UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W., SUITE 2900
ATLANTA, GEORGIA 30323-0199

Report No.: 50-261/94-10

Licensee: Carolina Power and Light Company
P. O. Box 1551
Raleigh, NC 27602

Docket No.: 50-261 License No.: DPR-23

Facility Name: H. B. Robinson

Inspection Conducted: March 7 - 10, 1994

Inspector: N. Economos 4-7-94 Date Signed

Approved by: J. J. Blake, Chief 4-7-94 Date Signed
Materials and Processes Section
Engineering Branch
Division of Reactor Safety

SUMMARY

Scope:

This announced reactive inspection was performed to observe corrective actions in response to loose parts discovered in Steam Generator "C".

Results:

In the areas inspected, violations or deviations were not identified.

On February 22, 1994, the licensee commenced an investigation in response to a trouble alarm received from the loose parts monitor in S/G "C". Following an analysis of the recorded noise, the licensee shutdown the plant to investigate conditions in S/G "C". Visual examination of the secondary side revealed two strips of metal resting on the tubesheet, near the periphery by handhole No. 3. A metallurgical investigation revealed the composition of both metal objects were similar to welding electrodes specification(s) 8018 and 9018, believed to have been used to fabricate replacement steam generator shell welds.

Eddy Current (ET), examination of tubes in suspect locations resulted in the plugging of two tubes, R1-C90 and R3-C90. Both tubes exhibited significant localized wear at the point of contact with the metal objects. This condition was observed with the video and confirmed by ET. During the next scheduled refueling outage the licensee will perform a video inspection of S/G(s) A & B to look for loose parts. This matter has been identified as Inspector Followup Item 94-10-01 (paragraph 3) for tracking purposes. The licensee's technical support group showed significant strengths in organizational project oversight and expertise in executing this work effort.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*R. Clark, Manager Maintenance
*T. Cleary, Manager Technical Support
*C. Hinnant, Vice President, Robinson Plant
*K. Jury, Manager Licensing, Regulatory Programs
*R. Lewis, Steam Generator (S/G) Engineer, Nuclear Services Department
*D. Meleg, Level III NDE Examiner, Corporate
*J. Moon, Manager, Operations Support
*P. Musser, Manager Engineering & Technical Support Nuclear Assessment Department (NAD)
*M. Pearson, General Manager, Robinson Plant
*S. Wheeler, S/G Team Leader, Dayshift

Other licensee employees contacted during this inspection included engineers, operators, technicians, and administrative personnel.

NRC Resident Inspector(s)

W. Orders, Senior Resident Inspector
C. Ogle, Resident Inspector

*Attended exit interview

2. Loose Parts in Secondary Side of S/G "C" (IP73753).

On February 21, 1994, the licensee received a trouble alarm signal from the Digital Metal Impact Monitoring System, (DMIMS) which was subsequently analyzed by Westinghouse as a metallic object in the secondary side of S/G "C". On February 24, 1994, the licensee commenced reactor cooldown in preparation for an inspection to locate and retrieve the loose metal objects. During a telephone conference on March 2, 1994, between the licensee, NRR and Region II, the inspector ascertained that two metal objects (strips) had been located and retrieved from the subject steam generator. The metal objects were described as having similar width and thickness approximately 1 inch wide x $\frac{1}{4}$ inch thick, while the lengths were described as, approximately 11 inches and three inches respectively. On March 7, 1994, the inspector visited the H. B. Robinson plant to observe the Eddy Current examination of selected S/G tubes; evaluated results and corrective actions taken to assure safe plant operation.

Background:

The original S/G(s) at H. B. Robinson were replaced in 1984 with Westinghouse 44F series. Each S/G has a total of 3214 tubes, each measuring 0.875 inch outside diameter and 0.050 inch wall thickness. The tube material is inconel 600. The tube bundle consists of 45 rows and 92 columns, supported by six support plates and four anti-vibration bars.

Eddy Current examination of S/G tubes has been performed in accordance with Technical Specification (TS), 4.2, Inservice Inspection of Steam Generator Tubes and ASME Code Section XI, 1986 Edition requirements. See NRC Inspection Report 50-261/93-20 for details on Eddy Current examination performed during scheduled refueling outages, i.e., the Fall of 1993.

At the completion of the Fall 1993 Eddy Current examination, 100 percent of the tubes in each of the three S/G(s) had been inspected. Tube inspection is defined as the length of the tube from the tubesheet on the hot leg, over the U-bend to the first support on the cold leg side of the S/G. Through discussions with cognizant licensee personnel, the inspector ascertained that S/G "C" has two tubes which were plugged during previous outages - these are as follows:

Year	Tube Row	Column	Location	Reason for Plugging
1988	7	92	Cold Leg	Manufacturing Marks
1990	2	90	Cold Leg	Loose parts, OD wear

While on-site, the inspector ascertained that the bobbin coil inspection of a planned population of 483 tubes in S/G "C" was completed. Approximately 25 tubes had been scheduled for re-examination and re-evaluation for high noise signals. This work effort was still in progress.

3. Video Inspection, Retrieval and Identification of Loose Parts.

Following plant shutdown, the licensee performed a remote video inspection of the secondary side of S/G "C". The inspection was confined to the top of the tubesheet and included tubes on either side of the tube lane and the periphery/annulus. There was no attempt made to inspect any other elevations, i.e., support plates at this time. This inspection appeared to confirm the recorded DMIMS signals in that, two loose parts were located near handhole No. 3, close to the periphery. The longer of the two objects was observed resting across the tube lane and wedged between columns 90 and 91 but leaning against three rows of tubes in column 90. Wear marks (gouges) were observed on the hot and cold leg side of tube R1-C90. The wear indications were located on the tube, just above the tubesheet. The smaller of the two objects was found lodged against the blowdown pipe. Both objects were retrieved and analyzed by the licensee and Westinghouse. Results of these analyses showed that both metal objects were made of the same low allow steel material, which had a cast microstructure, most likely from a welding process. A likely alloy, based on the analysis results, would be SA-A533 Type C. However, because the analysis reports showed the material contained > 1.0% of nickel, it appeared to conform to welding electrode specification(s) 8018 and 9018, the type used in the fabrication of S/G shell welds. The subject reports also indicated that a metallagraphic examination of the cross sectional surfaces disclosed a cast structure with heavy porosity. The material was reported to be

magnetic and exhibited a hardness in the range of R_B80 to 91. The outer surface of both objects was heavily oxidized, with a hard oxide layer. The reports concluded that the two metal objects were probably the root portion of welds removed by carbon arc gouging during fabrication of the steam generator shell welds. The inspector noted that although the reports provided an adequate identification of this material the licensee could not specifically identify whether this material originated at the vendor's shop or on site during replacement of the steam generators. Discussions with the licensee revealed that the girth welds of the replacement steam generators, identified as the most likely source for the material, were fabricated on site and were backgouged from the outside of the steam generator. This fabrication method would be expected to prevent such material from falling into the secondary side or annulus of the S/G(s). Because of this uncertainty, the licensee will perform a similar video inspection in S/Gs "A" and "B" during the next scheduled refueling outage to look for similar objects which may be lodged in similar spaces. This matter was identified as inspector followup item, IFI 261/94-10-01 "Perform Video Inspection of S/G(s) "A" & "B" Secondary Side for Loose Parts".

4. Eddy Current (ET) Inspection and Findings.

Tube selection for ET examination included an array of tubes around the periphery, two rows on either side of the tube lane and a group inside the area bounded by rows one through 20 and columns 86 through 92 on both hot and cold leg sides of the S/G near handhole three. In total, the population of selected tubes designated for ET examination amounted to 483 tubes. ASEA Brown Boveri, Combustion Engineering Inc. (ABB/CE), was contracted by the licensee to perform the examination. Controlling documents/procedures used for the examination and analysis of data were as follows:

SP-1240, Rev 1,	Steam Generator Eddy Current Testing, Special Procedure
ROB-410-004, Rev 5,	Procedure for Multifrequency Eddy Current Examination of Nonferromagnetic Steam Generator Tubing Using MIZ-18A Equipment
ROB-410-005, Rev 4,	Eddy Current Data Analysis Procedure Evaluation of Westinghouse Steam Generator Tubing
ROB-410-006, Rev 2,	Procedure for Control of Eddy Current Data for Use with Multiforth or Eddynet Acquisition Systems
Analysis Guidelines,	H. B. Robinson Unit 2 August, 1993, S/G ECT Data Analysis Guidelines

Because of the relatively small work scope the data acquisition equipment and personnel were stationed inside containment. This was in contrast to the normally used eddynet system which utilizes a remote system. The examination was performed with bobbin coil probes, 0.720 inch diameter and the MIZ-18A testing equipment. System calibration was accomplished using an ASME Code calibration standard made of inconel 600 tubing material. Data evaluation was performed by two analysts, one of which was a level IIIA. The licensee's Level III ET examiner reviewed the data and provided technical support and/or expertise with items requiring resolution. Calibration checks were performed as required by procedure, i.e., once every four hours and at the start and completion of tape. The inspector observed calibration performed on tape number CC01 (end of tape) and determined that it had been performed satisfactorily. In addition, the inspector observed shift turnover, performed on the morning of March 8, 1994. Examinations performed during the shift were discussed, which included the number of tubes examined, those requiring re-examination, equipment performance, and the work plan for the day. Later in the day, the day crew identified a discrepancy in tube location/identification in the lot of tubes run by the night shift. The problem was described as a slight manipulator misalignment resulting in a movement of approximately one half tube. Although the operator compensated for this misalignment in terms of tube identification, the decision was made to re-examine the tubes in that questionable lot and avoid possible data discrepancy.

Findings:

Eddy Current examination results confirmed those found by the remote video inspection discussed earlier in this report. Two tubes were found with OD wear indications. Tube R1-C90 exhibited a 33% through wall indication (TWI) on the hot leg side and a 57% TWI on the cold leg side. The other tube R3-C90, exhibited a 26% TWI on the cold leg side. Both tubes were plugged, the latter was plugged as a preventive measure.

In addition to this examination effort, the licensee reviewed all 1987 to 1993 ET data, covering 100% of the tubes inspected between the tubesheet and the flow baffle. This was done in S/G "C" to look for evidence of wear from loose parts and found no indications that would relate to this problem. Also, through discussions with cognizant licensee personnel, the inspector ascertained that both damaged tubes underwent examination, on the cold leg side, during the 1990 refueling outage and were found to be free of degradation.

5. Steam Generator Tube Repair

The two damaged tubes designated for repair, were plugged by ABB/CE using the following procedures:

STD-410-054 Rev. 4	Remote Mechanical Tube Plug Installation
STD-410-054 Rev. 1	Manual Mechanical Tube Plug Installation Using Remote Torque System
Traveler No. 2001237-PLG Rev. 0	Mechanical Tube Plugging Steam Generator with 0.875 "O.D., 0.50" Wall Tubes

In addition to reviewing the above documents the inspector observed calibration of the torque monitoring equipment which was performed in accordance with STD-410-050 Rev. 4. This was performed satisfactorily as it met the minimum requirements described under paragraph 4 of the subject procedure.

Plug installation was observed with the aid of a video monitor. In this effort, the inspector observed the activity for compliance with the applicable procedure including cleaning the ID of the parent tube, size rolling the tube, plug installation, and plug roll expansion. Plugs used at this time were procured under purchase order number PCP94-036. A review of the certified material test report disclosed that the plugs were made of inconel - 690 material per requirements of ASME Code Sections II and III (83S85). The material was produced from heat number 752455 by Sandvick Tube Inc. The plugs were manufactured by ABB/CE under order No. XS10370006. They were receipt inspected by the licensee who issued MRR number 94-151 to identify code edition and drawing number discrepancies. These discrepancies were evaluated and dispositioned to accept the material in the as is condition since design, material and properties were not in question.

6. Personnel Qualification/Certification

The inspector reviewed personnel qualification documentation as indicated below for examiners who performed the examinations detailed in the paragraphs above. These personnel qualifications were reviewed in the following areas: employer's name; person certified; activity qualified to perform; current period of certification; signature of employer's designated representative; basic used for certification; and, annual visual acuity, color vision examination, and periodic recertification.

Examiner Records Reviewed

Method	Level	Employer	Number
ET	II	ABB/CE	4
ET	IIA	ABB/CE	3
ET	IIIA	ABB/CE	1
ET	IT	ABB/CE	2
Tube Plugging	--	ABB/CE	9

Through this review and discussions with technical personnel the inspector determined that technicians were adequately trained to perform their assigned task and that the qualification records presented for review were in order.

7. Exit Interview

The inspection scope and results were summarized on March 10, 1994, with those persons indicated in paragraph 1. The inspector described the areas inspected and discussed in detail the findings. Although reviewed during this inspection, proprietary information in not contained in this report. Dissenting comments were not received from the licensee.

IFI 261/94-10-01, Perform Video Inspection of S/G(s) "A" and "B" Secondary Side for Loose Parts