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June 17, 1985

Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. Hugh L. Thompson, Jr., Director
Division of Licensing

Gentlemen:

RESPONSE TO GENERIC LETTER 85-02
UNITS NO. 1 AND 2
SALEM GENERATING STATION
DOCKET NOS. 50-272 AND 50-311

PSE&G hereby submits its response to Generic Letter 85-02, dated April 17, 1985, concerning Steam Generator Tube Integrity and Steam Generator Tube Rupture Mitigation.

Should you have any questions, do not hesitate to contact us.

Sincerely,

Attachment

C Mr. Thomas Kenny
Senior Resident Inspector

Mr. Donald C. Fischer
Licensing Project Manager

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ATTACHMENT

Response to Generic Letter 85-02

DESCRIPTION OF PROGRAMS FOR ASSURING STEAM GENERATOR TUBE INTEGRITY AND FOR STEAM GENERATOR TUBE RUPTURE MITIGATION

Salem Generating Station

1.a. Prevention and Detection of Loose Parts (Inspections)

Visual inspections of the secondary side of the steam generators have been performed during each refueling outage in conjunction with sludge lancing. These visual examinations are performed as necessary to prevent and detect undesirable conditions that could adversely impact the structural integrity and availability of the steam generators. These inspections are conducted to determine the general condition of the steam generators and focus on:

1. The tube lane, row 1 tubes and flow slots,

2. Sludge lanced areas and the conditions associated with sludge build up,

3. Steam separator and dryer components, and

4. Detection of, and damage associated with foreign objects in the tube sheet area, including the periphery of the tube bundle.

The inspections are performed utilizing direct and remote visual examination techniques (still cameras and fiber optics). Fiber optic equipment with video monitoring capabilities has been used for thorough examinations of the secondary side of the steam generators.

1.b. Prevention and Detection of Loose Parts (Quality Assurance)

Introduction of foreign material into the primary or secondary side of the steam generators is precluded through procedures for tool and miscellaneous item control, accountability, and closure inspections. A tool and miscellaneous items control form is used to account for tools and equipment used during an operation.

All items entering or exiting the controlled area are inventoried. Lanyards are utilized when recovery of lost items would be difficult. Tape or restraining bands secure essential personal items such as glasses and dosimetry. Temporary covers are installed over openings to preclude introduction of foreign objects. Upon completion of work, a comprehensive review of the tracking form and direct or remote visual inspection of the controlled area is required prior to closing the steam generator. Cleanliness requirements for the controlled area are identified which apply to components and parts removed from the internals of major components.

2.a. Inservice Inspection Program (Full Length Tube Inspection)

The Salem Technical Specifications define tube inspection as an inspection of the steam generator tube from the point of entry (hot side) completely around the U-bend to the top support of the cold leg. However, inspections are frequently performed on the entire length of the tube (tube end to tube end), which includes the hot leg side, U-bend, and cold leg side.

Some difficulty has been encountered in performing these full length inspection on tubes with tight radius U-bends (tube rows 1 to 10). Full length inspections are performed from the hot side tube end up into the U-bend as far as possible, and then from the cold side tube end up into the U-bend. These inspections significantly increase radiation exposure to personnel because access to the cold leg side is required. They are only performed when it is judged that the information to be gained from the inspection can justify the additional radiation exposure.

2.b. Inservice Inspection Program (Inspection Interval)

The Salem Technical Specifications require performance of eddy current inspections at intervals of not less than 12, nor more than 24 calendar months after the previous inspection. In addition, if the results from two consecutive inservice inspections fall within the C-1 category, or if two consecutive inspections demonstrate that previously observed degradation has not continued and no additional degradation has occurred, the inspection interval may be extended to a maximum of 40 months.

PSE&G supports the staff recommended action whereby the maximum allowable interval of 40 months be increased to 72 months.

3.a. Secondary Water Chemistry Program

An important component in the overall program to assure steam generator tube integrity is the secondary water chemistry program, which was developed over a period of time at Salem.

Salem Unit No. 1 entered its first operating cycle in 1977. The unit operated for the majority of the fuel cycle with leaking condenser tubes and high dissolved oxygen concentrations in the feedwater system. Eddy current examination results during the first refueling outage revealed that some of the tube-to-tube support plate intersections had become dented. Although the denting was considered minor, several actions were taken to preclude further denting. These actions included installation of a full flow condensate polishing system, retubing the condenser (replaced copper nickel tubes with AL-6X tubes), and installation of a 1/3 flow condensate cleanup system for cycle cleanup prior to power operation. Upon return to operation for the second fuel cycle, steam generator chemistry and dissolved oxygen levels were noticeably improved.

Eddy current examinations performed during the second refueling outage in 1980 showed no detectable increase in the number of dented intersections. In addition, a system to return blowdown to the hot well was installed during this outage.

Salem Unit 2 entered its first operating cycle in 1981. Although the unit was equipped with a full flow condensate polishing system, there was some concern, since the condenser was tubed with copper nickel. The secondary water chemistry control program was implemented at that time. Based on an evaluation of Salem Unit 1 operating data and EPRI laboratory data on denting phenomena, the chemistry limiting conditions for operation were developed and implemented. These limiting conditions are generally more limiting than those specified in SGOG Special Report EPRI-NP-2704," PWR Secondary Water Chemistry Guidelines," October 1982. Because Salem's steam generator cation conductivity for normal operation is significantly lower than that recommended by the Westinghouse SGOG, a higher transient limit is specified.

The Station Chemistry Engineer has the responsibility for corrosion prevention in the steam generators. He has the authority to interpret plant water chemistry information and to recommend appropriate corrective actions to management.

Another important aspect of PSE&G's program is proper material selection. Material appropriate to its intended use is selected with due consideration of corrosion. Materials of construction of the plant are primarily carbon steel and other iron alloys, with only the moisture separator reheater tubing being copper nickel.

The success of the secondary water chemistry program at Salem is evident. Steam generator denting on Salem Unit 1 has shown no signs of progressing since it was first discovered over five years ago. Salem Unit 2 has never shown any signs of corrosion related phenomena since initial operation. PSE&G has and will continue to evaluate its program based on its own operating experience and that of the industry. Changes will be made to the program where evaluation indicates improvement is needed.

3.b. Condenser Inservice Inspection Program

Based on operating experience at Salem, PSE&G has found that a formal condenser inservice inspection program is not required. Both units have AL-6X condenser tubes, an on line condensate polishing system and a 1/3 flow startup condensate cleanup system. There is no copper bearing material in the condenser or feedwater heaters subject to attack by ammonia and oxygen. The major contribution of dissolved oxygen has been found to originate in the area below the condenser water line and at the suction of the condensate pumps. Air inleakage in the condenser above the water level has been a negligible contributor to dissolved oxygen in the condensate system.

Hydrostatic testing prior to pulling condenser vacuum has been found to be the most effective method for locating leaks below the hotwell water level, up to the suction of the condensate pumps. When the unit is in operation the most effective method for locating leaks has been to apply a sealant on the most likely components to be leaking (condensate pump suction strainer, etc.). The process continues until dissolved oxygen is no longer present.

In the case of air inleakage above the hotwell water level, the major portion of air is removed by the vacuum pumps.

The minor amount that remains will either combine with the condenser material to form iron oxide or appear as dissolved oxygen. The majority of the iron oxide is removed in the condensate polishing system. If the air inleakage is such that the unit cannot maintain rated load, the condensate dissolved oxygen will show a small increase. In these cases, use of a sonic leak detector has proven to be effective. Helium and mass spectrometers have been used to detect tube leaks.

All six condenser halves are equipped with on line cation conductivity monitors. These are backed up by sodium and cation conductivity monitors on each of the three condensate pump discharge headers.

Eddy current inspections are normally conducted on selected tubes during refueling outages. In addition, a periodic visual inspection of the condenser internals is also conducted. Inspections to date show no indication of AL-6X condenser tube degradation.

4. Primary to Secondary Leakage Limit

Standard Technical Specification (STS) limits for primary to secondary leakage are in effect at Salem.

5. Coolant Iodine Activity Limit

STS limits for coolant iodine activity are in effect at Salem.

6. Safety Injection Signal Reset

Safety injection is initiated by the safety related charging pumps, and suction is taken from the refueling water storage tank. Suction is not taken from the boric acid storage tanks.

Category C-2 Steam Generator Tube Inspection

The selection of additional tubes to be inspected, beyond the requirement in the Technical Specifications is based on several factors including types of indications, locations and patterns of indications, and degradation mechanisms. Also considered are both industry and Salem steam generator inspection histories. Decisions to inspect additional tubes are made in conjunction with Westinghouse, which has a specialized steam generator group. Westinghouse has also served as the inspection agent.

The same factors are used to determine whether to include all steam generators in the inspection. The steam generators are reinspected at the next refueling outage. This policy is based on analysis of previous data to determine propagation rate. If such data were insufficient to determine propagation rate, and the possibility of tube failure before the next scheduled refueling outage existed, conservative measures, such as removing the tube from service, would be taken.

In all of the situations discussed, the degradation mechanism and its potential for causing a tube failure is considered when deciding to go beyond Technical Specification requirements. The steam generator ISI data base is now sufficiently large that, as long as conditions remain satisfactory, we intend to reduce the scope of tube inspections to Technical Specification requirements only.

PSE&G recommends that existing Technical Specification requirements be changed to permit alternate sampling plans with commensurate penalties. Expanded sampling plans should permit expanded rejection levels prior to entering into C-2 or C-3 programs. We have found that the Technical Specifications do not provide sufficient latitude in expanding the scope of inspections in that they may require inspections in areas that are not relevant to the particular problem.