Public Service
Electric and Gas
Company

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Vice President - Nuclear Operations

November 2, 1988
NLR-N88161

United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Gentlemen:

RESPONSE TO NRC BULLETIN 88-09
SALEM GENERATING STATION
UNIT NOS. 1 AND 2
DOCKET NOS. 50-272 AND 50-311

Public Service Electric and Gas Company (PSE&G) has received the subject NRC bulletin regarding thimble tube thinning in Westinghouse designed reactors. The information requested by this bulletin is provided in the enclosure to this letter.

Since Salem Station has established an inspection program as described in the bulletin, this response is being submitted within 90 days of receipt of Bulletin 88-09.

Should you have any questions with regard to this transmittal, please do not hesitate to contact us.

Sincerely,

S. LaBruna

Enclosure

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ENCLOSURE

RESPONSE TO BULLETIN 88-09

Bulletin 88-09, entitled "Thimble Tube Thinning in Westinghouse Reactors," requires licensees to submit a written response that (a) confirms that an inspection program consistent with that described in Part 1 of the bulletin has been established and (b) confirms that inspections of the thimble tubes have been performed and that corrective actions were taken. Our response to these two items follows. Also included is the status of this inspection program in light of our recently installed improved thimble design.

INSPECTION PROGRAM

Part 1 of Bulletin 88-09 requires that an inspection program be established to monitor thimble tube performance. This program should include the following:

- the establishment, with technical justification, of an appropriate thimble tube wear acceptance criteria.
- the establishment, with technical justification, of an appropriate inspection frequency.
- the establishment of an inspection methodology that is capable of adequately detecting wear of the thimble tubes.

PSE&G has conducted an inspection program since October 1982. Salem Unit 1 began commercial operation in June 1977. During the third operating cycle in 1981, three thimble tube leaks developed. These leaks were isolated by closing the manual isolation valve for each line located in the seal table room. The cause of these leaks has since been determined to be flow induced vibrations between the core support plate and fuel assembly nozzles. During the third refueling outage, (January 1982) all thimble tubes were replaced in kind. During each subsequent refueling outage the thimble tubes have been eddy current tested to ensure that the thimbles were not degraded to an unacceptable degree. The results of the Salem Unit 1 inspection program are summarized below.

Salem Unit 1 Inspection Program

Refueling Outage	Results
4th Refueling Outage (October 1982)	Few wear indications observed.
5th Refueling Outage (July 1984)	More wear indications observed. Three thimble tubes isolated.

Refueling Outage	Results
6th Refueling Outage (April 1986)	Many wear indications. Ten thimble tubes isolated.
7th Refueling Outage (December 1987)	All thimble tubes removed and replaced with an improved design.

During each outage, the eddy current test results were evaluated. Acceptance criteria were established which either justified the use of the thimbles for another operating cycle or required that they be isolated. Appropriate action was taken based on this criteria. In December 1987, the thimble tubes were removed and replaced with an improved tube design that should greatly reduce flow induced wear.

Salem Unit 2 began commercial operation in October 1981. An identical inspection program was established in 1983 with the following results.

Salem Unit 2 Inspection Program

Refueling Outage	Results
1st Refueling Outage (May 1983)	Some wear indications found.
2nd Refueling Outage (February 1985)	Some wear indications. Three thimble tubes isolated.
3rd Refueling Outage (October 1986)	Many wear indications. Three thimble tubes isolated. The remaining thimble tubes were shortened to provide new wear surfaces.
4th Refueling Outage (September 1988)	All thimble tubes removed and replaced with an improved design.

As in Salem Unit 1, during each refueling outage eddy current tests were conducted and the results evaluated. Acceptance criteria were established and corrective actions, in the form of thimble tube isolation or shortening of tubes, were taken. An improved design was installed during the current Unit 2 refueling outage to greatly reduce flow induced wear.

IMPROVED THIMBLE DESIGN

The periodic inspections required by the Bulletin ensure that thimble tubes are isolated or replaced if they become unacceptably degraded. These inspections only monitor wear; they do not prevent it. PSE&G has improved the design of the thimble tubes and implemented modifications to the Salem units to greatly reduce flow induced vibrational thimble tube wear in the lower core plate region. These modifications were included in the design changes PSE&G implemented to meet the requirements of NUREG-0737, Item II.F.2 (Inadequate Core Cooling Instrumentation).

In letters dated April 4, June 19, August 13 and September 17, 1984, PSE&G committed to upgrade the core exit thermocouples (CETs) to meet the NUREG-0737 requirements. The NRC documented this in their safety evaluation dated October 24, 1984. The CETs are stationary thermocouples located within the core. The thermocouple columns are mounted on the reactor vessel head. They indicate the temperature of the reactor coolant exiting the core. The movable incore detector flux thimbles are mounted on the bottom of the reactor vessel. These tubes provide a path for the movable incore detectors. The detectors map the neutron flux by moving through the thimble tubes within the core. These two instrumentation systems were integrally combined as described below.

The top mounted thermocouple column penetrations on the Reactor Vessel Head were cut and capped. The thermocouple columns were removed from the upper internals. The original thimble tubes entering through the bottom of the reactor vessel were cut and removed. Replacement thimble tube assemblies with built in thermocouples were installed. These flux thimble thermocouple (FTTC) assemblies consist of an outer pressure boundary tube and an inner tube to act as a guide path for the movable in core flux detectors. Thermocouple and spacer cables are installed in the annulus between the two tubes. The tubes are fabricated from high strength Inconnel 600 material. In addition, the area of wear indication on these tubes was chrome plated. Also, wear inserts were installed in the lower core support plate region. PSE&G implemented these improvements on Salem Units 1 and 2 during their seventh and fourth refueling outages, respectively.

These improvements provide the following benefits in terms of wear reduction. The outer tube provides increased strength since it is made of Inconnel 600 material as opposed to previously used stainless steel. Also, the outer tubes are chrome plated in the area which previously showed wear for increased wear resistance. The addition of wear inserts reduces wear by limiting the forcing function and amplitude of vibrational motion the FTTCs can experience. This will limit the contact forces on the outer tube. The reduced forces will in turn reduce wear of the FTTC outer tube. Also, the wear inserts significantly increase the wear area so that the contact forces are distributed over a larger area of the FTTC outer tubes. This will reduce concentrated wear of the tubes in the fuel assembly nozzle areas.

PSE&G contracted the services of Combustion Engineering to conduct Salem specific tests to model the wear phenomenon and design the wear inserts. These tests, conducted in July 1987, identified the primary causes of the excitations that resulted in the wear of the flux thimbles. They were also used to optimize the design of the wear inserts to minimize the causes of the flux thimble vibrations. The test results further established the following benefits from the improved design. The addition of wear inserts decreases the wear rate by a factor of at least four by limiting the amplitude of the tube vibrations. The increase in wear area that the inserts afford decrease the wear rate by at least a factor of two. And finally, the chrome plating of the tube in the fuel nozzle area reduces the wear rate by at least a factor of five. These reductions are multiplicative, and result in a possible reduction in the wear rate by a factor of forty. However, to be conservative, Combustion Engineering concluded that the overall wear rate will be reduced by at least a factor of twenty. It is anticipated that with the improved wear resistance of the flux thimbles due to replacement material and chrome plating, and the installation of wear inserts to reduce forcing functions and vibrational amplitudes, the wear phenomena will be below the threshold value so that it shouldn't be a concern.

It should further be noted that the inner tube in the FTTC assembly provides an additional pressure barrier that was not previously present. Also, in the unlikely event of a leak through both tubes of the FTTC assemblies, the leak detection system and manual isolation valves will continue to provide assurance that the leaking FTTC assembly will be quickly identified and isolated.

Instead of continuing to inspect wearing thimble tubes, PSE&G has proactively replaced and modified the thimble tubes so that the potential for significant wear is greatly reduced. However, since the modified thimble tube design uses two concentric tubes with cables wound around the inner tube, eddy current testing conducted from within the inner tube will not yield meaningful results. As such, PSE&G cannot continue its current inspection program utilizing eddy current testing. At present, no alternative viable inservice inspection techniques exist that will adequately detect wear. Therefore, since PSE&G cannot inspect the current thimble tube design (the FTTC assemblies), and since a conservative interpretation of the test results show that the wear rate is reduced by at least a factor of twenty, it is PSE&G's position that no further inspections are necessary at this time. PSE&G will reevaluate the need for future thimble inspection. This reevaluation will be based on advancements made in inservice inspection techniques and the operating performance of the FTTC assemblies. Within four months after restart from the Salem Unit 2 seventh refueling outage, PSE&G will supplement this Bulletin response with our reevaluation for both Salem units. This approach is justified by the Salem specific test results that predict a very significant reduction in the wear rate and the recent replacement of the flux thimbles with FTTC assemblies.

Attachment 2

Audit Agenda

NRC AUDIT OF SALEM 1 & 2

ON BULLETIN 88-09

AGENDA

I. Review thimble wear problems occured in Salem 1 & 2

   A. Thimble inspection program and findings since 1982.

   B. Root cause of high rate wear (The rate is higher than other reactors of similar design.)

   C. Subsequent interim actions.

II. Review inproved thimble design

   A. Verification of design margins

   B. Periodic inspection program

      (1) The inspection method
      (2) The program
      (3) The acceptance criteria

   C. Assessment of actual performance

   D. Capability to isolate possible leakage

III. Document review

IV. Hardware inspection

Attachment 3

Photographs of Thimble Tube Failures

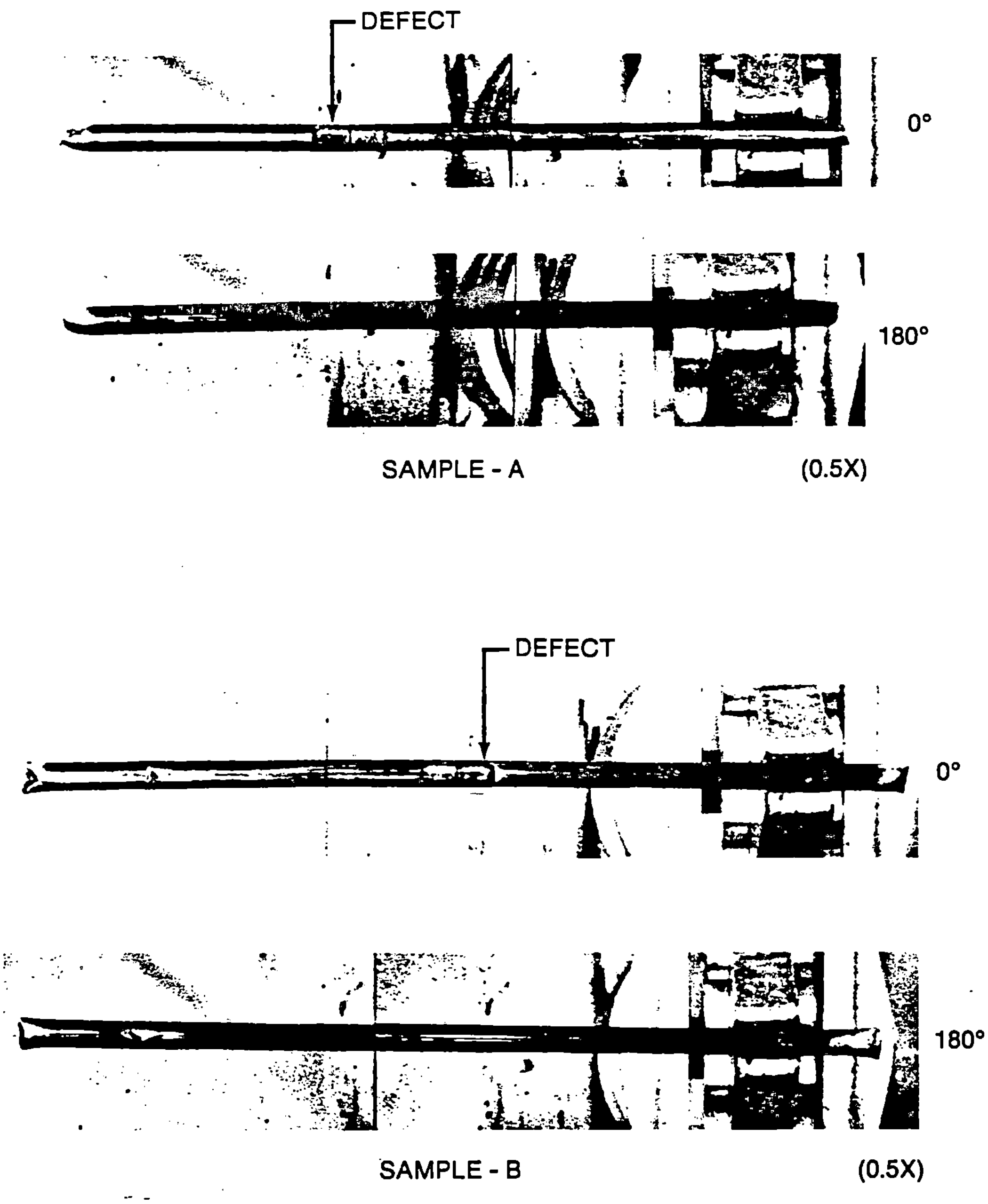
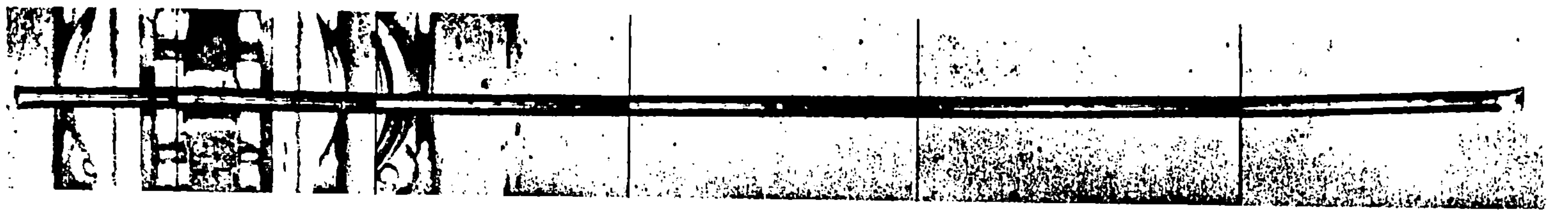


FIGURE 2-1. OUTSIDE DIAMETER SURFACE APPEARANCE OF THE AS-RECEIVED THIMBLE TUBE SAMPLES A AND B.



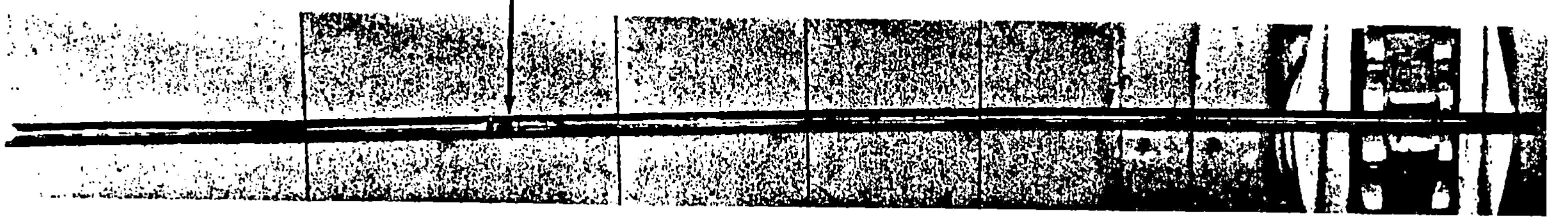
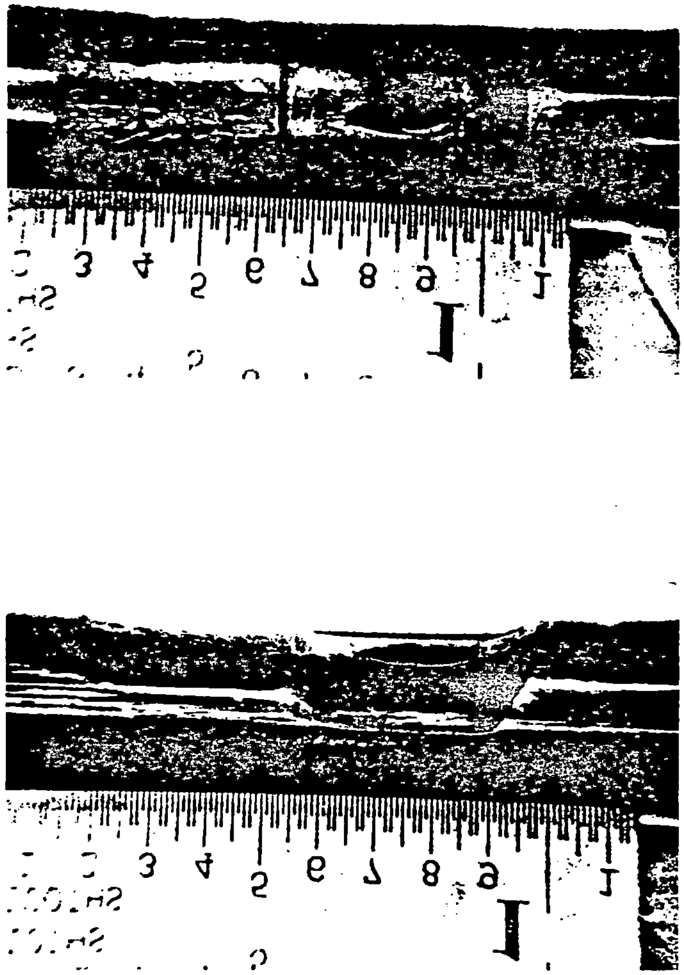


FIGURE 2-2. OUTSIDE DIAMETER SURFACE APPEARANCE OF THE AS-RECEIVED THIMBLE TUBE 'C'.



0°

270°

FIGURE 2-3. **CLOSE-UP VIEW OF THE OUTSIDE DIAMETER SURFACE APPEARANCE OF THE DEFECT REGION IN THE AS-RECEIVED THIMBLE TUBE 'B'.**

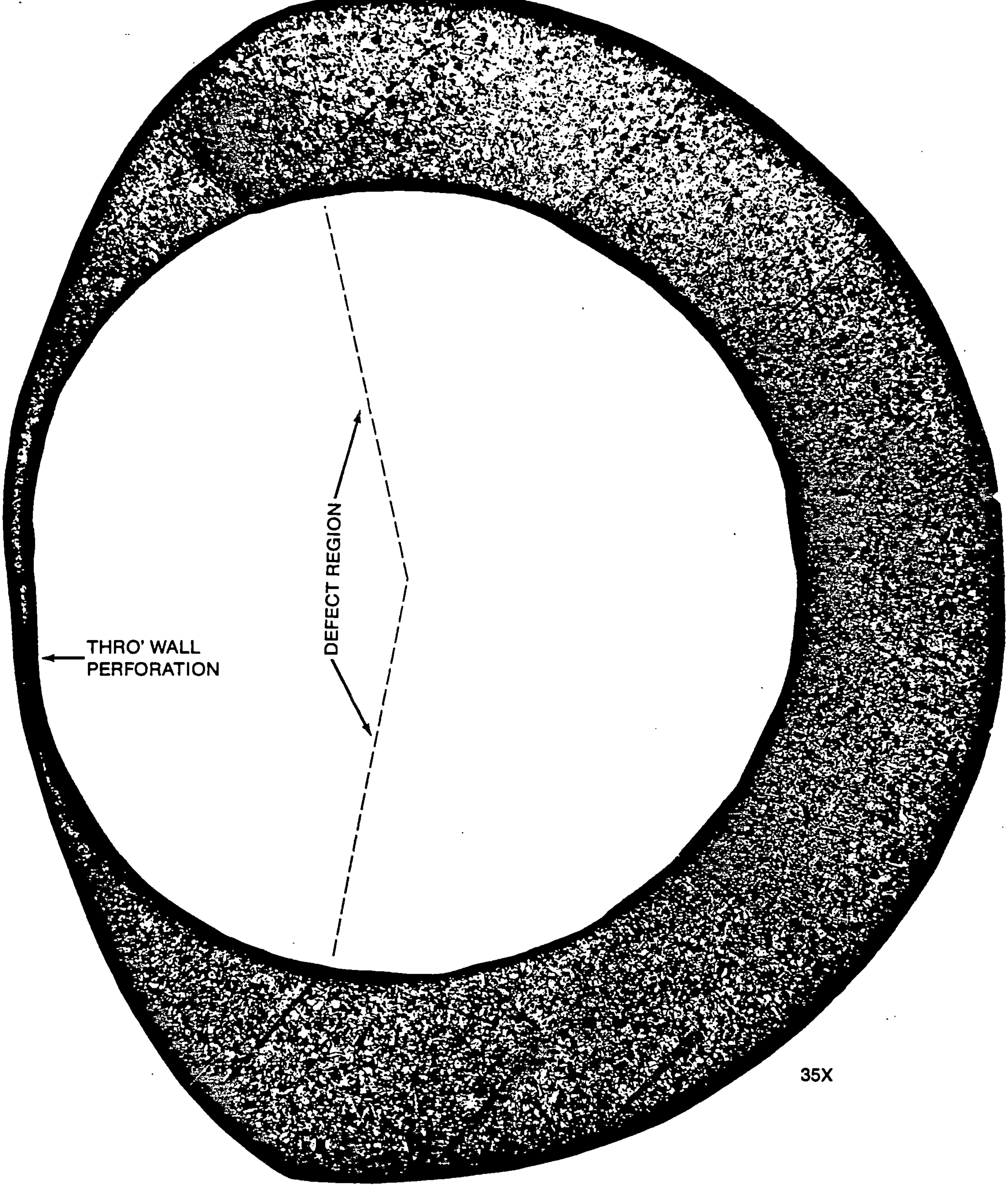
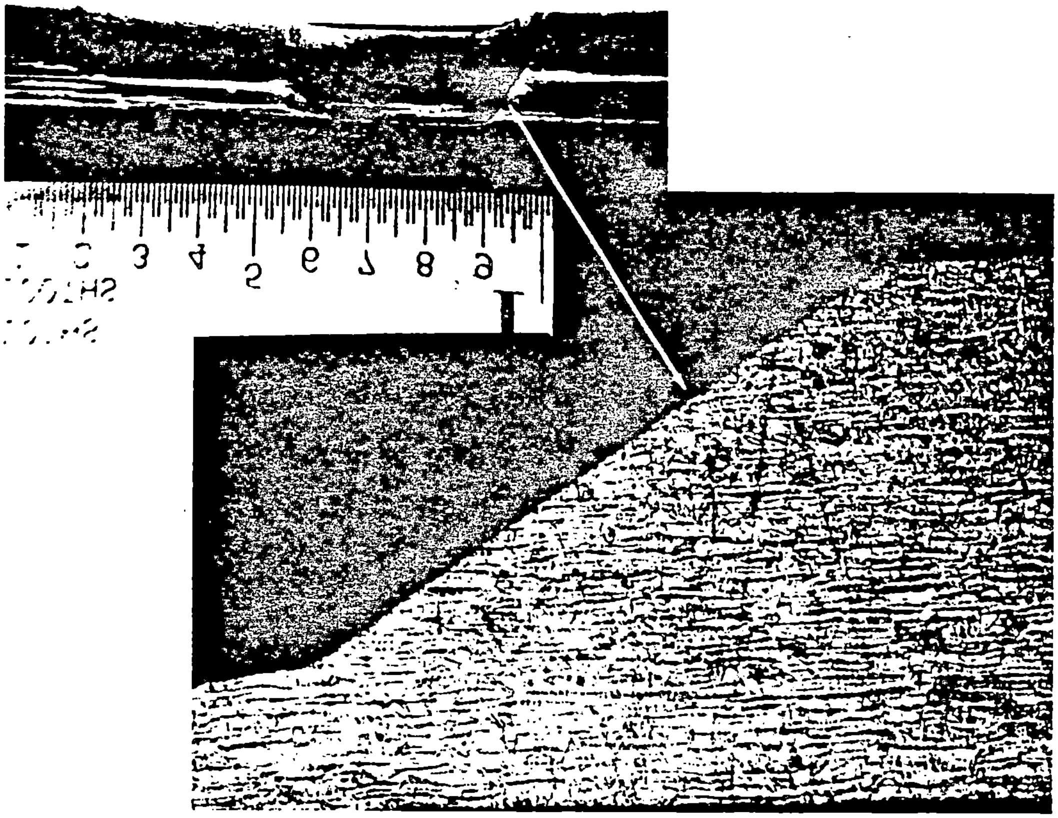


FIGURE 2-9. **MONTAGE OF LIGHT OPTICAL METALLOGRAPHS TAKEN ON A TRANSVERSE SECTION THROUGH THE DEFECT REGION OF THE TUBE SAMPLE 'A'.**

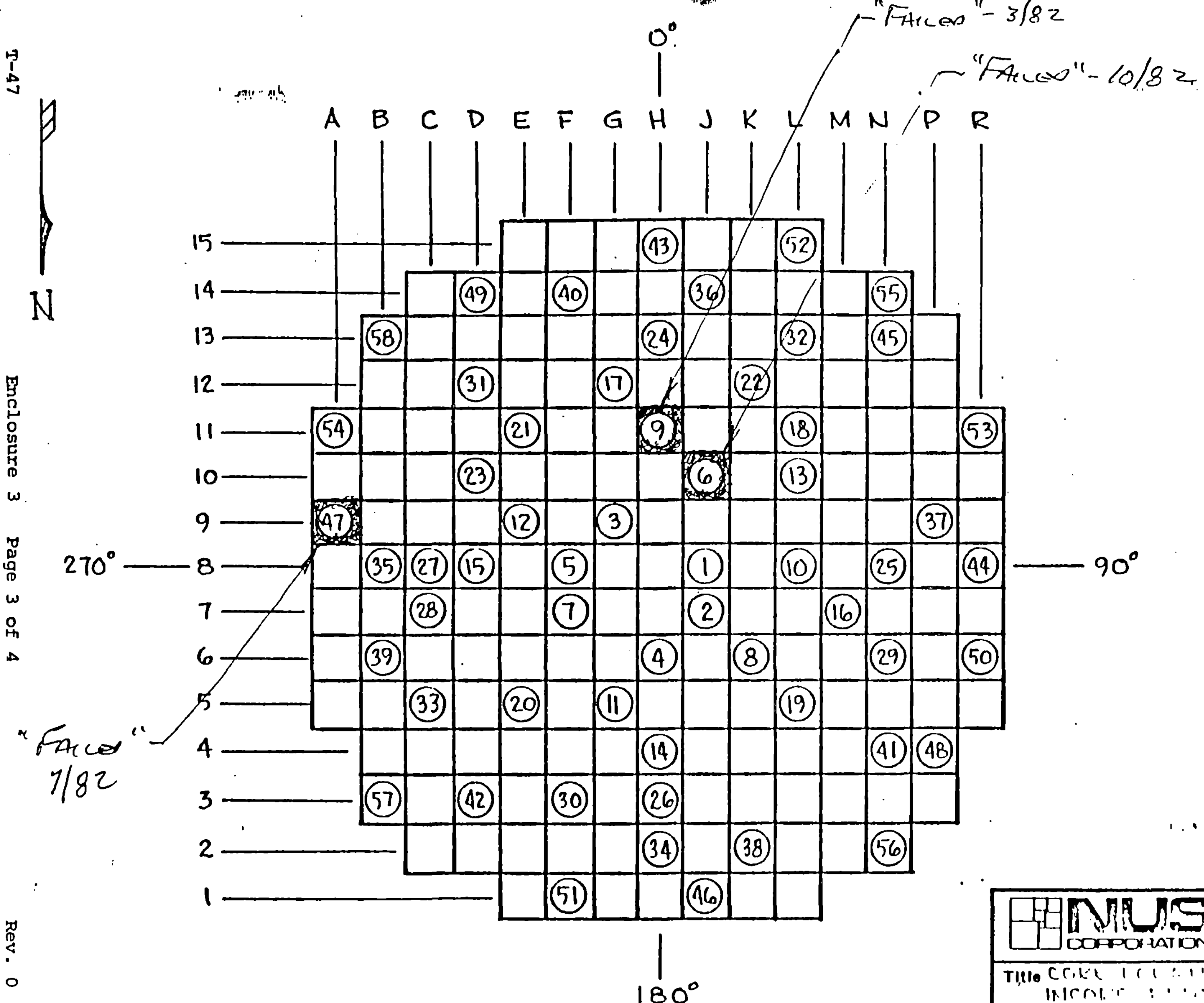


(50X)

FIGURE 2-10. **LIGHT OPTICAL METALLOGRAPH ON AN AXIAL SECTION OF THE TUBE 'B' AT THE DEFECT REGION.**

Attachment 4

Eddy Current Testing Inspection Results



LOCATIONS OF UNIT 1 THIMBLE TUBE FAILURES (1981)

NUS CORPORATION	CLEARWATER FLORIDA
Title CORE ... MAP FOR INCORE ...	
Project ... B.C.	
Date 12-10-81	Fig. No. 1
Procedure 08-02	

SALEM UNIT 1

INCORE THIMBLE EDDY CURRENT INSPECTION COMPARISON TABLE

% WALL LOSS INDICATION

THIMBLE #	OCT. 82 I.D.	OCT. 82 O.D.	JULY 84 I.D.	JULY 84 O.D.	APRIL 86 I.D.	APRIL 86 O.D.
1	0	0	0	0	-	30
2	0	0	0	0	-	30
4	0	0	10	0	-	40-50
5	0	0	0	15	-	50-60
8	0	10-20	30	25	-	30-40
9	0	0	0	25	-	50
12	0	0	20	0	-	20-30
13	0	0	10	0	-	20
14	0	0	0	0	-	50-60
15	45	0	45	15	-	20
16	0	0	0	0	-	30
17	0	40	0	65	-	80-90
18	0	0	0	15	-	40-50
19	0	0	0	0	-	30-40
20	0	0	10	0	-	50-60
21	0	0	0	0	-	60-70
22	0	0	0	0	-	20
23	0	0	0	0	-	60-70
24	0	0	30	0	-	20
26	0	0	20	0	-	0
27	0	0	10	35	-	20
28	0	30-35	0	25	-	40-50
31	0	0	0	0	-	30-40
32	0	0	0	0	-	20
33	0	0	0	0	-	50-60
34	0	0	30	0	-	0
38	0	0	20	0	-	0
39	0	0	10	0	-	50-60
40	0	0	0	0	-	20
43	0	0	10	0	-	0
46	BLOCKED	BLOCKED	10	0	-	20
47	0	0	10	0	-	20
48	0	0	10	0	-	0
49	0	0	0	0	-	20
51	0	0	0	0	-	20
53	0	0	10	50	-	40-50
54	0	0	0	50	-	80-90
56	0	0	10	0	-	0
57	0	0	20	0	-	0
58	40-45	0	45	0	-	50-60

- = <20% INDICATION
1982, 1984 EXAMINATIONS CONDUCTED BY CRAMER & LINDELL ENG. INC.
1986 EXAMINATION CONDUCTED BY MAPLEWOOD LABS.
ALL THIMBLE LOCATIONS NOT LISTED HAVE NO INDICATIONS OR INDICATIONS <20%.

SUMMARY OF EDDY CURRENT TEST
INSPECTIONS FOR UNIT 1

UNIT 2 EDDY CURRENT TEST

INSPECTION RESULTS - 1st + 2nd Outage

TABLE IV RESULTS FOR EACH TUBE

1st outage — 2nd outage

THIMBLE NUMBER	FUEL LOCATION	TOTAL LENGTH FROM SEAL TABLE-FEET	MAY 1983					FEBRUARY 1985				
			LENGTH INSPECTED FEET	MAXIMUM SIGNAL 200KHZ	MAXIMUM SIGNAL 61 KHZ	APPROXIMATE WALL LOSS PERCENT	COMMENTS	LENGTH INSPECTED FEET	MAXIMUM SIGNAL 200KHZ	MAXIMUM SIGNAL 61 KHZ	APPROXIMATE WALL LOSS PERCENT	COMMENTS
1	J8	109	108	22⁺/	17⁺/		@ CORE PLATE 97FT	109	30⁺/95°	33/100°	30	@ CORE PLATE (98 FT)
2	J7	110	110	10⁺/	30⁺/		@ CORE PLATE 97FT	110	27/70°	45⁺/80°	75	@ CORE PLATE (98 FT)
3	G9	108	108	15/	15/		@ CORE PLATE 96FT	108	17/120°	18/110°	0	@ CORE PLATE (97FT)
4	H6	106	106	20⁺/	35⁺/		@ CORE PLATE 95FT	106	35⁺/100°	30⁺/100°	20	@ CORE PLATE (95FT)
5	F8	105	105	0	0	0		105	0	0	0	
6	J10	109	108	0	0	0		109	0	0	0	
7	F7	106	106	5⁺/	25⁺/		@ CORE PLATE 96FT	106	35⁺/100	30⁺/95	20	@ CORE PLATE (98FT)
8	K6	109	109	0	0	0		109	0	0	0	

TABLE IV RESULTS FOR EACH TUBE

THIMBLE NUMBER	FUEL LOCATION	TOTAL LENGTH FROM SEAL TABLE-FEET	MAY 1983 LENGTH INSPECTED FEET	MAY 1983 MAXIMUM SIGNAL 200KHZ	MAY 1983 MAXIMUM SIGNAL 61 KHZ	MAY 1983 APPROXIMATE WALL LOSS PERCENT	MAY 1983 COMMENTS	FEBRUARY 1985 LENGTH INSPECTED FEET	FEBRUARY 1985 MAXIMUM SIGNAL 200KHZ	FEBRUARY 1985 MAXIMUM SIGNAL 61 KHZ	FEBRUARY 1985 APPROXIMATE WALL LOSS PERCENT	FEBRUARY 1985 COMMENTS
9	H11	108	108	25+/	20/		@CORE PLATE 96 FT	108	32+/115°	20/115°	0	@CORE PLATE (98FT)
10	L8	111	111	15+/	26/		@ CORE PLATE 100 FT	111	24+/100°	30/110°	20	@ CORE PLATE (98 FT)
11	G5	108	108	0	0	0		108	0	0	0	
12	E9	106	106	15+/	20+/		@CORE PLATE 96 FT	106	30/115°	22/110°	0	@ CORE PLATE (94FT)
13	L10	111	111	0	0	0		111	0	0	0	
14	H4	106	106	6/	6		BAL SHIFT @ 87 FT	106	9/100	6/85	20	ABNORMAL OD BALANCE SHIFT - POSSIBLE OD DAMAGE (@ 89 FT)
15	D8	108	108	20+/	30+/		@CORE PLATE 98 FT	108	35/120°	31/110°	0	@ CORE PLATE (96 FT)
16	M7	113	110	15/	16/		@CORE PLATE 102 FT	113	15/115°	16/95°	0	@CORE PLATE (96FT)

TABLE IV RESULTS FOR EACH TUBE

THIMBLE NUMBER	FUEL LOCATION	TOTAL LENGTH FROM SEAL TABLE-FEET	MAY 1983 LENGTH INSPECTED FEET	MAY 1983 MAXIMUM SIGNAL 200KHZ	MAY 1983 MAXIMUM SIGNAL 61 KHZ	MAY 1983 APPROXIMATE WALL LOSS PERCENT	MAY 1983 COMMENTS	FEBRUARY 1985 LENGTH INSPECTED FEET	FEBRUARY 1985 MAXIMUM SIGNAL 200KHZ	FEBRUARY 1985 MAXIMUM SIGNAL 61 KHZ	FEBRUARY 1985 APPROXIMATE WALL LOSS PERCENT	FEBRUARY 1985 COMMENTS
17	G12	108	108	40+	–	–		108	17 / 105 40+/20°	9 / 90 35+/45°	0-10 55	POSSIBLE OD DAMAGE @ 91 FT I.D. DAMAGE @ 87 FT
18	L11	111	111	25+/	20+/		@ CORE PLATE 100 FT	111	30+/105°	32/95°	0-10	@ CORE PLATE (99 FT)
19	L5	112	112	0	0	0		112	0	0	0	
20	E5	106	105	17/	14/		@ CORE PLATE 95 FT	106	15/115	12 /105	0	@ CORE PLATE (95 FT)
21	E11	104	104	0	0	0		104	0	0	0	
22	K12	112	112	15+/	33/		@ CORE PLATE 100 FT	112	20+/110°	30/110°	0	@ CORE PLATE (98 FT)
23	D10	104	104	20/	13/		@ CORE PLATE 90 FT	104	20+/120	13 / DISTORTED	0	@ CORE PLATE (85 FT)
24	H13	108	108	15/	16/		@ CORE PLATE 97 FT	108	17/130°	16/130°	0	@ CORE PLATE (98 FT)

TABLE IV RESULTS FOR EACH TUBE

THIMBLE NUMBER	FUEL LOCATION	TOTAL LENGTH FROM SEAL TABLE-FEET	MAY 1983					FEBRUARY 1985				
			LENGTH INSPECTED FEET	MAXIMUM SIGNAL 200KHZ	MAXIMUM SIGNAL 61 KHZ	APPROXIMATE WALL LOSS PERCENT	COMMENTS	LENGTH INSPECTED FEET	MAXIMUM SIGNAL 200KHZ	MAXIMUM SIGNAL 61 KHZ	APPROXIMATE WALL LOSS PERCENT	COMMENTS
25	N8	114	114	16+/ 19/20°	7/ 5/45°	55	@97 FT POSSIBLE ID DAMAGE (@8-10FT)	114	30/100° 19/20°	6/90° 5/50°	20 55	POSSIBLE OD DAMAGE @97FT KINK IN TUBE I.D. DAMAGE (@8-10FT)
26	H3	108	108	17/	16/		@CORE PLATE 96 FT	108	15/130°	14/120°	0	@ CORE PLATE (96 FT)
27	C8	104	104	0	0	0		104	0	0	0	
28	C7	106	106	15+/	20+/		@CORE PLATE 92FT	106	32/105°	26/105°	0-10	@ CORE PLATE (94 FT)
29	N6	113	113	0	0	0		113	0	0	0	
30	F3	108	108	0	0	0		108	0	0	0	
31	D12	105	105	17+/	36+/		@ CORE PLATE 95 FT	105	20+/85°	40/95°	50	@ CORE PLATE (96FT)
32	L13	111	111	16/	16/		@ CORE PLATE 100 FT	111	16/120°	14/110°	0	@ CORE PLATE (98 FT)

TABLE IV RESULTS FOR EACH TUBE

THIMBLE NUMBER	FUEL LOCATION	TOTAL LENGTH FROM SEAL TABLE-FEET	MAY 1983					FEBRUARY 1985				
			LENGTH INSPECTED FEET	MAXIMUM SIGNAL 200KHZ	MAXIMUM SIGNAL 61 KHZ	APPROXIMATE WALL LOSS PERCENT	COMMENTS	LENGTH INSPECTED FEET	MAXIMUM SIGNAL 200KHZ	MAXIMUM SIGNAL 61 KHZ	APPROXIMATE WALL LOSS PERCENT	COMMENTS
33	C5	103	103	0	0	0		103	0	0	0	
34	H2	108	108	20/	20/		@ CORE PLATE 97 FT	108	25/110°	22/105°	0	@ CORE PLATE (96 FT)
35	B8	102	102	16/	16/		@ CORE PLATE 90 FT	102	15/125°	16/DISTORTED	0	@ CORE PLATE (90 FT)
36	J14	110	110	17/	17/		@ CORE PLATE 97 FT	110	15/110°	18/90°	0	@ CORE PLATE (100 FT)
37	P9	115	115	0	0	0		115	0	0	0	
38	K2	112	112	25+/ 17/	30+/ 8/		@ CORE PLATE 101 FT BAL SHIFT @ 95 FT	112	50+/95° 17/90°	30+/100° 8/85°	30 40	@ CORE PLATE (102 FT) ABNORMAL BALANCE SHIFT-POSSIBLE OD DAMAGE @ 95 FT
39	B6	102	102	30+/	25+/		@ CORE PLATE 91 FT	102	32/115°	26/110°	0	@ CORE PLATE (94 FT)
40	F14	106	106	15+/	18/		@ CORE PLATE 95 FT	106	23/120°	20/100°	0	@ CORE PLATE (90 FT)

TABLE IV RESULTS FOR EACH TUBE

THIMBLE NUMBER	FUEL LOCATION	TOTAL LENGTH FROM SEAL TABLE-FEET	MAY 1983 LENGTH INSPECTED FEET	MAY 1983 MAXIMUM SIGNAL 200KHZ	MAY 1983 MAXIMUM SIGNAL 61 KHZ	MAY 1983 APPROXIMATE WALL LOSS PERCENT	MAY 1983 COMMENTS	FEBRUARY 1985 LENGTH INSPECTED FEET	FEBRUARY 1985 MAXIMUM SIGNAL 200KHZ	FEBRUARY 1985 MAXIMUM SIGNAL 61 KHZ	FEBRUARY 1985 APPROXIMATE WALL LOSS PERCENT	FEBRUARY 1985 COMMENTS
41	N4	113	113	0	0	0		113	0	0	0	
42	D3	105	105	0	0	0		105	0	0	0	
43	H15	109	90	0	0	0		109	0	0	0	
44	R8	116	115	0	0	0		116	0	0	0	
45	N13	114	114	26/	19/		@CORE PLATE 101 FT	114	27/110°	22/110°	0	@ CORE PLATE (105 FT)
46	J1	110	110	15/	11/		@ CORE PLATE 100 FT	110	15/130°	16/DISTORTED	0	@ CORE PLATE (97 FT)
47	A9	101	101	25+/	20+/		@ CORE PLATE 86 FT	101	16/115	20+/115	0	@CORE PLATE (90 FT)
48	P4	115	115	0	0	0		115	0	0	0	

TABLE IV RESULTS FOR EACH TUBE

THIMBLE NUMBER	FUEL LOCATION	TOTAL LENGTH FROM SEAL TABLE-FEET	MAY 1983					FEBRUARY 1985				
			LENGTH INSPECTED FEET	MAXIMUM SIGNAL 200KHZ	MAXIMUM SIGNAL 61 KHZ	APPROXIMATE WALL LOSS PERCENT	COMMENTS	LENGTH INSPECTED FEET	MAXIMUM SIGNAL 200KHZ	MAXIMUM SIGNAL 61 KHZ	APPROXIMATE WALL LOSS PERCENT	COMMENTS
49	D14	104	104	12/	16/		@ CORE PLATE 94 FT	104	16/120°	16/115°	0	@ CORE PLATE (92FT)
50	R6	116	115	0	0	0		116	0	0	0	
51	F1	105	105	15+/	10+/		@ CORE PLATE 94FT	105	10/120°	18/DISTORTED	0	@ CORE PLATE (94FT)
52	L15	113	113	20+/	25/		@ CORE PLATE 100 FT	113	35/110°	23/110°	0	@ CORE PLATE (103FT)
53	R11	116	115	0	0	0		116	0	0	0	
54	A11	101	101	10+/	16/		@ CORE PLATE 88 FT	101	16/125°	16/120°	0	@ CORE PLATE (90FT)
55	N14	114	114	0	0	0		114	0	0	0	
56	N2	114	114	0	0	0		114	0	0	0	

TABLE IV RESULTS FOR EACH TUBE

THIMBLE NUMBER	FUEL LOCATION	TOTAL LENGTH FROM SEAL TABLE-FEET	MAY 1983					FEBRUARY 1985				
			LENGTH INSPECTED FEET	MAXIMUM SIGNAL 200KHZ	MAXIMUM SIGNAL 61 KHZ	APPROXIMATE WALL LOSS PERCENT	COMMENTS	LENGTH INSPECTED FEET	MAXIMUM SIGNAL 200KHZ	MAXIMUM SIGNAL 61 KHZ	APPROXIMATE WALL LOSS PERCENT	COMMENTS
57	B3	102	102	0	0	0		102	0	0	0	
53	B13	102	102	22+/	12/		@ 86FT	102	35+/105°	15 /85°	0-10	POSSIBLE OD DAMAGE @ 85FT.

UNIT 2 EDDY CURRENT TEST

INSPECTION RESULTS - 3rd OUTAGE

/E OCTOBER 11, 1986

SHEET 1 OF 2

PSE&G RESEARCH CORPORATION
EDDY CURRENT EXAMINATION RESULTS

LOCATION SALEM NO. 2 UNIT
COMPONENT REACTOR INCORE FLUX THIMBLES

EXAMINER - ROMAN
EVALUATOR - ROMAN

THIMBLE NUMBER	CORE LOCATION	ORIGIN	% DEFECT	VOLTAGE	LOCATION
1	D 8 → J-8 KRP	OD	55	6.0	@ LCP
2	J 7	OD	40	2.0	@ LCP
3	G 9	OD	30	2.5	@ LCP
4	H 6	OD	40	3.0	@ LCP
5	F 8				
6	J 10				
7	F 7	OD	65	14.0	@ LCP
8	K 6				
9	H 11	OD	50	6.0	@ LCP
10	L 8	OD	50	4.5	@ LCP
11	G 5				
12	E 9	OD	30	3.0	@ LCP
13	L 10				
14	H 4	OD	55	3.0	80'-90'
15	D 8	OD	30	4.0	@ LCP
16	M 7	OD	35	5.0	@ LCP
17	G 12	OD	55	4.0	@ LCP
18	L 11	OD	70	4.0 / 14.0	80'-90' / @ LCP
19	L 5				
20	E 5				
21	E 11				
22	K 12	OD	25	3.0	@ LCP
23	D 10	OD	60	3.0	80'-90'
24	H 13				
25	N 8	OD	60	2.0	@ LCP
26	H 3				
27	C 8				
28	C 7	OD	35	3.0	@ LCP
29	N 6				
30	F 3				
31	D 12	OD	60	5.0	@ LCP
32	L 13				
33	C 5				
34	H 2	OD	50	4.0	@ LCP
35	B 8	OD	20	3.0	@ LCP
36	J 14	OD	25	3.0	@ LCP
37	P 9	OD	35	1.0	@ LCP
38	K 2	OD	55/70	10.0/4.0	@ LCP/90'-100'
39	G 6	OD	35	3.0	@ LCP
40	F 14	OD	40	4.0	@ LCP
41	N 4	OD	30	2.0	@ LCP
42	D 3				
43	H 15	ID	35	3.0	APPROX 100'
44	R 8				
45	N 13	OD	70	14.0	@ LCP
46	J 1				
47	A 9	OD	30	2.0	@ LCP
48	P 4				
49	D 14				
50	R 6				

/E OCTOBER 11, 1986

SHEET 2 OF 2

PSE&G RESEARCH CORPORATION
EDDY CURRENT EXAMINATION RESULTS

LOCATION SALEM NO. 2 UNIT
COMPONENT REACTOR INCORE FLUX THIMBLES

EXAMINER - ROMAN
EVALUATOR - ROMAN

THIMBLE NUMBER	CORE LOCATION	ORIGIN	% DEFECT	VOLTAGE	LOCATION
51	F 1				
52	L 15	OD	35	4.0	@ LCP
53	R 11				
54	A 11				
55	N 14				
56	N 2				
57	B 3	OD	65	2.0	80'-85'
58	B 13	OD	55	2.0	@ LCP

Recommend Isolate

Thimble #	LOC
1	J8
7	F7
14	H4
17	G12
18	L11
23	D10
25	N8
31	D12
38	K2
45	N13
57	B3
58	B13

Kenneth R Pike
11/7/86

Criteria for Selection

These 3 Thimbles show ~30% wall Remaining. This 30% will withstand ~3 times the RCS pressure and in fact some thimbles in service on S1C6 were operating with only 10 To 20% of wall thickness remaining without failure. All other thimbles in this Report show a Safety factor of greater than 3 with respect To ability To withstand RCS pressure. In addition since the Tubes are being moved back 1.5" there is NOT expected To be any additional wear on those locations already worn.