



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

Report No.: 50-416/87-32

Licensee: System Energy Resources, Inc.
Jackson, MS 39205

Docket No.: 50-416

License No.: NPF-29

Facility Name: Grand Gulf

Inspection Conducted: December 14-18, 1987

Inspectors: Alfred B. Ruff 3-2-88
A. Ruff, Team Leader, RII Date Signed

Team members and participating Inspectors:

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Plant System Section
Division of Reactor Safety

SUMMARY

Scope: This special, announced inspection was in the area of Environmental Qualification (EQ) of Electrical Equipment and included a review of System Energy Resources, Inc's (SERI) implementation of requirements of 10 CFR 50.49 for Grand Gulf Nuclear Station (GGNS) and an inspection of electrical equipment within the scope of 10 CFR 50.49.

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

The electrical equipment requiring environmental qualification at GGNS is qualified to the requirements of NUREG 0588 Category I or Category II. The NRC inspectors examined System Energy Resources, Inc. (SERI) program for establishing the qualification of equipment within the scope of 10 CFR 50.49.

The program was evaluated by an examination of SERI'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 Grand Gulf.

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

Results: Four violations were identified: (1) Commercial Grade Components installed in EQ Equipment, Paragraph 12; (2) Limitorque MOV, T-Drains and Grease Relief Valves, Paragraph 13.c.(2); (3) Raychem Heat Shrink Tubing in Unqualified Configurations, Paragraph 13.c.(4) and 13.c.(10); and (4) Qualification Package for Lubricants, Paragraph 13.c.(1).

REPORT DETAILS

1. Persons Contacted

Licensee Employees

- *Steve Bennett, Nuclear Licensing
- *J. C. Cesare, Nuclear Licensing
- *Ted H. Cloninger, Vice President - Engineering and Support
- *James E. Cross, Site Director
- *P. M. Different, Plant Licensing Engineer
- *Joel P. Dimmette, Manager - Plant Maintenance
- *Steve M. Feith, Director, Quality Programs
- *Steven P. Hutchins, Principal Electrical Engineer
- *Gerald B. Lantz, Nuclear Plant Engineering (NPE)/Electrical
- *Fred Lindsay, Plant Staff/Electrical
- *Allen S. McCurdy, Manager - Plant Operations
- *Dan Pace, Manager - Nuclear Design
- *J. L. Robinson, Plant Licensing Support
- *Fred W. Titus, Director Nuclear Plant Engineering

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

Other Organization

- *S. Pauly, Supervising Engineer, Impell Corporation

NRC Personnel and Resident Inspectors

- *D. Verrelli, Chief, Reactor Project Branch No. 1, Region II
- *U. Potapovs, Chief, Special Project Inspection Section, NRR
- *H. Dance, Chief, Project Section 1B, Region II
- *R. Butcher, Senior Resident Inspector
- *J. Mathis, Resident Inspector

- *Attended exit interview

2. Exit Interview

The inspection scope and findings were summarized on December 18, 1987, 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. The following new items were identified during this inspection:

- a. Violation 50-416/87-32-01, Commercial Grade Components installed in EQ Equipment, Paragraph 12.

- b. Violation 50-416/87-32-02, Limitorque MOV, T Drains and Grease Relief, Paragraph 13.c.(2).
- c. Violation 50-416/87-32-06, Raychem Heat Shrink Tubing in Unqualified Configuration, Paragraph 13.c.(4) and 13.c.(10).
- d. Violation 50-416/87-32-04, Qualification Package for Lubricants, Paragraph 13.c.(1).
- e. Unresolved Item 50-416/87-32-05, Nylon Wire Crimped Connectors on Limitorque Dual Voltage Motors, Paragraph 13.c.(2).
- f. Unresolved Item 50-416/87-32-06, Accuracy Calculations for PAM Instruments for Postulated Harsh Environments, Paragraph 13.c.(7).
- g. Unresolved Item 50-416/87-32-07, Summary Test Reports for Terminal Blocks to Category 1 Requirements to be Upgraded, Paragraph 13.c.(8).
- h. Unresolved Item 50-416/87-32-08, Seal Assembly for Victoreen Radiation Monitor Connectors, Paragraph 13.c.(11).

The licensee did identify some material as proprietary during this inspection, but this material is not included in this inspection report.

3. Licensee Action on Previous Enforcement Matters

NRC's Unresolved Items 50-416/86-39-04 concerning wiring in Bettis and Hiller actuators and 50-416/86-37-02 concerning Raychem splices are closed with this report. These items are discussed in Paragraphs 13.c.(5) and 13.c.(10), 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. Four unresolved items identified during this inspection are discussed in paragraphs 13.c.(2), 13.c.(7), 13.c.(8) and 13.c.(11).

5. Electrical Equipment Environmental Qualification Program and Procedure Review

The inspectors reviewed SERI/Grand Gulf EQ Program directives to verify establishment of an EQ Program in compliance with 10 CFR 50.49 including the following:

- Engineering Standard (ES) 31, Environmental Qualification Program.

- ES-19, Environmental Equipment Qualification Maintenance (includes NUREG 0588/10 CFR 50.49 Equipment list and Maintenance/Surveillance Requirements).
- ES-10, Installation Standard for Class 1E Equipment Environmental Sealing.
- Nuclear Plant Engineering Administrative Procedure 803, Preparation and Review of Environmental Qualification Documentation Packages.
- Nuclear Plant Engineering Administrative Procedure 804, Evaluation and Control of Documents Affecting the Equipment Qualification Control File.
- Maintenance Section Procedure 07-S-01-227, Equipment Qualification Program.
- Administrative Procedure 01-S-09-1, Procurement of Material and Services.

The above procedures along with procedures discussed elsewhere in the report confirm that an EQ program has been established for Grand Gulf. These procedures define the scope of the EQ Program and the responsibilities of various organizations for implementing it. The procedures assign the Nuclear Plant Engineering (NPE) staff the responsibility of preparing and controlling the Equipment Qualification Central Files and EQ list of equipment in the Grand Gulf EQ program.

The Grand Gulf Safety Evaluation Report (SER) and Supplemental Safety Evaluation Reports (SSERs) Nos. 2, 3, 4 and 5 and related licensee submittals were reviewed. Exhibit B of Appendix H to SSER 2 listed equipment items requiring additional information or corrective action for final qualification. The inspector compared this to the current EQ Master List noting that equipment had been replaced and/or qualification information provided as required. Exhibit C listed equipment that was to be included in maintenance and replacement schedules and subject to surveillance to ensure that excessive and or unpredicted age degradation was not occurring. A program was in place for this equipment. No deficiencies were identified with respect to Grand Gulf Nuclear Station (GGNS) meeting licensing and/or SSER commitments.

6. EQ Maintenance Program

EQ maintenance requirements are developed by NPE and transmitted to the plant staff via procedure ES-19. Maintenance Engineering uses ES-19 to input EQ requirements into the Maintenance Planning and Scheduling System (MPSS). Scheduling of EQ maintenance is done through the MPSS. MPSS Task Cards schedule required maintenance before the end of qualified life. Each qualified component with required EQ maintenance has a surveillance or mandatory Preventive Maintenance (PM) action assigned to ensure compliance with the maintenance requirements and time intervals.

SERI has established two EQ engineering groups on site. These are in NPE and Maintenance Engineering. The two groups are working together and should form the nucleus to ensure a well organized EQ program. Since EQ is an ever evolving area, this organization appears to be staying even or ahead of the issues.

One of the vendor test reports stated that in order to ensure the continued qualification of its equipment, it is assumed that the vendor recommended maintenance is being performed. This allows for the possibility of maintenance being missed because it was only recommended, not required, because of the licensee's maintenance philosophy. No instances of missing required maintenance were identified, however, the licensee stated that it would evaluate the possibility in the future.

The licensee has been responsive to EQ maintenance problems. Material Nonconformance Reports (MNCRs) were issued as far back as July 1983, more than two years prior to the EQ rule taking effect. Since 1983, the licensee has identified approximately 40 MNCRs related to EQ. Of this 40, eight were written during walkdowns for Inspection and Enforcement Information Notice (IEN) 86-03 for Limitorque wiring. Most of the MNCRs were written for clarification of perceived problems. Four of the MNCRs, however, were examples of failing to maintain equipment qualified. These were MNCR-0252-86, Late Motor Lubrication; MNCR-0595-86, Incorrect Solenoid Valve Installed; MNCR-0658-86, Unqualified Terminal Strip in MOV; and MNCR-0864-86, Safety Relief Valve (SRV) Connectors. Each of these were identified by the licensee and corrected. If they had been identified by NRC, they would be considered as four examples of one Severity Level IV violation. However, since (1) they were identified by the licensee; (2) fit in Severity Level IV; (3) they were reported, if required; (4) they have been corrected; and (5) they could not reasonably be expected to have been prevented by corrective action from a previous violation, no notice of violation will be issued for this in accordance with 10 CFR Part 2, Appendix C, Paragraph V.a.

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

The NRC Inspector reviewed and evaluated the licensee's actions for EQ-related IENs and IEBs. The inspector's review included examination of procedures and EQ documentation packages relative to Information Notices and Bulletins. The procedure review resulted in the determination that the licensee does have a system for distributing, reviewing, and evaluating IENs and IEBs relative to equipment within the scope of 10 CFR 50.49, and that pertinent IENs and IEBs are addressed in appropriate component EQ files. During the review of individual component qualification files, the inspectors did not identify any concerns with respect to Information Notices and/or Bulletins.

8. Environmental Qualification Equipment List

The licensee is required to maintain an up to date list of the equipment that must be qualified under 10 CFR 50.49. This list at GGNS is currently controlled as Appendix A to Engineering Standard ES-19. The list was

based on a review of the Final Safety Analysis Report (FSAR), Electrical Diagrams and Mechanical P&ID's to identify the electrical equipment that can be exposed to the postulated harsh environment of Design Basis Accidents and that are required to function in those environments to reach and maintain safe shutdown. Other equipment evaluated included certain post accident monitoring (PAM) equipment as specified by R.G. 1.97 and nonsafety-related electrical equipment whose failure under postulated harsh environmental conditions could prevent the satisfactory accomplishment of safety functions. To aid in documenting the basis for the Equipment List and to allow for future additions or deletions from the list, SERI is developing Shutdown Logic Diagrams (SLD's). The SLDs identify the systems required to shutdown the plant following an initiating event. From these SLD's, Safety Function Diagram (SFD) are developed which graphically shows the actions of the individual safety system from its initiation to completion of its safety function. All active, essential system components and interfaces necessary for the system to perform its safety functions are identified. To assess the completeness of the NUREG 0588/10 CFR 50.49 list and to verify the methodology used to develop the list, the Residual Heat Removal (RHR) system was selected as the system for review. The following specific documents were reviewed to determine the system components such as: Motor Operated Valves (MOV's), Solenoid Valves (SOV's), motors, and instrumentation that are required to bring the plant to a safe shutdown condition:

- ° Drawing No. M-1085B R32, P&I Diagram Residual Heat Removal System Unit 1
- ° Drawing No. EQ-7124-097 R0, E12 RHR System Loop "A" LPCI Composite
- ° Drawing No. EQ-7124-100 R0, E12 RHR System Loop "A" Suppression Pool Cooling Composite
- ° Drawing No. EQ-7124-102 R0, E12 RHR System Loop "A" Shutdown Cooling Composite
- ° Drawing No. EQ-7124-104R0, E12 RHR System Loop "A" Containment Spray Composite

All components that were identified as required to be on the Equipment List were included on the Equipment List.

9. EQ Modification Program

Administrative Procedure, 01-S-16-1, "Plant Design Changes and Modification", gives the requirements for initiation, control, review, implementation and documentation of plant design changes to ensure quality equivalent to that specified in the original design. Responsibilities of the various site organizations involved in the plant design program and the interfaces with offsite organizations have also been specified in writing.

Nuclear Plant Engineering (NPE) has been assigned responsibility for preparation of Design Change Packages (DCPs) which define final design and specify requirements for implementation of the change. The following NPE administrative procedures were reviewed to assess the adequacy of the licensee's control of EQ requirements in the modification program: Procedure No. 304, Design Change Packages, Revision 12; Procedure No. 323, Design Inputs, Revision 1; Procedure No. 324, Design Verification, Revision 0; Procedure No. 804, Evaluation and Control of Documents Affecting the EQ Central File, Revision 3.

The above procedures specify that the Responsible Engineer (RE), during preparation of the DCP, is required to incorporate all applicable codes and standards as part of the design input. The requirements of 10 CFR 50.49 although not specifically addressed are included by this design control requirement. In addition to the above, the RE is required to complete an Equipment Qualification Central File (EQCF) change review questionnaire (Form 804.2) in accordance with Procedure Number 804. This form documents the fact that the design change reviewed by the RE meets the requirements of 10 CFR 50.49. Upon completion of this review, a request may be made for review of the DCP by the Principal Electrical Engineer to determine its impact on the Equipment Qualification Documentation Packages (EQDP). Based on review of the program documents, it was determined that the licensee's design controls provide for incorporation of environmental qualification requirements in the design change program.

Five DCPs involving EQ related modifications were reviewed to verify the adequacy of procedural compliance with the design change program. Engineering requisitions associated with these DCPs for the procurement of equipment/components were also reviewed to determine conformance with the requirements of 10 CFR 50.49. No EQ related deficiencies were identified in the DCPs reviewed.

10. EQ Equipment Replacement and Spare Parts Procurement

Administrative Procedure, 01-S-09-1, "Procurement of Materials and Services/Safety-Related," established measures necessary to assure that applicable regulatory requirements, design bases, and other technical and quality requirements are included for the procurement of material, equipment, and services. Responsibilities for determining the safety class, quality level, and identification of the design bases have been assigned to the Materials Technical Supervisor and his staff. Materials Section Procedure, 12-S-01-1, "Procurement Document Processing-Safety Related," specifies the requirements for evaluation and processing of procurement documents by Material Specialist. This procedure defines the methods to determine technical and quality requirements for materials and services contracts.

As a result of the review of the above program documents, it was determined that the requirements for procurement of equipment and component within the scope of 10 CFR 50.49 was not adequately addressed.

Administrative controls for procurement of electrical equipment, modules, or components which must be environmentally qualified in accordance with 10 CFR 50.49 were not addressed in the program documents. Specifically, procedural requirements for procurement of new equipment to be added to the EQ Master List via design change; replacement-in-kind and spare parts purchases; or upgraded purchase in accordance with 10 CFR 50.49(1) were not specified in writing. Programmatic deficiencies involving dedication of commercially procured material used in EQ application were also identified.

Procurement documents for new equipment to be added to the EQ Master List, and upgraded purchases are reviewed by engineering design personnel. Nuclear Plant Engineering (NPE) Procedure 01-401, "Procurement of Material Equipment and Services," establishes the requirement that for procurements processed by NPE, an engineering review and completion of engineering inspection checklist will be performed by NPE. The Materials Technical Supervisor and his staff complete the procurement process in accordance with the controls delineated in Procedure 01-S-09-1.

Discussions with the SERI's management regarding these identified deficiencies revealed that they were aware of the procurement program deficiencies. In preparation for the NRC EQ inspection, a review of the EQ program procurement activities was performed by the licensee. Deficiencies were identified both with procurement procedures and past procurement activities. Discussions with SERI management regarding corrective actions to be taken for the programmatic deficiencies were held and the licensee committed to revising the procurement procedures to include EQ requirements by March 17, 1988.

A review of the most recent purchase order for eight equipment types within the scope of 10 CFR 50.49 was performed by the inspectors. No EQ deficiencies were identified.

11. EQ Training

Plant administrative Procedure 01-S-07-33, "Qualification and Certification of Maintenance Section Personnel" establishes training requirements to ensure qualification and certification of maintenance personnel. In discussions with the Nuclear Instructor Supervisor, it was determined that specialized training in the requirements of the EQ Program had been provided to maintenance personnel; i.e., Electrical, Instrumentation and Control, and Planning. The licensee stated that the engineering staff members from NPE had also been provided with this training.

The following lesson plans developed for the environmental qualification training were reviewed: EQ-101/Revision 0, Background and Fundamentals; EQ-102/Revision 0, EQ Engineering for Maintenance Work Planning Group; EQ-103/Revision 0, EQ Surveillance/Maintenance for Maintenance Personnel. Lesson Plan EQ-101, provided basic knowledge regarding the purpose of the

EQ Program, EQ Regulatory History, and the division of responsibilities and implementation of EQ requirements at Grand Gulf. The other lesson plans covered and ensured that the environmental qualification status of equipment was maintained as a result of work activities performed by the Maintenance Work Planning Group and Maintenance personnel. Objective evidence in the form of class attendance sheets were reviewed to verify completion of EQ training of five NPE engineers, four Electrical Maintenance personnel, four I&C Maintenance personnel, and five Maintenance Work Planners.

It was determined that training in the requirements of the EQ program had not been provided to the Material Technical Supervisor and his staff. Discussions with this group revealed that various aspects of the EQ Program are covered by their training program, e.g. required reading of applicable codes or standards. However, to better ensure an adequate personnel-procedural interface for this group, it was considered that EQ training at least equivalent to that provided other plant staff should be given to the Material Specialist group. The Licensee was responsive to this suggestion and committed to provide EQ training to the Material Technical Supervisor and his staff at the next scheduled training session.

12. QA/EQ Interface

The Manager, Nuclear Site QA and his staff had performed audits of the EQ Program to verify its compliance with 10 CFR 50.49, and applicable codes and standards. Quality Assurance Audit Report No. MAR 85/0088, Unit 1 was conducted during the period June 26 - July 19, 1985, to verify the adequacy of implementation of the EQ Program requirements. The NRC's Information Notice 85-39 which identified concerns with the implementation of 10 CFR 50.49 requirements at operating facilities, was used as a guide for this audit. Another audit of the EQ Program was conducted on November 4-20, 1985. The scope of this audit included reviews of NPE Procedure ES-19 and associated documents, a review of maintenance section Procedure 07-S-01-227 and maintenance activities performed to maintain the qualified status of equipment. Both audits identified deficiencies for which corrective actions were developed by licensee management.

Discussions with licensee management concerning involvement of the QA organization in the EQ Program revealed that the audit schedule did not include audits of the EQ program. Instead, during the conduct of scheduled audits, the elements of the EQ program that are contained within the performance area being audited are examined. Based on discussions with licensee QA organization personnel and review of objective evidence, there appears to be adequate involvement of this quality organization in the implementation of the EQ program.

In preparation for the NRC EQ inspection, the licensee conducted a review of EQ program procurement activities. They identified programmatic deficiencies which are discussed in paragraph 10, and inadequate procurement practices that are discussed in the following paragraph.

Material Nonconformance Report (MNCR) No. 454-87 was written on December 7, 1987, to document the procurement and installation of commercial grade replacement parts in EQ equipment. The scope of the problem appears to be limited. This is based on the inspector's review of the disposition of the MNCR by NPE of the various equipment types and systems involved. It was determined that the root cause was poor personnel-procedural interface within the Material Specialist group in that, (1) the procurement procedures were deficient and (2) the staff were inadequately trained in the requirements of the EQ program. This situation was made worse by a deficient dedication process for commercially procured replacement parts which did not require an engineering review by NPE. The use of commercial grade material in EQ application is a design change and is subject to design control measures delineated in ANSI N45.2.11-1974. In response to the inspector's question concerning corrective actions taken to assure the continued EQ status of installed equipment, licensee management stated: O-Rings for ASCO Kit #302-9296E (stock code GG 86164006) and Solenoids for ASCO Kit #8321AGE (stock code GG 85336008) were determined to be dispositioned as "Rework". Qualified replacement parts have been ordered, and Maintenance Work Orders (MWOs) have been prepared for their installation. Upon receipt of the ordered parts the MWOs will be implemented and the removed components will be forwarded to NPE for examination and if necessary destructive tests. Additionally, items in the warehouse associated with stock codes GG 86164006, GG 85336008, and GG 81106090 i.e. ASCO Solenoid Valve #29701-5 have been dispositioned as "Reject", and will be scrapped to prevent recurrence of installation.

At the time of the inspection, the environmental qualification status of equipment having spare or replacement parts associated with the above stock codes was indeterminate. The above material nonconformance is therefore classified as a licensee identified violation, in that commercially procured spares and replacement parts were installed in EQ equipment without an adequate dedication process. This is identified as Violation 50-416/87-32-03, Use of and Failure to Evaluate Commercial Grade Parts for EQ Applications.

13. Environmental Qualification Documentation Packages and In-Plant Physical Inspection

a. Environmental Qualification Documentation Packages (EQDP)

System Energy Resources's EQDP are prepared and controlled by the Nuclear Plant Engineering Department. The packages included an Equipment Evaluation Checklist, Aging and Radiation Calculation/Analysis, Environmental Parameters, Test Reports, NRC IENs and IEBs reconciliations, Vendor Notifications etc.

An EQDP 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 25 EQDPs 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 functional performances, evaluation of test anomalies, and applicability of EQ problems reported in NRC IE Information Notices and Bulletins and their resolutions. Most of the comments/concerns with these EQDP were resolved or corrected before the exit. Some of these comments/concerns and unresolved items are discussed in Section c.

b. In-Plant Physical Inspection

The NRC inspection team physically inspected some 30 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 material condition.

c. Comments on EQDP and Plant Walkdown Items

- (1) EQDP 15.1, Reliance Fan Motor - Review of this package indicated that Chevron SRI-2 grease was to be used for the lubrication of reliance fan motors with no substitution allowed. The licensee, however, uses Mobilux EP-2. The licensee stated that it procures all its lubricants from Mobil and that introduction of the Chevron product would increase difficulties in control and could possibly lead to misuse.

The licensee provided information to the inspectors, including a German written test report for Mobil Oil. The information was considered to be adequate to show qualification, however, the licensee did not have it in an auditable form. The licensee stated the EQ packages for lubricants not covered elsewhere would be included as part of the Generic EQ package. This is identified as Violation 50-416/87-32-04, Qualification Package for Lubricants.

- (2) EQDP 02.0, 02.1, 02.2, Limitorque Motor Operators - These files contain documentation to support Limitorque actuators with motors that have class B & H insulation and type RH insulation.

The RH insulation MOV are located throughout the plant, both inside and outside the drywell and containment. The class B & H insulations are used on MOVs located outside the containment.

The files contained Grand Gulf Nuclear Station (GGNS) positions on Limitorque EQ concerns some of which are: interfaces for control, indication, and power cable; internal jumper wire; required maintenance; resolutions to I&E Notices and Bulletins; the use of nylon crimp connectors as found in motor leads of dual voltage motors; and the use of grease reliefs.

In regard to interfaces of field cable, the Licensee has incorporated GE (File EQ01.1), Kulka (File EQ01.2), Curtis (File EQ01.3), Marathon (File EQ01.4), Buchanan (File EQ01.5), or Cinch-Jones (File EQ01.6) terminal boards. SERI was not using the Limitorque reports as the principle documentation to support qualification of these terminal boards.

Either AMP terminations, Scotch Tape splices or Kaychem splices were incorporated as terminations/connectors in the Licensees Limitorque actuators.

Internal jumper wire of the MOVs is either Rockbestos Firewall III (File EQ04.16), Raychem Flamtrol (File EQ04.8), or BIW Bostrad (File EQ04.9) cable.

The only I&E Notice not addressed in the Licensees Limitorque files was IEN 87-08, Degraded Motor Leads in Limitorque DC Motor Operator. When this concern was brought to the attention of Licensee personnel, documentation was presented that showed that the concerns of IEN 87-08 had been addressed but not added to the files because no actuators with DC motors were installed at GG.

SERI's position on the use of nylon crimp connectors on dual voltage motors installed in Limitorque actuators is documented in File EQ02.0, Volume 4, Tab L5. This section contained a letter from Limitorque stating that the nylon crimp connectors found in the actuators supplied to GGNS were the same or of similar material to those tested in Limitorque Report 600376A. Also contained in this section was an evaluation of Wyle Laboratories scope testing performed on Thomas and Betts nylon crimp connectors for the Clinton Nuclear Generating Station. Because GGNS connector were not specifically identified (nor could they be verified by visual examination) the traceability problem associated with these nylon crimp connectors, (see NRC Inspection Report No. 99900100/87-01), is identified as an Unresolved Item 50-416/87-32-05, Nylon Crimp Connector on Limitorque Dual Voltage Motors. It should be noted that the nylon insulated crimp connectors of the MOV located in the

drywell were replaced with qualified splices during this NRC inspection.

Two other items of concern were identified during the walkdown inspection of Limitorque motor operators. The orientation of the motor on Component ID 1E30F002B was such that the T-drains could not function as a drain, and there were no grease reliefs installed on the actuators located inside the drywell. Although grease reliefs were installed on actuators during the course of this onsite audit (where required), the analysis used to justify the as found configuration of the affected actuators was found to be unacceptable.

- (a) NUREG 0588 Section 2.2(3) references Section 5.2 of IEEE Standard 323-1971. Paragraph 5.2.3.7 of the IEEE Standard require the orientation and mountings be considered in the qualification of equipment. Paragraph 4.1.3 of the basic Limitorque Qualification Report B0058 stated that the mounting position chosen for qualification testing (motor horizontal with the switch compartment vertical up) was considered the worst possible condition because it allowed for any condensate that collected in the unit to flow through the motor to provide the most damaging effect on its insulation system. Because the motor orientation of 1E30F002E was found to be in the vertical up position, the "T" drains could not function as drains. No other provisions were incorporated on the actuator to allow for water to drain in the event of moisture intrusion under postulated accident conditions.
- (b) Actuators were installed inside the drywell that did not have grease reliefs. This is contrary to the information provided in Paragraph 6.0, "Design Life", of the basic Limitorque Qualification Report, B0058, dated January 11, 1980, Paragraph 6.0 states that grease relief valves are used to accommodated the extreme temperatures and pressures of containment DBA environments. NUREG 0588 Section 5.(1) endorses requirements of IEEE Standards. IEEE Standards 382-1972, Section 2, and 323-1974, Section 6, require all salient factors be shown to common between the tested valve operator and installed valve operator and that modifications to equipment items be evaluated to determine their effect on qualification. 10 CFR 50.49(f)(2) allows for supporting analysis to be used with testing of similar equipment to establish qualification. The analysis found in the licensees files did not adequately address the concerns reflected above.

The above is identified as a violation of NUREG 0588 Section 5.(1)/10 CFR 50.49(j) and is identified as 50-416/87-32-02. Similarity of Installed Equipment to The Test Sample was Not Established in the Qualification Files.

- (3) EQDP 09.2, Thermocouples Model 27620s manufactured by Thermoelectric - This file contained the qualification documentation for 20 thermocouples, ten of which are used to monitor the suppression pool water temperature, and the containment and drywell air temperatures.

The only maintenance identified in the file was O-ring replacement every 11 to 12 years (11.89) on the thermocouples located inside the drywell. This was based on the Arrhenius Methodology with ambient conditions of 135°F.

During the walkdown portion of the inspection, one thermocouple (T/C) head was considered to be loose so that the O-ring seal was questionable. The licensee stated that the standard practice for instrument technicians on re-closing the head covers is to ensure a hand tight seal. The licensee subsequently verified that the remaining T/Cs covers were handtight (none were loose) so that the O-ring sealing was effective. The test report and the vendor's technical manual do not provide a torquing requirement and pre-audit confirmation with the vendor indicated that a handtight cover closure was adequate to maintain a seal. The licensee determined and the NRC inspector agreed that this single questionable item would not affect the safe shutdown or operation of the plant. The licensee committed to up-grade the applicable procedures and/or training guidance to assure that hand tight closure of these covers is maintained in the future.

- (4) Hydrogen Recombiner - During the walkdown of the hydrogen recombinder, it was found that the terminations were made with Raychem splices in unqualified configuration. The splices were made with all leads connected together forming a 'V' shape and a single WCSF-N Raychem sleeve over the connection and cables. The sleeve was shrunk around all the cables with the top being "sealed" in a manner that appeared to have been heated and pinched together by hand. This configuration has not been tested by Raychem and would allow moisture intrusion between the cable leads where sealing was not adequate. Another problem with this configuration was that the top end of the sleeve could re-open whenever subjected to heat again. This splice configuration was not qualified for an accident environment with high humidity and/or spray.

Prior to the NRC inspection team's arrival, walkdowns were being performed by the licensee on various components identified by previous inspections. The splices on the hydrogen recombiner were characterized by the licensee as "cosmetically" unacceptable and work requests had been initiated to replace the existing splices because of their appearance. The NRC inspector determined that the effects of spray and high humidity was not adequately evaluated. The licensee stated that there was no sealing requirement for the splices in that the splices were located in an enclosure. The inspector determined that the enclosure was not moisture proof. At the exit, the licensee stated that the splices would be replaced with qualified Raychem kits. This replacement was completed under MWO-E76966 and MWO-E76967 by December 31, 1987. This is identified as an example of Violation 50-416/87-32-06, Raychem Heat Shrink Tubing Installed in Unqualified Configuration.

- (5) Bettis & Hiller Actuators - The inspector reviewed licensee activities with regard to a previously reported problem concerning the potential use of unqualified wiring with Bettis and Hiller actuators on air operated valves (AOV's). This was identified in NRC Report No. 50-416/86-39 as Unresolved Item 50-416/86-39-04. As a result of IEN 86-53, which was received by the licensee in July 1986, the licensee decided to initiate a comprehensive review of their Raychem splices at their earliest available opportunity, which occurred during their first refueling outage in September 1986. During the course of their inspection, the licensee identified 19 out of 99 valves that contained unidentified wiring. The installation of this wire was traced to a construction/maintenance activity in 1982. At the time this wire was installed, GGNs' construction standards, purchase and procurement specifications required class IE wire to be used in class IE applications. The unidentified wiring was immediately replaced with known qualified and traceable wiring. The wiring which was removed was categorized into eight different wire types. A representative sample of each of the wire types was sent off to a materials analysis firm to identify the specific insulation materials used. Once the specific materials were identified the licensee performed an analysis, documented in calculation EC-Q111-87001, RO which demonstrates the wiring had sufficient thermal and radiation withstand capability to perform its function. Based on this calculation, the inspector concluded that the wiring was qualifiable for its intended application. The licensee also stated that none of the 19 valves were in the ECCS System and that all these valves would have performed their safety (isolation) function within a minute of the postulated harsh environment accident. Because this item was licensee identified, would fit in the Severity Level IV category, had prompt corrective action taken and could not have been reasonably expected to have been prevented by any licensee's corrective action for a previous violation, no citation will be issued in accordance with the guidelines of 10 CFR 2 Appendix C, Paragraph V.A. This Unresolved Item is closed.

- (6) Cable Identification and Traceability to Cable EQDP - For the cable identification review, eight cable numbers were recorded during the walkdown. The licensee demonstrated the ability to enter his Electric Circuit Schedule (Computer Data Base E553) with the cable number and identify the Cable Code, the purchase order number, the purchase order item number and the master list number (Component identification number). For one of the cable identification numbers selected, cable from two vendors was used. The E553 file correctly identified two purchase orders and the item numbers for the cable.

With the cable code and cable identification number, the Licensee demonstrated the ability to enter his Quality Tracking System data base and identify the reel number used at the site. The licensee had a cross reference log that identified the vendor reel numbers for the corresponding site reel numbers. With the vendor reel number, the licensee was able to retrieve the receipt inspection to verify that the cable received was the cable that was installed. The licensee provided the receipt inspection forms for the eight cables identified.

With the Purchase Order Number and the component identification number, the licensee demonstrated he could retrieve, from the Purchase Order file, the identification of the manufacture and the detailed description of the cable. With the component identification number, the licensee demonstrated he could enter his ES-19 data base file and identify the Equipment Qualification file that demonstrates qualification of the cable.

- (7) Review of Insulation Resistance (IR) effects on Loop Accuracy - The inspector reviewed Calculation 0200-047-128, which included analysis to determine the effects of reduced IRs in harsh environments on instrument accuracy. The calculations included analyses for transmitters, RTDs, and thermocouples and included consideration of terminal blocks, splices, penetrations, and cables as applicable for different circuits. Terminal blocks are not used at GGNS in RTD or transmitter circuits where a steam environment is postulated. The maximum error loss from IR was calculated and was considered acceptable for the applications at GGNS. The Victoreen radiation monitor was also addressed in the file and the licensee was questioned on the basis for input data and acceptance criteria. The question was resolved by the licensee citing alternative test data to meet the 20 megohm requirement of Victoreen. Also included in this calculation was a position paper regarding accuracy criteria for post-accident monitoring (PAM) instruments. This paper implied that RG 1.97 did not require any accuracies for PAM instruments. The licensee position was

based on their interpretation of RG 1.97, on the typical values of loop error demonstrated for the PAM instruments contained within the EQ documentation packages, on the actions of the operator from the other indications and the trends of these indications. The licensee committed to perform conservative calculations on typical RG 1.97 variable loops to confirm expected loop accuracies for operator response. This is identified as Unresolved Item 50-416/87-32-06, Accuracy Calculation for PAM Instruments for Postulated Harsh Environments.

- (8) Documentation to Support NUREG 0588 Category I - Several of the files reviewed to Category I requirements had test reports which were not considered to be in accordance with applicable documentation requirements, especially with regard to supporting test data. NUREG 0588 Section 5.(1) references IEEE 323-1974. The documentation requirements of IEEE 323-1974 include such items as a) description of the test facility (test setup) and instrumentation used including calibration records reference, b) test data and accuracy, and c) supporting data. Supplement 2 to IEB 79-01B states that the staff will accept summary reports if the licensee makes the determination that necessary information and documentation is at an NSSS vendor's facility. Further, these type of files must be maintained current, auditable, and available throughout plant life. No documentation was produced by the licensee to indicate that they had audited more complete test records, no additional test reports were referenced by the EQ files, and no records indicated the existence of further test documentation. The licensee files which were considered inadequate to support NUREG 0588, Category I requirements included the Cinch Jones terminal blocks, and Marathon terminal blocks. The licensee stated that this would be re-examined for possible up-grading of subject file. This is Unresolved Item 50-416/87-32-07, Summary Test Reports for Terminal Blocks to be Up-Graded to Category I Requirements.
- (9) Raychem Stilan Cable (File #EQ04.13) - The Raychem Stilan Cable File was reviewed briefly and it was considered deficient with regard to Category I requirements. This cable is not presently used for EQ qualified application. The licensee stated that it would be removed from the EQ master list.
- (10) Raychem Heat Shrink Tubing - At the time of an inspection, the Raychem EQDP and a sampling inspection of the installed configurations were satisfactory (except for issue on the Hydrogen recombiner terminations discussed in paragraph 13.c(4) above). The Senior Resident Inspector opened Unresolved Item 50-416/86-37-02 in his report of November 1986 on this item. This report indicates that some Raychem configurations were deficient.

IEN 86-53, Improper Installation of Heat Shrinkable Tubing, dated June 26, 1986, was received at the utility in the early part of July. The first opportunity for inspection after receipt of this IEN, was the refueling outage of September 5, 1986 to January 1987. At this time, the licensee performed a routine walkdown inside containment for 10 CFR 50.49 equipment and the IEN concerns. As a result, some non-standard raychem heat shrink tubing installations were identified. The license determined from their records that these non-standard installations were not covered by existing GGNS test reports. Being in an outage, the licensee replaced all non-standard configurations as a conservative measure to insure that this item would not impact restart.

The licensee stated that they performed additional analysis and obtained additional test data to show that the non-standard Raychem configuration would have remained operable in the event of a DBA. (See SERI's Letter AECM-87/0045 of March 20, 1987 to the NRC.) This unresolved item is closed and up-graded to a violation identified as an example of 50-416/87-32-06, Raychem Heat Shrink Tubing Installed in Unqualified Configurations.

- (11) EQDP 14.1, Victoreen Radiation Monitor - The file for the Victoreen radiation monitors for high-range containment monitoring was reviewed. The qualification basis was NUREG-0588, Category I. The test conditions enveloped the plant profile and the accuracy of detector was properly addressed and is discussed in paragraph 13.c.(7) above. The test specimen was identical to the plant installed item except for installation.

This component was tested by Victoreen in a number of configurations. After eight unsuccessful attempts, the cable, and connector were sealed in stainless steel conduit from the detector to the LOCA chamber penetration. This was the only configuration that passed the LOCA test. The test report stated that the intention was to seal the connector, but that the proximity to the penetration made it convenient to seal up the cable as well. At GGNS, the connector assemblies are contained in a stainless steel (SS) box, connected to the detector housing with sealed high pressure metal bellows flex conduit, and sealed at the cable entrance points. During the walkdown inspection, the NRC inspector requested that the access cover on the SS box be removed in order to examine the splices. The GGNS technician had no trouble loosening the approximately 7-inch diameter cover cap and screwing it off of the 6-inch diameter threaded collar on the front of the junction box. It was clear that the cap had been only hand tight and also there was no gasket, or O-ring or other apparent sealing device for the heavy, machined stainless steel cap.

GGNS personnel contended that the cap was sealed because the collar was in fact a large pipe nipple with NPT tapered threads. They stated that their standard for sealing pipe thread was use of thread sealant and "three full turns."

Based on the observation and physical removal of the SS cap, the NRC inspector questioned whether a good moisture intrusion seal existed via the SS cap. It appeared that only an anti galling Neolube lubricant was used on the threads and "three full turns" for tightness of tapered pipe threads is considered to mean three turns past the point of hand tight. This would require a strap wrench to install or remove the SS cap. As a result of further discussion between the NRC and licensee engineers, which included possible sealing techniques for the cap, the licensee agreed to do an additional analysis to support their position and if necessary, to take additional measures to ensure that a good moisture intrusion seal exists for the cap on the SS connector assembly box. The licensee stated that this would be accomplished before restart. This is identified Unresolved Item 50-416/87-32-08, Seal Assembly for Victoreen Radiation Monitor Connectors.