U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-443/89-17

Docket No. 50-443

License No. NPF-56

Licensee: Public Service Company of New Hampshire
100 Elm Street
Manchester, New Hampshire 03105

Facility Name: Seabrook Station, Unit 1

Inspection At: Seabrook, New Hampshire

Inspection Conducted: November 6-10 and December 4, 1989

Inspectors: _____ 01.18.90
R. J. Paolino, Senior Reactor Engineer, PSS/EB — date

Other Participants and Contributors to the Report Include:

A. L. Della Greca, Reactor Engineer, PSS/EB, RI
Q. Decker Technical Consultant - INEL (Idaho National Engineering Laboratory)
M. Yost, Technical Consultant - INEL (Idaho National Engineering Laboratory)

Approved by: _____ 1/19/90
C. J. Anderson, Chief, Plant Systems Section, EB/DRS — date

Inspection Summary: Inspection on November 6-10, 1989 and December 4, 1989 (Inspection Report No. 50-433/89-17)

Areas Inspected: Special, announced inspection to review the licensee's implementation of an enviromental qualification (EQ) program for establishing and maintaining the qualification of electrical equipment important to safety within the scope of 10 CFR 50.49.

Results: One violation was identified involving licensee failure to demonstrate qualification of the installed configuration for ASCO valves in a harsh environment.

Details

1.0 Persons Contacted

1.1 New Hampshire Yankee

*R. Begor, Lead Surveillance Engineer
R. Gergeron, Engineering Program Manager
R. Cyr, Maintenance Manager
R. Deloach, Executive Director - Engineering/Licensing
B. Drawbridge, Executive Director - Nuclear Production
*R. Faix, Westinghouse Support Engineer
T. Feigenbaum, Senior Vice President
J. Grillo, Operations Manager
T. Harpster, Director of Licensing Services
M. Harrington, MRD Supervisor
J. Marchi, Nuclear Quality Group Auditor
*B. Metro, Nuclear Safety Licensing Engineer
T. Murphy, I&C Department Supervisor
M. Palumbo, Engineering Programs Engineer
D. Perkins, Licensing Engineer
J. Peschel, Regulatory Compliance Manager
N. Pillsbury, Director Quality Programs
E. Sovetsky, Technical Process Supervisor
W. Temple, NRC Coordinator
T. Trobaugh, Program Support Engineer
P. Tutinas, Engineering Program Supervisor - EQ
J. Vargas, Manager of Engineering
*J. Warnock, Nuclear Quality Manager

1.2 Consultants

P. Costello, Senior Electrical Designer - Impell Corporation
E. Kotowski, Engineering Programs Engineer - UE&C
H. Pitts, Program Support Engineer - Volt
N. Woodward, Senior Project Manager - Tenera

1.3 U.S. Nuclear Regulatory Commission

A. Cerne, Senior Resident Inspector

*Denotes personnel not present at the NRC exit meeting of November 10, 1989.

2.0 Purpose

The purpose of this inspection was to review the licensee's implementation of an electrical equipment environmental qualification program to meet the requirements of 10 CFR 50.49 for the Seabrook Station and to review their

implementation of corrective action commitments resulting from deficiencies identified in the NRC Safety Evaluation Report.

3.0 Background

NUREG-0588 was issued in December 1979 to promote a more orderly and systematic implementation of equipment qualification programs by industry and to provide guidance to the NRC staff for its use in ongoing licensing reviews.

The positions contained in that report provide guidance on (1) how to establish environmental service conditions, (2) how to select methods that are considered appropriate for qualifying equipment in different areas of the plant, and (3) other areas such as margin, aging, and documentation. In February 1980, the NRC asked certain near-term operating license (OL) applicants to review and evaluate the environmental qualification documentation for each item of safety-related electrical equipment and to identify the degree to which their qualification programs were in compliance with the staff positions discussed in NUREG-0588.

IE Bulletin 79-01B, "Environmental Qualification of Class 1E Equipment," issued by the NRC Office of Inspection and Enforcement (IE) on January 14, 1980, established environmental qualification requirements for operating reactors. This bulletin and its supplements were provided to licensee applicants for consideration in their reviews.

A final rule on environmental qualification of electrical equipment important to safety for nuclear power plants became effective on February 22, 1983. This rule, 10 CFR 50.49, specifies the requirements to be met for demonstrating the environmental qualification of electrical equipment important to safety located in a harsh environment. In conformance with 10 CFR 50.49, electrical equipment for Seabrook Unit 1 should be qualified according to the Category I criteria specified in Category I of NUREG-0588.

To document the degree to which the environmental qualification program complies with the NRC environmental qualification requirements and criteria, the applicant provided equipment qualification information by letters dated August 12, 1983, September 7, 1984, October 31, 1985, April 3, 1986, April 10, 1986, April 16, 1986, April 30, 1986, May 6, 1986, May 7, 1986, June 5, 1986, and June 6, 1986 to supplement the information in FSAR Section 3.11.

On February 25, February 26, and February 27, 1986, the staff, with assistance from EG&G Idaho, Inc., conducted an audit of the applicant's qualification files and equipment installed at the plant. Twelve files were audited to determine if the documents in the qualification files supported the qualification status determined by the applicant.

On the basis of the results of its review and subject to confirmation that all audit deficiencies have been corrected, the staff concluded that the applicant had demonstrated compliance with the requirements for environmental qualification as outlined in 10 CFR 50.49, the relevant parts of GDC 1 and 4, and Sections III, XI, and XVII of Appendix B to 10 CFR 50, and with the criteria as specified in NUREG-0588.

4.0 EQ Program

The NRC inspectors examined the implementation and adequacy of the licensee's EQ program for establishing and maintaining the qualification of electrical equipment in compliance with the requirements of 10 CFR 50.49. The licensee's EQ program encompasses electrical equipment important to safety which has the potential of being subjected to a harsh environment. Equipment important to safety as defined in 10 CFR 50.49 includes both safety-related and non-safety-related equipment plus certain post-accident monitoring equipment. Specifically included, are those systems required to achieve or support:

- Emergency reactor shutdown
- Containment isolation
- Reactor core cooling
- Containment heat removal
- Core residual heat removal
- Prevention of significant release of radioactive material to the environment

The licensee's program for establishing and maintaining qualification of electrical equipment within the scope of 10 CFR 50.49 is defined in the following licensee documents:

- Procedure No. 17230, Revision 1, dated August 30, 1988 entitled, "Equipment Qualification Program"
- Equipment Qualification Manual, Revision 2, dated October 3, 1989
- Design Control Manual, Revision 7, dated September 7, 1989
- Final Safety Analysis Report (FSAR), Section 3.11
- Safety Evaluation Report, Supplements 1 thru 8
- Procedure No. 31312, dated September 7, 1989 entitled, "Design Change Processing"
- Procedure No. 32200, dated June 18, 1987 entitled, "Preparation and Revision of Electrical EQ Files"
- Procedure No. 32215, dated April 4, 1982 entitled, "Equipment Qualification Maintenance Request Data Sheet"
- Procedure No. 34460, Engineering/Training Manual
- Harsh Environment Equipment Trending, dated September 21, 1989
- Service Environment Chart (Dwg. No. 300219)

These documents were reviewed to evaluate the procedural methods and their effectiveness for:

- Requiring all equipment that is located in a harsh environment and is within the scope of 10 CFR 50.49 be included on the Master List of electrical equipment requiring qualification
- Controlling the generation, maintenance and distribution of the EQ Master List
- Defining and differentiating between a mild and harsh environment
- Determining harsh environmental conditions at the equipment location through engineering analysis and evaluation
- Establishing and maintaining a file of plant conditions
- Establishing, evaluating and maintaining EQ documentation
- Training of personnel in the environmental qualification of equipment
- Controlling plant modifications such as installations of new and replacement equipment and providing for updating replacement equipment in accordance with 10 CFR 50.49 criteria

Based on the above, the inspection team concluded that the licensee has implemented a program to meet the requirements of 10 CFR 50.49, although minor deficiencies were identified which are discussed in the Details Section, Paragraph 9.0, of this report.

5.0 EQ Master List

The licensee is required to establish and maintain a current list of equipment which must be qualified under 10 CFR 50.49. The licensee has established a comprehensive, systematic program for identifying safety related electrical equipment required to be environmentally qualified. Safety-related equipment is defined as that equipment which is relied upon to remain functional during and following design basis events to ensure (a) integrity of the reactor coolant pressure boundary, (b) capability to shut down the reactor and maintain it in a safe shutdown condition, and (c) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to the guidelines of 10 CFR 100.

The electrical equipment important to safety which was considered for inclusion within the scope of the Seabrook program includes the following:

- Safety-Related (class 1E) Electrical Equipment
- Non-Safety-Related Electrical Equipment whose failure under postulated environmental conditions could prevent satisfactory accomplishment of safety functions .
- Post-Accident Monitoring Equipment

The inspection team reviewed the current Seabrook EQ Master List, dated October 27, 1988 selecting four items which were not on the current EQ Master List but appeared on the 1985 EQ Master List. The licensee was able to provide documentation which contained the engineering evaluation/analysis for deleting these items from the current EQ Master List. Items reviewed were documented in Design Change Request (DCR) Nos. 00675, 87-0158, 86-349 and 88-79.

Based on the above, the inspection team concluded that the licensee does have an EQ Master List which is properly maintained in accordance with 10 CFR 50.49 requirements.

No deficiencies were identified.

6.0 EQ Training

The licensee's training policy and responsibilities are defined in its Manual Procedure No. 18700, NHY Training Program. The requirements and instructions to implement the training program of the above procedure are contained in Engineering Procedure No. 34460. With respect to Equipment Qualification the licensee's program requires that all technical staff receive, among other specialized topics, environmental qualification training. The instruction material is general in nature and provides the trainee with an overview of the program which addresses issues ranging from regulatory and technical requirements to maintenance of safety related equipment. In addition to the generic EQ training described above, technical personnel, on an as needed basis, receive "internal training in specific procedures, manuals, reports, codes, and standards" as per paragraph 4.3 of Engineering Procedure No. 34460. New and revised procedures are distributed via internal memoranda which requires the recipient signature "to verify...reading and appropriate understanding of each individual procedure."

The method used to train engineering personnel in the requirements of the procedure does not assure the necessary comprehension which is otherwise provided in the classroom. However, in recognition of the fact that all technical personnel receive training in basic environmental qualification concepts the licensee's EQ program is considered adequate.

Review of training records and distribution lists attached to internal memoranda indicate compliance with the licensee's procedures for EQ training. Within the scope of the review, no violations were identified by the inspector.

7.0 Bulletins and Information Notices

NRC Information Notices and Bulletins are administratively controlled in accordance with the licensee's procedure NYRE which addresses all incoming regulatory correspondence. Accordingly, Information Notices and Bulletins are received by the Operational Programs Manager who, upon review and determination of required actions, distributes copies to the functional managers responsible for performing the detailed review and response.

The NRC inspector reviewed a sample of three recent Information Notices, 88-19, 89-33, and 89-48, and determined that their review had been performed in accordance with the above procedure.

During the construction period, Notices and Bulletins were transmitted by the licensee to the Architect/Engineer and to the NSSS supplier who performed the required review and actions. Review of the files pertaining to several equipment qualification related Information Notices (82-04, 82-11, 82-52, 83-45, 83-72, 84-23, 84-44, 84-47, 84-57, 84-68, 84-78 and 84-90) demonstrated adequate handling of the issues. With respect to Information Notice 84-90, on November 4, 1987, the licensee, with its letter NYN-87187, submitted to NRC its analysis verifying the adequacy of the shutdown margin. The analysis was accepted by the NRC in its letter of January 13, 1988. Within the scope of this inspection, no violations were identified.

8.0 QA/QC Interface

The licensee's Quality Assurance Department is responsible for conducting audits to verify the licensee's compliance to the equipment qualification (EQ) requirements set forth in 10 CFR 50.49 and Seabrook's QA Program Manual. During the course of this inspection, the NRC reviewed two EQ audits conducted by the licensee's QA Group. Both audits, one in 1987 (Report No. 87-A07-01) and one in 1988 (Report No. 88-A07-02) verified the licensee's compliance with 10 CFR 50.49, IEEE 323-1974, the Production Equipment Qualification Program Manual (NPEQ), and the Equipment Environmental Qualification Program, NHY-17230. Within the scope of the audits, QA reviewed EQ programs and files, conducted interviews with key personnel, reviewed documentation packages pertaining to plant modifications, and performed walkdowns of selected equipment and areas.

Evaluation of the aforementioned reports, revealed that the QA audits resulted in one finding and contained a total of seven observations. The NRC inspector also noted that (1) the deficiency, relating to the implementation of a procedure without appropriate review, was properly dispositioned and subsequently verified by QA; and (2) the QA observation resulted in appropriate program adjustments.

Within the scope of this review, the NRC inspector did not identify any deficiencies.

9.0 Equipment/Component Enviromental Qualification File

The licensee's EQ files were examined to verify the qualified status of the safety related Class 1E equipment within the scope of 10 CFR 50.49. The review consisted of comparing plant service conditions with qualification test conditions and verification of the basis for these conditions. The inspectors selectively reviewed areas such as required 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, component materials, tested configuration versus installed configuration and documentation for both); evaluation of adequacy of test conditions; aging calculations for qualified life and replacement interval determination; effects of decreases in insulation resistance on equipment performance; adequacy of demonstrated equipment accuracy; evaluation of test anomalies; and applicability of EQ problems reported in Information Notices/Bulletins and their resolution.

The inspectors sampled 16 EQ files. The EQ files selected, covered such areas as electrical cables, Limitorque motor operated valves, electrical penetrations, solenoid operated valves, seals, temperature sensors and pressure/level transmitters. These files contain documentation utilized by the licensee to provide the basis for demonstrating that the equipment type is qualified. The equipment type being a specific component or equipment, designated by the manufacturer and model number, which is representative of all identical equipment/components in a plant area exposed to the same or less severe environmental service conditions.

Except for the following deficiencies, the documentation supporting the qualification of electrical equipment important to safety has been evaluated and assembled into complete, auditable and controlled environmental qualification files.

Within the scope of this inspection no violations were identified.

9.1 Endevco Accelerometers and TEC Cable Assemblies, EQ File No. 252-30-01

The Endevco Accelerometer and TEC Cable assemblies, model no. TEC 1414, are located inside containment, zones CS-11 and CS-13, and are used to provide continuous on-line monitoring of vibrations indicative of flow through safety relief valves.

Environmental testing results for the Endevco Accelerometer and TEC Cable assembly are reported in EQ File No. 252-30-01, which contains TEC report 517-TR-03, Rev. 2, "Final Qualification for TEC Valve Flow Monitoring System," dated 12/81, and TEC report 517-TR-05, Rev. 3, dated 1/83.

During the plant walkdown it was noted that RTV was installed on the transient shield gasket. However, during the file review there was no mention of RTV being used during qualification testing. To resolve this issue, PSNH contacted Technology for Energy Corporation (TEC) for clarification. TEC responded on November 9, 1989 stating that RTV #732 and #738 sealant was used in all phases of qualification testing. The use of the RTV complies with the installation instructions. The installed plant configuration is identical to the as tested condition.

Equipment Qualification file number 252-30-01 will be revised and issued by November 30, 1989 to reflect the use of the RTV sealant. The EQ file revision will be prepared in accordance with Engineering Procedure 32512.

9.2 Valcor Solenoid Valves, EQ File No. 173-07-01

The Valcor Solenoid Valves (SOV) are located inside containment, zone CS-12, and are used for containment isolation, post accident monitoring and emergency core coolant safety injection.

Environmental testing results for the Valcor SOV's are reported in EQ file 173-07-01, which contains MR 526-5631-20-3, Rev. B, dated February 19, 1986, "Similarity Qualification Test Report on Solenoid Valves for PSHN" and QR 52600-5940-2, Rev. C, April 24, 1981, "Qualification Test Report on SNUPPS Valve."

During the file review it was noted that two valves, ID numbers RC-FV-2881 and WLD-FV-8331, were not installed with qualified conduit seals. However, PSNH has issued and completed Engineering Change Authorization (ECA) numbers 03/113474 and 03/101621 installing qualified seals. PSNH stated the EQ file will be revised and issued incorporating the above ECA's by November 30, 1989. This will be revised and prepared in accordance with the requirements of Engineering Procedure 32512. (Subsequent to this inspection in January 1990, the licensee installed qualified conduit seals for the above two valves. Installation of the seals was documented by the licensee in MMOD 89-620. This documentation was reviewed by the NRC resident inspector. No deficiencies were identified.)

Based on the above and on additional supporting documentation contained in the EQ file, it is concluded that the Valcor Solenoid Valves are qualified for their application at the Seabrook Station.

9.3 Electrical Conduit Seals, EQ File No. 118-03-01

The electrical conduit seals (Conax Model 1100 series) are used throughout the plant to seal various devices against moisture intrusion.

Review of the environmental testing results for the model 1100 series indicates that one of two units tested (#66-1) blew a fuse at 660 vac and that the ensuing analysis attributed the failure to moisture intrusion followed by arcing. However, the test at reduced voltage (155 vac) was continued with satisfactory results.

The licensee indicated that the seals are used in devices where the maximum voltage is 125 vac (i.e., limit switches and solenoid coils).

To prevent the use of seals in applications where the voltages exceed the test voltage of 155 vac, the licensee is revising the EQ file to include this restriction. The EQ file revision will be completed by November 30, 1989.

Within the scope of this inspection, no violations were identified.

9.4 ASCO Solenoid Valves, EQ File No. 236-11-01

ASCO solenoid valves are used in various applications throughout the plant and their qualification is addressed in several packages coinciding with the purchase orders issued. For the purposes of this inspection two randomly selected files were reviewed, Nos. 236-11-01 and 248-37-03. Evaluation of these files revealed that qualification was based on ASCO Test Report No. AGR-67368, Revision 0. Qualification test anomalies, identified in the report, involving solenoid failures due to moisture intrusion were determined to be the result of inadequate sealing of the conduit connections. In evaluating these failures, the manufacturer concluded that a properly sealed vented conduit/junction box system as described in the ASCO Catalog NP-1, "Valve Installations and Maintenance Instruction" sheets would prevent similar performance anomalies due to moisture entry into the solenoid enclosure. Licensee installation drawing No. 1-NHY-3000230, revision 24, does not reflect the manufacturer's conclusion on solenoid coil failures and the required corrective action. The installation drawing instructions appear to be based on manufacturer's Bulletin No. 206-381, Form No. V6001R1, 1981 entitled: "Installation and Maintenance Instructions" and does not consider the qualification test anomalies and concluding manufacture's resolution.

Under the heading "wiring" the bulletin states: "connect wiring through a conduit of suitable quality for the expected environment to a vented electrical junction box located in the same area as the valve. The junction box system should be oriented such that any accumulated moisture will not run into the solenoid enclosure."

The licensee's installation drawing and instructions, based on the above, contradicts the manufacturer's concluding statement following evaluation of qualification test anomalies which calls for a properly sealed system.

There is no evidence in the test report to indicate that a coil exposed to a steam/100% RH environment through a vented system is qualified.

This item is a violation of 10 CFR 50.49 (f) in that the licensee has not been able to demonstrate by testing or analysis that the solenoid coils in the installed configuration are qualified. (50-443/89-17-01)

Following the inspection, the licensee performed a review of the solenoid valves installed without conduit seals and, in a meeting on December 4, 1989 held at the NRC regional offices, committed to the following:

1. Thirty of the 111 solenoid valves involved will be modified to add conduit seals.

2. For eight valves located outside containment, the licensee will justify qualification on the basis that they experience no harsh environment during a LOCA and perform no safety function during a hot water line break outside containment.

3. For 39 valves which have an operability Code C, the licensee will perform a failure modes and effects analysis to show that failure of these valves will not adversely affect other equipment sharing the same power source. Equipment with operability Code C, as defined in Appendix E of Regulatory Guide 1.89, Revision 1, is "Equipment that will experience environmental conditions of design basis accidents through which it need not function for mitigation of such accidents and whose failure (in any mode) is deemed not detrimental to plant safety or accident mitigation; it need not be qualified for any accident environment."

4. For 34 valves which are subject to a harsh environment but deenergize on the isolation signal, the licensee will justify qualification on the basis of their operability time. In addition, the licensee will evaluate effects of failures as a result of a small break LOCA.

5. The conduit seals will be installed prior to the plant startup.

6. The analyses for the conditions described in items 2, 3, and 4, above will be completed and added to the applicable documentation packages by January 31, 1990.

On the basis of a preliminary review of the licensee's analysis, the lack of conduit seals for the valves under Items 2, 3, and 4 do not constitute a safety concern.

This item is unresolved pending NRC review of the completed licensee analysis of items 2, 3 and 4. (50-443/89-17-02).

In calculating the qualified life of normally energized solenoid valves the licensee assumed a temperature rise of 80°C above ambient. Since the manufacturer conducted extensive tests to determine the temperature rise of the critical valve components when the solenoid

coil is energized, the inspector requested that the calculations be updated to use actual test data. The licensee responded that it had obtained such data from the manufacturer and that it would be incorporated into the EQ packages via a Design Coordination Report (DCR) 88-13. This item is unresolved pending updating of the ASCO EQ files (50-443/89-17-03).

10.0 Plant Walkdown

The plant physical inspection consisted of an examination of safety related electrical equipment selected from the EQ Master List. The equipment selected was located and installed inside and outside containment and consisted of limitorque motor operated valves, pressure/level transmitters, solenoid valves, electrical splices, conax seals, and electrical penetrations. The inspectors examined characteristics such as mounting configuration, orientation, connection interfaces, model/type, moisture seals, environment, accessibility, cleanliness and physical condition.

During the course of this walkdown the inspection team noted that several devices which rely on conduit seals for qualification (Rosemount transmitters, NAMCO Limit Switches and ASCO solenoid valves) were installed without the seals. In addition, one ASCO solenoid valve (1-RH-FY-2426) was found to be fitted with a Conax conduit seal but located below flood level.

Later review of the applicable qualification reports revealed that (1) the Rosemount transmitters and the NAMCO limit switches without conduit seal had been assigned operability code C (see paragraph 9.4.3); and (2) the ASCO solenoid valve subject to submergence had been appropriately addressed under Amendment 48 of the FSAR, RAI 430.62, dated January 1983.

11.0 Unresolved Items

Unresolved items are matters about which more information is required in order to ascertain whether they are acceptable items or violations. Unresolved item(s) are discussed in Details, paragraph 9.4.

12.0 Exit Meeting

The inspectors met with licensee corporate and site personnel (denoted in Details, paragraph 1) at the conclusion of the inspection on November 10, 1989 and a subsequent meeting in the Region 1 offices on December 4, 1989. The inspector summarized the scope of the inspection and the inspection findings at that time.

At no time during this inspection was written material provided to the licensee.