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W3F1-2005-0037

May 24, 2005

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

Subject: Waterford 3 SES
Docket No. 50-382
License No. NPF-38
Combined Category C-3 and 15-Day Special Report SR-05-001-00 on the 13th Refueling Outage Steam Generator Tube Inservice Inspection

Dear Sir or Madam:

Pursuant to Technical Specification (TS) 6.9.2, Entergy Operations, Inc. (Entergy) provides the following Combined Category C-3 and 15-Day Special Report SR-05-001-00 on the 13th Refueling Outage Steam Generator Tube Inservice Inspection, for Waterford Steam Electric Station Unit 3. This Special Report provides the results of the Refuel 13 Steam Generator Tube Inservice Inspection in accordance with TS 4.4.4.5.a and 4.4.4.5.c.

The Waterford 3 Steam Generator (SG) tube inspections were performed during the RF13 scheduled refueling outage that began on April 17, 2005. The inspections performed on both SGs involved a 100% full-length bobbin coil examination of all inservice tubes and a 100% rotating pancake coil (RPC) probe inspection of the hot leg (HL) expansion transition (ET) region. The RPC used consists of a plus-point coil, a 0.115 inch pancake coil, and a 0.080 inch pancake coil. The RPC was also utilized for confirmation of bobbin coil calls. The Plus Point coil was used to test the small radius U-bends, dented eggcrate (EC) intersections and any wear indications that required RPC testing.

In accordance with TS 4.4.4.5.a, the SG tube inspections resulted in plugging 247 tubes in SG 31 and 223 tubes in the SG 32. Sleeves were not utilized to repair these tubes identified during this inspection.

In accordance with TS 4.4.4.5.c, the SG tube inspections resulted in classifying SG 31 Category C-3, due to more than 1% of the inspected tubes being defective. The number of inspected tubes for SG 31 was 8779 of which 247 tubes were plugged during this inspection.

Attachments 1 and 2 summarize the results of these inspections.

A047

This letter contains no commitments. If you have any questions concerning the above, please contact Greg Scott at (504) 739-6703 or Robert O'Quinn at (504) 739-6387.

Very truly yours,

Robert J. Murillo
Licensing Manager, Acting

RJM/GCS/cbh

Attachments:
1. RF13 Combined Category C-3 and 15-Day Special Report
2. RF13 Steam Generator Plugged Tube Indications

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Attachment 1

Special Report SR-05-001-00
W3F1-2005-0037

RF13 Combined Category C-3 and 15-Day Special Report

RF13 Combined Category C-3
and 15-Day Special Report

Waterford 3 began the outage with 8779 tubes in Steam Generator (SG) 31 and 8866 tubes in Steam Generator (SG) 32 in service. This report documents both the 15 day plugged tube report and C3 report as required by Technical Specifications. There were 247 tubes plugged in SG31 and 223 plugged in SG32. The following is a summary of the historical repairs to date:

Year	Outage	EFPY	SG 31	SG 32	Total	Cumulative
1985	PRE-SER		154	169	323	323
1986	RF01	1.01	0	0	0	323
1987	RF02	2.08	0	1	1	324
1989	RF03	3.31	11	8	19	343
1991	RF04	4.55	161	161	322	665
1992	RF05	5.83	4	5	9	674
1994	RF06	7.15	4	2	6	680
1995	RF07	8.52	15	4	19	699
1997	RF08	9.90	29	26	55	754
1999	RF09	11.02	12	10	22	776
2000	RF10	12.37	28	38	66	842
2002	RF11	13.60	26	10	36	878
2003	RF12	15.20	127	50	177	1055
2005	RF13	16.68	247	223	470	1525
Total			818	707		

1.0 STEAM GENERATOR DESIGN

The Waterford 3 Model 70 (3410 MWT) re-circulating steam generators were designed and fabricated by Nuclear Steam System Supplier Combustion Engineering (CE), Inc. in accordance with ASME Code, Section III NB for Class I vessels. The Waterford 3 steam generators each consist of 9,350 high temperature mill annealed inconel 600 U-tubes arranged in a one-inch inner diameter triangular pitch pattern representing 103,574 ft² of heat transfer area. The U-tubes are 3/4" O.D. by 0.048" nominal wall thickness explosively expanded the full depth of the tube sheet (Westinghouse – formerly CE's Explansion Process) and welded to the primary cladding. The secondary tube bundle support structure consists of carbon steel eggcrates. The secondary supports are arranged in the following order:

- seven full horizontal eggcrate supports

- three horizontal partial eggcrates supports
- two anti-vibration straps (hot and cold batwings)
- seven vertical straps

Waterford 3's primary design inlet (hot leg) temperature is 611°F with an outlet temperature (cold leg) of 553°F. As a result of a 1992 T-Hot reduction, Waterford 3 currently operates with an inlet temperature of 605°F and an outlet temperature of 545°F. This was accomplished at the start of cycle six in an effort to reduce the susceptibility to primary and secondary water stress corrosion cracking induced by hot leg temperatures above 600°F.

2.0 INSPECTION RESULTS

The initial scope and expansions based on number of examinations are listed in Table 2.1:

Table 2.1
Initial Scope and Expansions

Test Type	# Planned	% Scope	Expansion
SG31			
Bobbin	8779	100 %	No
RPC ET HL	8779	100 %	No
RPC Low Row U-bends (rows 1-2)	121	100 %	No
Dented/Ding	157	20 %	No
Wear	67	20%	Yes
SG32			
Bobbin	8866	100 %	No
RPC ET HL	8866	100 %	No
RPC Low Row U-bends (rows 1-2)	122	100 %	No
Dented/Ding	185	20 %	No
Wear	67	20 %	No

The bobbin inspections were performed predominantly from the cold leg sides of both steam generators. RPC testing was conducted from both hot and cold legs. There were 247 tubes plugged in SG31 and 223 tubes plugged in SG32. Table 2.2 lists the number of "indications" identified by generator during RF13:

Table 2.2
Indications Identified During RF13

Tube Status	SG - 31	SG - 32
Tubes inservice prior to RF	8779	8866
Total Number of tubes previously removed from service	571	484
Repair Candidates from RFO13:		
Hot Leg Top of Tubesheet Axial Indications (Above TTS)	2	2
Hot Leg Top of Tubesheet Circ. Indications (Above TTS)	1	0
Hot Leg Tube Sheet Axial Indications (Within Tubesheet)	5	0
Hot Leg Tube Sheet Circ. Indications (Within Tubesheet)	16	1
Tubesheet with Axial and Circumferential Indications	0	0
Support Plate With Axial Indications	101	23
Support Plate With Circumferential Indications	0	0
Batwings With Axial Indication	0	3
Batwings With Volumetric Indication	0	2
Customer Decision Preventative (NSY, PLP, PVN or NTE/PTE)	18	23
Customer Decision Preventative Bobbin Percents <40%	0	1
Hot Leg Volumetric Indications	0	1
Cold Leg Volumetric Indications	4	0
Row 1 - Row 2 U-Bend Indications	0	0
Bobbin Percents => 40%	2	5
Restricted/Obstructed Tubes or Unable to Complete Test	0	0
Total Candidate Tubes to be Repaired	**123**	**57**
Stabilizers Installed During RF13	36	51
Tubes Plugged During RF13 - EC Results	123	57
Tubes Plugged During RF13 - Batwing Preventative	124	166
Total Tubes Plugged - Post RF13	818	707

3.0 EVALUATION OF INSPECTION RESULTS

The inspections were performed with equipment and techniques qualified in accordance with Appendix H of the Electric Power Research Institute (EPRI) PWR Steam Generator Examination Guidelines, Rev. 6. Each mechanism will be discussed individually.

3.1 Top of the Tubesheet Circumferential Cracking (Expansion Transition)

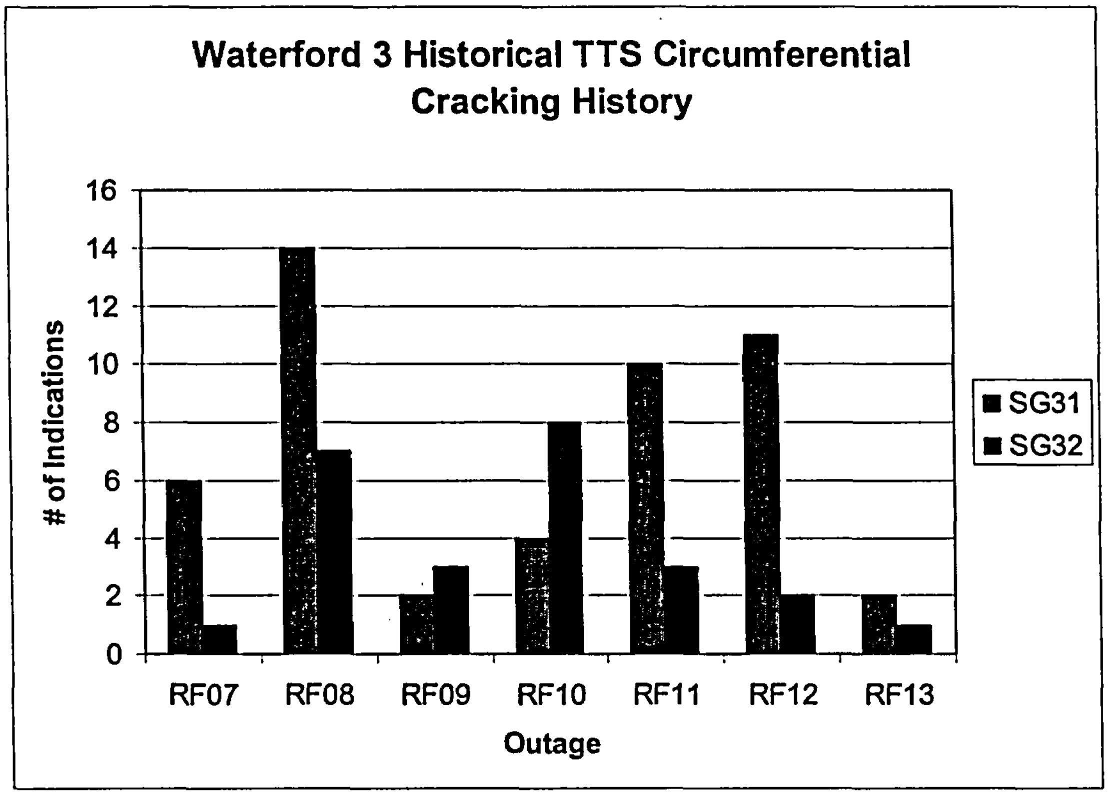
This was the eighth 100% inspection of the top of the tube sheet (TTS) region with a rotating probe. The Plus Point coil was used for detection of both axial and circumferential cracking. The extent of testing was + 3 inches to – 11 inches from the secondary face of the tube sheet. Listed in Table 3.1.1 are the outage, sample size, number of indications, and probe used for the indications identified at the top of the tube sheet.

TABLE 3.1.1
TTS CIRCUMFERENTIAL HISTORY

Outage	Sample	SG31	SG32	Probe
RF06 (1994)	100 %	0	0	Plus Point
RF07 (1995)	100 %	6	1	Plus Point
RF08 (1997)	100 %	14	7	Plus Point
RF09 (1999)	100 %	2	3	Plus Point
RF10 (2000)	100 %	4	8	Plus Point
RF11 (2002)	100 %	10	3	Plus Point
RF12 (2003)	100 %	11	2	Plus Point
RF13 (2005)	100 %	2	1	Plus Point

The number of circumferential indications found per SG in each inspection is shown in Figure 3.1.1.

Figure 3.1.1
TTS Circumferential Cracking



Screening of the indications was performed for in-situ testing. None of the indications met the minimum criteria for testing.

3.2 Circumferential Cracking within the Tubesheet

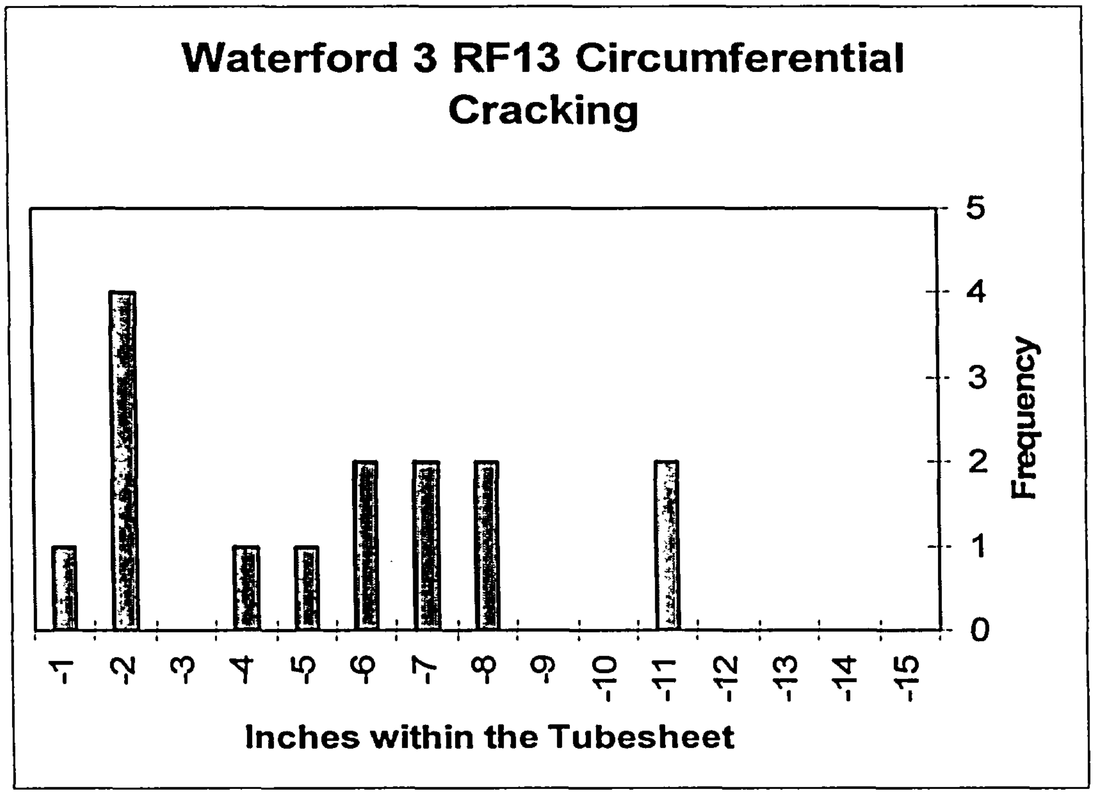
Circumferential cracking within the tubesheet has been identified as primary water stress corrosion cracking (PWSCC) or originating from the inside diameter of the tube. In an attempt to quantify this, the inspection extent was increased this outage to eleven inches below the secondary face or top of the tubesheet. Table 3.2.1 provides the number of circumferential indications detected within the tubesheet during the RF13 inspection:

Table 3.2.1
Circumferential Indications within the Tubesheet

	SG31	SG32
Circumferential Indications within the Tubesheet	16	1

During the last inspection (RF12), the depth of the inspection was eight inches into the tubesheet whereas this inspection, the depth was increased to 11 inches to be consistent with C*. A breakdown by location of the cracking within the tubesheet is provided in Figure 3.2.1:

Figure 3.2.1
Circumferential Cracking within the Tubesheet



Based on WCAP 16208, stabilization was performed on all circumferential indications above -3 inches. None of the indications exceed the in-situ selection criteria.

3.3 Axial Cracking at the Top of the Tubesheet

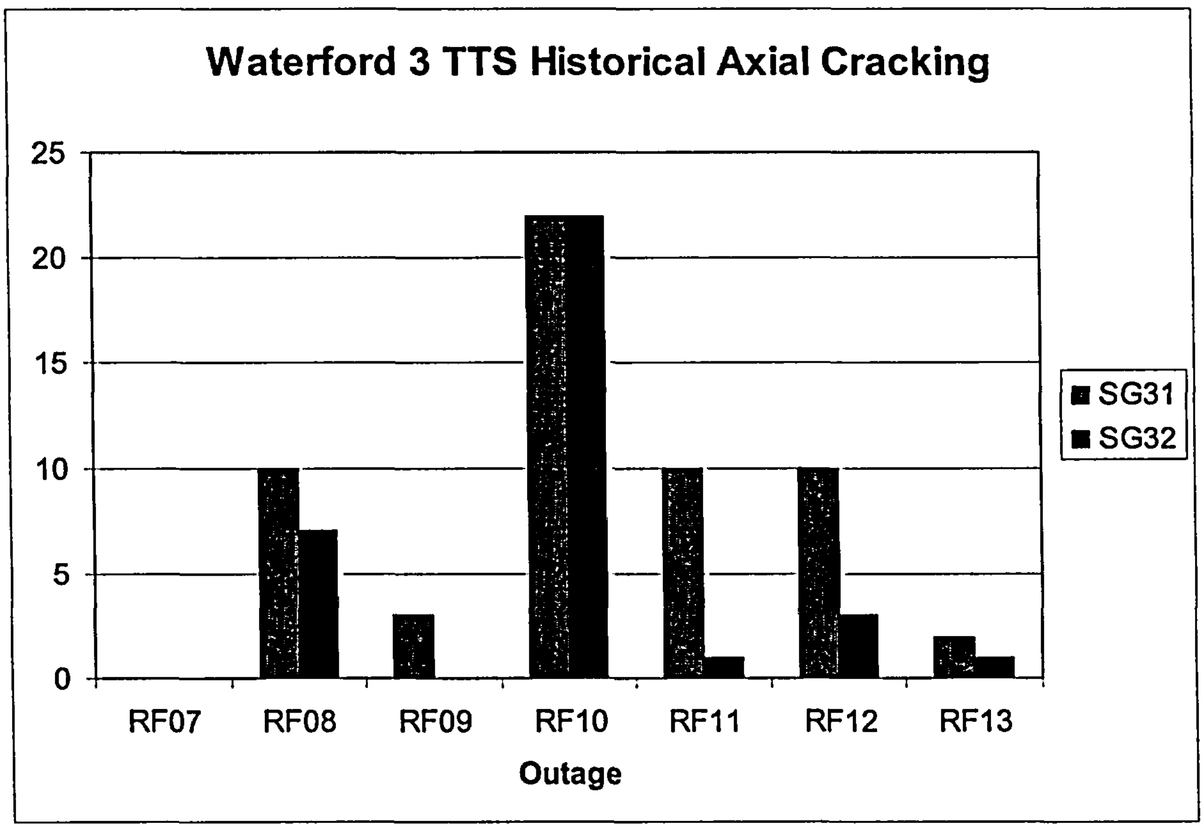
Historically, axial cracking at the top of the tubesheet has been the predominant damage mechanism at Waterford 3, excluding mechanical wear. The historical summary for this mechanism is listed in Table 3.3.1:

Table 3.3.1
Historical Top of the Tubesheet Inspections

Outage	Sample	SG31	SG32	Probe
RF06 (1994)	100 %	0	0	Plus Point
RF07 (1995)	100 %	0	0	Plus Point
RF08 (1997)	100 %	10	7	Plus Point
RF09 (1999)	100 %	3	0	Plus Point
RF10 (2000)	100 %	22	22	Plus Point
RF11 (2002)	100 %	10	1	Plus Point
RF12 (2003)	100 %	10	3	Plus Point
RF13 (2005)	100 %	2	1	Plus Point

This is displayed graphically below in Figure 3.3.1:

Figure 3.3.1
TTS Axial Cracking



None of the TTS axial cracks exceeded the in-situ screening criteria for burst or leakage.

3.4 Freespan Indications

During the previous inspection (RF12), there were 3 freespan axial cracks identified in a tube adjacent to a stayrod. During the most recent inspection (RF13), no freespan axial cracks were identified.

3.5 Axial Cracking (Eggcrate)

Cracking at eggcrates was first detected at Waterford 3 in 1999 (RF09). The eggcrate support flaws at Waterford 3 are classified as axially oriented outside diameter stress corrosion cracking. The cracking can be a single crack or multiple cracks interconnected in the tube within the eggcrate support. As noted in Figure 3.5.1, SG31 has the largest number of flaws occurring at the hottest support plate (01 Hot) and generally decreases as the temperature decreases. SG32 does not have a statistically large enough number to determine the exact distribution. Figure 3.5.2 depicts the number of indications by outage.

Figure 3.5.1
Eggcrate Flaw Distribution

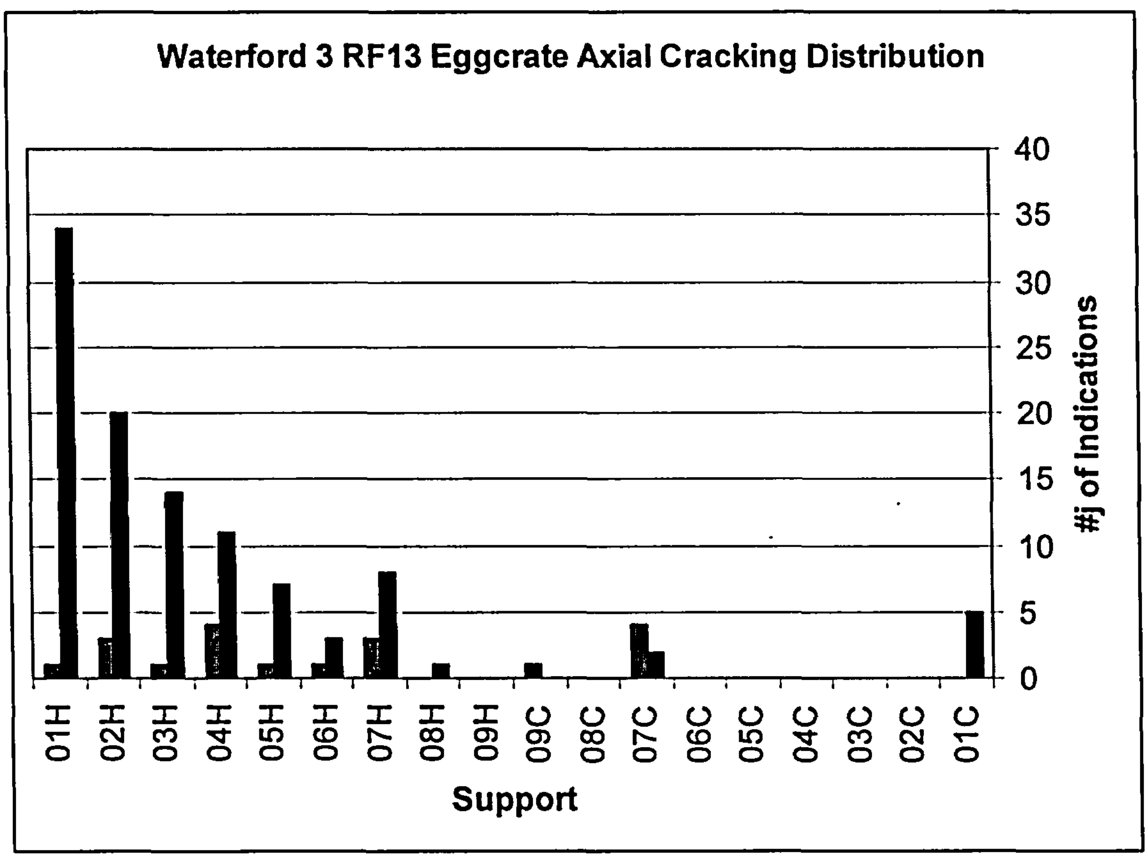
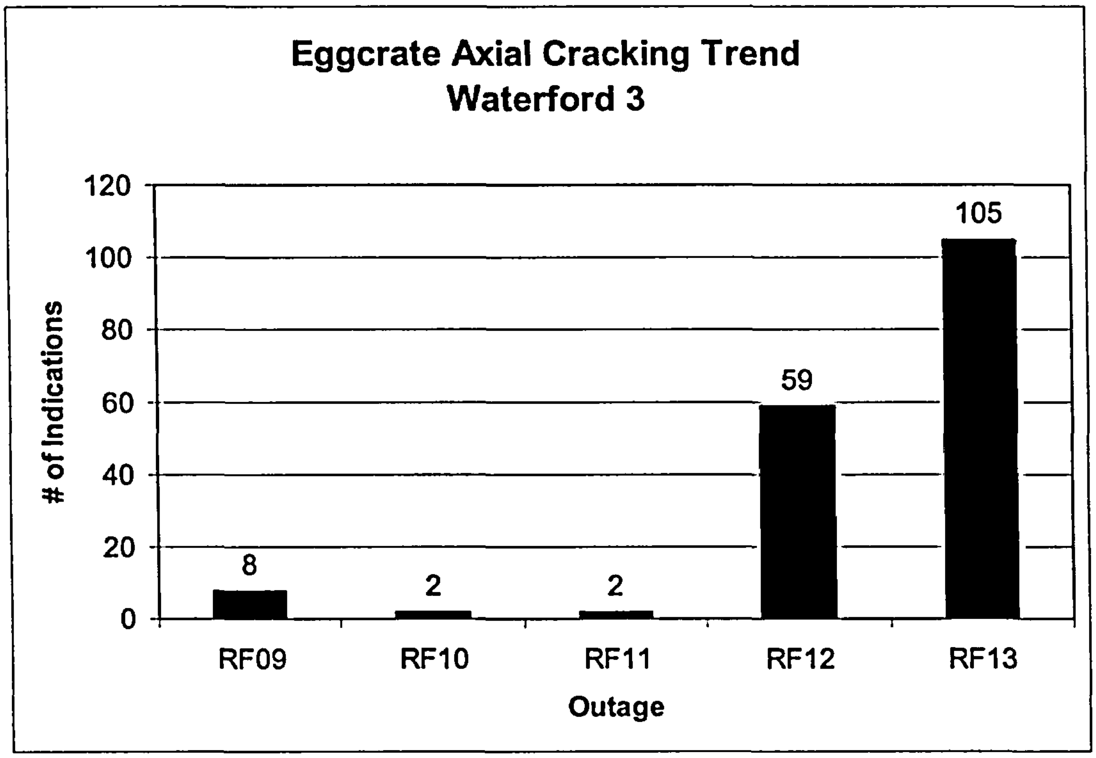


Figure 3.5.2
Eggcrate Axial Flaws by Outage



None of the eggcrate flaws detected during RF13 inspection met the in-situ pressure test criteria.

3.6 Dent/Ding Inspection

The initial inspection program required that in each steam generator 20% of the dents at intersections identified with the bobbin coil as having voltages ≥ 2.0 and freespan dings with voltages ≥ 5 were tested with the +Point coil probe. No degradation was identified.

3.7 Small Radius U-bend Inspection

During RF13, 100% of the u-bends in rows 1 & 2 of both generators were tested with the plus point. There were no indications identified.

3.8 Batwing Damage

During the RF13 inspection, it was determined that two of the batwing (diagonal strap tube support) in SG32 were not in their normal position. It appears that the batwings had dropped approximately 2 inches down from the normal position. Further evaluations also determined that a number of new wear was associated with the affected batwings. A large preventative repair campaign was developed to address the condition.

4.0 ROOT CAUSE AND CORRECTIVE ACTIONS

Tubing degradation has been previously reported in earlier inspections. The root cause for the degradation is attributed to age and material of the steam generator tubing and the secondary environment. Copper is believed to be a major contributor. In the RF10 refueling outage (2000), a high temperature chemical cleaning was performed to remove iron, copper and residual amounts of lead from the tube bundle. Problems encountered during the cleaning resulted in the copper being plated out. This not only prompted concerns about crack initiation but also a reduction in probability of detection with eddy current. Therefore, a second chemical cleaning was planned and performed during the RF12 outage. The level of detection was greatly improved from that of the RF11 outage, which resulted in a transient relative to the number of indications identified at the eggcrate supports. The chemical cleaning was expected to be 60-85% effective at removing the copper deposits. Those intersections that contained copper deposits that resulted in significant noise (Bobbin Amplitude >0.53 Vvm & RPC amp >0.5 V; >0.5" length) on the eddy current tests were preventatively removed from service. This accounted for 11 total tubes. During the RF13 inspection, it was noted that the amount of copper was even less than what was identified in RF12. This would indicate that the copper was loose after the chemical clean and was dispersed during operation.

The increased number of indications at the eggcrates is consistent with industry experience. The RF12 value was 59 while the RF13 value was 105 in the bounding generator. This was bound by the operational assessment for the previous operating cycle.

Molar ratio control was initiated early in plant life. Since that time, minor adjustments have been made to maintain a neutral to slightly acidic environment. The more recent hideout return data indicated that near neutral conditions have been maintained.

CONDITION MONITORING

Results from the RF13 inspection were compared to the operational assessment results. The actual number of detected indications was within the frequency of occurrence predicted by the operational assessment model. Thus, the flaw distribution predicted by the model was reasonable with respect to the actual flaw projections.

In-situ pressure testing was not required since all flaws identified did not exceed the screening criteria for testing. Therefore, both the structural and leakage integrity requirements were met.

CONCLUSIONS

In summary, a comprehensive eddy current examination was performed. Both steam generators were tested 100% full length with the bobbin coil and 100% at the hot leg ET region with Rotating Pancake Coil (RPC). The areas tested included 100% of the small radius U-bends (rows 1-2), 20% of the wear and 20% of the dented intersections in the eggcrates and freespan.

The indications identified in the tubesheet and at the expansion transition were smaller and lower in numbers than the previous inspection.

Eggcrate axial cracks, which are the dominant degradation mechanism identified during RF13, are calculated to burst at pressures well above that identified for structural adequacy in Regulatory Guide 1.121.

Waterford 3 utilizes N-16 monitors for primary-to-secondary leakage detection. TS 3.4.5.2c states that Reactor Coolant System leakage shall be limited to 75 gallons per day primary-to-secondary leakage per steam generator. Abnormal operating procedures are in place in the event that leakage is detected. Other methods for detecting leakage include a condenser off-gas radiation monitor, steam generator blowdown monitors, main steam line radiation monitors, in addition to the utilization of blowdown grab samples. Entergy Operations is sensitive to the potential rapid progression of tube leakage and will take the necessary measures upon detection, should a primary-to-secondary leak occur. Operators routinely train on primary-to-secondary leaks and tube ruptures utilizing the simulator. The primary-to-secondary leakage during the last operating interval was < 2 gallon per day.

Based upon the comprehensive actions performed during RF13 in conjunction with the ability to rapidly detect and respond to any primary-to-secondary leakage, as described above, Waterford 3 is safe to resume plant operation.

Operational assessments are performed per the guidance of NEI 97-06, Steam Generator Program Guidelines revision 1, January 2001.

Attachment 2

Special Report SR-05-001-00
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RF13 Steam Generator Plugged Tube Indications

SG31 Plugged Tube Indications

Tube #	ROW	COL	IND	PER	LOC	INCH
1	9	1	SAI		01H	0.6
	9	1	SAI		01H	-0.37
2	14	2	SAI		01H	0.15
3	20	2	SAI		03H	-0.2
4	67	11	PTP			
5	4	18	SAI		03H	0.76
6	11	19	SAI		02H	0.54
	11	19	SAI		02H	0.97
7	13	19	SAI		03H	0.92
8	17	19	SAI		03H	0.46
	17	19	SAI		04H	0.95
8	17	23	SAI		03H	-0.15
10	2	26	SAI		07C	-0.36
	2	26	SAI		07C	-0.32
11	112	32	SAI		01C	-0.79
	112	32	SAI		01C	0.35
	112	32	SAI		01C	-0.52
	112	32	SAI		01C	-0.3
	112	32	SAI		01C	0.54
12	8	36	SAI		01H	0.98
13	99	39	SAI		02H	0.14
14	91	41	SAI		03H	0.87
15	8	44	SAI		07H	0.96
16	84	44	SAI		01H	-0.12
	84	44	SAI		01H	0.15
	84	44	SAI		01H	0.81
17	113	45	MAI		01H	0.93
18	101	47	SAI		05H	0.92
19	32	50	SCI		TSH	-0.16
20	53	51	SAI		05H	0.19
	53	51	SAI		05H	0.76
21	30	52	SAI		07H	-0.82
	30	52	SAI		07H	0.43
22	48	52	SCI		TSH	-2.52
	48	52	SCI		TSH	-2.49
	48	52	SCI		TSH	-2.14
	48	52	SCI		TSH	-1.7
23	40	54	SAI		06H	0.72
24	33	55	SAI		01H	-0.62
25	107	55	SAI		02H	0.86
26	20	56	SAI		05H	0.83
27	40	56	MAI		07H	0.78
28	11	57	SAI		01H	-0.59
29	107	57	SAI		02H	0.84
30	41	59	SAI		04H	0.9
31	20	60	SCI		TSH	-11.62
	20	60	MCI		TSH	-11.48
32	88	60	SAI		01H	0.16

SG31 Plugged Tube Indications

Tube #	ROW	COL	IND	PER	LOC	INCH
33	1	63	PTP			
34	3	63	PTP			
35	7	63	PTP			
36	2	64	PTP			
37	4	64	PTP			
38	6	64	PTP			
39	8	64	PTP			
40	10	64	PTP			
41	12	64	PTP			
42	48	64	SCI		TSH	-8.75
	48	64	SCI		TSH	-7.33
43	9	65	PTP			
44	11	65	PTP			
45	13	65	PTP			
46	15	65	PTP			
47	69	65	SCI		TSH	-4.19
48	14	66	PTP			
49	16	66	PTP			
50	18	66	PTP			
51	20	66	PTP			
52	68	66	SCI		TSH	-6.96
53	72	66	SAI		04H	0.96
	72	66	SAI		05H	-0.54
	72	66	SAI		05H	0.87
54	130	66	SAI		02H	0.85
55	17	67	PTP			
56	21	67	PTP			
57	23	67	PTP			
58	69	67	SCI		TSH	-6.38
	69	67	SAI		02H	0.72
	69	67	SAI		04H	0.63
59	141	67	SAI		02H	0.8
60	143	67	PTP			
61	20	68	PTP			
62	22	68	PTP			
63	24	68	PTP			
64	26	68	PTP			
65	28	68	PTP			
66	64	68	SAI		02H	0.84
67	29	69	PTP			
68	31	69	PTP			
69	33	69	PTP			
70	35	69	SCI		TSH	-2.46
71	47	69	PTP			
72	143	69	PTP			
73	45	71	PTP			
74	143	71	PTP			
75	46	72	PTP			

SG31 Plugged Tube Indications

Tube #	ROW	COL	IND	PER	LOC	INCH
76	47	73	SAI		TSH	-0.81
77	49	73	PVN		03H	21.47
78	48	74	PTP			
79	49	75	PTP			
80	57	75	SAI		08H	0.87
81	50	76	PTP			
82	100	76	SAI		04H	0.93
83	49	77	PTP			
84	51	77	PTP			
85	50	78	PTP			
86	60	78	SAI		01H	0.9
87	49	79	PTP			
88	53	79	PTP			
89	52	80	PTP			
90	76	80	SAI		02H	0.95
91	53	81	PTP			
92	119	81	SAI		01H	0.8
93	54	82	PTP			
94	56	82	PTP			
95	53	83	PCT	46	BW9	1.69
96	55	83	SAI		01H	0.63
97	57	83	PTP			
98	67	83	PTP			
99	54	84	PTP			
100	56	84	PTP			
101	62	84	PTP			
102	66	84	PTP			
103	70	84	PTP			
104	55	85	PTP			
105	57	85	PTP			
106	59	85	PTP			
107	61	85	PTP			
108	63	85	PTP			
109	65	85	SAI		07H	-0.27
110	69	85	PTP			
111	71	85	PTP			
112	73	85	PTP			
113	54	86	PTP			
114	56	86	PTP			
115	58	86	PTP			
116	60	86	PTP			
117	62	86	PTP			
118	64	86	PTP			
119	70	86	PTP			
120	53	87	PCT	42	BW9	-2
121	55	87	PTP			
122	59	87	PTP			
123	61	87	PTP			

SG31 Plugged Tube Indications

Tube #	ROW	COL	IND	PER	LOC	INCH
124	63	87	PTP			
125	54	88	PTP			
126	56	88	PTP			
127	58	88	PTP			
128	60	88	PTP			
129	62	88	PTP			
130	64	88	PTP			
131	53	89	PTP			
132	61	89	PTP			
133	97	89	SCI		TSH	0.13
134	54	90	PTP			
135	78	90	SAI		03H	0.92
136	55	91	PTP			
137	54	92	PTP			
138	53	93	PTP			
139	54	94	PTP			
140	78	94	SAI		03H	-0.27
141	86	94	SAI		07H	-0.14
142	102	94	SAI		02H	0.75
143	53	95	PTP			
144	52	96	PTP			
145	49	97	PTP			
146	53	97	PTP			
147	55	97	SAI		04H	-0.36
148	50	98	PTP			
149	52	98	PTP			
150	72	98	SCI		TSH	-8.39
151	49	99	PTP			
152	51	99	PTP			
153	53	99	PTP			
154	50	100	PTP			
155	86	100	SAI		06H	0.78
156	49	101	PTP			
157	103	101	SAI		01H	0.76
158	50	102	PTP			
159	47	103	PTP			
160	46	104	PTP			
161	48	104	PTP			
162	45	105	PTP			
163	47	105	PTP			
164	54	106	SAI		03H	0.99
165	29	107	PTP			
166	31	107	PTP			
167	33	107	PTP			
168	20	108	PTP			
169	22	108	PTP			
170	24	108	PTP			
171	26	108	PTP			

SG31 Plugged Tube Indications

Tube #	ROW	COL	IND	PER	LOC	INCH
172	28	108	PTP			
173	54	108	SAI		02H	1.06
174	92	108	SAI		TSH	-0.04
175	17	109	PTP			
176	21	109	PTP			
177	23	109	PTP			
178	115	109	SAI		01H	0.79
179	14	110	PTP			
180	18	110	PTP			
181	138	110	PTP			
182	9	111	PTP			
183	11	111	PTP			
184	13	111	PTP			
185	137	111	PTP			
186	139	111	PTP			
187	2	112	PTP			
188	4	112	PTP			
189	6	112	PTP			
190	8	112	PTP			
191	10	112	PTP			
192	12	112	PTP		TSH	0.68
193	136	112	PTP			
194	138	112	PTP			
195	1	113	PTP			
196	3	113	PTP			
197	5	113	PTP			
198	7	113	PTP			
199	19	113	SAI		01H	-0.26
	19	113	SAI		01H	0.33
	19	113	SAI		07H	1.03
200	139	113	PTP			
201	6	114	SAI		01H	0.73
202	11	115	SAI		01H	0.63
203	23	115	SAI		01H	0.47
204	69	115	SAI		01H	0.81
205	8	116	MAI		01H	1.09
206	18	116	SCI		TSH	-7.37
207	37	117	SAI		01H	0.98
208	75	117	SAI		04H	0.77
209	6	118	SAI		01H	1.04
210	86	118	SAI		02H	0.73
211	12	120	MAI		01H	0.85
212	17	121	MAI		01H	0.92
	17	121	SAI		02H	-0.9
213	31	121	SAI		01H	-0.21
214	127	121	PTP			
215	126	122	PTP			
216	128	122	PTP			

SG31 Plugged Tube Indications

Tube #	ROW	COL	IND	PER	LOC	INCH
217	21	123	SAI		03H	0.91
218	49	123	SAI		01H	1.06
219	79	127	SAI		TSH	0.53
220	89	127	SAI		04H	0.78
221	46	128	SAI		TSH	-10.84
222	43	129	SAI		02H	0.87
223	68	130	SAI		05H	-0.28
224	6	132	MAI		02H	0.79
225	98	132	SAI		04H	0.94
226	5	133	SAI		01H	0.75
227	59	133	SAI		01H	-0.65
	59	133	SAI		01H	-0.45
	59	133	SAI		01H	-0.08
228	16	134	SAI		06H	0.76
	16	134	MAI		02H	0.34
229	5	135	SAI		04H	0.86
230	47	135	SAI		03H	-0.68
231	16	136	SAI		02H	0.85
232	8	140	SAI		TSH	-9.48
	8	140	SAI		TSH	-8.31
233	69	141	SAI		02H	0.26
234	22	142	SAI		02H	0.37
235	45	143	SCI		TSH	-5.91
236	42	144	SAI		04H	0.53
237	90	144	NSY		02H	32.97
238	102	144	NSY		08C	14.11
239	81	149	SAI		01H	0.81
240	8	156	SAI		03H	0.88
241	50	158	PTP			
242	11	159	SAI		03H	0.84
	11	159	SAI		07H	0.82
243	6	162	SAI		03H	0.91
244	1	171	SVI		TSC	0.53
245	3	171	SVI		TSC	0.1
246	2	172	SVI		TSC	0.13
247	4	172	SVI		TSC	0.38

Legend:

TSH – Tubesheet Hot
SAI – Single Axial Indication
MAI – Multiple Axial Indication
SCI – Single Circumferential Indication
MCI – Multiple Circumferential Indication
SVI – Single Volumetric Indication
PCT– Percent Through Wall
PTP– Preventative Tube Plug
NSY – Noisy Tube
PVN – Permeability Variation

SG32 Plugged Tube Indications

Tube #	ROW	COL	IND	PER	LOC	INCH
1	11	11	SAI		03H	0.86
2	56	12	PTP			
3	36	16	PTP			
4	5	19	SAI		02H	-0.81
5	78	28	PTP			
6	33	35	PTP			
7	24	38	SAI		TSH	0.34
8	78	38	PTP			
9	119	39	PTP			
10	34	44	SAI		07H	0.66
11	75	49	SAI		02H	0.69
12	40	50	SAI		07H	0.6
13	85	53	SAI		04H	0.71
14	85	55	SAI		09C	-0.65
15	95	59	PTP			
16	23	61	PTP			
17	25	61	PTP			
18	106	62	SAI		04H	0.6
19	3	63	PTP			
20	5	63	PTP			
21	7	63	PTP			
22	23	63	PTP			
23	2	64	PTP			
24	4	64	PTP			
25	6	64	PTP			
26	8	64	PTP			
27	10	64	PTP			
28	12	64	PTP			
29	9	65	PTP			
30	11	65	PTP			
31	13	65	PTP			
32	15	65	PTP			
33	14	66	PTP			
34	16	66	PTP			
35	18	66	PTP			
36	20	66	PTP			
37	21	67	PTP			
38	22	68	PTP			
39	24	68	PTP			
40	26	68	PTP			
41	28	68	PTP			
42	29	69	PTP			
43	31	69	PTP			
44	33	69	PTP			
45	45	71	PTP			
46	46	72	PTP			
47	48	74	PTP			
48	142	74	PTP			

SG32 Plugged Tube Indications

Tube #	ROW	COL	IND	PER	LOC	INCH
49	49	75	PTP			
50	50	76	PTP			
51	52	76	SAI		01H	-0.8
	52	76	SAI		01H	0.73
52	49	77	PTP			
53	50	78	PTP			
54	54	78	PTP			
55	56	78	PTP			
56	49	79	PTP			
57	51	79	PTP			
58	53	79	PTP			
59	55	79	PTP			
60	57	79	PTP			
61	52	80	PTP			
62	54	80	PTP			
63	56	80	SAI		05H	-0.33
64	58	80	PTP			
65	53	81	PTP			
66	55	81	PTP			
67	57	81	PTP			
68	77	81	SAI		02H	-0.13
69	95	81	SAI		01H	-0.22
70	54	82	PTP			
71	56	82	PTP			
72	58	82	PTP			
73	60	82	PTP			
74	62	82	PTP			
75	64	82	PTP			
76	66	82	PTP			
77	68	82	PTP			
78	70	82	PTP			
79	72	82	PTP			
80	74	82	PTP			
81	76	82	PTP			
82	78	82	PTP			
83	80	82	PTP			
84	82	82	PTP			
85	84	82	PTP			
86	53	83	PTP			
87	55	83	PTP			
88	57	83	PTP			
89	59	83	PTP			
90	61	83	PTP			
91	63	83	PTP			
92	65	83	PTP			
93	67	83	PTP			
94	69	83	PTP			
95	71	83	PTP			

SG32 Plugged Tube Indications

Tube #	ROW	COL	IND	PER	LOC	INCH
96	73	83	PTP			
97	75	83	PTP			
98	77	83	PTP			
99	79	83	PTP			
100	81	83	PTP			
101	83	83	PTP			
102	85	83	PTP			
103	91	83	SAI		BW3	-0.97
104	54	84	PTP			
105	56	84	PTP			
106	58	84	PTP			
107	60	84	PTP			
108	62	84	PTP			
109	64	84	PTP			
110	66	84	PTP			
111	68	84	PTP			
112	70	84	PTP			
113	72	84	PTP			
114	74	84	PTP			
115	76	84	PTP			
116	78	84	PTP			
117	80	84	PTP			
118	82	84	PTP			
119	84	84	PTP			
120	55	85	PCT	41	BW9	1.57
121	57	85	PTP			
122	65	85	PTP			
123	67	85	PTP			
124	69	85	PTP			
125	145	85	SVI		BW1	4.79
126	147	85	SVI		BW1	3.25
127	58	86	PTP			
128	64	86	PTP			
129	53	87	PTP			
130	55	87	PTP			
131	57	87	PTP			
132	59	87	PTP			
133	63	87	PTP			
134	65	87	PTP			
135	58	88	PTP			
136	60	88	PTP			
137	64	88	PTP			
138	53	89	PTP			
139	55	89	PTP			
140	57	89	PTP			
141	59	89	PTP			
142	61	89	PTP			
143	54	90	PTP			

SG32 Plugged Tube Indications

Tube #	ROW	COL	IND	PER	LOC	INCH
144	56	90	PTP			
145	58	90	PTP			
146	60	90	PTP			
147	62	90	PTP			
148	55	91	PTP			
149	57	91	PTP			
150	59	91	PTP			
151	61	91	PTP			
152	123	91	SAI		BW2	0.72
153	54	92	PTP			
154	56	92	PTP			
155	58	92	PTP			
156	53	93	PTP			
157	55	93	PTP			
158	54	94	PCT			
159	56	94	PTP			
160	53	95	PTP			
161	83	95	SAI		04H	0.71
162	52	96	PTP			
163	49	97	PTP			
164	51	97	PTP			
165	50	98	PTP			
166	74	98	SAI		TSH	1.03
167	49	99	PTP			
168	51	99	PTP			
169	50	100	PTP			
170	49	101	PTP			
171	71	101	SCI		TSH	-0.08
172	48	102	PTP			
173	88	102	PTP			
174	47	103	PTP			
175	57	103	SAI		07H	0.5
176	46	104	PTP			
177	45	105	PTP			
178	29	107	PTP			
179	31	107	PTP			
180	33	107	PTP			
181	20	108	PTP			
182	22	108	PTP			
183	24	108	PTP			
184	26	108	PTP			
185	28	108	PTP			
186	17	109	PTP			
187	21	109	PTP			
188	23	109	PTP			
189	143	109	PTP			
190	14	110	PTP			
191	18	110	PTP			

SG32 Plugged Tube Indications

Tube #	ROW	COL	IND	PER	LOC	INCH
192	20	110	PTP			
193	96	110	PTP			
194	9	111	PTP			
195	11	111	PTP			
196	13	111	PTP			
197	15	111	PTP			
198	2	112	PTP			
199	4	112	PTP			
200	6	112	PTP			
201	8	112	PTP			
202	12	112	PTP			
203	1	113	PTP			
204	3	113	PTP			
205	5	113	SAI		01H	0.04
206	7	113	PTP			
207	9	113	PTP			
208	5	115	SAI		01H	-0.16
209	22	118	SAI		06H	0.35
210	54	118	PTP			
211	138	118	PTP			
212	48	128	PCT	48	BW5	0.8
213	128	130	SVI		TSH	10.94
214	127	131	PTP			
215	46	134	PTP			
216	84	136	SAI		BW5	-0.86
217	18	140	PTP			
218	31	141	SAI		04H	0.93
219	47	143	PCT	44	BW5	1.08
220	49	143	PTP			
221	6	146	NSY		04H	30.72
222	2	148	SAI		07C	-0.47
	2	148	SAI		07C	-0.5
223	2	150	SAI		07C	0.35
	2	150	SAI		07C	0.21

Legend:

TSH – Tubesheet Hot
BW – Bat Wing
SAI – Single Axial Indication
MAI – Multiple Axial Indication
SCI – Single Circumferential Indication
MCI – Multiple Circumferential Indication
SVI – Single Volumetric Indication
MVI – Multiple Volumetric Indication
PCT – Percent Through Wall
PTP – Preventative Tube Plug
NSY – Noisy Tube