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

Report Nos.: 50-269/88-03, 50-270/88-03, and 50-287/88-03

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

Docket Nos.: 50-269, 50-270, and 50-287

License Nos.: DPR-38, DPR-47, and DPR-55

Facility Name: Oconee 1, 2, and 3

Inspection Conducted: February 22-26, 1988

Inspectors: Albert B. Ruff 5/12/88
A. Ruff, Team Leader — Date Signed

Team members and participating Inspectors:

J. Jacobson, NRR
B. Levis, RII
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C. Smith, RII
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Approved by: Norman Merriweather for 5/17/88
T. Conlon, Chief — Date Signed
Plant System Section
Division of Reactor Safety

SUMMARY

Scope: This special announced inspection was in the areas of Environmental Qualification (EQ) of electrical equipment. It included a review of Duke Power Company's (DPC) implementation of requirements of 10 CFR 50.49 for Oconee Nuclear Station and an inspection of EQ electrical equipment. The initial Environmental Qualification of electrical equipment for Oconee Nuclear Station was required under IEB 79-01B (DOR Guidelines).

The program was evaluated by an examination of DPC qualifcation documentation files, review of procedures for controlling the EQ effort, and verification of adequacy and accuracy of the program for maintaining the qualified status of the applicable equipment at Oconee.

Based on the inspection findings, which are discussed in the report, the inspection team determined that DPC has implemented a program to meet the requirements of 10 CFR 50.49 for Oconee although some deficiencies were identified.

Results: Four violations were identified: (1) Inadequate Maintenance Procedures, Section 6; (2) Reactor Building Level Transmitter's Oil Level Not at Top of Instrument Termination Junction Box, Section 13.c.(3); (3) Similarity Analysis for Installed Cable to Tested Vendor Specimens Not Established in EQ Files, Section 13.c.(9); and (4) Similarity Analysis for Qualification of Installed Configuration for High Range Radiation Monitors Not Established, Section 13.c.(10).

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*R. L. Dobson, Design Engineering (DE)/Electrical (E)
*T. L. Edwards, DE/Mechanical Nuclear (MN)
*Bill Foster, Nuclear Production Department (NPD), Oconee Nuclear Station (ONS)
*Sherry Grier, NPD/General Office (GO)
*Paul Guill, NPD/Licensing
*Craig Harlin, Compliance Engineer, Oconee
*T. P. Harral, DE/E
*Don Havice, ONS, Instrumentation and Electrical (I&E)
*T. L. Jamerson, ONS/Maintenance Service
*Richard Ledford, ONS/Quality Assurance (QA)
*Clay Little, NPD/GO
*Bill McAlister, NPD-ONS-I&E
*Ted McMeekin, DE/E
*Fred Owens, Regulatory Compliance, Oconee
*R. G. Sokul, DE/E
*R. J. Smith, DE/E
*P. M. Street, ONS/Maintenance Services
*Al Sweney, NPD/ONS/I&E,
*M. S. Tuckman, Station Manager
*Mike Whisnant, PTS/I&E Production Training Services/Instrumentation Electrical
*S. H. Walker, DE

Other licensee employees contacted included craftsmen, engineers, technicians, operators, mechanics, security force members, and office personnel.

NRC Personnel and Resident Inspectors

*T. Peebles, Reactor Project Section Chief, Region II
*P. Skinner, Senior Resident Inspector
*L. Wert, Resident Inspector

*Attended exit interview

2. Exit Interview

The inspection scope and findings were summarized on February 22, 1988, with those persons indicated in paragraph 1 above. The inspectors described the areas inspected and discussed in detail the inspection

findings. No dissenting comments were received from the licensee except with regard to the similarity violation for cable files indicated below. The licensee considered that their Environmental Qualification Files were adequate in these areas. The following new items were identified during this inspection:

a. Violation 50-269,270,287/88-03-01, Inadequate Maintenance Procedures, Section 6.

b. Unresolved Item 50-269,270,287/88-03-02, Operability Evaluation Concerning Problem Investigation Report 87-0231, Section 12.

c. Violation 50-269,270,287/88-03-03, Reactor Building Level Transmitter's Oil Level Not at Top of Instrument Termination Junction Box, Section 13.c.(3).

d. Violation 50-269,270,287/88-03-04, Similarity Analysis for Installed Cable to Tested Vendor Specimens Not Established in EQ Files, Section 13.c.(9).

e. Violation 50-269,270,287/88-03-05, Similarity Analysis for Qualification of Installed Configuration for High Range Radiation Monitors Not Established in EQ File, Section 13.c.(10).

3. Licensee Action on Previous Enforcement Matters

This subject was not addressed in the inspection.

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 Section 12.

5. Electrical Equipment Environmental Qualifications (EQ) Program and Procedures Review

The inspectors reviewed procedures that are used to implement the requirements of 10 CFR 50.49. Individual procedures and instruction, are discussed in the report. Duke Power Company's Environmental Qualification Documentation Packages (EQDP) are prepared and controlled by Design Engineering in accordance with Section II.4.5, of their Design Engineering Department Manual, and Duke Power Company's Response to IE Bulletin 79-01B.

The management and staff at Oconee have been actively involved in the EQ program. In an effort to stay abreast of the changing trends in the industry, Oconee has taken additional actions to improve and enhance their program. The EQ program as it exists meets the requirements of 10 CFR 50.49.

6. Maintenance Program

EQ Maintenance requirements for the Oconee Nuclear Station are prescribed in the Equipment Qualification Reference Index (EQRI). The EQRI is supposed to call out all required maintenance to ensure equipment remains in a qualified condition. It is from these requirements that the procedure writers are to develop the procedures.

Although the requirements are in the EQRI, some items have been missed. The omissions were due to either a misinterpretation of how to use the EQRI and its references; or, the sheer mass of documents that must be reviewed and interpreted; or, a lack of meaningful communication between Design Engineering and the site; or, a combination of all of the above. Examples of maintenance not addressed properly in procedures are the missing requirement to ensure proper oil level in the Gem/Delaval Reactor Building Level Switches; failure to check for T-drains and grease reliefs on Limitorque actuators; and exceeding lubrication frequencies. These are examples of one violation, identified as 50-269,270,287/88-03-01, Inadequate Maintenance Procedures. Further discussion on the level switches is in Section 13.c.(3); and on the Limitorque actuators in Section 13.c.(4).

The maintenance requirement for lubricating the Westinghouse High Pressure Injection Pump in the EQRI is not spelled out. In the reference material, the vendor states that in order to assure the equipment remains qualified it is assumed that the vendor recommended maintenance program is being met. This is due to the fact that the motor was aged and irradiated without any lubricants and the LOCA test was with new lubricant. The vendor recommended a six month oil replacement frequency to ensure the motor is in "as new conditions".

The licensee's operations group was replacing the lubricant on an annual basis. This could not be verified prior to early 1986 due to missing records. An evaluation of the lubricant was in the qualification package to show a qualified life for irradiation of 40 years. Further evaluation by the licensee showed that the motor's qualifications had not been degraded while performing an annual replacement. The licensee committed to placing this information in the qualification package and to allow for a maximum of nine months between replacement.

The missing lubrication documents mentioned above were noted by a licensee audit 85-20, by NRC Inspection Report 50-269,270,287/86-16 and by licensee audit NP 87-20(ON). The lubrication program was taken over by maintenance around October 1987 and equipment has been or is scheduled to be lubricated under the new program.

While reviewing work history on Limitorque actuators, it was noted that grease reliefs and T-drains had been installed during the week preceding the inspection. This work was being performed due to a Problem Investigation Report (PIR) that was submitted in October 1987 but that was never

processed. No explanation was given for the PIR not being processed, however, it was re-issued during the inspection. The problem of missing grease reliefs and T-drains was discovered by an employee familiar with limitorques who was hired during 1987. The employee was reviewing procedures and noticed there were no checks for T-drains or grease reliefs. The limitorque procedures are undergoing review and revisions.

In order to have a better interface between the EQRI and the maintenance procedures, the licensee committed to an enhancement program to review EQ maintenance procedures to ensure all requirements have been properly translated from the EQRI to the procedures.

Overall the EQ maintenance program is acceptable. It is changing and improving as the overall maintenance program is being upgraded as a result of prior inspections. Procedure changes and transfer of responsibilities have taken place that should improve the program; however, further evaluation is required to determined the extent of the improvement.

7. IE Information Notices (IENs) and Bulletins (IEBs)

The program for handling IENs and IEBs at Oconee is the same as that at the Catawba Nuclear Station discussed in report 50-413, 414/88-07 and is acceptable. The responsibility for implementing this program was turned over to the Operation Experience Management and Analysis Section (OEMA) in July 1987. Since that time, there has been only one notice issued relating to EQ.

OEMA received IEN 87-66 in December 1987, and evaluated it per Directive No. 4.8.1(s). The recommended action was to route to Design Engineering and Maintenance - Parts/Materials Inventory for information only. It was then transmitted via a Report Transmittal Form as Problem Awareness Material which is "material that is disseminated for information only and consists of those items that are "nice to know", but which are not an immediate concern from the standpoints of nuclear safety, economic risk, and generating reliability." The notice should have been transmitted as Problem Avoidance Material with a reponse required. When the transmittal was received by Design Engineering, an engineer recognized the error and had a proper evaluation of the notice performed and documented.

The root cause of this problem is the lack of training in EQ to people who are responsible for reviewing material that is potentially related to EQ. EQ Personnel Training is discussed in Section 12 of this report.

IENs reviewed included: 78-04, 79-28, 79-03, 84-44 and 84-78. Other notices reviewed will be covered in other sections of this report.

8. EQ Master List

The original list of equipment requiring environmental qualification was submitted to NRC by Duke Power Company in their IEB 79-01B response for Oconee Station. The systems and components listed in this response were identified as those subjected to the environmental conditions resulting from a postulated LOCA or HELB inside the Reactor Building or a HELB outside the Reactor Building and required to function to mitigate the consequences of those accidents. Other systems and components which were subsequently considered and evaluated for harsh environmental conditions included those necessary for safe shutdown and those systems and components required to be installed as a result of Three Mile Island.

Since the original submittal, the Design Engineering organization had developed the Equipment Qualification Reference Index (EQRI), document OLT-2786-03.01, with latest revision dated May 8, 1987. This document serves as the interface between the design organization and the station personnel and identifies the specific components which are required to be environmentally qualified along with the necessary procurement, installation, maintenance and surveillance requirements which ensure that qualification will be maintained. Tabs B through S of the EQRI contain the specific equipment identification numbers of the EQ equipment and it is this list that the design engineering organization considers to be its masters list of EQ equipment. Since the EQRI is a design document, additions and deletions to the master list are controlled in accordance with the normal design control process.

To assess the completeness of the master list the Safety Injection System was reviewed. Specifically, the following documents 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.

OFD-101A-2.1 R8
OFD-101A-2.2 R4
OFD-101A-2.3 R2
OFD-101A-2.4 R9
OFD-101A-2.5 R5
OFD-102A-2.1 R3
OFD-102A-2.2 R4
OFD-102A-2.3 R1
Emergency Operating Procedure EP/1/A/1800/01 R7

All components noted as requiring qualification were included in the appropriate section of the EQRI.

9. EQ Modification Program

The Nuclear Station Modification Manual, Revisions 5, is the controlling procedure for the preparation and implementation of Design Change Packages (DCPs) prepared by either the corporate engineering office or the site

based Project Services group. Design controls have been specified that ensure applicable regulatory requirements and design bases are correctly translated into specification, drawings, procedures and instructions to form DCPs. Considerations of the environmental qualification requirements of equipment are included as design inputs.

Oconee Nuclear Station EQ Criteria Manual, Volume 1, Revision 10, provides specific guidance to the responsible engineer regarding environmental parameters applicable to buildings or rooms. Section 5.0 of this manual describes the environmental conditions for normal operation and post-accident operation for various locations within the plant. These environmental conditions are used as the basis for generation of procurement specification for equipment within the scope of a nuclear station modification. Additionally, Design Engineering Department Manual Section II.4.5, Environmental Qualification of Electrical Equipment, assigns responsibilities and describes the procedure for determining the environmental qualification requirement of electrical equipment. The design process further provides for the update of vendor technical manual and shop drawings upon implementation of a nuclear station modification. Maintenance of the environmental qualification status of equipment installed via a design change is assured through update of the Environmental Qualification Reference Index (EQRI) which specifies qualification activity requirements, e.g., maintenance and procurement.

A review of nuclear station modification packages NSM #ON-1294, revision 1 and NSM #ON-2304, revision 1; and Exempt Change OE-931 was performed. Because of the inadequate implementation of NSM #ON-1294, licensee management has enhanced the design-engineering program in the following ways. Project Services Manual Section 4.6, Nuclear Station Modification, has been revised to more clearly specify the requirements for review of installed design change packages. Additionally, Section 5.1, Design and Review of Modifications, has been revised to include requirements for referencing EQ related information on the engineering instructions for installed design change packages. No EQ related deficiencies were identified in the design-engineering program.

10. EQ Equipment Replacement and Spare Parts Procurement

Oconee Nuclear Station Quality Standards Manual for Structures, Systems and Components, Section 3.6, establishes the quality standard and specifies the criteria to be used for environmentally qualified electrical components. Equipment, parts or components within the scope of 10 CFR 50.49 (b)(1), (b)(2),or (b)(3) are classified as QA Condition 1.

Administrative controls for the procurement of new equipment, identical replacement parts and components, and upgraded equipment are specified in the EQRI, procurement section.

Administrative controls applicable to the procurement process are specified in Station Directive 2.3.1, Material Requisition. Requirements have been established for the EQ Coordinator to review requisitions prepared for procurement of environmentally qualified equipment. Additional requirements have also been established for a Qualified Reviewer to verify QA Condition level and storage protection. EQ equipment are procured as QA Condition 1 with the requirements of 10 CFR 21 imposed. These administrative controls ensure that applicable quality and technical requirements are specified for procurement activities.

Technical requirements, for new equipment/components to be added to the plant, are defined during the design engineering-process. Environmental parameters, as determined by equipment location in the plant, are provided by Oconee Environmental Qualification Criteria Manual. These parameters are delineated in procurement specifications with the requirements that the equipment is to be qualified to IEEE 323-1974.

Spare items, i.e., equipment/components/parts, are procured to the original or upgraded specification/requisition requirements. An annual spare parts evaluation is performed to determine the need for replacement equipment. Upon determination of a need for replacement equipment, a plan is formulated and documented on the "Spares Evaluation Form".

Replacement equipment is procured in accordance with the requirements of 10 CFR 50.49(1). Sound reasons to the contrary for not up-grading equipment qualification are documented on the "Equipment Replacement Summary" form. Upgraded procurement are performed within the controls of the nuclear station modification program and are processed similarly to new equipment/component procurements.

The procurement and use 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 has been established by licensee management. Responsibilities have been assigned to the Design-Engineering organization for performing commercial grade item evaluations. Additional requirements for conditioning prior to use, including restrictions in use of the various categories, have been established.

A review of six purchase orders for various equipment types was performed. No EQ related deficiencies were identified during this review.

11. EQ Personnel Training

The Employee Training, Qualification, and Safety (ETQS) program provides for training of craft personnel in specific tasks. The program requires that each craftsman be trained to a procedure prior to performing a task

that is implemented by use of that procedure. The ETQSs program does not provide for training of the craft in the basics of the Oconee EQ Program.

Discussions with the Director of Maintenance Training and other licensee personnel, revealed that a formalized training program for indoctrination of the craft in the requirement of the EQ Program had not been established. Licensee management stated that in a response to Internal Investigation Report (IIR) 087-41-1, "Procedure Violation Caused by a Management Deficiency in Failing to Provide Adequate Training for Craft Personnel to Properly Perform Oconee Nuclear Station Approved Procedures," a need was identified for a formalized EQ training program. A lesson plan is in the preliminary stages of preparation with a commitment date of March 18, 1988, for completion.

Interviews with staff members in the Project Services organization also confirmed that no EQ training had been provided to this group, other than those aspects of the EQ Program addressed in the Qualified Reviewer training course. Licensee management in the site QA/QC organization presented objective evidence in the form of attendance lists which verified that select members from this group had been provided off site training in the requirements of the EQ program.

Based on a review of deficiencies documented in Audit Reports and PIRs, it was determined that significant contributing factors are inadequacies in the work-site control process involving personnel-procedural interface and/or personnel-hardware interface requirements. The root cause for the problem documented on PIR 1-087-0231, and discussed in Section 9 (Implementation of NSM #ON-1294) of this report, has been correctly identified as inadequate craft training, i.e., inadequate personnel-procedural interface. In addition, lack of knowledge regarding EQ equipment requirements was apparent in the personnel-hardware interface, in that a potential moisture intrusion problem was not recognized by the craft for the pressure transmitters they had installed.

The licensee's accepted Operational QA Programs, Duke Topical Report (Duke 1-A) Amendment 11, Section 17.22; Station Directives 4.4.1, Training and Qualifications; and Station Directive 4.4.3, Qualification of Interfacing Individuals, requires that necessary training be provided to station employees to assure they will be equipped to perform their work assignments in a safe and effective manner. It was concluded that the problem documented on PIR-1-087-0231 is indicative of a programmatic breakdown in the EQ training of station employees. Timely corrective action through implementation of the EQ Program lesson plan subsequent to March 18, 1988 is required to resolve this licensee identified deficiency.

12. QA/QC Interface

Discussions with licensee management revealed that audits of the EQ Program had been performed by the Corporate QA organization. Departmental audit numbers SP-85-2(GO), "Environmental Qualification of Electrical Equipment", and VP-87-20(ON), "Maintenance and On-site Transmission" were

reviewed to determined the nature of the problems identified by the QA organization. In addition, an assessment was performed of the adequacy of the root cause analysis for identified problems, along with the adequacy of the developed corrective action plans. Based on this review the inspector concluded that appropriate corrective actions had been developed and/or implemented for the identified problems.

A review was performed of Problem Investigation Reports (PIRs) to assess the adequacy of the developed corrective actions, and the technical basis for determination of equipment operability status. One Unresolved Item was identified during this effort and is discussed below.

PIR 1-087-0231 documents the investigation of a deficiency identified with the installation of Unit 1 Reactor Coolant System (RCS) wide range pressure transmitters 1PT-21, 1PT-22, and 1PT-23. The pressure transmitters were installed on March 13, 1986, during implementation of nuclear station modification package NSM ON-12494. They were found on October 17, 1987, in an installed configuration not in accordance with design nor the EQ tested configuration. Specifically, the Construction and Maintenance Division (CMD) electrical crew did not use grafoil tape on the threaded pipe connection to the transmitter enclosure. In addition, they did not torque the threaded fittings to 150 inch-pounds as specified in the implementing procedure. The craft also changed the configuration of the installed transmitters by use of a 90 degree elbow between the transmitter and the field conduit connection.

The installation was corrected by the licensee on October 24, 1987. An evaluation was also performed to establish the operability status of the transmitters while in the non-EQ tested configuration. This operability evaluation, however, did not consider the primary failure mechanism which is terminal block leakage currents caused by a surface moisture film. Additionally, the operability evaluation did not include an analysis of the errors contributed by the terminal block leakage current to the transmitter loop accuracy. Further, a comparison of the transmitter loop accuracy, including leakage current error, was never made for the plant functional performance requirements, i.e., RCS Wide Range Pressure set points. These transmitters provide the signals for actuation of the Engineered Safeguards Protective System which is a 2-out-of-3 coincidence logic system.

Licensee management concurred with the inspector regarding the inadequacies of the operability evaluation. They committed to revise the evaluation in order to determine operability status of the transmitters from April 26, 1986, when the Unit entered the start-up mode, to October 17, 1987, when the improper installations were discovered. Pending completion of the operability evaluation by the licensee, and review for technical adequacy by the NRC, this is identified as Unresolved Item 50-269,270,287/88-03-02, Operability Evaluation Concerning PIR 1-87-0231.

13. Environmental Qualification Documentation Packages (EQDP) and in Plant Physical Inspection

a. Environmental Qualification Documentation Packages

System Component Identification Worksheets (SCIW) and System Component Evaluation Worksheets (SCEW) are part of the EQDP. The SCIW identifies all EQ electrical equipment per system for all three units and the SCEW provides specification and qualification requirements and the applicable references. In addition, a central part of the EQDP is the EQRI. A section of the EQRI identifies each specific type of qualified equipment by manufacture and model number. It also identifies the qualification activity requirements and references the documents which allows the Nuclear Production Department to maintain the qualification status of equipment. This document also has mandated maintenance/replacement requirements.

The NRC inspectors examined some 30 EQDPs for selected equipment types. In addition to comparing plant service conditions with test conditions and verifying the bases for these conditions, the inspectors selectively reviewed areas, such as; required post-accident operating time compared to the duration of time the equipment has been demonstrated to be qualified, similarity of tested equipment to that installed in the plant (e.g., insulation class, materials of components of the equipment, tested configuration compared to installed configuration, and documentation of both), evaluation of adequacy of test conditions, aging calculations for qualified life and replacement interval determination, effects of decrease in insulation resistance on equipment performance, adequacy of demonstrated accuracy, evaluation of test anomalies, and applicability of EQ problems reported in NRC IENs and IEBs and their resolutions. Most of our comments/concerns with these EQDPs were resolved or corrected during the inspection. Some of these comments/concerns and unresolved items are discussed in the following section c.

b. In Plant Physical Inspection

The NRC inspection team physically inspected 20 qualified components and selected field run cables. The inspection team examined characteristics such as mounting configuration, orientation, interfaces, name plate data, ambient temperature, moisture intrusion seals, splices, terminal blocks, internal wiring and physical conditions.

c. Comments on EQDPs and Plant Walkdown Items

(1) File OM 360-9-Joy/Reliance Fan Motor, Model No. 600276-3

The Joy/Reliance Fan Motors are used as Reactor Building Cooling Fan Motors. The file review for the motors showed that they are qualified to requirements specified in IEB 79-01B (D.O.R.

guidelines). Both the maintenance concerns and replacement plans were addressed in the file. During the walkdown inspection one Reactor Building cooling fan installation was inspected and no anomalies were noted.

(2) Rosemount Pressure Transmitters, Model No. 1153OD

The Rosemount Pressure Transmitters, Model No. 1153D recently replaced the Motorola Model No. 56PH. The transmitters are used to monitor Reactor Coolant Pressure (wide range). The qualification for these new transmitters were to 10 CFR 50.49 requirements which was supported by Rosemount Qualification Report D8300040 Volumes I, II & III Revision A and Wyle Lab Report 45592-3. During the walkdown inspection one installation was examined. The transmitter was properly mounted and sealed and no anomalies were noted.

(3) File OM-26&A-47 - Gem/Delaval Liquid Level Transmitters Model No. 60620 and XM-60625

The Gem/Delaval liquid level transmitters are used to monitor the reactor building (RB) wide range water level. The licensee stated that these units are qualified to 10 CFR 50.49 requirements by Wyle Test Report 45700-1. A review of the EQDP confirmed the licensee's position.

During a plant walkdown, two level transmitters were inspected. Both had low silicon oil level in their instrument termination junction box. This low oil level puts the instruments in a condition outside the as tested qualified condition. Since the qualification test had the silicon oil at the top of the junction box, this is a violation identified as 50-269, 270,289/88-03-03, RB Level Transmitter's Oil Level Not at Top of Instrument Termination Junction Box. The licensee stated that the additional silicon oil would be added on Unit 2 transmitters prior to restart and that they would check and fill the junction boxes as necessary on Units 1 and 3 at the next available outage. In addition, the licensee stated that they would revise the maintenance procedures to clearly state silicon oil fill requirements.

Since this condition could exist for Units 1 and 3, the licensee provided justification for continued operation in their Problem Investigation Report (PIR) 2-088-0033. This was evaluated and considered to be satisfactory.

(4) File OM-245-0979 - Limitorque Motor Operated Valves (MOVs) Model SMB/SB, Located Inside and Outside Containment

Test reports supporting equipment qualification of the Limitorque MOVs at Oconee to the DOR Guidelines are Limitorque Test Reports 100456, 600376A, Rev. B, 600198, B0003, F-C3271, and B0058, and the documentation contained in Duke File OM-245-0979. File review resulted in no open items/concerns.

Plant walkdown was performed on six Limitorque MOVs. Three are located inside containment and three are located outside containment. All are in the Reactor Building Isolation System. From the plant walkdown inspection and discussion with Oconee personnel, the following concerns were identified.

(a) Unit #2's HP-26, an outside containment dual voltage MOV, had a blind barrel crimp connector (nylon insulated wire joint) for the motor connection windings. The licensee stated that HP-26 was the only Limitorque MOV required to mitigate an HELB in the penetration room and that Limitorque Test Report B0003 envelopes the postulated accident environment in this area. All electrical connection for MOVs inside the containment are made by splicing and heat shrink tubing (No blind crimp connectors are used). Two dual voltage MOVs in the containment were looked at during the walkdown inspection and these were as the licensee indicated.

(b) Discussion with the licensee disclosed that some in-containment MOVs were shipped by limitorque and installed at Oconee without T-Drains and/or grease reliefs. The licensee discovered this problem in October 1987 and has corrected it in Units 1 and 2 and has committed to an inspection and installation (if necessary) of T-Drains and grease reliefs in Unit 3 at the next Unit 3 outage. The licensee's JCO states that all limitorque operated valves inside the containment are used for containment isolation. Containment isolation MOVs receive an ES signal and move to their safe position within a short time before temperature and pressure increases and no post accident operability is required of these valves to maintain safe shutdown of the plant. Based on the licensee position concerning containment isolation valves as stated above, and the fact that T-Drains were not installed in Limitorque Report 600198, the above is not being cited as a violation. The licensee is installing grease reliefs and T-Drains on these MOVs as a conservative measure.

(c) On Limitorque 2RC-5 a badly frayed jumper wire on the limit switch was observed. Prior to the exit meeting, the licensee initiated a maintenance order to replace this jumper and showed, through electrical drawings, that this particular jumper actually served a non-EQ function on the RC-5 actuator.

(d) On actuator 2HP-26, which is mounted with the limit switch cover down, thick oil (grease) was observed inside the cover and the limit switch itself appeared to have oil on it. the licensee committed to increase the surveillance and maintenance of the Oconee limitorque MOVs in an attempt to isolate and reduce oil leakage.

Typically, during the course of the Limitorque EQ audit, several generic concerns are addressed. The following is a brief discussion of these concerns and the Oconee resolution of each.

- In-Compartment Heaters (IEN-86-71) - Some inside containment and outside containment Limitorques at Oconee have in-compartment heaters but they are all fused and the fuses have been removed. Additionally, warnings have been placed at the fuse locations stating that fuses are not to be installed. Inspection of two typical electrical schematic drawings verified the heaters are de-energized via fuse removal.

- Actuator Operations Under Degraded Voltage - Oconee furnished documentation and representative sample calculations showing their limitorque motors are adequately sized to supply the required thrust (from MOVATs testing) at 80% rated voltage.

- Magnesium Rotors (IEN 86-02) - Oconee has six Limitorque MOVs with magnesium rotors. Four of these are administratively locked closed and the remaining two are not located in areas with the type of harsh environment necessary to degrade the MOVs.

- Unidentified Jumper Wires (IEN-86-03) - File investigation, interrogation of plant personnel, walkdown sheets, and maintenance/surveillance procedures showed only qualified wires to be present in the Oconee MOV compartments. Plant walkdown verified this.

- Degraded Insulation on Peerless DC Motors (IEN-87-08) - There are no peerless DC motors with the suspect Nomex-Kapton insulated leads installed at Oconee.

- Underrated Terminal Blocks (IEN-83-72) - Oconee has nearly completed an upgraded program in which all Limitorque terminal blocks inside containment are being replaced with Raychem splices. The only terminal blocks left are Marathon 300 which are environmentally qualified.

Finally, lubrication procedures were investigated. Only Exxon Nebula EP0 or EP1 is used in the main gear box; Mobile 28 or Beacon 325 is used in the limit switch gear box. Lubrication maintenance is performed at no greater than 24-month intervals. The six-month Limitorque recommended cycling of the MOVs for part coating and grease mixing is not performed at Oconee. Operating experience coupled with the fact that all MOVs are cycled as part of the Limitorque maintenance program at least once every 24 months justifies this position.

(5) File OM-337-0080-001 - Viking Electrical Penetration Assemblies (EPA)

Test reports supporting qualification of the Viking EPAs to the DOR Guideline requirements are Duke/Viking Qualification Test Summary for Electrical Penetration Assemblies, OM-337-0080-001, and the documentation contained in the EQ file. File review resulted in no concerns.

Plant walkdown was performed on Viking penetration tag numbers 2RX-C02, 2RX-D06, 2RX-C04, and 2RX-EF5. The first three were viewed from inside containment, the last (EF5) was viewed from the outside containment side. The outside terminations were via four terminal boards in EF5. The inside terminations were via amphenol connectors directly to the penetration leads. Both types are environmentally qualified for the harsh environment they are used in.

The plant walkdown resulted in one minor question. The junction boxes covering the amphenol connectors were not water tight and had holes in the top. Subsequent file review showed the environmental qualification testing was performed without the junction boxes installed so no moisture protection credit is taken for the boxes. They serve mainly for physical protection of the amphenol connectors. The inspector considers the Viking EPAs to be environmentally qualified for their use at Oconee.

(6) Cable Identification and Traceability to Cable EQDP

During the plant walkdown inspection, nine circuit numbers from field wires were collected from the various equipment inspected. The licensee was asked to identify and establish qualification of the cable, using the numbers provided.

The paper trail provided by the licensee for this identification/qualification is as follows:

(a) Connection diagram identifies the cable number serving the device.

(b) Cable sheets list the cable numbers, respective cable type number, and route.

(c) Purchase requisitions identify the vendor from whom the cable type was procured with the purchase order number.

(d) Vendors certify that cable procured on an applicable purchase order is environmentally qualified per the applicable test report. This vendor certification is included in the test report file.

The cable numbers that were traced to the applicable EQ test report per the above method during the Oconee EQ inspection audit were: 2EXSF2901, 2EMI112A, 2EXSF2903A, 2EMI110A, 2EXSF2903B, 2EXI210, 2EXS85A, 2EXS85B, 2EXS85C.

This exercise showed that the licensee was able to trace and establish qualifications for field cables.

(7) Moisture Intrusion Seals

A review of Duke Power Company report TR-069 was conducted. This report contained information relative to the environmental qualification of 3M Scotchcast Brand Resin No. 9 and Swagelok connectors. Basis for qualification was substantiated by Duke report CNM-1364.00-0007-001 where a connector assembly was subjected to a simulated Loss of Coolant Accident. The tested accident conditions were found to envelope the Oconee inside containment accident profile. The tested configuration allowed no moisture intrusion before, during, or after the LOCA test. The report qualified the connector-resin combination for all areas inside the plant except those that could be submerged.

Equipment subject to submergence qualification is based upon Duke report TR-063. In this report the 3M Scotchcast Brand Resin No. 9 was potted directly into a detector fitting. No Swagelok connectors were used. The report showed that this combination would perform acceptably for all postulated environments at Oconee including submergence.

(8) Raychem Splice Connections

A review was conducted of the Duke files relative to the qualification of a variety of Raychem Splice configurations. Qualifications was based on Corporate Consulting Report No. 86-1995 and Wyle Reports 17859-02P and 17859-02B. The Wyle reports demonstrated qualification of a number of splice configurations not in accordance with Raychem's recommended

installation instructions. All of the Raychem samples were shown to pass the EQ test. The tested conditions were found to envelope those expected at the Oconee plant. The combination of tests contained in this file provides a qualification basis for many types and variations of Raychem splice configurations installed at Oconee. Raychem splice connections were examined during the walkdown inspection. No unqualified Raychem splice configurations were observed during the walkdown inspection.

(9) Generic Cable File Similarity/Auditability Concern

None of the cable files reviewed included similarity analyses addressing installed equipment and tested vendor specimens. Additionally, most of the files did not specifically identify or describe plant installed equipment. For instance, all cable files except the Anaconda cables left out descriptions for installed cable insulation material, insulation thicknesses, formulation and other cable configuration information. The licensee was able to locate the similarity information in all cases and satisfied the inspector questions on each file. It was recommended that these analyses be included in the qualification files. The licensee took exception to this request. They considered that this type of documentation to be unnecessary. The term "similarity" was questioned, with apparent preference for such terms as auditability, traceability, file clarification or augmentation. The inspector found that similarity analyses, as required by all levels of EQ requirements (DOR, NUREG 0588, 10 CFR 50.49), were not in the files. There were no technical concerns with the written similarity analyses subsequently provided; however, since the files were incomplete at the time of the inspection, this is identified as violation 50-269,270, 287/88-03-04, Similarity Analyses for Installed Cables to the Tested Vendor Specimens Not Established in EQ Files.

The following is a sample of cable files reviewed:

(a) Brand Rex FR-XLPE Instrument Cable, File No. CNM-1354. 00-0070-001

The cable qualification basis is 10 CFR 50.49. Qualification is based on Franklin Report No. F-C5120-4 (for Brand Rex) dated January 11, 1982. The test profile enveloped plant accident environmental conditions. An Arrhenius analysis was provided to show one-year post-LOCA operability at 125°F. A 40-year qualified life was shown via Arrhenius analysis for accelerated aging conditions of 168 hours at 136°C. Cable performance was demonstrated with

- acceptable insulation resistance readings taken during the LOCA simulation. Test samples included a 2/c, 16AWG, 7 strand, 20 mil XLPE insulated, 45 mil Hypalon jacketed cable. The plant cable tag numbers did not provide enough information to fully identify installed cables. The licensee contact traced this cable information through the purchase order/Mill Power order/Brand Rex part number/Duke Power file number process and identified both 25 and 30 mil insulation thicknesses. No findings were identified other than that identified above.

(b) Samuel Moore EPDM/Hypalon Instrument Cable, File No. OM-0316-0198-001

The qualification basis is 10 CFR 50.49. The file included an Isomedix report of June 1978 and a Franklin Report No. F-C3683 dated November 1973. Tested cables included 1 and 2/c, 16AWG, 7 strand, 20 and 30 mil EPDM, 45 mil Hypalon. The licensee reports that only 20 mil EPDM/10 mil is installed in the plant (see first paragraph in Section 9 above). When questioned regarding which test report really establishes qualification, the licensee responded that the Isomedix report alone provided adequate data. Though both test reports tested cables similar to plant installed cables, the Franklin report includes questionable IR data. The licensee agreed to evaluate the need for the Franklin report and to possibly delete it from the qualification file. Test profiles in the Isomedix report enveloped plant requirements. Post-LOCA operability was met through an Arrhenius analysis. Insulation resistance values were marginally acceptable. The lowest value was used for instrument loop accuracy calculations for loops which include Samuel Moore cable. Aging conditions were adequate to demonstrate 40 year qualified life.

(c) BIW CSPE Bostrad 7 Instrument Cable, File No. OM-0316-0050-001

Qualification basis is 10 CFR 50.49. BIW Report No. 82E047, dated May 28, 1982, establishes qualification. Plant requirements were enveloped by the simulated LOCA environment. The 1-year post-LOCA operability period was analyzed by Arrhenius techniques. Tested samples included 7/c, 16AWG, 19 strand, 30 mil CSPE (Bostrad 7), 45 mil Bostrand 7 jacket. As discussed in the first paragraph of Section 9 above, the licensee verified installed configuration as 25 mil/45 mil thicknesses of identical material. Due to the low voltage application, the similarity response was accepted provided a summary is added to the qualification file. Acceptable insulation resistance data and other performance parameters were included in the test report.

(d) Brand Rex FR-XLPE Coax, File No. CNM 1354.00-0021-001

Qualification basis is 10 CFR 50.49. Qualification data is provided in Brand Rex (Franklin) Report F-C5120-2 dated September 2, 1980. After a lengthy discussion of traceability documentation, the licensee identified the installed plant cable as RG 59 B/U identical to tested samples of 60 mil XLPE insulation, Hypalon jacket. It was recommended that the licensee address this "similarity" information in the qualification package (see first paragraph of Section 9). Aging conditions established a 40 year qualified life at 90°C. The plant environmental requirements were adequately enveloped with acceptable margins. As in all the cable files, a post-LOCA operability Arrhenius analysis was provided. Insulation resistance readings taken periodically during the LOCA simulation were acceptable.

(e) Anaconda Control Cable, File No. OM-0316-0065-001

Qualification basis is 10 CFR 50.49. Qualification is based on Franklin Report No. F-C4350-3, July 1976. Five specimens of power cable and one control cable sample (7/c, 12AWG, 7 strand, 30 mil EPR, 15 mil/60 mil hypalon) were tested. In this case only, the file included a letter which identified the installed cable configuration (3/c, 12AWG, 19-25 strand, 30 mil EPR, 15 mil Hypalon and neoprene). In this letter, a similarity analysis was provided which included qualification of neoprene jacketed cable. The test report showed enveloping of plant environmental requirements and included an Arrhenius analysis for post-LOCA operability. Aging was analyzed to justify 40 year life. Insulation resistance readings and post-test withstand test results supported acceptable performance.

(10) Victoreen High Range Radiation Monitor (HRRM), File No. OM-0333A-0106-001

Qualification basis is 10 CFR 50.49. Qualification was based on Victoreen Report 950.301. Numerous problems plagued the test, resulting in a final qualified installation which required cables and connectors to be encased in hermetically sealed epoxied terminations and in sealed stainless steel conduit from the monitor to the containment penetration. The BIW cables (assembly 878-1) and sealants were specifically excluded from qualification by Victoreen, with reference made to other BIW qualification reports. To preclude the problems due to moisture

intrusion, electrical shorting and associated failures, the file included a termination procedure (#910077) as a modification to the test plan which documented the methods required to install these radiation monitors. When properly installed in accordance with this procedure, the test report demonstrated qualification. Plant environmental requirements are enveloped by the test. Operability and accuracy requirements are demonstrated in the report.

The plant walkdown observations of the actual HRRM installation showed that the installed configuration does not meet the tested configuration. The cables (Brand Rex Coax) run from the sealed monitor connections through open cable trays to the containment penetration. Though the terminations are sealed, this installed configuration is similar to interim configurations in the qualification test report which yielded unacceptable results. With very low operating current levels subject to adverse affects from comparable low leakage currents, the final test configuration, in the Victoreen Report 950.301, required isolation of cable and terminations from the LOCA environment.

The licensee provided letters, dated August 15 and August 26, 1983, that were sent to the NRC, and other documents that showed there were considerable problems in getting an operable HRRM system. The licensee could not get the initial installation of the HRRM system to work even in a non-hostile environment. The initial installations include the BIW cable supplied by Victoreen. A package of summarizing details for the final installed configuration of the Oconee operable HRRM system was provided. This included a connection procedure to the Victoreen detector that used Scotchcast 9 sealant in the Brand Rex Coax connector and Sylgard No. 186 in the connector at the monitor. The Brand Rex Coaxial cable was field routed via cable trays. The cable connection at containment Viking penetration was sealed with Scotchcast 9. The licensee claimed qualification per the Victoreen test report and Brand Rex qualification report.

No similarity analysis was provided comparing Brand Rex and BIW cable nor was the lack of conduit in the installed configuration addressed. No similarity analysis was made for termination seals and no analysis was made for the Viking EPA's or the Brand Rex-specific IRs and their effect on instrument accuracy. An installation-specific analysis of IR effects and functional and safety requirements of these monitors was requested, but because of time restraints the official Oconee approved loop accuracy calculation for the installed configuration could not be provided before the exit meeting. This item is identified as violation 50-269, 270, 287/88-03-05, Similarity Analysis for Qualification of Installed Configuration of High Range Radiation Monitor Not Established in EQ file.

(11) States Terminal Blocks, File No. OM-360-25

The inspector reviewed the file for states terminal blocks which are used in relatively mild, outside containment applications. The licensee stated and verified that terminal blocks are associated with solenoid valves. The qualification basis is 10 CFR 50.49(k), and tested to IEEE 323-1971 requirements. Qualification is based on QTF Report No. TR-028 for McGuire Station, and supplemented by Gould-Brown Boveri #33-53729-05. The former report included tests for Stanwick, Buchanan, and States terminal blocks, model numbers M25104 and M25006 for the latter. Installed blocks were verified by the licensee as States model M25012. These are identical in material construction to M25006, except for the number of lugs (12 versus 6). Plant terminal blocks are installed in a vertical configuration. The licensee did not address either similarity or mounting orientation in the file. In the test, the polyprophylene barrier plates melted. Despite this, the terminal blocks still met test acceptance criteria and insulation resistance and leakage currents were adequate. Plant environments were enveloped with significant margins. Considering this and the relatively mild requirements, plus the satisfactory results of the test report, the similarity and configuration concerns were not pursued. The licensee agreed to document similarity, installation and application information in the file.

(12) Instrument Loop Accuracy Calculations

The instrument loop accuracy calculations for the following loops were reviewed:

- Calc. No. OSC-2578 (2/10/88) for Wide Range Reactor Building Water Level, LT90, 91.
- Calc. No. OSC-2651 (11/13/87) for Reactor Building Normal & Emergency Sump Level, ON-LWDLT113, 120; ON-LPILT 3P, 112
- Calc. No. OSC-2876 (2/18/88) for Core Exit Incore Thermocouples
- Calc. No. OSC-2609 (2/5/88) for Emergency Range Steam Generator Level, FDWLT 80, 81, 82, 83

When asked why other instrument loops associated with critical LOCA and post-LOCA functions were not included, the licensee responded that these were the only loops identified for long term post accident operability. The formal responses to R.G. 1.97 address other loops, some of which are currently being assessed for inclusion in the loop accuracy calculations.

A number of specific questions regarding the assumptions and analyses were posed and resolved as follows:

- Only four loops were included and analyzed in this package. The licensee responded that these were the only 1E applications involving EQ-related in-containment instrument loops needed for "long-term" post-LOCA critical monitoring. All other circuits are either associated with mild environments, not required for long-term operability (i.e., trip functions only), or not associated with "environments that produce leakage current inaccuracies". Additionally, R.G. 1.97 modifications will include loop accuracy calculations as appropriate.

- A number of specific technical questions were posed concerning values for particular elements from the Westinghouse methodology used in the loop accuracy analyses. In a telecon with corporate engineers in Charlotte, N. Carolina, all of these specific details were addressed, with a followup written response. All concerns were adequately resolved.

- One of the "partial" packages did not include the summary of the Westinghouse methodology analysis which was provided in other calculation packages. In the telecon, it was stated that an independent analysis of the total loop had been performed, though not provided. What was provided were the calculations specific to IR effects, which are made part of the total loop calculations. There was no need to review the calculations; what was needed was clarification of what analyses are done, where they are located, and how the various calculation sets are related and tied together. There was no technical concern which required further inquiry.