance. In reply, the licensee stated that all Balance of Plant (BOP) Barton 764 transmitters in a LOCA or HELB environment have a ±10% accuracy requirement for environmental effects.

The responses to IE Notices 81-029, 82-052, and 83-072 were reviewed and considered to be acceptable.

The leakage current calculations were reviewed and found to be acceptable. The impact of an increased instrument loop inaccuracy due to post-accident cable leakage has been assessed by the licensee for the setpoints used in the station emergency procedures. The pressurizer level instrument error was determined to have increased in the nonconservative direction. Due to the magnitude of the instrument error and existing error allowance, there is no urgent need to reverse the setpoints. The setpoints will be revised on a schedule consistent with the ongoing emergency procedure maintenance program. This is acceptable.

A walkdown inspection was performed on two Barton 386A transmitters, namely 2NILT5260 and 2NILT5270. The devices were identified by the manufacturer nameplate and Catawba equipment tag. The wire splices and cable attachment appeared to be properly installed. The Raychem splices were found to be bent in half to fit inside the conduit housing. Investigation of the Raychem splice qualification file determined that the installed configuration (i.e., small bend radius) was acceptable. The junction box for each transmitter could not be easily traced through the cable tray. However, it was observed that the cable trays and transmitters were located above flood level.

(14) Foxboro Pressure Transmitter Model N-E10 Series TX File No. CNM 1211.00-1792

These transmitters are located in mild and harsh environments in the auxiliary building. The transmitters covered by this file are qualified by type tests and similarity analyses to the intent of IEEE 323-1974 and 344-1975, in accordance with NUREG 0588 Category II requirements. The EQ file included the Wyle Test Report 45592-4 for Foxboro N-E10 series pressure transmitters.

A cursory review of the EQ file was performed. The file includes a statement of qualification by similarity on the basis of materials, mounting method, weight, dimension, center of gravity, and functional performance. A complete justification of similarity is provided in Foxboro Document Q0AAC012. This report was not reviewed for lack of time.

The licensee's response to IE Notice 85-52 was reviewed. The licensee stated that Foxboro Model E controllers are not used at Catawba.

The reviewer noted that radiation exposure for the annulus filter transmitters exceeded the qualification level 2.0E8 Rads. The licensee provided a letter summarizing a pinpoint radiation analysis for these transmitters. The highest Total Integrated Dose was calculated as 3.83E7 Rads. This was acceptable.

(15) Limitorque Motor Operated Valves, EQ File CNS-1205.19-00-0001

The file for Limitorque Valve Actuators SMB/SBD (containment-type) and SMB (outside containment-type) included the following reports:

- Limitorque Test report B0058, dated 1980.
- Limitorque Test Report 600376A (App. B), dated 1972.
- Limitorque Test Report 600456 (App. C), dated 1975.
- Limitorque Test Report B0003 (App. D), dated 1975.
- Limitorque Lubrication Data Form LC8.
- Limitorque Maintenance Form LC9.

In addition to the above test reports, the licensee supplied for review the following documents pertaining to EQ issues at Catawba:

- Significant Deficiency Report number SD 413-414/84-15, dated 7/6/84, and associated letters from Duke Power to the NRC dated 9/11/84 and 12/27/84.

- Duke Power maintenance procedures for Limitorque MOVs.

- Environmental Qualification References Index (EQRI).

- Duke Power internal letter concerning the resolution to IE Notice 86-71, dated 10/10/86.

- Limitorque Hookup Wire Functional Verification, Duke Power Test Report Number TR-076, (IE Notice 86-03 response).

- Installation Specification Manual, "Inspection of Jumper Wiring in the Limit Switch Compartment of Limitorque MOVs," dated 9/15/86.

During the review of the files the following issues were discussed with the licensee. Each issue/concern was resolved by the licensee and are presented below.

- Are motor brakes (Ding or Inertia) used on Limitorque MOVs at Catawba?

  No motor braking devices are used.

- Are T-drains and Grease Reliefs installed where required?

  T-drains not installed during initial installation were installed per Significant Deficiency Report 413-414/84-15. Subsequently the EQRI was revised to note the requirement to install T-drains during actuator installation. Actuators receiving grease reliefs are shipped with these reliefs already installed as required per the procurement orders. However, walkdown of limitorque operators on Unit 2 identified that paint had been applied over the drains.

- Address IE Notice 79-03 concerning the use of Beacon 325 lubricant in the main and intermediate gear boxes. Are there any actuators in an environment of _140°F that contain Beacon 325 lubricant?

  There are no Limitorque actuators installed in locations where normal (non-accident) temperatures exceed 140°F.

- What are the procedure for cycling the Limitorque actuators twice a year as recommended in test report B0058?

  All safety-related valves are cycled periodically (as allowed by nuclear safety or operational criteria) per the IWV program. Duke Power considers this item a recommendation rather than a necessity for environmental qualification.

- Are any motor or limit switch compartment heaters installed? If so are they de-energized?

  All heaters have been de-energized per the work request supplied in response to IE Notice 86-71.

- What type of internal wiring (jumpers) are used in the limit switch compartments?

  Duke Power has addressed this issue in their response to IE Notice 86-03. All internal jumper wire has been replaced with qualified Rockbestos or Raychem wire for in-containment MOVs.

- Are there any terminal boards used in the limit switch compartments?

  Inside containment Limitorque MOVs, that are required for long-term post-accident conditions, utilize terminal blocks in control circuits only (120 V). All other Limitorque MOVs are containment isolation valves and do not utilize terminal blocks. Raychem splices are used in place of connection boards.

- Have "Megger" tests been performed on the motors and leads?

  Megger tests were performed by the Construction Department during installation. Documentation is available at the station and was supplied to the inspector.

- Supply documentation identifying the type of cable used to replace unqualified wire (field run) in the limit switch compartment as stated in your response to IE Notice 86-03.

  Documentation was supplied showing that all unqualified wire installed in the MOVs have been replaced with qualified Rockbestos or Raychem wire.

- The worst-case radiation (TID) parameters for this environmental zone is 6.0E8 rads. The Limitorques are qualified to 2.04E8 rads TID. You have stated that pinpoint analysis is being conducted to demonstrate a lower required TID. Has this analysis been completed?

The MOVs in question are 1VE4, 1VE9, 2VE4 and 2VE9. An evaluation of the TID for these Limitorque operators was performed. The results of this analysis can be found in calculation # CNC-1229.00-00-0014, Rev. 10, page 2421. The results show that the worst-case is 1.9E7 TID.

- Provide justification for submergence requirements for in-containment Limitorque MOVs.

  The submergence question is resolved in FSAR, chapter 6.3, page 6.3.2.1. This states that there is sufficient time for them to close before being flooded. To prevent possible repositioning after flooding, the valves motor control circuits have been modified to prevent any spurious limit switch operation from repositioning the valves. Also breakers and fuses are coordinated such that, in the case of faults caused by submergence, the faulted valve circuits will be isolated without adversely affecting the upstream class 1E power sources.

During the plant walkdown the following Limitorque Motor Operators were physically inspected:

- 2KC364B, size SMB-00, with Reliance Motor class RH insulation.
- 2KC345A, size SMB-00, with Reliance motor class R insulation.
- 2VX001A, size SMB-000, with Reliance Motor class RH insulation.

The above actuators and motors were inspected to TI 2515/75 instructions. The only item of concern that was determined during the inspection of the actuators was the possibility of the "T-drains" being plugged with paint and not allowing water to drain as required. This was brought to the attention of the licensee as a generic concern. The licensee later performed an inspection of all limitorques on both Catawba units for plugged or missing T-drains. A total of 42 actuators were discovered with plugged T-drains or with T-drains not installed at all. Table 1 is a list of the affected tag numbers. Functional T-drains have since been installed on all the affected actuators. In addition, Duke performed an operability analysis to show that the limitorque operators could have performed their safety function. The root cause of these deficiencies (clogged and missing T-drains) appear to be due to inadequate training and procedures to ensure correct and complete T-drain installation and maintenance. To prevent recurrence the licensee

committed to the following corrective actions (1) the Construction and Maintenance Department will retrain painter craft by March 30, 1988, (2) Station I&E will revise procedures to clarify T-drain installation requirements by February 25, 1988, and (3) Station I&E will conduct formal T-drain installation training by March 30, 1988. This item is a violation of 10 CFR 50.49 for failure to ensure the as-built configuration was in accordance with the qualified tested configuration. This item is identified as violation 50-413, 414/88-07-07, Plugged or Missing T-Drains on Limitorque Valve Motor Operators.

One additional concern was identified regarding the installation of T-drains on Limitorque Motor Operators. During the walkdown T-drains on limitorque valve No. 2NI-122B were not installed at the low point. This configuration does not appear to be qualified. This item was identified to the licensee as Unresolved Item 50-414/87-07-08, T-Drains on Limitorque operator not installed at low point.

Table 1

Total List of Limitorque Actuators With Plugged or Missing T-Drains

1KC364B	1NM201A	1VX002B	2KC394A	2NC253A	2NV055A
1KC394A	1NV055A	1VE004	2KC413B	1NM187A	2VC007B
1NI115A	1NV066A	1VE009	2KC429B	2NM190A	2WL450A
1NI183B	1NV236B	1ND024A	2NC054A	2NM197B	2VE009
1NM007B	1NV035A	1ND059B	2NC250A	2NM200B	2VE004
1NM026B	1VF001A	1NI047A	2NC251B	2NM207A	2NM025A
1NM200B	1VX001A	2KC345A	2NC252B	2NM210A	2NI183B

(16) Conax Electrical Penetrations, Type N, EQ File CNS-1361.00-048-001

The qualification file contains the following Conax test reports:

- Report IPS-1037, Rev. D1, 10/31/83, "Design Qualification Report for Electric Penetration Assemblies for McGuire/ Catawba Nuclear Stations 1 and 2."

- Report IPS-1332, Rev. A, 2/18/86, "Design Qualification Report of 50 Ohm Triac Feedthrough Kits Installed in Electric Penetration Assemblies for Catawba/McGuire Nuclear Stations 1 and 2."

Two issues that were identified during the review of the file were discussed with the licensee and resolved prior to the conclusion of the audit. They were:

- The file did not contain documentation which determined the qualified life of the Conax Penetrations. This documentation was supplied in files CNM-1361.00-0062-001 (conax test report IPS-325) and an auditable trail was provided to the auditor.

- It was noted during the walkdown that Litton connectors were associated with the Conax Penetration enclosure box. The licensee was requested to provide documentation supporting the qualification of these connectors. The file provided was CNM-1354.12-0026-001, which included test reports: CE-NPSD-230-P, 4/83; CE-NPSD-275-P; and Retrofit report CE-NPSD-296-P, 5/85.

During the walkdown Conax Electrical Penetration 2PENT121 was physically inspected. It was observed that plastic caps were attached to the spare Litton connectors outside of the enclosure box. When the licensee was asked to justify this, the response was that they are for housekeeping purposes only. Environmental sealing is not required since the conductors are solid wire and the connector is potted. Moisture intrusion into the electrical penetration cannot occur. They also stated that the caps are not required for equipment qualification. Documentation was provided to the auditor to support the above statements. No other discrepancies or anomalies were identified.

(17) D. G. O'Brien Electrical Penetrations, Types F, G and K, EQ Files CNS-1361.00-0016-002, Rev. 6 and CNS-1351.00-0016-0003, Rev. 7

This equipment penetrates the wall between the inside of containment and the annulus to form part of the pressure barrier. These penetrations are actually installed on the inside of containment. The worst case environmental parameters in both the inside of containment and the annulus have been considered.

The qualification file numbers are CNS-1361.00-0002 and -0003 which contain the following test reports:

- D. G. O'Brien report number ER-252, Rev. A., dated 8/15/77, "Prototype Test Report Low Voltage Power and Instrumentation Electrical Penetrations."

- D. G. O'Brien report number ER-327, "Qualification report for Triaxial Connectors for Electrical Penetrations."

- Wyle Laboratories Report Number 45869-1

A cursory review of the qualification file for the D. G. O'Brien Electrical Penetrations was made. One item of concern that was addressed was how Duke Power responded to IE Notices 81-20 & 29.

The licensee's response was that the Type "K" electrical penetration plugs were tested at Wyle Laboratories (Wyle Report Number 45869-1). More emphasis was placed on accurately simulating the actual station environment under accident conditions. The qualification of the Type "K" electrical penetration plugs were reverified as documented in file CNM-1361.00-0016-001, pages 5-1 through 5-335, pages 6-1 through 6-91 and pages 7-1 through 7-25.

During the walkdown D. G. O'Brien Electrical Penetrations 2PENT105, Type F, 2PENT111, Type K, and 2PENT112, Type G were physically inspected. No discrepancies or anomalies were identified during the inspection.

(18) Namco Limit Switches, EQ Files CNM-1205.19-0042 and CNM-1225.00-0063

During the plant walkdown inside Unit 2 containment, the NRC inspector noted that the switch compartment cover plate gasket on a NAMCO Model EA 180 limit switch, plant ID No. 2NCLL0251, was improperly installed rendering the limit switch environmentally unqualified. The inspector confirmed that the switch was listed on the EQ master list as requiring qualification. No other NAMCO limit switches required to be qualified were observed to have improperly installed gaskets. This was identified as an unresolved item at the exit meeting pending determination of the safety function of the switch and the conditions under which it must perform that function. Subsequent to the inspection, Duke informed the NRC that the sole function of the switch was to provide open indication for normally-open reactor vessel head inner omega seal leakage detection line isolation valve 2NC° 25A. Duke stated that the switch provides non-essential position indication which will not mislead the operator. They further stated that the gasket had been promptly replaced (See Problem Investigation Report 2-C88-0054), that other limit switches had been inspected with no other deficiencies identified, and that an investigation into the cause of the improper installation was being initiated.

This is identified as violation 50-414/88-07-06, Unqualified Namco Limit Switch.

(19) Electric Hydrogen Recombiners, EQ File WCAP-7709-L

During the walkdown of the Unit 2 Hydrogen Recombiners, the splice configuration was questioned. The Unit 2 recombiners had a Raychem sleeve over the splice joint in what appeared to be a one-to-four configuration. The inspectors were told that the Unit 1 configuration was different and was actually a taped splice done in accordance with an engineering evaluation.

Investigation by the licensee on the Unit 2 recombiners showed that there was a qualified four-to-one Raychem breakout kit underneath the sleeve; therefore; the splice was found to be acceptable. The licensee also looked at the Unit 1 splices to measure seal lengths on the conductors. By using at least three test reports, the licensee was able to show that the Unit 1 splices were qualifiable. However, the qualification file did not demonstrate qualifiability and the licensee stated that the file would be corrected by the addition of the similarity analysis and several test reports. This is identified as Violation 50-413/88-07-01, Inadequate Documentation of Qualification of Splices for Hydrogen Recombiners.

(20) Raychem

The NRC inspector evaluated Duke's actions in response to IE Information Notice (IN) 86-53 (Improper Installation of Heatshrink Tubing) for Catawba in accordance with the guidelines of Temporary Instruction (TI) 2500/17. The inspector reviewed Catawba Nuclear Specification No. CNS 1390.01-0074, Rev. 20, dated February 14, 1988, for installation of Raychem heatshrink splice insulation. Duke stated that plant work and inspection procedures for installation of Raychem heatshrink tubing splice insulation are based directly on this specification. The Duke specification was found to be consistent with Raychem specifications. While the date of the current revision to the Raychem specification was quite recent, the acceptance criteria most often seen violated in the field had been incorporated in a revision prior to Revision 18, dated October 2, 1986, indicating that installation specifications consistent with manufacturer's specifications had been in effect no later than shortly after the issuance of IN 86-53 (July 1986).

The inspector then reviewed records of Duke walkdown inspections of Raychem splices in response to IN 86-53. The documentation indicated that splices had been chosen on a sample basis with the emphasis on the harshest environments and splices that records showed had been installed before implementation of the installation procedures in accordance with Raychem specifications. Duke personnel found that splices were either in compliance with Raychem qualified configurations or that deviations

from Raychem specifications were within the bounds of recent EQ testing of non-standard configurations sponsored by the Nuclear Utility Group on Environmental Qualification (NUGEQ) of which Duke is a member. Duke had incorporated reports of this testing in EQ documentation files for Raychem splices to demonstrate qualification for the as-found conditions, however they stated that many of the splices had been replaced anyway to provide extra margin and all replacement/new splices are done to the latest specifications. Duke further stated that no splices were found that were not qualifiable under the NUGEQ testing.

The NRC inspector's review of training documentation indicated that ETQS Training and Qualification Guide, Task No. IE-9025, "Stripping, Splicing, et. al., Wiring Class 1E Cables and Devices, Rev. 2, dated June 1, 1987, referenced installation procedure IP/O/A/3890/08C which was based on CNS 1390.01-00-0074, Rev. 20. Training and Qualification records indicated that the appropriate craft personnel had been trained in proper Raychem installation techniques and were qualified to Task No. IE-9025 by satisfactory performance and explanation of the referenced procedure.

7. Inspector Followup Item (IFI)

(Closed) IFI 50-413/87-20-02, Unqualified Wire in Annulus Ventilation (VE) System.

This item was opened as a result of a licensee review of the qualification file for the VE system. It was noted that the file required qualification of the wire to 8.0E6 Rads and the file showed qualification to 1.0E6 Rads.

The licensee provided a justification for continued operation in June 1987 which had information showing the wire needed to be qualified for only 2.0E5. Additionally, during the inspection, information was provided to show that the wire was actually qualified for greater than 8.0E6.

Based on the fact that the wire is qualified, this item is considered closed.