UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATING TO LICENSING BASIS CHANGES FOR

PUBLIC SERVICE ELECTRIC AND GAS COMPANY

SALEM NUCLEAR GENERATING STATION, UNITS 1 & 2

DOCKET NOS. 50-272 & 50-311

1.0 INTRODUCTION

By letter dated February 8, 1996, Public Service Electric and Gas Company (PSE&G, the licensee) proposed to change the design basis for Salem Nuclear Generating Station, Units 1 and 2. The proposed change would replace the air dryers in the Emergency Diesel Generator (EDG) air start systems, as the method for removing system moisture that was found acceptable in Supplement 5 to NUREG-0517, Safety Evaluation Report, as the means of ensuring reliable EDG operation. In lieu of air dryers, the licensee proposes to replace the system with piping and components made of corrosion resistant materials, except for the air receiver materials, and a filtration system.

2.0 PROPOSED DESIGN CHANGE

In response to the recommendations of NUREG/CR-0660, "Enhancement of On-Site Emergency Diesel Generator Reliability," the licensee committed to maintain an atmospheric dew point of -100°F in the EDG air start systems. To accomplish this, the Salem design included desiccant air dryers between the air compressors and the starting air receivers in the EDG air start system. Over time, the licensee has observed that the desiccant air dryers are not adequately removing moisture and may be allowing desiccant carryover into the air start system. Because the system piping and components are primarily made from carbon steel, the moisture in the system is causing rust. The rust and desiccant carry over has the potential for fouling system components which could cause the air start system to fail to function or otherwise impact EDG reliability.

The type of dryer associated with the original licensing basis has two sections which are alternately regenerated using dry air from the section in service. At Salem, the compressed air is only used to start the EDGs, with no other functions such as control air. Consequently, the compressors do not cycle very often, and there is not enough air flow to regenerate the air dryers. Consequently, they tend to malfunction and become saturated. This, in turn, creates the rust and desiccant carryover concerns discussed above.

To resolve this problem, the licensee has proposed to modify the air start system by replacing the desiccant dryers with a filtration system.

Enclosure

The design change will minimize moisture in the air start system by installing an after cooler, moisture separator, and after filter between the air compressors and the air receivers. The after cooler is designed to reduce the temperature of the entering air from 450°F to 120°F. This will result in condensing most of the moisture in the air which will then be removed in the moisture separator. The moisture separator is designed to remove 99% of entrained liquids and solids that exceed 10 microns in size, and has an automatic trap to drain separated liquids. The after filter is the coalescing type and is designed to remove 93% of water, oil, and particulate that is 0.1 micron or larger in size. With the above system in operation, the air entering the air receivers will be clean and, at worst, at saturated conditions. To further ensure there will be no free water in the system, the licensee will continue to "blow down" (i.e., opening the drain valve at the bottom) the air receivers twice each day to remove any free water that may possibly accumulate.

Removal of particulates from the compressed air will be accomplished with a 10 micron air filter at the compressor intake, and the above moisture separator and coalescing after filter. The after filter will also remove lubricating oil carryover from the compressor. Since the air dryers will have been removed, there will be no problem with desiccant carryover. The design change also includes #20 mesh strainers in the air lines downstream of the air receivers to remove any foreign matter that may come from the air receiver (the only ferrous metal component in the system). These strainers will have a blowdown valve and will be subject to a "blow down" following each EDG start. This will remove any particulate that may have collected during the EDG start cycle. Finally, should any particulate get past the in-line strainers, it will be prevented from reaching critical system components by a filter in the pressure regulating valves.

3.0 STAFF EVALUATION

Moisture in an airstart system can cause problems in several ways. It can cause rust which can foul system components or act as an abrasive on parts such as air start motor vanes, causing excessive wear and malfunctions. Moisture can also mix with airborne particulates such as dust, oil, or desiccant, and form a sludge that will cause components to stick and malfunction. Components made of ferrous metal can become rusted and malfunction, or problems can result from any combination of these effects.

Moisture related problems in air start systems can be minimized by removing the moisture before it can enter the system by using air dryers. However, the experience at Salem has demonstrated that the use of air dryers is not necessarily the best solution. An alternative to air dryers is a system designed to remove free water and particulate from the air, and designing the system to be tolerant of moisture in the vapor state without malfunction. The licensee has chosen to adopt this alternative approach to moisture control in the EDG air start system.

The proposed system design will remove free water from the air supply and limit the source of possible particulates in the system to the air receivers. The air receivers are made of carbon steel and will be retained in the new design. Consequently, there is the possibility of rust formation that could potentially enter the system. Rust formation will be minimized by eliminating free water as discussed above, and any loose rust particles that do form will fall to the bottom of the air receivers. Since the starting air lines to the EDG are located at the top of the air receivers, the possibility of any of the limited rust particles that may be present being carried over with the air stream during an EDG start is substantially reduced, and any that does will be caught in the strainers or reducing valve filters.

The licensee's proposed system design will operate with a higher moisture content than a system with a properly functioning air dryer. However, as discussed above, the only ferrous metal component in the proposed design will be the air receiver. All other components will be made from corrosion resistant materials (stainless steel, aluminum, bronze), and will be capable of operating in the expected environment.

The proposed air start system design will provide an acceptable alternative to the recommendations of NUREG/CR-0660 by eliminating free water and particules, and minimizing rust contamination by using corrosion resistant materials. Of these items, eliminating free water is the most significant since it is the most likely source of air start system malfunctions.

Section V of NUREG/CR-0660 contains recommendations regarding the use of dryers in air start systems. That study describes, at some length, the problems that had and could occur as a consequence of "wetted surfaces in the presence of air." "Wetted surfaces" require free water by well understood and effective devices prior to the air entering the system. Based on this, the staff concludes that the licensee's proposed changes to the EDG air start systems provide an adequate alternative to achieve the objectives of the recommendations of NUREG/CR-0660 and are, therefore, acceptable.

4.0 CONCLUSION

The staff concludes that the proposed design of a filtration system for the EDG air start system is an acceptable alternative to the former air dryer system. This design will provide an air source suitably free of free water and particulates to ensure reliable operation of the air start system, and the associated emergency diesel generators. On this basis, the staff concludes that the design change is acceptable and satisfies the applicable regulatory requirements, including General Design Criterion 17 in Appendix A to 10 CFR 50. The design change does not require any changes to the plant technical specifications.

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