



December 28, 1990

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U. S. Nuclear Regulatory Commission
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SUBJECT: Arkansas Nuclear One - Unit 1
Docket No. 50-313
License No. DPR-51
Once Through Steam Generator (OTSG)
Inservice Inspection Report

Gentlemen:

Arkansas Nuclear One, Unit 1's (ANO-1) Technical Specification 4.18.6 requires the complete results of the inservice inspection of the OTSG tubes be submitted to the NRC. Attached is the Steam Generator Tubing Inservice Inspection Report for ANO-1's ninth refueling outage.

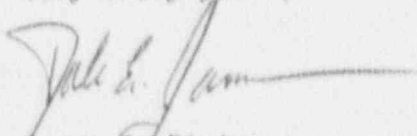
The random sample inspections of the "A" and "B" OTSG had Category C-1 results. The subsequent inservice inspections will be conducted at a 10 to 24 month interval in accordance with the current Technical Specifications.

In previous related discussions with Mr. Tom Alexion, NRR ANO-1 Project Manager and Mr. Emmett Murphy of the staff, it was agreed that the time interval for submitting this report would start when the last job order for eddy current testing was signed off in the Control Room. We will revise the appropriate procedures to incorporate this understanding of Technical Specification 4.18.6 reporting requirements. This action will be completed before the next refueling outage.

This report supplements the information provided in letter 1CAN119013 (dated November 29, 1990), which was required to be submitted per Technical Specifications 4.18.6 and 6.12.5. This submittal completes the reporting requirements of Technical Specification 4.18.6.

Should you have any questions regarding this issue, please contact me.

Very truly yours,


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JJF/RWC/sgw

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ARKANSAS NUCLEAR ONE - UNIT ONE

STEAM GENERATOR TUBING INSERVICE INSPECTION REPORT FOR THE NINTH REFUELING OUTAGE

INSPECTION SUMMARY

An inservice eddy current inspection was performed on tubes in the Arkansas Nuclear One Unit 1 (ANO-1) Once Through Steam Generators (OTSGs) "A" and "B" during the period from October 10, 1990, to October 26, 1990. The previous inservice inspection, conducted September 9, 1983 through October 26, 1988, resulted in a twenty four (24) month inspection interval (per ANO-1 Technical Specification 4.18.4.a).

The ninth refueling outage (1R9) inspection was conducted in accordance with Technical Specification 4.18. The first sample included the 3% random sample from each steam generator with exceptions as provided in Technical Specification 4.18.3.a.

In the "A" OTSG, 971 tubes were inspected full length, 148 sleeved tubes were inspected for the 80 inch length of the sleeves. All 4661 non-plugged tubes in the wedge region (described by Technical Specification Figure 4.18.1 and Technical Specification 4.18.3.a.3(3)) were inspected from the 15th tube support plate up. The random sample inspections of the "A" OTSG had Category C-1 results. The subsequent inservice inspection shall be conducted at a 10 to 24 month interval in accordance with the current Technical Specifications.

In the "B" OTSG, 916 tubes were inspected full length, 76 sleeved tubes were inspected for the 80 inch length of the sleeves. In addition, all 4606 non-plugged tubes in the wedge region (described by Technical Specification Figure 4.18.1 and Technical Specification 4.18.3.a.3(3)) were inspected from the 15th tube support plate up. The first random sample inspection had Category C-1 results. The subsequent inservice inspection shall be conducted at a 10 to 24 month interval in accordance with the current Technical Specifications.

The multi-frequency method of eddy current testing was utilized during the inspection to determine tube wall degradation.

INSPECTION RESULTS

Tube wall degradation was observed in both the "A" and "B" OTSGs. In the "A" OTSG, 10 defective tubes (i.e., $\geq 40\%$ throughwall (TW) imperfections per Technical Specification 4.18.5.a.6) were identified. All 10 of these were sleeved. In addition, 6 tubes were sleeved based on suspect indications and further analysis performed utilizing a rotating pancake current coil (RPC), and 12 tubes in the lane region were sleeved as a preventive measure. In the "B" OTSG, 34 defective tubes were identified. These 34 tubes were sleeved. In addition, 2 tubes were sleeved and 9 were plugged based on suspect indications and further analysis performed utilizing a RPC analysis, and 35 tubes in the lane region were sleeved as a preventive measure.

Tables 1 and 2, attached, list the defective tubes for the "A" and "B" OTSGs, respectively. Defect location, size (%TW), and disposition as indicated by the primary inspection technique (bobbin coil) are also listed. Tables 3 and 4 list the remaining reportable indications ($\geq 20\%$ but $< 40\%$ TW imperfections per Technical Specification 4.18.5.a.2) in the "A" and "B" OTSGs. Degradation location, size, and disposition, if any, are also provided. Table 5 lists the tubes sleeved based on RPC analysis in the "A" OTSG. Table 6 lists the tubes plugged based on RPC analysis in the "B" OTSG. Tables 7 and 8 lists the tubes sleeved as a preventive measure in the "A" and "B" OTSG respectively.

PLUG REMOVAL

Because of the concerns over primary water stress corrosion cracking (PWSCC) of Alloy 600 steam generator tube plugs, detailed discussions between ANO, Babcock & Wilcock (B&W), and Westinghouse were conducted to determine the action plan for the 1R9 refueling outage. As a result of these discussions, three heats of B&W ribbed plugs installed were considered to need further evaluation. Those heats were: NX-3531, NX-2960, and W-945. Further discussions led to the scope of plug removal for this outage as follows: Remove five of the NX-3531 and two of the W-945 plugs from the "B" OTSG and conduct a metallurgical examination to look for PWSCC or intergranular attack (IGA). Any PWSCC or IGA detected would result in removal of the remaining plugs from those heats installed in the OTSGs. Due to experience at other plants, heat NX-2960 was deferred until next outage for further evaluation. The results of the examination of the seven plugs removed showed no significant PWSCC or IGA present, and therefore no additional plugs were removed. The seven hot leg plugs removed were replaced with Alloy 690 sleeves.

On October 27, 1990, six plug locations were discovered leaking in the lower bowl of the "A" OTSG during the secondary chemical cleaning heatup with deionized (DI) water. The leakage continued through the start of the iron removal step, but eventually ceased prior to completion of that step. Approximately 350 ml of that water was taken from the lower bowl and analyzed. The results indicated that this was primary system water and the tubing did not have through wall defects in the area that the chemical cleaning solvent was exposed to.

Later visual inspections of the leakage areas showed that the problem was with B&W "u-cup" welded plugs. Two of the welded plugs were lacking a complete 360 degree circumferential weld. The remaining four plugs appeared to have poor welds, with some sections puddled and others thin, but did seem to have full 360 degree coverage. In all cases, no evidence of cracking or any other type of defect or damage was found. All ribbed plugs in the leaking areas were visually inspected and were found to be free from any problems. During the heatup of the "B" OTSG for chemical cleaning, no leakage was discovered.

The six leaking plugs were all removed and replaced with Alloy 690 rolled plugs. In addition, the following actions were taken:

- 1) a visual inspection of the plugs installed in the upper head of the "A" OTSG was conducted, and all appeared to have no signs of leakage or defects;
- 2) the plug ends of the ribbed plugs (both B&W and Westinghouse) installed in the upper head of "A" were verified to be intact by the use of a depth gauge inserted into the plug; and
- 3) a visual exam of all welded "u-cup" and explosive plugs in the upper heads of both OTSGs was performed and all appeared to be acceptable.

As a summary, the following tubes had plugs removed during IR9:

ROW-TUBE	OTSG	HOT/COLD LEG	DISPOSITION
83-12	B	HL	SLEEVED
81-23	B	HL	SLEEVED
79-15	B	HL	SLEEVED
121-3	B	HL	SLEEVED
81-19	B	HL	SLEEVED
83-15	B	HL	SLEEVED
82-23	B	HL	SLEEVED
65-10	A	CL	690 ROLLED PLUG
72-8	A	CL	690 ROLLED PLUG
72-10	A	CL	690 ROLLED PLUG
72-15	A	CL	690 ROLLED PLUG
75-32	A	CL	690 ROLLED PLUG
80-7	A	CL	690 ROLLED PLUG

Based on the results of the removed plug examinations and the inspections described above, the plugs installed in the ANO-1 OTSGs are considered acceptable for the duration of Cycle 10.

TABLE 1

"A" OSTG TUBE DEFECTS
($\geq 40\%$ Throughwall Indications)

ROW-TUBE	LOCATION	% THROUGHWALL	DISPOSITION
38-16	UTSF + 7.93 ¹	46	SLEEVED
46-4	UTSF + 14.97	42	SLEEVED
68-3	UTSF + 10.75	40	SLEEVED
70-28	UTSF + 1.05	41	SLEEVED
71-26	UTSF + 0.10	63	SLEEVED
71-42	UTSF + 0.21	76	SLEEVED
75-20	UTSF + 0.80	40	SLEEVED
75-20	UTSF + 1.11	45	SLEEVED
81-29	UTSF + 0.32	58	SLEEVED
95-1	UTSF + 0.31	86	SLEEVED
99-1	UTSF + 0.47	49	SLEEVED

- (1) Designation for defects/imperfections in the upper tubesheet area. In this case, the defect/imperfection is 7.93 inches above the upper tubesheet secondary face (UTSF).

TABLE 2

"B" OTSG TUBE DEFECTS
(≥ 40 % Throughwall Indications)

ROW-TUBE	LOCATION	% THROUGHWALL	DISPOSITION
28-9	UTSF + 5.38	46	SLEEVED
56-2	UTSF + 6.08	46	SLEEVED
64-5	UTSF + 3.28	41	SLEEVED
65-3	UTSF + 7.56	42	SLEEVED
70-6	UTSF + 4.44	58	SLEEVED
70-17	UTSF + 6.29	53	SLEEVED
70-33	UTSF + 5.65	40	SLEEVED
71-10	UTSF + 5.27	55	SLEEVED
71-13	UTSF + 4.13	72	SLEEVED
72-34	UTSF + 6.62	50	SLEEVED
72-34	UTSF + 9.24	40	
73-4	UTSF + 4.14	48	SLEEVED
73-6	UTSF + 4.47	79	SLEEVED
79-6	UTSF + 4.97	73	SLEEVED
79-10	UTSF + 4.64	41	SLEEVED
79-10	UTSF + 5.26	44	
79-10	UTSF + 6.06	46	
79-11	UTSF + 8.29	53	SLEEVED
79-11	UTSF + 8.62	41	
79-12	UTSF + 3.12	56	SLEEVED
79-12	UTSF + 6.79	45	
79-28	UTSF + 3.51	44	SLEEVED
80-3	UTSF + 5.26	63	SLEEVED
80-11	UTSF + 4.40	40	SLEEVED
80-12	UTSF + 4.49	41	SLEEVED
82-6	UTSF + 8.31	49	SLEEVED
82-14	UTSF + 8.09	55	SLEEVED
83-3	UTSF + 3.16	42	SLEEVED
83-3	UTSF + 3.56	45	
83-10	UTSF + 5.35	51	SLEEVED
83-11	UTSF + 9.45	61	SLEEVED
86-2	UTSF + 2.50	41	SLEEVED
86-3	UTSF + 9.08	41	SLEEVED
86-11	UTSF + 3.67	41	SLEEVED
87-1	UTSF + 4.95	59	SLEEVED
87-1	UTSF + 4.39	51	
87-2	UTSF + 5.38	50	SLEEVED
87-24	UTSF + 7.66	43	SLEEVED
87-24	UTSF + 7.54	43	
88-2	UTSF + 4.31	50	SLEEVED
93-6	UTSF + 5.39	43	SLEEVED
102-2	UTSF + 6.04	49	SLEEVED

TABLE 3

"A" OTSG TUBE DEGRADATION
 (20-39 % Throughwall Indications)

ROW-TUBE	LOCATION	% THROUGHWALL	DISPOSITION (IF ANY)
16-28	UTSF + 14.60	21	
37-33	UTSF + 13.08	33	
59-19	UTSF + 17.2	23	
62-1	UTSF + 7.11	31	
69-8	UTSF + 8.57	31	
69-9	UTSF + 6.58	27	
69-10	UTSF + 7.23	21	
69-42	UTSF + 11.86	31	
72-22	UTSF + 7.36	37	
81-8	UTSF + 5.6	31	
82-19	UTSF + 6.70	23	
82-19	UTSF + 10.51	23	
82-59	UTSF + 16.15	31	
82-61	UTSF + 16.3	35	
83-5	UTSF + 4.38	31	
83-27	UTSF + 10.15	32	
92-2	UTSF + 0.91	20	
99-1	UTSF + 1.37	26	SLEEVED
99-1	UTSF + 3.19	38	
104-2	UTSF + 6.89	34	
104-15	UTSF + 12.04	28	
113-115	UTSF + 6.41	38	
120-93	UTSF + 5.85	30	
122-99	UTSF + 5.19	30	
146-9	UTSF + 18.82	23	
149-13	UTSF + 8.37	23	

TABLE 4

"B" DTSG TUBE DEGRADATION
(20-39 % Throughwall Indications)

ROW-TUBE	LOCATION	% THROUGHWALL	DISPOSITION (IF ANY)
41-2	UTSF + 2.34	33	
41-2	UTSF + 6.27	33	
45-3	UTSF + 8.04	35	
45-3	UTSF + 7.95	38	
56-2	UTSF + 6.08	32	SLEEVED
63-1	UTSF + 5.40	27	
63-3	UTSF + 6.27	28	
63-10	UTSF + 5.94	20	
63-19	UTSF + 2.88	25	
64-2	UTSF + 7.36	35	
64-5	UTSF + 5.15	28	SLEEVED
67-10	UTSF + 6.61	25	
68-15	UTSF + 7.28	23	
68-39	UTSF + 4.90	22	
69-2	UTSF + 2.93	38	
69-2	UTSF + 3.37	32	
69-6	UTSF + 5.36	30	
70-6	UTSF + 5.06	20	SLEEVED
71-8	UTSF + 7.09	20	
71-9	UTSF + 4.81	32	
71-11	UTSF + 4.01	38	
71-27	UTSF + 5.95	30	
71-58	UTSF + 4.95	31	
71-58	UTSF + 5.79	30	
71-58	UTSF + 7.60	36	
72-14	UTSF + 3.15	20	
72-17	UTSF + 8.51	35	
72-20	UTSF + 4.74	37	
72-56	UTSF + 5.10	23	
73-4	UTSF + 3.06	30	SLEEVED
73-11	UTSF + 3.97	35	
73-13	UTSF + 4.41	36	
73-50	UTSF + 5.95	26	
74-20	UTSF + 3.60	38	
78-9	UTSF + 4.44	39	
78-9	UTSF + 3.13	20	
78-16	UTSF + 4.12	22	
78-17	UTSF + 3.10	25	PLUGGED
78-17	UTSF + 5.42	31	
78-17	UTSF + 12.74	37	

TABLE 4 (CONTINUED)

"B" OTSG TUBE DEGRADATION
(20-39 % Throughwall Indications)

ROW-TUBE	LOCATION	% THROUGHWALL	DISPOSITION (IF ANY)
79-3	UTSF + 7.01	32	
79-11	UTSF + 4.62	37	SLEEVED
79-14	UTSF + 7.11	39	
79-16	UTSF + 5.69	34	
79-26	UTSF + 4.30	34	
80-9	UTSF + 3.44	31	
80-26	UTSF + 4.41	33	
80-26	UTSF + 6.69	30	
81-15	UTSF + 3.18	37	
81-15	UTSF + 4.56	39	
81-26	UTSF + 4.48	24	
82-6	UTSF + 4.90	35	SLEEVED
82-15	UTSF + 5.84	35	
82-18	UTSF + 3.11	24	
82-33	UTSF + 4.57	35	
83-3	UTSF + 5.38	35	SLEEVED
83-24	UTSF + 5.59	30	
83-26	UTSF + 3.32	21	
83-26	UTSF + 4.41	20	
83-69	UTSF + 5.18	25	
85-23	UTSF + 1.62	35	
85-24	UTSF + 6.88	20	
86-3	UTSF + 0.30	25	SLEEVED
86-6	UTSF + 5.47	35	
87-2	UTSF + 6.23	33	SLEEVED
87-24	UTSF + 8.31	37	SLEEVED
89-4	UTSF + 5.72	24	
89-4	UTSF + 7.72	37	
89-24	UTSF + 5.52	23	
90-1	UTSF + 4.08	28	
90-2	UTSF + 0.72	30	SLEEVED
90-3	UTSF + 4.81	28	
90-8	UTSF + 11.06	23	
91-3	UTSF + 5.46	23	
94-2	UTSF + 3.10	31	
94-4	UTSF + 4.58	25	
96-89	UTSF + 19.13	25	
97-1	UTSF + 5.11	35	
97-4	UTSF + 8.73	23	
98-2	UTSF + 4.81	23	
98-2	UTSF + 6.80	28	
120-4	UTSF + 7.06	24	
134-3	UTSF + 0.46	35	SLEEVED
141-22	UTSF + 25.65	24	

TABLE 5

"A" OTSG TUBE SLEEVING BASED ON RPC

ROW-TUBE

80-3

81-4

81-21

82-5

84-1

87-9

TABLE 6

"B" OTSG TUBE PLUGGING BASED ON RPC

ROW-TUBE

69-3
71-4
72-3
73-5
74-14
78-14
78-17
81-3
84-1

TABLE 7

"A" OTSG PREVENTIVE TUBE SLEEVING

ROW-TUBE

75-16
75-17
75-18
75-22
75-23
75-25
75-26
76-64
77-16
77-21
77-24
77-25

TABLE 8

"B" OTSG PREVENTIVE TUBE SLEEVING

ROW-TUBE

75-11
75-12
75-13
75-14
75-15
75-16
75-17
75-18
75-19
75-20
75-21
75-22
75-23
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