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

Report No.: 50-395/88-01

Licensee: South Carolina Electric and Gas Company
Columbia, SC 29218

Docket No.: 50-395 License No.: NPF-12

Facility Name: Summer

Inspection Conducted: January 11-15, 1988

Inspector: A. Ruff 4-20-88
A. Ruff, Reactor Inspector, Region II, Date Signed
Team Leader

EQ team members and participating inspectors:
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SUMMARY

Scope: This special, announced inspection was in the area of Environmental Qualification (EQ) of Electrical Equipment. It included a review of South Carolina Electric and Gas Company's (SCE&G) implementation of the requirements of 10 CFR 50.49 for V. C. Summer Nuclear Station (VCSNS) and an in-plant physical inspection of electrical equipment within the scope of 10 CFR 50.49. Because the plant was operating, the in-plant physical was not made on equipment in the containment. An in containment inspection of EQ equipment will made at some future plant outage.

Environmental Qualification (EQ) for electrical equipment at VCSNS was initially required to meet NUREG 0588 Category II requirements.

The Electrical Equipment requiring Environmental Qualification at Summer are qualified to the requirements of NUREG 0588 Category I or Category II. The NRC inspectors examined SCE&G's program for establishing the qualification of equipment within the scope of 10 CFR 50.49. The program was evaluated by an

examination of SCE&G's qualification 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 Summer.

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

Results: Three violations were identified: (1) Missed EQ Maintenance Requirements, Paragraph 6; (2) Insufficient Information in Qualification Files for Lubricants, Paragraph 13.c(1); and (3) Insulation Resistance (IR) Values for Performance Characteristics Not Properly Established in Environmental Qualification Files (EQF), Paragraphs 13.c(4) and (5).

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*S. H. Bailey, Associate, Manager Procurement Engineer
*C. W. Bowman, Manager Scheduling
*O. S. Bradham, Director, Nuclear Plant Operations, SCE&G
*S. G. Carroll, Engineer
*R. Clary, SCE&G Manager, Nuclear Engineer
*M. W. Clonts, Manager, Modification and Contractor Services
*S. T. Crumbo, Senior Engineer
*H. I. Donnelly, Senior Licensing Engineer
*W. R. Heggins, Associate Manager Regulatory Compliance
*D. O. Hicks, Electrical Engineer
*S. R. Hunt, Nuclear Quality Control Manager
*J. S. Jordan, Engineer
*D. K. Kelly, Principal Electric Engineer
*J. C. LaBorde, Senior Engineer L&C I&C
*D. A. Lavigne, Manager, Materials and Procurement
*F. J. Leach, Quality Assurance Manager
*F. A. Miller, Jr., IT&R
*G. Moffatt, Associate Manager - Nuclear Engineer, SCE&G
*D. R. Moore, Director, Quality and Procurement Services
*A. A. Morris, Jr., NCSG
*G. J. Mundy, Senior Engineering Technician
*D. Nauman, SCEG, Vice President Nuclear Operations
*J. Nesbitt, Electrical Maintenance Supervisor
*K. W. Nettles, Group Manager Technical Services
*C. J. Osier, Associate Manager Maintenance Engineering
*A. M. Paglia, Manager, Nuclear Licensing
*C. A. Price, Manager Technical Oversight
*J. Proper, QA Supervisor, Operations
*M. D. Quinten, Manager, Maintenance Services
*A. R. Roun, Manager, Technical Support
*J. L. Skolds, Deputy Director, Operations and Maintenance
*G. G. Soult, Manager, OPS
*J. A. Wactor, Senior Electrical Engineer
*D. C. Warner, Manager, Nuclear Fuel Management
*R. J. Waselus, Electric Supervisor - Nuclear Engineer, SCE&G
*T. L. Wessner, Nuclear Engineering
*V. H. Willems, Controls System Engineering
*F. H. Zander, Manager, Nuclear Technical Education and Training

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

Other Organizations

*J. P. Durham, Impell, Corporation, Section Manager
*B. A. Karrasch, Impell Corporation, Division Manager
*S. Pauly, Impell Corporation, Supervising Engineer
*T. L. Penland, Engineering and Project/GPC
*W. A. Williams, Jr., Special Assistant, Nuclear Operations - Santee Cooper

NRC Personnel and Resident Inspectors

*D. M. Verrelli, Chief, Reactor Project Branch No. 4, Region II
*J. J. Hayes, Jr., NRR Project Manager
*R. Prevatte, Senior Resident Inspector
*P. Hopkins, Resident Inspector

*Attended exit interview

2. Exit Interview

The inspection scope and findings were summarized on January 15, 1988, with those persons indicated in Paragraph 1. The inspector described the areas inspected and discussed in detail the inspection findings. No dissenting comments were received from the licensee. The following new items were identified during this inspection:

a. Violation 50-395/88-01-01, Missed EQ Maintenance Requirements, Paragraph 6.

b. Unresolved Item 50-395/88-01-02, Mixed Grease in Limitorque Valve Operators, Paragraph 6.

c. Unresolved Item 50-395/88-01-03, Resolution of NCN-2852 and NCN-2661, Paragraph 12.

d. Violation 50-395/88-01-04, Insufficient Information in Qualification File for Lubricants, Paragraph 13.c.(1).

e. Violation 50-395/88-01-05, IR Values for Performance Characteristics Not Properly Established in the EQFs, Paragraphs 13.c.(4) and (5).

f. Unresolved Item 50-395/88-01-06, Re-evaluation of Instrument Loop Accuracy Calculation Concerning Negative Margin, Paragraph 13.c.(9).

The licensee identified some material as proprietary during this inspection. That material is not included in this inspection report.

3. Licensee Action on Previous Enforcement Matters

NRC Violation 50-395/87-30-01, Raychem splice, NRC Unresolved Items 50-395/86-15-02, Limitorque Wiring Qualification, and 50-395/87-30-03, Ambient Temperature Greater than Design, are closed with this report.

These items are discussed in paragraphs 13.c.(3), 13.c.(6) and 14 respectively.

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. Three unresolved items identified during this inspection are discussed in paragraphs 6, 12, and 13.c.(9).

5. Electrical Equipment Environmental Qualification (EQ) Program and Procedure Review

a. General

The inspectors reviewed procedures that are used to implement the requirements of 10 CFR 50.49. Discussions of individual procedures will be in the appropriate sections that follow. Management Directive 31, Revision 0, defines the requirements of the EQ program for VCSNS.

The management and staff at VCSNS have been taking actions to improve and upgrade their EQ program. Overall responsibility for the EQ program belongs to the Nuclear Engineering Section of the Technical Services Group. For the most part, the EQ program was keeping up with industry trends; however, after a reactive inspection at VCSNS in October 1987, management decided that extra effort was needed to stay abreast of EQ developments. Consequently, an extensive upgrade program was initiated and the early results have been very positive. An effort as extensive as that undertaken at VCSNS would not be possible without the complete backing of management and the dedication of the staff.

b. Safety Evaluation Report (SER) Commitments

Supplement 4 (August 1982) to the VCSNS SER identified four equipment types that were not yet qualified. Supplement 5 dated November 1982 stated that the plant could be safely operated until the first major shutdown or refueling outage after June 1983 pending qualification of this equipment. A licensee submittal dated May 17, 1983, identified one more item requiring additional documentation to support qualification. The licensee's January 31, 1985, response to Generic Letter 84-24 stated that qualification of all five items was completed.

c. Regulatory Guide 1.97 Equipment

The SER for RG 1.97 was issued November 13, 1987 and received by the licensee on November 19. The SER accepted the licensee's RG 1.97 program except for three areas requiring further action; licensee response was required within 90 days. The licensee stated that the

response was being prepared and would be submitted on schedule. Except for those three areas, all other equipment required by the RG 1.97 SER to be qualified was identified as qualified.

6. EQ Maintenance Program

In 1982, the Computerized History and Maintenance Program System (CHAMPS) was established and included EQ related activities. This system contains information on maintenance history, required preventive or surveillance maintenance, and task sheets for maintenance. The CHAMPS system also furnishes the EQ maintenance schedule.

EQ maintenance, in general, is input as a required maintenance and does not, therefore, have a grace period applied. One example was found where the grace period was applied to the lubrication of the Emergency Feed Water Pump, MMP-0021A. The CHAMPS records show that the motor lubrication maintenance was performed November 1984, October 1985, December 1986, and had not been performed since. The last two periods exceed the annual time period specified in EQP-M01-G02-0682. This is identified as Violation 50-395/88-01-01, Missed EQ Maintenance Requirements.

The licensee provided justification to show that the motor in question remained qualified and would be operable until the maintenance is next performed. The licensee committed to perform a review of the maintenance history of all EQ equipment to ensure all activities necessary to support the qualification of equipment has been performed within the required time interval.

Review of the maintenance requirements for the Victoreen High Range Radiation Monitors did not include sending the detector back to the vendor at a five year frequency. Initial investigation of this apparent discrepancy indicated that the detector was designed for a forty year life, but that the five year cycle was imposed in response to a vendor suggestion. The five years could be exceeded provide the detector exhibited satisfactory calibration results. Subsequently, the licensee was informed by the vendor that the five year requirement had been removed from the technical manual in Revision F in November 1985. The inspectors were aware of the five year requirements, however, they, as well as the licensee, were not aware of the rescinding of the requirements. The vendor documented the change to the licensee in a letter dated January 14, 1988. It should be noted that this change was effective more than two years ago and few licensees appear to be cognizant of the change.

A potential of mixed greases was identified by the licensee in 1984 and documented in NCN-1673. The licensee was not able to provide any evidence that NRC was informed of the issue. NCN-1673 was closed out in 1987. As a result of questions regarding the mixed grease issue, the licensee did further research and found that not all Limitorque operators that were in a harsh environment had the grease changed out by November 15, 1985, as NCR-1673 indicated. Due to finding the additional operators, the licensee initiated NCN-2852-46 in January 1988, to address these particular valves/

operators. Also, the licensee committed to perform a follow-up review to verify that all Limitorque operators in a harsh environment have had the grease changed. This is Unresolved Item 50-395/88-01-02, Mixed Grease in Limitorque Valve Operators.

The results of testing prescribed in NCN-2852-46 will be required to close this item. The testing is scheduled to be completed prior to start-up after the Fall 1988 refueling outage.

As part of the enhancement program, the licensee has reviewed the preventive maintenance tasks loaded into the CHAMPS program and compared them to the vendor manual recommended activities. Some discrepancies were discovered and the licensee committed to correcting the discrepancies and is in the process of making the corrections.

7. IE Information Notices (IEN)s and Bulletins (IEBs)

Prior to June 1987, IENs and IEBs along with other industry operating experiences were handled by the Nuclear Licensing Section. Since June 1987, these have been handled by the Nuclear Safety Section of Technical Services. The procedures governing review of these items were reviewed and found to be acceptable except for procedure TS-301, Revision 0, "Industry Operating Experience Review." TS-301 did not have any provisions for routing EQ related reviews to the appropriate Equipment Qualification File (EQF). IEN summaries for EQ related items have been placed in the EQFs as part of the enhancement program during the past few months. The licensee committed to revise TS-301 to ensure IEN summaries are placed into the EQFs.

The Senior Engineer, Nuclear Safety, is responsible for the handling of IENs and industry experiences relating to EQ. Discussions with the Senior Engineer, Nuclear Safety, indicated that there had been no formal training provided. Further discussion of EQ training is in Paragraph 11.

8. Environmental Qualification Master List

10 CFR 50.49(d) requires that each licensee prepare a list of electrical equipment important to safety that is required to be environmentally qualified by 10 CFR 50.49. The original equipment list for VCSNS was submitted to NRC in May 1983. In developing the list SCE&G determined, by review of FSAR Chapters 5 through 11 and 15, those systems and electrical equipment required for safe shutdown and accident mitigation. These equipment items are listed in FSAR Tables 3.11-0 and 3.11-0A. The equipment was then further categorized to list specific functional requirements, the required accident for which it must operate, and harsh environmental conditions which could be experienced. Those equipment items which are classified as Category A or B are required to be environmentally qualified. Revisions to the list are controlled in accordance with the plant's design control process and require a Safety Evaluation be performed in accordance with 10 CFR 50.59.

To assess the completeness of the equipment list, the Safety Injection System was selected as the system for review. Associated flow diagrams (E-302-691 R7, E-302-692 R3, E-302-693 R4, and E-302-675 R4) 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 and which experience harsh environmental effects of Design Basis Accidents. All equipment items which were identified as requiring qualification were included on the equipment list in FSAR Tables 3.11-0 and 3.11-0A with the exception of those equipment items which were designated by the licensee as RG 1.97 Category D2 items. Specifically, transmitters FT-940, FT-943, FT-605A and FT 605B, and temperature elements ITE 606A and ITE 606B were not included on the equipment list. These items are monitored by the operator during accident mitigation to verify proper system operation. The licensee stated that these items were not included on the FSAR list because the FSAR list included only 1E equipment. The specific equipment items noted above were non 1E devices. However, the items, including ancillary equipment, were environmentally qualified and equipment qualification files existed which established their qualification. RG 1.97 equipment appeared on another list included in Table 1 to Technical Requirements Package No. TRP-17, Post Accident Monitoring System (PAMS) Instrumentation. In addition, appropriate controls were in place such that these environmentally qualified devices were treated as quality related equipment. To alleviate possible confusion, however, the licensee agreed, as part of its EQ enhancement program to revise the FSAR equipment list to include all RG 1.97 Category 2 environmentally qualified instruments.

9. EQ Modification Program

The licensee's design control program provides controls to ensure applicable regulatory requirements and design bases are correctly translated into specifications, drawings, procedures, and instructions to form a Design Change Package (DCP). The following procedures delineate the design control measures to ensure incorporation of environmental qualification considerations during the design process:

> Technical Services Procedure No. TS-137, Program for Review and Maintenance of Environmental and Seismic Qualifications for Safety-related Systems, Revision 4.
>
> Technical Services Procedure No. TS-129, Design Development/Design Package, Revision 8.
>
> Technical Services Procedure No. TS-131, Design Verification, Revision 4.

Procedure No. TS-137 requires review of new or modified equipment required to support plant modifications to ensure the requirements of 10 CFR 50.49 are met. Responsibility for performance of these reviews has been assigned to the Technical Services group which has cognizance of the

engineering design program. Detailed instructions for assessment of environmental qualification requirements have been provided in Appendix 1 of procedure TS-137. This review, performed during the design process, documents the status of qualification to the requirements of 10 CFR 50.49 and establishes baseline qualification data.

The preparation of the Design Change Package (DCP) and the method for verifying the adequacy of the design/modification change are addressed in procedures TS-129 and TS-131. Considerations for the effect of the design change to 10 CFR 50.49 requirements are part of the design input. The lead engineer is further required to determine documents affected by the design change such as Environmental Qualification Report and EQ File Index. These documents are listed or referenced on the Modification Request Form (MRF). Other aspects of the design process with potential for having an impact on the environmental qualification status of equipment are appropriately controlled, e.g. updating of vendors technical manual, and revising or updating the data in the CHAMPS program used for equipment maintenance. Environmental considerations are included within the design review process employed for verification of the design. The verification process also includes an inspection of the installed equipment using a Field Inspection Checklist. This inspection is intended to (1) provide a traceable link between the equipment installed and the equipment that was tested, and (2) verify the actual installed configuration relative to the as-tested equipment configuration.

The inspector reviewed two DCPs, MRF-20801, and MRF-20720, that were implemented to meet the requirements of Regulatory Guide 1.97. Discussion with the cognizant engineers and review of the DCPs revealed no environmental qualification deficiencies.

10. EQ Equipment Replacement and Spare Parts Procurement

The licensee accepted QA program, FSAR Section 17.2.4, establishes requirements for the inclusion of technical and QA requirements on purchase requisitions. It further mandates that procurement documents for spare and replacement parts of safety related structures, systems, and components shall be subjected to controls at least equivalent to those used for the original equipment. Technical Services procedure, TS-137, Section 7.3.3, imposes the above administrative controls for the procurement of material within the scope of 10 CFR 50.49, and establishes requirements for procurement of environmentally qualified material to be performed in accordance with procedure TS-126, Safety-related and Quality Related Procurement by Requisition-Interface with Nuclear Purchasing Procedures Manual.

Technical Service procedure TS-126 delineates the administrative process for the procurement of equipment that ensures applicable regulatory requirements, design bases, and other technical and quality requirements, are included on procurement documents. It provides for the classification of structures, systems, and components in accordance with the guidelines contained in procedure TS-114, Structures, Systems, and Equipment

Classification. The three basis classifications are safety-related (SR), non-nuclear safety (NN), and quality related (QR). Specific guidance is provided in Exhibit 1-3 to procedure TS-114 which addresses the classification of equipment within the scope of Regulatory Guide 1.89, Qualification of Class 1E Equipment of Nuclear Power Plants. Quality Assurance program requirements are determined by the classification of the equipment/component to be procured, and are imposed on the procurement documents in accordance with Appendix A to procedure TS-126.

Procurement technical requirements are developed for new procurement, replacement-in-kind procurement, and for spares and replacement parts in accordance with procedure TS-113, Procurement Technical Requirements Development, Review and Processing. These technical requirements may be imposed on the requisition package by use of (1) NP-5/5A form which states the technical requirements and/or reference documents that contain the requirements; or (2) NP-2A form which states the technical requirement for "Dedication" of commercial grade procurement. A Technical Work Record (TWR) is prepared to document the basis for dedication, and is made a part of the procurement document record.

The dedication process for commercially procured equipment/component is delineated in Design Guide Number PR-03. This procedure provides guidance to the Procurement Engineering and Technical Services Staff for developing dedication criteria for spare or replacement parts whose function could affect safety-related or quality related equipment or systems. Procedural guidance has also been provided to these personnel for performing (1) critical to function attributes determination, (2) equal to/better than evaluations, and (3) on-site certifications.

Responsibilities for implementation of the procurement program for EQ equipment has been assigned to the Director, Quality and Procurement Services. Within the Materials Procurement Section, the Associate Manager, Procurement Engineering, and his staff interfaces with the Technical Services group to ensure that design basis and other applicable regulatory requirements are not degraded during the procurement process. Additionally, the Quality Engineering staff reviews procurement documents to verify imposition of quality requirements, commensurate with the classification and end use of the material being procured.

The inspector reviewed nine purchase orders for various equipment types and/or spare replacement parts. No EQ deficiencies were identified.

Based on the review of the above procurement documents and review of the procurement program procedures, the inspector determined that licensee had established a program that provides for the procurement of equipment within the scope of 10 CFR 50.49.

11. EQ Personnel Training

The licensee accepted QA program, FSAR Section 17.2, establishes requirements for job specific technical indoctrination and training of both onsite and offsite personnel. It further requires that the proficiency of personnel performing quality-affecting activities be maintained through retraining, re-examination, and/or recertification. The inspector conducted interviews with the Manager, Nuclear Craft Training, and other licensee staff members and verified that both onsite and offsite personnel had been provided training in the requirements of VCSNS EQ program.

Objective evidence in the form of lesson plans, attendance sheets, and results of written examination was reviewed by the inspector. Pursuant to these reviews, the inspector determined that the Electrical and Instrumentation and Control (I&C) personnel had been indoctrinated and trained in the requirements of the EQ program. Additional specialized training such as "Raychem Basic Installer/Inspector Training Course" had also been provided.

Discussions with licensee management revealed that a formalized training program had not been established for indoctrination and training of Quality Engineering, Quality Assurance, Nuclear Engineering, and Procurement Engineering personnel. From review of objective evidence, however, the inspector determined that EQ awareness training had been provided to select members of the above groups. Gilbert Commonwealth memorandum dated August 21, 1986, from K. E. Nodland to V. C. Summer Project Personnel, described a training class that addressed equipment qualification and appropriate design control measures. Further objective evidence in the form of Technical Services Training forms verified that EQ training had been provided to Procurement Engineering staff members.

After an NRC EQ inspection of October 20-23, 1987, the licensee developed and is presently implementing an "Equipment Qualification Enhancement Program." Task 9 of this enhancement program includes activities directed towards the provision of EQ training for Engineering, Procurement and QA personnel. Other activities address specific component training for the craft, eg. Raychem, and the establishment of general EQ training for maintenance craft and QC personnel. The inspector discussed the enhanced EQ training program with licensee management and requested information concerning its status. The scheduled completion date for implementation of the EQ training program for all personnel is April 1, 1988. Based on the discussions with licensee management and review of objective evidence, this effort appears to be on schedule.

Within this area inspected, no violations or deviations were identified.

12. QA EQ Interface

The inspector determined that the QA organization had performed audits and surveillances of the EQ program to verify its compliance with 10 CFR 50.49 and applicable codes and standards. The report of a QA audit of the EQ program conducted November 15, 1982 through August 12, 1983 was reviewed by the inspector. The objective of this audit was to determine the status and adequacy of the licensee's effort to environmentally qualify Class 1E electrical equipment for the VCSNS. The audit identified deficiencies in the implementation of the EQ program as delineated in Nuclear Engineering Procedure NE-137 (May 21, 1982). Corrective Action plans developed to address the identified programmatic deficiencies appeared adequate.

A Type II surveillance, II-15-86-CC, Class 1E Equipment Qualification, was conducted May 14-30, 1986, in the performance areas of (1) maintenance of EQ files, and (2) implementation of EQ requirements in maintenance and surveillance procedures, and maintenance practices. This narrow scope in depth look at the implementation of the EQ program in the performance area of maintenance covered functional responsibilities and internal/external organizational interfaces of the following organizations: Electrical Maintenance, Maintenance Engineering, Technical Services, Procurement Engineering, Records (EQ Central File), Quality Assurance/Quality Control, and Chemistry. A total of sixteen findings resulted from this surveillance. A generic problem indicative of a programmatic breakdown was identified in the performance area of EQ Training of plant personnel. This issue was reviewed during the NRC EQ followup inspection of October 20-23, 1987, wherein the inspection team determined that a contributing factor to the problem of the unqualified taped splice configurations was inadequate EQ training of plant personnel. Based on review of objective evidence and discussion with licensee's QA personnel, the inspector determined that developed corrective action plans implemented for the above deficiencies appeared to have been adequate.

Subsequent to the NRC EQ followup inspection of October, licensee management has reviewed their EQ program to identify programmatic weaknesses, and have performed walkdowns of equipment that is accessible during plant operation to verify that installed configuration matches the as-tested configuration documented in the EQ file. Maintenance Special Instructions (MSI) were prepared and used during the equipment walkdowns.

The inspector determined that equipment is presently being walked down on the basis of accessibility. However, an MSI has not yet been prepared for walkdown of instrumentation circuits. In response to the inspector's query regarding this issue, licensee management committed to prepare and issue the instrumentation MSI by February 12, 1988.

As part of the continuing EQ Enhancement program, deficiencies identified by the licensee during equipment walkdowns are documented on Nonconformance Notice (NCN) 2852. Disposition 42 of this NCN describes the nature of the deficiencies found; addresses operability of the equipment; and provides Justification for Continued Operation (JCO) for

equipment not yet inspected. Licensee's actions are in accordance with the instructions contained in Generic Letter 86-15.

The nature of the deficiencies documented on NCN-2852, (Disposition 42) involved different equipment types and affect various systems. Additionally, NCN-2661 was prepared to identify, document, and initiate corrective actions for deficient termination of solenoids pigtails. Corrective actions for these identified problems are still incomplete. Because of the broad scope of the deficiencies documented on NCNs 2852 and 2661, and licensee's ongoing effort to develop and implement a corrective action plan, this issue is identified as an unresolved item. Licensee management has committed to provide the NRC information concerning the continuing resolution of the above NCNs. Pending completion of the equipment walkdowns and NRC review of the results of licensee's inspection, this is identified as Unresolved Item 50-395/88-01-03, "Resolution of NCN-2852 and NCN-2661."

13. Environmental Qualification Documentation Packages and in Plant Physical Inspection

a. Environmental Qualification Files (EQF)

South Carolina Electric and Gas Company's EQF are prepared and controlled by Nuclear Engineering. The packages included a Checklist to evaluate the NUREG 0588/10 CFR 50.49 Qualification Status. This checklist contains guidelines for evaluating the qualification methods, margin, aging, qualification documentation, equipment interface, etc. It contains the test reports, field verification checklist, correspondence that support environmental qualifications, calculations and analysis, etc. An EQF is prepared for each specific type of qualified component designated by manufacturer and model that are exposed to the same environmental service conditions.

The NRC inspectors examined some 35 EQFs for selected equipment types. In addition to comparing plant service condition 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 IE Information Notices and Bulletins and their resolutions. Most of comments/concerns with these EQFs 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 configurations, orientation, interfaces, name plate data, ambient temperature, moisture intrusion seals, splices, terminal blocks, internal wiring and physical conditions.

c. Comments on EQF and Plant Walkdown Items

(1) EQF-LU2-G13-1282 Lubricants - Grease

This file was intended to qualify the various greases used at VCSNS. The file claimed qualification to NUREG-0588 Cat II. Review of the file indicated that qualification by similarity to Chevron SRI 2 could be made, however, there was no statement or argument made in the file for qualification by similarity. Since this file was intended to qualify the Gulf products for the majority of uses, similarity needed to be established with the other lubricants that the Gulf lubricants were replacing. This was not done at the time of inspection. In addition other lubricants were not included in this package. For example, the Dow-Corning products were omitted even though the licensee had the information elsewhere to qualify the products.

During the course of the inspection, the licensee gathered needed information to show similarity for the Gulf products and committed to putting this information into the EQF and to make the necessary corrections in order to bring the file into compliance. The licensee also committed to including the supporting data for Dow Corning lubricants in the appropriate EQF(s). The file discrepancies constitute Violation 50-395/88-01-04, Insufficient Information in Qualification File for Lubricants.

(2) EQF-SW4-N01-1184-1 (Model EA-180); EQF-SW4-N01-1184-2 and Supplemental Evaluation (Model EA-740); EQF-SW4-N01-0785 (Model EA-180); and EQF-SW4-N01-0682, two parts (Models EA-180 and EA-740) - Namco Limit Switches.

One concern was noted during review of these files. Component identification is typically provided for the valve serviced by the limit switches. The files do not specify how many, and which limit switches for each valve require qualification or which require cable entrance seals. This information is contained in the CHAMPS data base, or is developed for replacement equipment where necessary by functional review of elementary diagrams. The licensee agreed to revise the EQ files to relate individual limit switches to the valve and to indicate where seals are required. In the interim, detailed review of

several plant walkdown cases satisfied the inspectors that the licensee is correctly qualifying limit switches and installing cable entrance seals where necessary.

(3) EQF-CA7-R05-0782 (Models WCSF-N splices and NMCK termination kits); EQF-CA7-R05-0185 (NPKV connection kits); and EQF-CA7-R05-1185 (8.7 kv termination kits) - Raychem Splices

These files were reviewed in detail, together with licensee NCN #2852, which describes licensee corrective action taken with regard to plant splices addressed by Violation 50-395/87-30-01 from an October 1987 inspection by NRC Region II. The inspectors concluded that the licensee's activities for inspecting existing plant splices and installing new and replacement Raychem splices are satisfactory. Approximately 75 Raychem splices were inspected during the plant walkdown and no deficiencies were observed. Based on the file review, walkdown and the licensee's inspection/replacement program, which has not identified any splices that fall outside the acceptance criteria of industry sponsored tests, Violation 50-395/87-30-01 is closed.

(4) File EQF-C05-C08-1084 - Conax Corp. Electrical Penetration Assemblies (EPAs)

The licensee claims qualification to the requirements of NUREG-0588, Category I, based on Conax Test Reports IPS-1089, IPS-353.1, and IPS-1146.

The file referenced Conax Test Report IPS-325, data sheets B through M, to establish demonstrated performance characteristics for insulation resistance (IR) values during exposure to DBE, LOCA conditions. Test Report IPS-325 did not include LOCA testing for qualification. The Loop Accuracy Calculation, VCS-0423-DC15, used an IR value for Conax EPAs and referenced Conax Test Report IPS-1146 as supporting this value with data taken during LOCA testing. Test Report IPS-1146 was reviewed and found to contain data for IR readings taken at ambient conditions (77°F and 0 psig) and not data taken during LOCA conditions.

Both of these file discrepancies were addressed by the licensee and resolved. The licensee stated the correct IR data could be found in Conax Test Report IPS-1089. Test Report 1089 was reviewed and found to contain acceptable data. The licensee committed to provide the correct references in the file and in VCS-0423-DC15 Loop Accuracy Calculations.

The use of IR values provided in the instrument loop accuracy calculation for Conax EPAs was not properly established in the EQF. This is identified as an example of Violation 50-395/

88-01-05, IR Values for Performance Characteristics Not Properly Established in the EQF.

(5) EQF-C05-D01-0782 - 0682 - D. G. O'Brien EPAs

The licensee claims qualification to the requirements of NUREG-0588, Category I, based on D. G. O'Brien Test Reports ER-268 and ER-252.

The loop accuracy calculation VCS-0423-DC15, uses an input resistance from D. G. O'Brien EPAs and connectors. This was obtained by a straight line plot of two values of resistance with respect to temperature, 58°F and 212°F, and extrapolating the value during LOCA conditions. The licensee stated the linear extrapolation was supported by the volume resistivity curve as a function of temperature for polysulfone, which is approaching a linear curve over the temperature range of concern. A review of the referenced file, D. G. O'Brien Test Report ER-268, indicated the 58°F data point was room temperature prior to the start of the LOCA test. The temperature inside the test chamber (containment side of the EPA) was 135°F. When this data point was plotted and extrapolated to LOCA conditions, it gave an IR value which was needed as an input to the loop accuracy calculations. The 212°F data point was not taken at the worst condition during the LOCA test; instead, it was obtained 10 days later during the cooldown phase at 0 psig. The licensee stated that although no IR data were taken during the LOCA test, the test configuration consisted of a 0.25-amp fuse, which with a test voltage of 600 volts ac and 14 pins in the connector, would blow for an IR of less than approximately 5.0 E+05 ohms pin to shell.

The Licensee performed instrument loop sensitivity calculations by assigning artificial IR values of 100, 200, 500, and 800 kohms for D. G. O'Brien EPAs and connectors. The sensitivity calculations indicated that IR value greater than 800 kohms gave no new accuracies which did not meet requirements (AWDNMR). The licensee also stated the AWDNMR which result with 800 kohms IR are at the 10th of percent range.

Penetrations and connectors used at VCSNS are similar to ones tested for the Duke Power Company, McGuire and Catawba stations. The results are documented in D. G. O'Brien Test Report ER-252. Similarity of this equipment and the equipment installed at VCSNS is established by D. G. O'Brien Letter N-3333 dated July 9, 1981. The data taken in ER-252 indicate a worst case IR of 1.2 E+02 megohm (pin to pin) at 300°F, 15 psig dry steam and 2.5 megohm at 250°F, 15 psig wet steam.

From the above information, it can be concluded that the extrapolation methodology is providing values of IR which are consistent or supported by Test Report ER-252 for similar connectors under LOCA conditions. Also, the sensitivity of the actual values provides significant room for error in the extrapolation, assuring that the impact on safety is not significant. Based on the additional information presented during the inspection, the inspector concluded the D. G. O'Brien EPAs and connectors covered by this file meet the NUREG-0588, Category I, requirements.

The original method used to calculate instrument loop IR contributions for D. G. O'Brien EPAs and connectors for use in VCS-0423-DC15, Loop Accuracy Calculations, Attachment 3, page 23 of 23 is considered to be invalid. During the course of the audit, the Licensee provided the additional calculations discussed above and committed to continue to pursue test data which contained IR readings obtained during actual LOCA test conditions to augment the similarity of D. G. O'Brien EPAs and connectors. Since use of IR values provided in the initial instrument loop accuracy calculation for D. G. O'Brien EPA's was not properly established in the EQF, this is identified as an example of Violation 50-395/88-01-05, IR Values for Performance Characteristics Not Properly Established in EQF.

(6) EQF-V05, -L01-0782, 0385, 0682 - Limitorque Valve Operations

The inspector reviewed the EQ file for Limitorque Valve Operators. This review substantiated the licensee position that these operators were qualified to NUREG 0588 Category II.

The file contained a section that addressed the Licensee's response to IENs pertaining to Limitorque Valve Operators. The records for licensee's action on IEN 86-03, Potential Deficiencies in Environmental Qualification of Limitorque Motor Valve Operator Wiring, showed that a field inspection was made for each environmentally qualified motor operator. The inspection was in accordance MSI No. 20700 and NCN 2325. Any internal wire that could not be identified as being qualified was replaced with qualified wire. Based on the result of the plant walkdown inspection and a review of the licensee's actions to resolve IEN 86-03, Unresolved Item 50-395/86-15-02, Limitorque Wiring Qualification, is closed.

(7) Cable Identification and Traceability to Cable EQFs

During the plant walkdown inspection, 15 circuit numbers from field wires, and four conduit numbers were collected from the various equipment inspected. The licensee was asked to identify and establish qualification for the cable using the numbers provided.

The licensee provided drawings for the listed conduits, electrical circuit records for the listed circuits, bill of material sheets, cable specifications, and EQ files. This information was adequate to show traceability and qualification for the cables and showed the inspectors that the licensee was able to trace and establish qualification for their field cables.

(8) EQF-IN6-V05-0682 - Victoreen High Range Radiation Monitor

The qualification for the high range radiation monitors was based on NUREG 0588, Category I. The plant environment was enveloped by the test conditions. Installed equipment is identical to the tested samples.

There were questions as to the installed (versus tested) configuration and whether triax cable is used versus the tested coax cable. The licensee provided drawings and microfilm documents which verified that installation was completed in accordance with Victoreen recommended procedures since the plant was operating this could not be verified during the walkdown. Another EQF-C05-D01-0385 referenced qualification of triax connectors which are adapted and mated to the coax cable used on the Victoreen. This connector is shown on the "as-built drawing (E-215-185, sheet 9) which was in the package of historical documentation provided. The review of this file and records indicated that qualification was established.

(9) File VCS-0423-DC15, Instrument Loop Insulation Resistance Calculations

The preliminary file of instrument loop accuracy calculations for Class 1E instrument loops in harsh environments was reviewed. The analysis provides a review, on an individual instrument loop basis, of IR affects from cabling, connectors, and field splices. Generally, the approach and format are very good. All calculations were summarized in individual example IR calculation packages in Appendix H of the file, identified as follows:

IR Error - Transmitter Loop	VCS-0423-DC13
IR Error - RTD Loop	VCS-0423-DC17
IR Error - In-core Thermo-couple Loop	VCS-0423-DC18
Neutron Flux Monitoring Loop Accuracy Including IR Losses	VCS-0423-DC20
Loop Error - Victoreen High Range Monitor	VCS-0423-DC21

Other appendices in the file provided a tabulation of the safety-related equipment located in harsh environments; a tabulation of the circuits for those instruments with locations, temperatures, cable lengths, and connector/splice identification; a compilation of temperature/IR data for the cables, connectors, splices, and terminal blocks by bill of material and circuit location; and a listing of instrument accuracy requirements for both inside and outside the harsh environment locations. These data were used, in conjunction with the calculation procedures above, to derive IR error calculations for each instrument loop. Appendices E and F summarized the IR errors, total loop error, maximum allowable error, and remaining margin. Though IR error effects are directional, for conservatism this calculation provided a non-directional error analysis. The detailed calculations are given in Appendix G.

Some of the items discussed are as follows:

(a) Unidentified terminal blocks appeared to be associated with the in-core thermocouples outside containment, with no model, tag numbers, or EQ file reference. A "conservative" value of 10^4 ohms IR was assumed for these terminal blocks. The licensee response was that these terminal blocks are Kulka Model JN091679-02 qualified as part of the in-core thermocouple assemblies per EQF-C05-C08-1084. Since these are only associated with thermocouples, and the assumed IR value was 45% of the "worst case" data of similar terminal blocks by four other vendors, this item was resolved.

(b) The document concluded that "positive margins remain for the instrumentation required to be operational in a harsh environment." In Appendix F and G, many instances of negative margins were noted. Appendix F noted that "the margin may be positive or negative" with no explanation. Already mentioned above was that the calculation was to provide a more conservative non-directional analysis. The licensee responded that many of the negative margin results are being "re-evaluated" with respect to allowable errors and excess conservatism that resulted from ignoring the directional nature of the input data errors. Additionally, the licensee deemed a number of the "maximum allowable error" results inappropriate or overly conservative and are in the process of reevaluating the allowable errors. Generally, the approach in the file is good, much has been done to address instrument loop accuracy, and the licensee committed to a continuing effort to address the deficiencies in the analysis and to finalize the document. This issue was left as an Unresolved Item 50-395/88-01-06, Re-evaluation of Instrument Loop Accuracy Calculations Concerning Negative Margin

(c) A question was posed as to whether the lowest IRs taken during LOCA conditions were always used as the input value for "test resistance". The licensee response was that either the lowest value was used or, where data was lacking, a conservative analysis was used to input appropriate IR effects.

(d) In conjunction with the review of the D. G. O'Brien file, it was discovered that the IR value inputs for the D. G. O'Brien connectors were extrapolations from a linear curve derived from the data points, one taken at 58°F (0 psig) and the other taken "post-LOCA" at 212°F and 0 psig. It was pointed out that values were not taken during the LOCA test and that the method of linearizing IRs versus temperature, disregarding pressure and potential moisture intrusion effects, was not considered valid. This was addressed as part of the D. G. O'Brien qualification file review, which is discussed elsewhere in the report. The licensee was eventually able to produce additional data that substantiate the values used in the IR calculations for this file.

(10) EQF-CA4-S02-0682 Samuel Moore Instrument Cable, File

The qualification basis is NUREG 0588, Category I. An acceptable similarity analysis was provided in the supplemental evaluation for the tested cable. An extensive justification was provided explaining testing deviations from IEEE 323-1974, stating that testing was done in accordance with IEEE 383-1974. The plants environmental and accident conditions were enveloped by the test profiles with acceptable margins. The supplemental evaluation provided a good discussion of gamma/beta radiation dose requirements and justification of beta shielding and gamma plus data comparisons. Insulation resistance readings were taken before, after, and during the LOCA simulation. In addition, another 70 day extended exposure was conducted to further verify successful qualification of the samples. Questions were raised concerning the IR values used in the instrument loop accuracy evaluations and the specific document that provided this analysis. The licensee provide the needed information. Based on this review it was considered that the cable is qualified.

(11) EQF-CA4-B20-0682 Brand Rex Coaxial Type Cable 2/c Twinax

The qualification basis is NUREG 0588, Category I. Acceptable cable performance (IR) was monitored and demonstrated during this test. The licensee's cables were purchased for low voltage use in the acoustic leak monitoring system. An adequate similarity analysis was provided, performance requirements were defined and met, and the plant environmental requirements were

enveloped for the tested cable. An analysis of gamma plus beta exposure was provided, taking credit for 50% beta reduction for cable tray/conduit shielding. The test cable samples were exposed to 200 megarads gamma. The qualified life is 40 years at 70°C, with aging of 7 days at 136°C. Questions were posed regarding a "General Note 42" and the administrative control of cable supplies to preclude use in voltage applications in excess of the stated limitations. The note was from the NUREG 0588 reviews and will be added to the file. Administrative control of cable use was established; however, it was recommended to clearly flag and identify at the front of the file the specific voltage limitations of these cables to help preclude inadvertent misapplication. No findings were identified.

14. Unresolved Item 50-395/87-30-03

To address the NRC concerns expressed in Unresolved Item 87-30-03, Ambient Temperature Greater Than Design, SCE&G investigated the cause of the high temperatures noted in the East and West penetration areas and calculated the affect of the higher temperatures on the qualified lives of EQ equipment located in those area, and then took measures to prevent reoccurrence. The licensee determined that higher than design temperatures were experienced in these areas due to personnel securing HVAC fans in order to help control the pressure in the feedwater Isolation Valve Nitrogen Accumulator Tanks. The licensee then performed a test to determine the maximum temperatures which could be experienced in these areas. The results from these measurements, with some applied conservatisms were used to recalculate the qualified lives of affected equipment items. The calculation, documented in Disposition 44 to NCN 2852 dated January 13, 1988, and Gilbert Letter CGGS-36887 dated January 8, 1988, shows that although the qualified lives for some components had been reduced, none had been exceeded. Where required, the replacement date for some equipment was changed as appropriate. To prevent this condition from reoccurring the Manager of Nuclear Engineering issued a memorandum, CGSS: 20673, File 16:0020 dated January 10, 1988, stating that the necessary HVAC components be run on a continuous basis and providing actions to be taken if operational or maintenance concerns preclude the normal operation of the equipment. This unresolved item is closed.