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

Report No.: 50-395/85-40

Licensee: South Carolina Electric and Gas Company
Columbia, SC 29218

Docket No.: 50-395 License No.: NPF-12

Facility Name: Summer

Inspection Conducted: October 21-25 and November 14-17, 1985

Inspector: R. W. Newsome 11-27-85
R. W. Newsome Date Signed

Approved by: J. D. Blake 11/27/85
J. D. Blake, Section Chief Date Signed
Engineering Branch
Division of Reactor Safety

SUMMARY

Scope: This routine, unannounced inspection involved 62 inspector-hours on site in the areas of Rotopeening of Steam Generator Tubing, Eddy Current Examination of Steam Generator Tubing, Anchor/Darling Swing Check Valve Deficiencies, IE Bulletin 79-13, and Inspector Followup Items.

Results: No violations or deviations were identified.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*O. S. Bradham, Director, Nuclear Plant Operations
*D. A. Nauman, Director, Nuclear Services
*J. G. Connelly, Deputy Director, Operations and Maintenance
*A. R. Koon, Associate Manager, Regulatory Compliance
D. Lavigne, Manager, Quality Control
*F. A. Miller, Associate Manager, Quality Control Systems
*A. D. Torres, Nondestructive Examination (NDE) Supervisor
*D. R. Moore, Group Manager, Quality Services
*B. G. Croley, Group Manager, Technical and Support Services
*G. G. Putt, Manager, Scheduling and Material Management
*M. D. Quinton, Manager, Maintenance Services
L. B. Collier, Welding Supervisor
*S. R. Hunt, Associate Manager, Surv. System
*H. I. Donnelly, Senior Engineer, Regulatory Compliance
*M. N. Browne, Manager, Technical Support
*K. W. Nettles, Group Manager, Technical Services
*R. B. Clary, Manager, Nuclear Engineering
*B. T. Estes, Jr., Senior Mechanical Engineering
*J. S. Frick, Shift Technical Advisor
P. LaCoe, Engineer, Regulatory Compliance

NRC Resident Inspector

R. Prevatte, Senior Resident
*P. C. Hopkins

*Attended exit interview

2. Exit Interview

The inspection scope and findings were summarized on October 25 and November 17, 1985, with those persons indicated in the above paragraph. The inspector described the areas inspected and discussed in detail the inspection findings. No dissenting comments were received from the licensee.

The licensee did identify as proprietary some of the material provided and reviewed by the inspector during this inspection; however, this material is not discussed in this report.

3. Licensee Action on Previous Enforcement Matters

This subject was not addressed in the inspection.

4. Unresolved Items

Unresolved items were not identified during this inspection.

5. Independent Inspection Effort

Steam Generator Tubing Rotopeening (49053)

a. Primary water stress corrosion cracking (PWSCC) of mill annealed Inconel 600 steam generator tubing has been identified as having a potentially significant impact on steam generator availability. To provide a means for reducing the residual tensile stresses which contribute to PWSCC occurring on the hot leg inside diameter (ID) of full depth, mechanically rolled, steam generator tubes, Westinghouse Electric Corp. (W) has developed a tube rotopeening process that is applied as a mechanical stress relief procedure for the inside of steam generator tubes and has applied this process to slightly more than 52 percent of the steam generator tubes at this plant. The rotopeening was terminated at this point due to the unexpected length of time being required to perform the rotopeening operation. The licensee has indicated that other processes are being condsidered for protecting against PWSCC in those tubes which have not yet been rotopeened.

b. Process Description

The rotopeening tooling is designed to rotopeen the inside surface of the roll expanded portion of the steam generator tube located within the tubesheet. Peening begins just above the tubesheet primary surface and terminates a short distance above the top of the tubesheet. The rotopeening process involves the introduction of high compressive stresses on the inside tube surface by peening the surface with small tungsten carbide balls which are captured at the ends of a plastic strip or flap. The plastic flaps are affixed to a metal shaft that is rotated at high speed within the tube forcing the balls to impinge on the tube wall thereby producing the desired compressive stress condition.

Rotopeening is performed by rotating a flapper through the use of a mandrel having its centerline offset from the centerline of the tube. Coincident with rotation of the flapper, the mandrel is rotated about the tube centerline which provides orbital motion. While rotating and orbiting, the flapper is also oscillated axially in the tubes. This provides a flap deflection at impact with the tube wall around the entire ID surface. These various motions are provided by the design of the rotopeening spindles and support tooling.

c. The inspector reviewed the below listed W documents and procedures relative to the rotopeening process in order to evaluate the adequacy of process controls and documentation requirements, and to determine the extent of the licensee's rotopeening program.

- Rotopeening Licensing Report for V. C. Summer (Proprietary)
- The Application of a Rotopeening Process to Steam Generator Tubes
- PLE-FP-0041(85)(R-0) - "Operating Plant (Hot Plant) Remote Tube Rotopeening"
- PLE-FP-0047(85)(R-0) - "Automatic Rotopeening Control System (ARCS) Set-up and Verification"
- PLE-FP-0046(85)(R-0) - "Hot Plant STGEN Rotopeening Tool Operations"

d. The inspector observed the below listed B steam generator tubes being rotopeened. These observations were made in order to evaluate procedure adequacy relative to the process. The inspector also reviewed the Tube Verification Log and the ERG-2 computer and Unidex Control calibration sheets.

Tube Location Row/Column
41 - 59
39 - 59
45 - 58
43 - 58
45 - 58
43 - 59

e. Several non-conformance reports (NCR) were generated during the tube rotopeening operations due to a variety of reasons. Refer to the tabulations below for specific causes and number of tubes affected.

	Steam Generator		
	A	B	C
- Flap and/or bead loss	456	545	589
- Overpeened (peened twice)	7	6	3
- To high or to low peening RPM	34	2	18
- Possible spindle contact damage	18	124	10
- Miscellaneous	14	10	11

f. The rotopeening process would seemingly have some impact on the conductivity of the material which had undergone rotopeening. The baseline eddy current examinations which had been completed prior to the rotopeening operation, as required by the American Society of Mechanical Engineers (ASME) Code, Section XI, could be adversely

affected since eddy current examinations are very sensitive to changes in material conductivity. The W rotopeening licensing report addresses the before and after rotopeening effects on eddy current examination, however, the tests were performed in a laboratory environment and additionally, the inspector was unable to determine the tubing conditioning prior to the eddy current tests. The licensee committed to conducting a partial eddy current examination of the tubing sections in the hot leg side of the steam generators as this area is the only portion of the tubing that is to undergo rotopeening.

g. Following the rotopeening operations, the licensee conducted an eddy current examination on a minimum of 80 tubes, 30 tubes in steam generator B known to have indications prior to the rotopeening operation and 50 tubes in steam generator A with no prior indications. This examination was conducted to verify that only minimal changes had occured between the before and after rotopeening eddy current examination data. The inspector observed eddy current examinations being performed and the examination data taken during this examination was compared with the eddy current examination data taken before the rotopeening operation. Comparison of the data did not indicate that the rotopeening operation appreciably affected the pre-rotopeening eddy current examination data. Examination data for the tubes listed below was used by the NRC inspector to make this comparison.

Tube Identification

Steam Generator A[1]		Steam Generator B[2]	
Row	Column	Row	Column
12	20	27	16
13	20	36	25
7	27	36	26
12	30	46	29
13	30	44	35
33	50	23	50
34	50	23	56
25	70	34	60
26	70	36	60
27	70	32	64
28	70		
29	70		
25	71		
26	71		
28	71		
29	71		
25	72		
26	72		
27	72		
28	72		

29	72
35	72
36	72
37	72
38	72
39	72
10	77
11	77
12	77
13	77
40	77
9	78
10	78
11	78
5	79
6	79
10	80
11	80
12	80
13	80
40	80
4	81
5	81
6	81
9	81
15	81
16	81
13	85
15	85

1 Tubes with no indications before rotopeening

2 Tubes know to contain one or more indications before rotopeening

h. The licensee is conducting an eddy current examination on a sufficient number of tubes, that are identified by the NCR's referred to in the above paragraph, to determine if any of these tubes were damaged by the adverse actions reported during the rotopeening operation. The NRC inspector co-evaluated eddy current results for more than 150 of these tubes. There did not appear to be any determental damage to the inside of the tubes evaluated. Some tube end damage was noted visually on at least two tubes where the rotopeening tooling had bumped against the tube ends. Disposition of the tube end damage and completion of the eddy current examinations was still in progress at the conclusion of this NRC inspection.

Within the areas examined, no violations or deviations were identified.

6. Anchor/Darling Check Valve Deficiencies (50075)(55050)

a. Anchor/Darling 150 and 300 lb. pressure class swing check valve deficiencies

(1) Background

Anchor/Darling Valve Company alerted SCE&G, via letter dated August 19, 1985, that another Nuclear Generating Station had discovered lock welds missing on several 150 and 300 lb. pressure class swing check valves.

Most of these valves utilize a set screw in the hinge support for the purpose of keeping the hinge pin from rotating. On some designs, this set screw also prevents the hinge pin from sliding out of the hinge support. The set screw is required to be lock welded to prevent it from backing out in service. The absence of this lock weld is a safety concern since the set screw could conceivably back out in service allowing the hinge pin to slide out of the hinge support thus causing a loss of valve operability.

In a related problem, the disc nut pin on several check valves was not lock welded as shown on the valve assembly drawing. This lock weld is necessary to retain the disc nut pin which prevents the disc nut from backing off the disc and rendering the valve inoperable.

A review of SCE&G's records indicated that a total of 61 valves were installed. Ten different systems are involved, with a majority of the valves located in safety-related systems.

Licensee examination of the first two valves revealed missing tack welds in both valves. Non-conformance Notice (NCN) No. 2051 was issued requiring that all of the valves be inspected, repaired if necessary, and the inspection findings be documented and forwarded to Nuclear Engineering for completion of a 10 CFR Part 21 evaluation.

At the conclusion of the October 21-25 inspection period a total of 14 valves had been examined and two additional deficient conditions had been identified by the licensee. The deficiencies were: missing tack welds on the cap screws to disc hinge support and missing tack welds on the hinge support to bonnet. These welds are clearly shown on the drawings supplied by Anchor/Darling.

Of the 14 valves examined, only one valve has not had any deficiencies while the majority of the remaining valves have been deficient in more than one area. Three of the valves examined have been 900 lb. pressure seal style valves with two of the three not having the disc nut peened or welded to the disc.

(2) The inspector has reviewed examination and repair documentation for the below listed valves to determine the adequacy of the procedure controls being used and documentation requirements as imposed by controlling codes and specifications.

Valve I.D.	Status
XVC01015B-EF	Completed
XVC01013B-EF	Completed
XVC09570-CC	Completed
XVC01022A-EF	Completed
XVC01034A-EF	Completed
XVC01014-EF	In-Process
XVC09602-CC	In-Process

The inspector visually examined the two in-process valves listed above to verify the weld quality and appearance.

(3) The inspector reviewed maintenance procedure MMP-445.015 (R-2), 4/23/85, Maintenance of Anchor/Darling Bolted Bonnet Swing Check Valves, to confirm the adequacy of the procedure.

(4) The inspector reviewed welder qualification records for two of the welders engaged in the repair of the valves. The welders were identified as RG welder #2 and RP welder #5.

b. Anchor/Darling Tilting Disc Check Valves

The licensee was alerted by Anchor/Darling, via letter dated August 16, 1985, to the possibility of deficiencies, cracked tack welded bushings, on three valves of this type that had been purchased by the licensee. These three valves had been removed from service and discarded by the licensee approximately two years ago. No further action is required regarding these valves.

Within the areas examined, no violations or deviations were identified.

7. Eddy Current Inservice Inspection (ISI)

The inspector examined documents, activities, and records as indicated below to determine whether ISI was being conducted in accordance with applicable procedures, regulatory requirements and licensee commitments. The applicable code for ISI is American Society of Mechanical Engineers Boiler and Pressure Vessel (ASME B&PV) Code, Section XI, 1977 edition with addenda through Winter 1978.

Conam Inspection is conducting the eddy current examinations on behalf of the licensee. The examinations are being conducted as a combination of required ISI and an augmented examination of all of the steam generator tubing within the tubesheet on the hot leg side of all three steam

generators. All three steam generators had tubes with indications which exceeded 40 percent of thru wall after the examinations had been completed. See tabulation below for number of tubes in each steam generator.

Steam Generator A - 35 tubes
Steam Generator B - 79 tubes
Steam Generator C - 47 tubes

Note: Some tubes in steam generator B will be re-examined, following the rotopeening operation discussed in paragraph 5., to support the initial tube evaluation.

a. Review of Procedure (73052)

The inspector reviewed Eddy Current Procedure STP-404.901 (R2), Steam Generator Tube Inspection, for technical content relative to: multichannel examination unit, multichannel examination equipment is specified, examination sensitivity, material permeability, method of examination, method of calibration and calibration sequence, acceptance criteria, qualification of NDE personnel, and procedure approval.

b. Observation of Work and Work Activities (73753B)

The inspector reviewed certification records of equipment, materials, and NDE personnel which had been and will be utilized during the required ISI examinations during this outage. The reviews conducted by the inspector are documented below.

(1) Examiner Qualification

The inspector reviewed the qualification documentation for the below listed Conam eddy current examiners in the following areas: employer's name; person certified; activity qualified to perform; effective period of certification; signature of employer's designated representatives; basis used for certification; and annual visual acuity, color vision examination and periodic recertification.

Examiner	Level
MMC	I
DME	IIA
JPD	IIB
FJE	I
JJF	III

(2) The inspector reviewed certification documentation for the eddy current calibration standard identified as Z787.

c. Data Review and Evaluation (73755B)

The inspector reviewed records of the eddy current examinations indicated below. The reviews were compared with the applicable procedures and the ASME Code in the following areas: the multichannel eddy current examination equipment has been identified including indicator, meter, tube, strip recorder and tape; method for maximum sensitivity is applied; method for determining material permeability; material permeability has been recorded; method of examination has been recorded; examination equipment has been calibrated in accordance with the applicable performance reference; amplitude and phase has been calibrated with the proper applicable calibration reference and is recalibrated at predetermined intervals; required coverage of steam generator tubes occurs during the examination; acceptance criteria is specified or referenced and is consistent with the procedure or the ASME B&PV Code; and results are consistent with acceptance criteria.

Steam Generator B

Tube I.D. Row - Column			Tube I.D. Row - Column		
4	-	62	15	-	49
36	-	61	30	-	48
36	-	60	33	-	46
3	-	58	7	-	44
19	-	58	35	-	44
43	-	58	15	-	43
12	-	55	29	-	40
20	-	56	34	-	40
3	-	54	35	-	60
3	-	52	33	-	60
24	-	50	34	-	60

In addition to the above review, records of completed eddy current examinations were reviewed to ascertain whether: the method(s), technique and extent of the examination complied with the ISI plan and applicable NDE procedures; findings were properly recorded and evaluated by qualified personnel; programmatic deviations were recorded as required; personnel, instruments, calibration standards, and NDE materials were designated.

Within the areas examined, no violations or deviations were identified.

8. Inspection and Enforcement Bulletins (IEB) (92703B)

(Closed) IEB 79-13: Cracking in Feedwater System Piping

This IEB required the licensee to radiograph the steam generator feedwater nozzle-to-pipe and adjacent pipe-to-pipe welds to determine if cracking has

occurred at these locations. The licensee has completed the required volumetric examination of these welds and no cracking was evident. The NRC inspector has reviewed the radiographs listed below with their associated documentation and concurs with the licensee's evaluation.

Weld ID	S.G.	Film Reviewed
FW-9	C	0-3 nozzle-to-pipe
FW-9	C	3-6 nozzle-to-pipe
FW-9	C	6-9 nozzle-to-pipe
FW-9	C	9-12 nozzle-to-pipe
FW-9	C	0-6 pipe-to-pipe
FW-9	C	6-11 pipe-to-pipe
FW-9	C	11-16 pipe-to-pipe
FW-9	C	16-0 pipe-to-pipe
FW-12	A	12-15 nozzle-to-pipe
FW-12	A	15-18 nozzle-to-pipe
FW-12	A	18-0 nozzle-to-pipe
FW-12	A	11-16 pipe-to-pipe
FW-12	A	16-0 pipe-to-pipe
FW-17	A	0-5 pipe-to-pipe
FW-17	A	5-11 pipe-to-pipe
FW-17	A	11-16 pipe-to-pipe
FW-17	A	16-0 pipe-to-pipe
FW-17	B	0-5 pipe-to-pipe
FW-17	B	11-16 pipe-to-pipe

9. Inspector Followup Items (IFI) (92701B)

(Closed) IFI 395/80-30-05, Power Wire Brushing Surfaces to be Penetrant Examined. This item was opened to address the NRC inspector's concern that power wire brushing of surfaces prior to liquid penetrant examination was allowed which may close surface openings and be detrimental to the penetrant examinations. The licensee has issued change B to the Welding Manual Procedure, WM-1.0, Rev. 8, which will not allow the use of power wire brushing when preparing surfaces for examinations unless specific approval is authorized. The inspector reviewed the procedure change and has no further questions regarding this matter.

(Closed) IFI 395/84-26-03, Which Spent Fuel Rack Records Are Considered Permanent Plant Records. This item was identified because it was not clear, to the NRC inspector, which spent fuel records were required by the licensee and for what length of time these records were to be retained by the licensee. The inspector reviewed the licensee's Nuclear Operations Records Accumulation and Retention Chart and with this document and the licensee's purchase order number for the spent fuel rack contract, was able to determine which records were required and the length of retention. The inspector has no further questions regarding this matter.