U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report Nos. 50-272/93-17
50-311/93-17
50-354/93-15

Docket Nos. 50-272
50-311
50-354

Licensee: Public Service Electric and Gas
P. O. Box 236
Hancocks Bridge, New Jersey 08038

Facility Name: Salem Nuclear Generating Station Units 1 and 2
Hope Creek Nuclear Generating Station

Inspection At: Hancocks Bridge, New Jersey

Inspection Conducted: May 24-28, 1993

Inspector: P. Patnaik 6-17-93
P. Patnaik, Reactor Engineer, EB, DRS Date

Approved By: H. J. Kaplan for E. H. Gray 6-17-93
E. H. Gray, Chief, Materials Section Date

Areas Inspected: Review of the program and a sample of inspection data on the eddy current examination of steam generator tubes and the erosion/corrosion monitoring of high energy piping of Salem Unit 2 during the seventh refueling outage. Close out findings of previous inspections 50-272/92-08 on Salem Unit 1 and 50-354/92-11 on Hope Creek in the area of erosion/corrosion.

Results: A review of the eddy current examination program and a sample of inspection data indicated compliance to regulatory requirements. The licensee has implemented an upgraded erosion/corrosion monitoring program at Salem Unit 2 during the outage which meets the latest industry guidelines. The Notice of Deviation and Unresolved Items of previous inspections Salem Unit 1, and Hope Creek in the erosion/corrosion area were closed out upon review and verification by the inspector of licensee supplied information.

DETAILS

1.0 STEAM GENERATOR EDDY CURRENT EXAMINATION

1.1

The steam generator eddy current examination is performed to ensure integrity of steam generator tubes and hence the reactor coolant pressure boundary. This examination was performed during the seventh refueling outage of Salem Unit 2, to comply with requirements of the Technical Specification.

1.2 Finding

The licensee performed bobbin coil examination of fifty percent of the tubes in steam generators 22 and 24. This sample was comprised of the six percent required by the Technical Specification and an additional forty four percent which included tubes with previous indications. The majority of bobbin coil indications were due to wear at antivibration bars (AVB) and distorted signal indications at the supports. There were a significant number of dents greater than 5 volts in amplitude in both steam generators. In the (AVB) region (Row 27, Col 33 and Row 27, Col 35) of steam generator 22, there were two pluggable indications. As a result, the sample for bobbin coil examination was expanded by twelve percent per the Technical Specification. The licensee planned to perform rotating pancake coil (RPC) examination of fifty percent of the tubes in the region of hot leg tubesheet of the number 22 and 24 steam generators. This region was selected due to historical cracking in the explosion transition region of tube expansion in the tubesheet. However, some wear indications were observed just above the top of the tubesheet in both steam generators. These were re-evaluated by RPC using the AVB calibration standard to construct an amplitude based curve. Two indications measured less than 20 percent through wall, two greater than 40 percent and the remainder were between 30 percent and 39 percent through wall. In regard to uncertainty of measurement the licensee decided to preventively plug all indications which were greater than 30 percent through wall. Due to indications found by RPC, the scope of examination by RPC was expanded to cover 100 percent examination of tubes within the tubesheet on the hot leg side of both steam generators.

Based on the results of bobbin coil examination, supplemental RPC examination was also performed at the hot leg support plates with dent indications. The RPC examination revealed no detectable degradation at any of the intersections examined in either steam generator. In all, thirty-eight tubes were plugged of which, thirty-one tubes were plugged due to imperfection depths greater than or equal to 40 percent and seven tubes were plugged due to imperfection depths between 30 and 40 percent. The certifications of eddy current examination personnel were reviewed for compliance with ASNT requirements. There was no discrepancy noted.

1.3 Conclusion

For those areas inspected, the eddy current examination met the requirements of the NRC Regulatory Guide 1.83 and the Technical Specification. Licensee's data evaluation and plugging criteria for defective tubes were found to be conservative.

2.0 CLOSEOUT OF FINDINGS FROM PREVIOUS EROSION/CORROSION INSPECTIONS OF SALEM UNIT 1 AND HOPE CREEK

2.1 (Closed) Deviation (50-272/92-08-01)

The NRC inspection (50-272/92-08) on Salem Unit 1 identified a deviation to the Updated Final Safety Analysis Report (UFSAR) Section 10.4.7.1 which states that the feedwater piping outside the containment is designed to ANSI B31.1 (1967 Ed) Code. ANSI B31.1 requires that power piping systems be designed for the most severe condition of coincident pressure and loading. For portions of the feedwater system, the normal operating pressure is 1150 psig, but the feedwater pump maximum design output pressure is 1870 psig.

Contrary to the above, the NRC review of licensee's disposition of degraded components in the feedwater system outside the containment, e.g. expanders, elbows, pipe bends, etc. that were below minimum design wall due to manufacturing error and erosion/corrosion, indicated licensee's acceptance based on operating pressure alone which violated the applicable design code ANSI B31.1 (1967) specified in the UFSAR.

During this inspection (93-17), the inspector verified the following corrective actions by the licensee.

- PSE&G has issued documents identifying the feedwater design pressure and feedwater maximum working pressure to be used to calculate the required minimum pipe wall thickness. These pressures were identified in accordance with ANSI B 31.1 Code .

- PSE&G has issued a methodology for conservatively calculating the Erosion/Corrosion (E/C) rate and the predicted minimum wall thickness to the next refueling outage as outlined in the procedure titled PSE&G Erosion/Corrosion program for Salem Unit 1 & 2 (SC.DE-AP.ZZ-0055(Q)).

Based on a review of Salem Unit 2 E/C data analysis during the recent outage on various systems, the inspector verified the application of the methodology. The Notice of Deviation 50-272/92-08-01 is closed.

2.2 (Closed) Deviation 50-354/92-11-01

The NRC inspection (50-354/92-11) on Hope Creek identified a deviation to PSE&G's commitment in response to Generic Letter 89-08. The Erosion/Corrosion program addressed in PSE&G's Engineering Evaluation for Hope Creek refueling outage 3 specified under paragraph 4.3 that a grid size of one inch shall be used for ultrasonic examination of pipe sizes six inches in diameter and under. Contrary to this, the field data showed that a grid size of two inches was used for examination of six inch diameter pipes and below. This is a deviation from the engineering evaluation provided in response to NRC Generic Letter 89-08.

During this inspection (50-354/93-15), the inspector verified that the deviation was isolated to the incorrect grid size on one pipe reducer. The ultrasonic data for the reducer indicated little or no wall thinning and consequently, the use of a two inch grid size was not safety significant. The Notice of Deviation 50-354/92-11-01 is closed.

2.3 (Closed) Unresolved Item 50-354/92-11-01

The NRC inspection (50-354/92-11) on Hope Creek had an unresolved item (354/92-11-1) concerning Hope Creek CHEC E/C computer records. During the inspection, the CHEC analysis for the condensate, feedwater and the extraction steam systems were not available for inspector's review. Subsequently, during the inspection 93-15, the inspector was given the reconstructed CHEC analysis of the feedwater and the condensate system components. The extraction steam system however was not analyzed by CHEC since the system contains two phase flow. The inspector's review of the reconstructed CHEC analysis of the feedwater and the condensate system components was satisfactory. Hence, the unresolved item (50-354/92-11-01) is closed.

2.4 Conclusion

The licensee has implemented detailed procedures and programmatic standards for the E/C monitoring program for Salem and Hope Creek which clearly address component selection, examination and disposition. Additionally, the licensee's engineering personnel have been trained in the use and the requirements of the above documents. The training records were also made available for the inspector's review during this inspection. The implementation of the upgraded program was evident during the May '93 outage of Salem Unit 2. The current program meets the industry standards and is considered to be highly effective in long term Erosion/Corrosion monitoring at Salem and Hope Creek.

3.0 Long Term Erosion/Corrosion Monitoring Program of Salem Unit 2 (IP 49001)

3.1 Scope

The monitoring of erosion/corrosion (E/C) in high energy piping is important to maintain structural integrity of piping and components. During this inspection, the licensee's upgraded program implemented since March 1993 was reviewed. The program addressed selection of components for examination, thickness measurement, evaluation of data and disposition.

3.2 Findings

During the seventh refueling outage of Unit 2, the licensee selected 136 components for examination from the following list of systems using CHECMATE computer code, industry experience, and plant specific operating experience. Out of 136 components, 60 components were selected by CHECMATE analysis.

List of Systems

Heater Drains
Gland Seal Steam
Moisture Separator Reheater (MSR) Drains
Bleed Steam
Cold Reheat
Steam Generator Blow Down
Miscellaneous Drains
Heater Vents
Condensate
Feedwater
Feedwater Recirculation
Turbine Drains
Auxiliary Feed

Following initial examination, 27 components were added as an expanded sample with the total number of components evaluated being 163. The licensee replaced eleven components due to the predicted wall thickness being less than the minimum wall thickness.

The erosion/corrosion data on the following components were reviewed.

System	Component ID	Component
• Feedwater	2-SFG-2-01	Orifice, Pipe
• MSR Drains	2S-MSR-321A-01	Pipe
• Heater Drain	2S-HD-546-L2	Elbow

The evaluation of data in estimating wear rate, predicting wall thickness, and establishing the remaining pipe wall was in compliance with the procedure outlined in the program document SC.DE-AP.ZZ-0055(Q) Rev. 1.

The ASME Code job package for the replacement of feedwater elbow (2-SGF-19-L1) of steam generator #24 due to erosion/corrosion was reviewed. The following documents were reviewed.

- Modification Concern Resolution (MCR) Form
- Weld History Record
- Welding Procedure
- Baseline examination per ASME Code Section XI

These documents were comprehensive and contained the appropriate information. There was no discrepancy noted in the review.

3.3 Conclusion

For those areas inspected, the long term Erosion/Corrosion monitoring of susceptible components of Salem Unit 2 complied with the licensee's upgraded program. A review of the program and the procedures indicated that these documents comply with the latest industry guidelines. The implementation of the program was found to be effective.

4.0 Entrance and Exit Meetings

Members of the licensee's management were informed of the scope and the purpose of this inspection at the entrance meeting that took place on May 24, 1993. The findings of the inspection were presented to and discussed with members of the licensee's management at the conclusion of the inspection on May 28, 1993. The licensee did not disagree with the findings of the inspection. A list of attendees at the exit meeting is appended to this report as Attachment 1.

Attachment 1

NRC EXIT MEETING

May 28, 1993

PSE&G Personnel

C. Conner	Supervising Engineer
M. Gray	Licensing Engineer
M. Laham	Sr. Mechanical Plnr
L. Lake	Sr. ISI Engineer
D. Lamastro	E&PB
C. Manges	Licensing Engr (Actg HC SLE)
R. Montgomery	E&PB Engineer
J. Nichols	Mgr. Reliability & Assmt.
J. Ranalli	Nuc. Mech. Engr. Mgr.
S. Robitzski	System Engineer
W. Schultz	Mgr. Station QA Salem
K. Pike	Mgr. Salem Tech. Rept. Actg.
E. Villar	Licensing
C. Vondra	GMSO

US Nuclear Regulatory Commission

S. Barr	Resident Inspector
P. Patnaik	Reactor Inspector