Florida Power
CORPORATION

February 21, 1990
3F0290-08

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Subject: Crystal River Unit 3
Docket No. 50-302
Operating License No. DPR-72
Special Report 90-003

Dear Sir:

The attached Special Report 90-003 entitled "Report on Steam Generator Eddy Current Inspection" is submitted in accordance with Technical Specifications 4.4.5.5.b and 6.9.2.(g). Technical Specification 4.4.5.5.a requires a 15-day report to the NRC when a steam generator tube is plugged. The 15-day report was made in FPC's April 7, 1989 letter.

Sincerely,

P.M. Beard, Jr.
Senior Vice President
Nuclear Operations

PMB/JWT

Attachment

xc: Regional Administrator, Region II
Senior Resident Inspector

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SPECIAL REPORT 90-003

REPORT ON STEAM GENERATOR EDDY CURRENT INSPECTION

The following information in this Special Report is prepared in accordance with the requirements of Technical Specification 4.4.5.5.b. The report includes:

1. The Number and extent of tubes inspected.

2. The location and percent of wall thickness penetration for each indication.

3. Signal/Noise indications, indications < 20% through wall, indications 20 -39% through wall, and indications 40% through wall or greater.

4. Identification of tubes plugged.

1.0 INTRODUCTION

The Inconel 600 tubing in the two once-through steam generators (OTSG's) at Florida Power Corporation's Crystal River Unit 3 was inspected during a scheduled reactor coolant pump outage in March, 1989. The code examination of the 0.625" nominal OD x 0.037" nominal wall tubing was performed by Babcock and Wilcox (B&W) Company personnel using standard bobbin coil techniques. Supplemental examinations were performed using a multi-element 8x1 probe and B&W's EDDY-360 rotating pancake coil probe. This report documents the results of these examinations.

2.0 SUMMARY

The following table summarizes the results found during this inspection:

TABLE 1

	OTSG "A"			OTSG "B"		
	BOBBIN	8X1	EDDY-360	BOBBIN	8X1	EDDY-360
TUBES INSPECTED	2464	382	13	1738	368	25
IND'S 40-100% TW	1	0	1	0	0	0
IND'S 20-39% TW	8	3	7	2	4	5
IND'S <20% TW	11	1	2	12	0	10
S/N INDICATIONS	34	0	0	48	0	0

NOTE: S/N indicates that the signal-to-noise ratio for an indication is too low for an accurate through-wall depth (TW) to be made.

	OTSG "A"	OTSG "B"
TUBES PLUGGED	(71-61) 1 Tube	No Tubes Plugged

3.0 EXAMINATION

The examination, equipment, and personnel were in compliance with the requirements of the Babcock and Wilcox SPIS QA Manual for Inservice Inspection, the CR-3 technical specifications, Section XI of the ASME Boiler and Pressure Vessel Code, 1983 Edition through the Summer 1983 Addenda, and industry standards.

The steam generator tubing examinations were performed by technicians qualified to Level I, under the direct supervision of personnel qualified to Level II in accordance with B&W Personnel Qualification Procedure ISI-24. The data was evaluated by personnel qualified to a minimum of Level IIA in accordance with Procedure ISI-24. The examination and evaluation procedures used during the eddy current inspection were approved by personnel qualified to Level III in accordance with Procedure ISI-24.

All examinations were conducted from the outlet of the steam generator. The acquisition of the data was performed using Zetec's MIZ-18 System. Eddy current analysis was performed using Zetec's DDA-4, Edition 18.6 Rev. 5 Data Analysis Software. Site specific analysis guidelines were incorporated into the evaluation process.

Bobbin coil examinations were performed using 0.510" diameter probes in OTSG "A" and 0.500" diameter probes in OTSG "B". Upper tubesheet (UTS) tube-end damage in OTSG "B" resulted in the use of a smaller diameter probe to allow probe passage though the upper tube end. Frequencies of 600, 400, 200, and 35 kHz operating in the differential and absolute modes were utilized. The 400 and 200 kHz differential frequencies were mixed to enhance defect detection at tube support plate intersections.

The multi-element 8x1 probe examination was performed using frequencies of 400 and 150 kHz in the absolute mode. This examination was performed to identify any indications that may have been missed due to the bobbin coils' inherent limitation of detecting circumferential cracks, to determine circumferential extent of any indication detected, and to further substantiate the bobbin coil techniques. The tube sample inspected by the 8x1 probe was limited to the lane and wedge regions of both generators.

The EDDY-360 examinations, using a B&W straight EDDY-360 probe, were performed at frequencies of 290 and 150 kHz operating in the absolute mode. The frequencies were generated with a Zetec MIZ-18 remote data acquisition unit. The EDDY-360 probe was rotated through the tube at four revolutions per second as a probe driver mechanically indexed the probe axially at 0.1 inch per revolution, resulting in an inspection speed of approximately 0.4 inches per second. The probe driver and all eddy current parameters were computer controlled utilizing B&W designed software. The eddy current data was stored on digital data tapes.

The 290 kHz channel was utilized as the primary examination frequency. An amplitude curve was used to estimate percent-through-wall depths. Curves plotting signal amplitude versus % TW were derived using a tubing calibration standard containing ID and OD axial and circumferential EDM notches. The data points used to generate these curves were stored in the setup files on the "Eddy" disk of the software operating package.

Official results of the data analysis were recorded on DDA-4 data disks, then loaded into B&W's Eddy Current Data Management System. This system was used to check data for invalid entries, to perform data sorting routines, and to ensure that all of the proper tubes and locations were examined. The data sheets with the final analysis results were complied and printed using this system. The original eddy current data tapes have been provided to Florida Power Corporation.

4.0 RESULTS

4.1 OTSG "A"

A total of 2464 tubes were examined during this outage using the standard bobbin coil technique, and 382 tubes selected from the lane and wedge regions were examined with the multi-element 8x1 probe. In addition, 13 tubes were examined with the EDDY-360 probe.

- Based on bobbin coil data, one tube exhibited an indication of $\geq$ 40% through wall (TW), eight tubes exhibited indications of 20-39% TW, 11 tubes exhibited tube degradation <20% TW, and 34 tubes contained indications with a signal-to-noise ratio (S/N).

- 8x1 data reported three tubes exhibiting indications of 20-39% TW and one tube exhibiting an indication of <20% TW.

- EDDY-360 data reported one tube exhibiting an indication of $\geq$ 40% TW, seven tubes exhibiting indications of 20-39% TW, and two tubes exhibiting indications of <20% TW.

- One tube (71-61) was removed from service based on a 55% TW indication located just below the upper tubesheet face (UTSF-0.3").

4.2. OTSG "B"

A total of 1738 tubes were examined during this outage using the standard bobbin coil technique, and 368 tubes selected from the lane and wedge regions were examined with the multi-element 8x1 probe. In addition, 25 tubes were examined with the EDDY-360 probe.

- Bobbin coil data reported two tubes exhibiting indications of 20-39% TW, 12 tubes exhibiting indications of <20% TW, and 48 tubes exhibiting S/N indications.

- 8x1 data reported four tubes exhibiting indications of 20-39% TW.

- EDDY-360 data reported five tubes exhibiting indications of 20-39% TW and ten tubes exhibiting <20% TW indications.

- No tubes were found to have pluggable indications in excess of 40% TW.

4.3 GENERAL INFORMATION

A comparison of bobbin, 8x1, and EDDY-360 calls can be found in Tables 2 and 3 for OTSG's "A" and "B", respectively. Also, in Table 2 the calls indicative of wear in the lane region from the 9th to the 15th tube support plates can be found. Tubes examined with EDDY-360 were selected with FPC's concurrence from previous history, 8x1, and bobbin coil indications.

4.4 SECONDARY REVIEW

A secondary review was performed on all bobbin coil data utilizing B&W's Automated Data Screening (ADS) system. The purpose of this secondary review was to ensure a complete and accurate primary analysis was accomplished.

There was a very close correlation between the results of primary and secondary review during this outage. Any discrepancies between the primary analyst and ADS were resolved by the on-site B&W Level III. The final data sheets reflect the results of the resolved primary and secondary analysis.

TABLE 2

OTSG "A"

COMPARISON OF BOBBIN COIL, 8x1, AND EDDY-360 RESULTS

TUBE	LOCATION	BOBBIN %TW	8x1 %TW	E-360 %TW	COMMENTS
16-41	11th TSP + 15.30"	20	*	14	ODI
22-69	8TH TSP + 34.50"	18	*	*	ODI
24-89	13TH TSP + 30.70"	13	*	*	ODI
29-73	3RD TSP + 12.00"	5	*	*	ODI
35-59	12th TSP + 10.20"	20	*	22	ODI
42-68	11TH TSP + 2.80"	2	*	*	ODI
47-58	5TH TSP + 20.00"	17	*	*	ODI
54-71	8TH TSP + 20.90"	14	*	*	ODI
56-3	10th TSP + 0.00"	24	*	NDD	ODI
58-125	13th TSP + 24.60"	20	*	27	ODI
	LTSF + 20.80"	11	*	*	ODI
	LTSF + 32.80"	17	*	*	ODI
61-1	9th TSP + 0.00"	S/N	*	4	ODI
64-127	10th TSP + 0.00"	38	*	22	Wear
71-61	UTSF + 0.30"	55	*	61	ODI/plugged
77-3	15th TSP + 0.00"	*	37	27	Wear
77-4	15th TSP 0.00"	*	38	22	Wear
77-5	15th TSP + 0.00"	39	34	27	Wear
77-32	UTSF + 22.40"	*	14	*	ODI
77-124	9th TSP + 0.00"	37	*	21	Wear
	10th TSP + 0.00"	34	*	20	Wear
78-123	8th TSP + 0.00"	26	*	NDD	Wear

ODI = Outside Diameter Indication
UTSF = Upper Tube Sheet Secondary Face
LTSF = Lower Tube Sheet Secondary Face
NDD = No Detectable Damage
TSP = Tube Support Plate
* = Tube not inspected by this method.

TABLE 3

OTSG "B"

COMPARISON OF BOBBIN COIL, 8x1, AND EDDY-360 RESULTS

TUBE	LOCATION	BOBBIN %TW	8x1 %TW	E-360 % TW	COMMENTS
7-11	12th TSP + 24.40"	11	*	NDD	ODI
7-20	7th TSP + 0.00"	6	*	NDD	ODI
7-29	7th TSP - 1.50"	12	*	NDD	ODI
23-68	LTSF - 13.00"	2	*	*	ODI
10-12	9th TSP - 1.50"	S/N	*	15	ODI
28-93	8th TSP - 1.50"	37	*	20	ODI
31-7	8th TSP - 1.50"	5	*	NDD	ODI
37-8	7th TSP + 0.00"	10	*	NDD	ODI
40-8	7th TSP + 0.00"	10	*	NDD	ODI
46-83	LTSF + 2.50"	8	*	13	ODI
52-15	3rd TSP - 1.50"	S/N	*	5	ODI
59-113	7th TSP - 1.50"	S/N	*	3	ODI
62-7	15th TSP + 24.20"	S/N	*	16	ODI
	15th TSP + 20.00"	S/N	*	16	ODI
64-114	4th TSP + 0.00"	28	*	24	ODI
67-52	7th TSP - 1.50"	S/N	*	4	ODI
73-1	14th TSP - 9.00"	*	20	19	ODI
77-12	UTSF + 20.50"	*	29	26	ODI
78-13	UTSF + 20.90"	*	23	25	ODI
	UTSF + 16.00"	*	NDD	19	ODI
79-4	15th TSP - 14.50"	*	32	35	ODI
82-6	9th TSP - 1.50"	11	*	4	ODI
105-33	LTSF + 8.70"	13	*	NDD	ODI
106-32	LTSF + 6.70"	4	*	NDD	ODI
117-73	7th TSP + 1.50"	6	*	NDD	ODI
124-39	7th TSP - 1.50"	NDD	*	7	ODI

ODI = Outside Diameter Indication
UTSF = Upper Tube Sheet Secondary Face
LTSF = Lower Tube Sheet Secondary Face
NDD = No Detectable Damage
TSP = Tube Support Plate
* = Tube not inspected by this method.