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Southern Nuclear Operating Company

*the southern electric system*

Dave Morey  
Vice President  
Farley Project

April 13, 1994

Docket No. 50-348

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

Joseph M. Farley Nuclear Plant - Unit 1  
Licensee Event Report No. 94-002-00

Gentlemen:

Joseph M. Farley Nuclear Plant, Unit 1, Licensee Event Report No. 94-002-00 is being submitted in accordance with Technical Specification 4.4.6.5. If you have any questions, please advise.

Respectfully submitted,

Dave Morey

REM/ctt:C3SGLTR.DOC

Enclosure

cc: Mr. S. D. Ebner  
Mr. B. L. Siegel  
Mr. T. M. Ross

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LICENSEE EVENT REPORT (LER)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1) Joseph M. Farley Nuclear Plant - Unit 1 DOCKET NUMBER (2) 05000348 PAGE (3) 1 OF 5

TITLE (4) Steam Generator Tube Degradation and Tube Status

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)		
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES		
03	26	94	94	002	00	04	13	94	05000348		

OPERATING MODE (9) 6

POWER LEVEL (10) 000

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 7: (Check one or more of the following) (11)

<input type="checkbox"/> 20.402(b)	<input type="checkbox"/> 20.405(c)	<input type="checkbox"/> 50.73(a)(2)(iv)	<input type="checkbox"/> 73.71(b)
<input type="checkbox"/> 20.405(a)(1)(i)	<input type="checkbox"/> 50.36(c)(1)	<input type="checkbox"/> 50.73(a)(2)(v)	<input type="checkbox"/> 73.71(c)
<input type="checkbox"/> 20.405(a)(1)(ii)	<input type="checkbox"/> 50.36(c)(2)	<input checked="" type="checkbox"/> 50.73(a)(2)(vii)	<input checked="" type="checkbox"/> OTHER (Specify in Abstract below and in Text, NRC Form 366A) Tech Spec 4.4.6.5.a/c
<input type="checkbox"/> 20.405(a)(1)(iii)	<input type="checkbox"/> 50.73(a)(2)(i)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)	
<input type="checkbox"/> 20.405(a)(1)(iv)	<input type="checkbox"/> 50.73(a)(2)(ii)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)	
<input type="checkbox"/> 20.405(a)(1)(v)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME R. D. Hill, General Manager - Nuclear Plant TELEPHONE NUMBER 205 899-5156

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE)  NO

EXPECTED SUBMISSION DATE (15)

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

The following report is being submitted in accordance with Technical Specification 4.4.6.5.a to report the number of steam generator (S/G) tubes plugged or repaired, and in accordance with Technical Specification 4.4.6.5.c to report the results of S/G tube inspections which fall into Category C-3. During the Unit 1 Twelfth Refueling Outage (U1RF12), eddy current inspections were performed on 100 percent of the available tubes in all three steam generators. As a result of this inspection, 1C steam generator had 48 tubes in service during Cycle Twelve that were found to be defective (1.47 percent of the total number of tubes inspected in 1C steam generator), which requires inspection results to be classified as Category C-3. These tubes were either plugged or sleeved. Following these actions, the equivalent tube plugging percentage in each steam generator is: 4.74 percent in 1A, 2.61 percent in 1B, and 3.70 percent in 1C. This results in an overall equivalent tube plugging of 3.69 percent. In addition to the required tube plugging and sleeving, several ongoing programs have been established to reduce the probability of future tube degradation.

**LICENSEE EVENT REPORT (LER)  
TEXT CONTINUATION**

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TEXT (if more space is required, use additional NRC Form 366A's)(17)

**Plant and System Identification**

Westinghouse -- Pressurized Water Reactor  
Energy Industry Identification System codes are identified in the text as [XX].

**Summary of Event**

This report is being submitted in accordance with Technical Specification 4.4.6.5 a to report the number of S/G tubes [AB] plugged or repaired, and in accordance with Technical Specification 4.4.6.5.c to report the results of S/G tube inspections which fall into Category C-3. During U1RF12, eddy current inspections were performed on 100 percent of the available tubes in all three steam generators. As a result of this inspection, 1C steam generator had 48 tubes in service during Cycle Twelve that were found to be defective (1.47 percent of the total number of tubes inspected in 1C steam generator) which requires inspection results to be classified as Category C-3. These tubes were either plugged or sleeved. Following these actions, the equivalent tube plugging percentage in each steam generator is: 4.74 percent in 1A, 2.61 percent in 1B, and 3.70 percent in 1C. This results in an overall equivalent tube plugging of 3.69 percent.

The results of the S/G tube inspections were determined to be in category C-3 on March 26, 1994.

The S/G tube plugging was completed on April 6, 1994.

**Description of Event**

Prior to U1RF12, Southern Nuclear Operating Company (SNC) developed an eddy current inspection plan to inspect all non-plugged tubes in all three S/G's. The eddy current inspection plan included:

- 100 percent full length bobbin probe inspection of all available tubes (except Row 1 and Row 2 U-bends).
- 100 percent hot leg roll transition, rotating pancake (RPC) probe inspection of all available tubes.
- RPC inspection of Row 1 and Row 2 U-bends.
- RPC inspection of all distorted indications.

In addition to performing the above plan, as part of a 2.0 volt interim plugging criteria for support plates, a RPC inspection of all support plate indications greater than 1.5 volts by bobbin, an Augmented RPC support plate inspection program of all dents greater than 5.0 volts by bobbin, a random sample of residuals, and a random sample of support plate indications <1.5 volts, was performed.

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TEXT (If more space is required, use additional NRC Form 365A's)(17)

The following is a summary of the tube status for each S/G:

	S/G - 1A	S/G - 1B	S/G - 1C
Tubes plugged prior to UIRF12	155	87	116
Sleeved tubes in-service prior to UIRF12	37	24	75
Percent plugging equivalent prior to UIRF12	4.62	2.60	3.53
Tubes determined defective during UIRF12	27	13	48
Total in-service sleeves after UIRF12	71	42	156
Total in-service sleeved tubes after UIRF12	60	37	119
Total plugged tubes after UIRF12	158	87	120
Percent plugging equivalent after UIRF12	4.74	2.61	3.70

There were four major degradation mechanisms for the tubes found defective during this inspection: primary water stress corrosion cracking (PWSCC) in the Wextex expansion area, outer diameter stress corrosion cracking (OD SCC) above the top of the tubesheet in the sludge pile area, OD SCC at support plates, and SCC at the U-bends. These are similar to the mechanisms reported in LER's 92-005-00 (Unit 1), 93-003-00 (Unit 2), 91-003-00 (Unit 1), 90-005-01 (Unit 2), 87-004-02 (Unit 2), and 86-004-00 (Unit 2). Table 1 under Additional Information, provides a summary of the above indications.

Wextex Expansion Area

There were 12 defective indications in the Wextex expansion area (which includes the tubesheet and transition zone): two in S/G 1A, three in S/G 1B, and seven in S/G 1C. Circumferential cracks in the transition zone were identified in one tube in S/G 1B and one tube in S/G 1C. Neither of these tubes required stabilizers. The transition zone was inspected by a 100 percent bobbin inspection and 100 percent RPC inspection ( $\pm$  3 inches at the top of the tubesheet).

Above the Top of the Tubesheet

There were 94 defective indications above the top of the tubesheet in the sludge pile area: 22 in S/G 1A, 15 in S/G 1B, and 57 in S/G 1C.

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TEXT (If more space is required, use additional NRC Form 366A's)(17)

Tube Support Plate

There were three defective indications at support plate intersections: two in S/G 1A and one in S/G 1B.

U-bend Area

There were two defective indications above the seventh support plate in the U-bend area of S/G 1A.

Cause of Event

Investigations and evaluations performed identified four areas where tube defects were observed: PWSCC in the Wextex expansion area, OD SCC above the top of the tubesheet within the sludge pile area, OD SCC at support plates, and SCC at the U-bends.

Reportability Analysis and Safety Assessment

This event is being reported in accordance with Technical Specification 4.4.6.5.a and c. The health and safety of the public was not affected.

Corrective Action

The S/G tubes have been plugged or sleeved as required. In addition, the following actions have been taken in order to reduce the probability of future tube degradation:

1. A program of boric acid addition is being continued to reduce the potential for OD SCC.
2. A program of morpholine, monoethanolamine (ETA), or other advanced amines, per EPRI guidelines, is being continued to reduce the potential for sludge accumulation. Also, hydrazine addition to reduce Oxygen concentration in the secondary side of the S/G's has been increased per new EPRI guidelines.
3. The Westinghouse pressure pulse cleaning process was used in all three S/G's to remove contaminants from the crevices between the tubes and support plates.
4. During the Unit 1 Tenth Refueling Outage, the Westinghouse U-bend heat treat process was completed on all Row 1 and Row 2 tubes in service to reduce the potential of U-bend SCC.
5. During the Unit 1 Eighth Refueling Outage, tube lane blocking devices were removed.
6. During the Unit 1 Fifth and Sixth Refueling Outages, many of the secondary components containing copper were replaced with components containing stainless steel.
7. The Westinghouse sludge lancing process was used in all three S/G's to remove contaminants in the sludge pile area.

Additional Information

Similar events were reported in LER's 93-003-00 (Unit 2), 92-005-00 (Unit 1), 91-003-00 (Unit 1), 90-005-01 (Unit 2), 87-004-02 (unit 2), and 86-004-00 (Unit 2).

No components failed during this event.

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TEXT (If more space is required, use additional NRC Form 366A s)(17)

TABLE I  
Summary of Indications

	S/G - 1A	S/G - 1B	S/G - 1C
Number of tubes probed in UIRF12	3233	3301	3272
Number of defective tubes in UIRF12	27	13	48
Number of defective indications above the tubesheet in the sludge pile area	22	15	57
Number of defective indications in the Wextex expansion area - transition zone	2	3	7
Number of defective indications in the Wextex expansion area - tubesheet zone	0	0	0
Number of defective indications in freespan or U-bend area	2	0	0
Number of defective indications at support plates	2	1	0

Note: The sum of the number of defective indications at the different locations does not equal the number of defective tubes since some of the tubes had multiple indications.