3.11 ENVIRONMENTAL DESIGN OF MECHANICAL AND ELECTRICAL EQUIPMENT

The electrical portions of the Engineered Safety Features and the Reactor Protection Systems are designed to remain functional in all abnormal environments anticipated under normal, test, and design basis accident conditions. This section presents information on the design basis and qualification verifications for mechanical and electrical equipment for these systems. Section 3.7 presents the seismic design requirements and Section 3.10 presents the seismic qualification of electrical equipment.

On May 23, 1980, the NRC Commissioners issued Memorandum and Order CLI-80-21 which stated that the DOR guidelines and NUREG-0588 set the requirements that Licensees and Applicants must meet regarding the environmental qualification of safety-related electrical equipment to satisfy 10CFR50, Appendix A, General Design Criteria (GDC) 4. This evaluation was conducted and the required information is detailed in the docketed "Salem Generating Station, Environmental Qualification Review Report," Volumes 1 and 2, transmitted to the NRC on December 12, 1980, and in subsequent revisions. This information was reviewed by the NRC staff and their consultant, the Franklin Research Institute. Safety Evaluation Reports (SERs) for both units were issued initially in mid-1981 and in January 1983. Public Service Electric & Gas (PSE&G) has responded, as required, to the "Open Items" in these SERs.

3.11.1 Equipment Identification and Environmental Conditions

3.11.1.1 Equipment Identification

Class 1E equipment that is located in a harsh environment and must operate to mitigate the effects of an accident and maintain the plant in a safe condition are identified in the SAP database.

3.11.1.2 Accident Conditions

Plant environments in various plant zones for an array of accident conditions are also contained in the "Salem Generating Station, Environmental Design Criteria, document S-C-ZZ-SCD-1419.

3.11.1.3 Normal Operating Environment

Temperature in the control room and adjoining equipment room is maintained for personal comfort at 70°F ± 15°. Protective equipment in this space is designed to operate within design tolerance over this temperature range. Design specifications for this equipment specify no loss of protective function over the temperature range from 40°F to 110°F. Thus there is a wide margin between design limits and the normal operating environment for control room equipment.

Within containment, the normal operating temperature for protective equipment, except out-of-core neutron detectors and equipment inside the Pressurizer Enclosure, will be maintained below 120°F. Protective instrumentation is designed for continuous operation within design tolerance in this environment. Out-of-core neutron detectors are designed for continuous operation at 135°F, and the normal operating temperature will be maintained below this value. The detectors will withstand operation at 175°F for short durations (8 hours). Process instrumentation in containment which is vital to plant protection is designed to survive the post-accident environment long enough to perform the required protective function. Pressurizer Enclosure equipment has been evaluated and qualified to higher temperatures.

Qualification testing has been performed on various safety systems such as Process Instrumentation, Nuclear Instrumentation, and Relay Racks. This testing involved demonstrating operation of safety functions at elevated ambient temperatures to 120°F for control room equipment and in full post-accident environment for required equipment in containment. Detailed results of some of these tests are proprietary to the suppliers, but are on file at the suppliers and available for audit by qualified parties.

The initial qualification test of individual components, and the integrated tests of the systems as a whole, complement each other to assure performance of the system as designed to prove proper operation of the actuation circuitry. For engineered safety features inside the containment, qualification testing and/or analysis is performed under the effects of the conservative post accident environmental parameters where applicable.

3.11.2 Qualification Tests and Analyses

For Class 1E equipment, Salem Station meets the Institute of Electrical and Electronics Engineers (IEEE) Standard 323-1971, "IEEE Standard for Qualifying 1E Equipment for Nuclear Power Generating Stations." Containment fan cooler motors have been tested according to IEEE Standard 334-1971, "Trail use Guide For Type Tests of Continuous Duty Class 1 Motors Installed Inside Containment of Nuclear Power Generating Stations."

Comprehensive testing and/or analysis is conducted for that Class 1E electrical equipment and components which are required to function during and subsequent to any of the design basis accidents. The program consists of performing tests of individual pieces of equipment in the manufacturer's shop, integrated tests of the system as a whole in the field, and periodic inspection and tests of the activation circuitry and mechanical components to assure reliable performance upon demand, throughout the plant lifetime.

3.11.3 Qualification Test Results

The results of qualification tests for all safety-related equipment that is required to operate in a harsh environment and mitigate the effects of an accident are contained in the Salem Equipment Qualification Binders.

3.11.4 Loss of Ventilation

The control room, equipment rooms, relay room, and switchgear rooms will not experience a harsh environment caused by a high energy break analysis, main steam line break, loss-of-coolant accident, or recirculated fluids. These areas are served by Class 1E redundant ventilation equipment which are also not subject to harsh environments and are located in benign areas for radiation doses following an accident.