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U. S. Nuclear Regulatory Commission
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Subject: Arkansas Nuclear One - Unit 2
Docket No. 50-368
License No. NPF-6
2P00 Steam Generator Tubing Inspection Results

Gentlemen:

Arkansas Nuclear One, Unit 2 (ANO-2), Technical Specifications (TSs), section 4.4.5.0 requires a report of the 2P00 mid-cycle outage steam generator (SG) tubing inspection results to be submitted to the NRC within 30 days of entering Mode 4. The safety evaluation report for ANO-2 TS Amendment 217 (2CNA070002) also requires the condition monitoring results and operational assessment to be submitted to the NRC in the 30 day report. Accordingly, the 2P00 SG condition monitoring and operational assessment inspection results are attached.

Additionally, ANO-2 TS 4.4.5.5 requires an annual report on steam generator inspections. This report will be submitted within its required frequency at a later date.

Should you have any questions concerning the attached report, please contact me.

Very truly yours,

for

Jimmy D. Vandergrift
Director, Nuclear Safety

JDV/fpv
attachment

A001

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CONDITION MONITORING AND OPERATIONAL ASSESSMENT INSPECTION RESULTS ARKANSAS NUCLEAR ONE – UNIT TWO 2P00 TRI-CYCLE OUTAGE

1.0 PURPOSE

In accordance with NEI 97-06 and the safety evaluation report for Arkansas Nuclear One, Unit 2 (ANO-2) Technical Specifications **Amendment 217 (2CNA070002)**, an evaluation of the ANO-2 steam generator (SG) tubing inspection results from the tri-cycle outage (2P00) have been compared to the assumptions made in the operational assessment performed after the last inspection (2P99). The purpose of the evaluation is to determine the acceptable run time to ensure meeting the prescribed performance criteria. Additionally, in-situ testing of the largest flaws observed in the 2P00 inspection was performed to validate the performance criteria used for leakage and burst calculations. Finally, an evaluation based on the results has been performed to determine if the unit can be safely operated for the remainder of the fuel cycle, which is approximately five weeks. The report only addresses the axial cracking at the eggcrate supports on the hot leg. The remainder of the degradation mechanisms are addressed in the previous operational assessments.

2.0 EVALUATION

The initial step in performing the condition monitoring assessment is to review the outputs from the model used in the previous operational assessment (OA). The 2P99 OA evaluated the 01Hot – 07Hot eggcrate axial cracking

The scope of the 2P00 outage inspection focused on the lower eggcrates on the hot leg side of both generators. The bobbin inspection was conducted from the tube end hot (TEH) to the 07 hot support plate. Indications identified by bobbin at the 01H – 03H supports were tested by MRPC without resolution. All other indications were first resolved, then tested with MRPC.

2.1 Results of the OA

The following projections were calculated from the previous OA's:

Degradation Mechanism	Conditional Probability of Burst at Postulated SLB (95% Confidence Level)	95/95 Leak Rate at Postulated MSLB (GPM)
Axial ODSCC at Eggcrate hot leg (half cycle)	**0.0010**	**0.0100**

Axial ODSCC at Eggcrate cold leg (full cycle)	0.0005	0.0030
Freespan Axial ODSCC hot leg (half cycle)	0.0005	0.0000
Freespan Axial ODSCC cold leg (full cycle)	0.0005	0.0030
Axial at Dented Eggcrates (full cycle)	0.0000	0.0000
Wear at Batwings (full cycle)	0.0000	0.0000
Sludge Pile Axial (full cycle)	0.0003	0.0570
Circumferential ODSCC at Expansion Transitions*	0.0088	0.0460
Leakage due to Hardware (plugs and sleeves)	N/A	0.0022
Total of all Degradation Mechanism	**0.0116**	**0.1212**
NEI 97-06 Limit for 1 Burst	0.05	
NEI 97-07 and SAR Limit for Leakage		1.0000

Additionally, the following were calculated as outputs from the model:

Flaw Type	**Range of Detectable Limiting Generator Indications**	**Best Estimate POB at 3ΔP**
Eggcrate (01-07H)	64-176	8.54%

The following is a summary of the results from the 2P00 inspection:

2.1.1 Number of Indications Detected

Number Detected

Mechanism	OA Value	Actual Result (2P00)	Bounding Generator
Eggcrate Axial	64-176	148	SGB

The number of indications detected were consistent with the calculated values in the OA. The "B" SG was the dominant generator for axial cracks in the eggcrates. The "A" SG

had 64 axial indications in the eggcrates, which is bound by the calculated number in the OA.

2.1.2 In-Situ Testing

The performance criteria associated with meeting or exceeding three times the normal operating differential pressure (3ΔP) and less than one gpm leakage at main steam line break (MSLB) were demonstrated with in-situ testing. Seven tubes were tested in the "B" SG, and one additional tube was tested in the "A" SG relative to the screening criteria specified by EPRI. The screening was performed initially utilizing the raw RPC data. This included the following:

Length	≥ 1.00 inches, regardless of depth
Leakage	≥ 85% maximum depth and ≥ 0.10 inches
Structural	≥ 77% maximum depth and ≥ 0.42 inches

Those flaws that passed the screening were profiled for maximum depth, average depth and length. The profiled flaws that met the criteria below were tested.

Leakage	≥ 85% for ≥ 0.1 inches
Structural	≥ 77% average depth

The target values were derived by adjusting the actual values for temperature and instrument uncertainties, bladder correction and conservatism.

	Actual (psig)	Target (psig)
Normal operating	1350	1600
Intermediate	1925	2200
Main steam line break (MSLB)	2500	2800
1.4 X MSLB	3500	4350
3ΔP	4050	4950

The results of the in-situ testing performed during the 2P99 inspection follow:

	NOP		MSLB		Max Pressure	Comment
Tube	Pressure	Leakage	Pressure	Leakage		
67-121	1659	0	2873	0	5300	
40-108	1636	0	2803	0.0056	4908	Burst
5-41	1650	0	2865	0.0031	5300	
79-75	1636	0	2818	0		
80-98	1622	0	2803	0		
95-99	1636	0	2831	0		

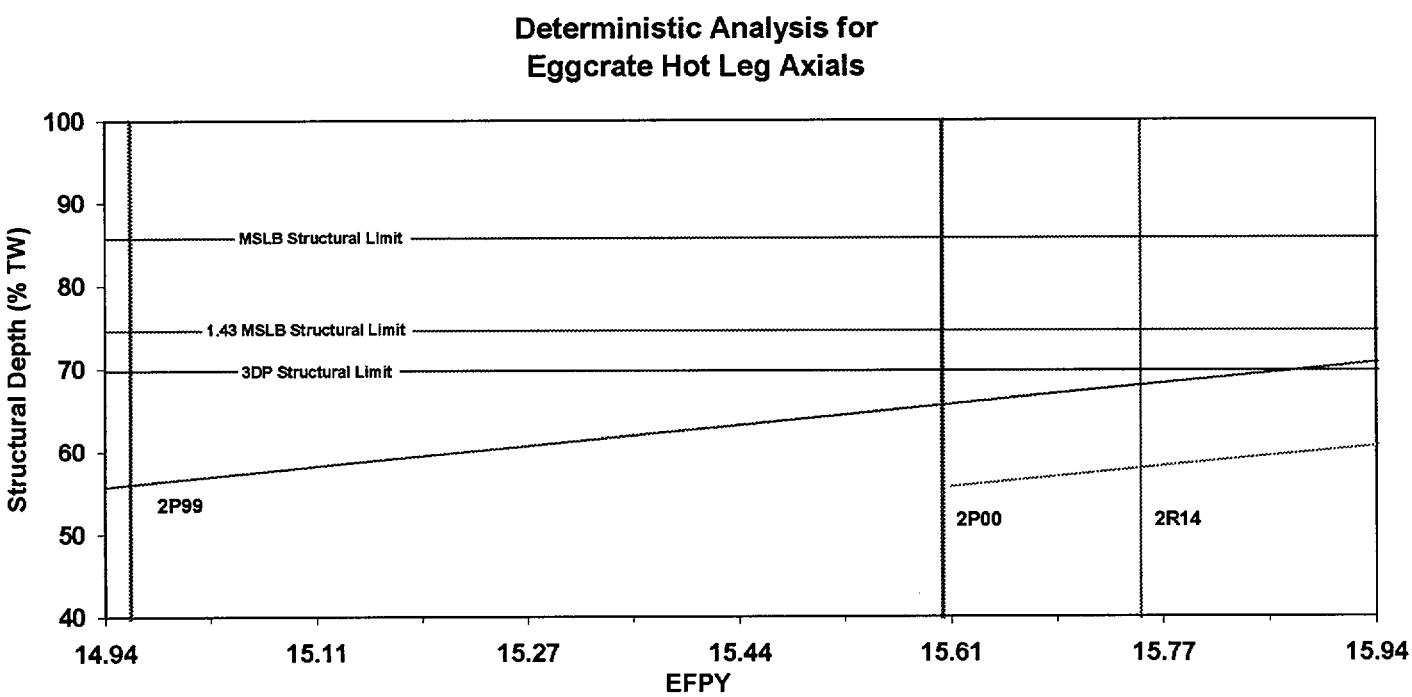
17-33	1636	0	2822	0.0036	5300	
48-68	1600	0	2800	0.0013	5300	

These results were close to the predicted values and met the acceptance criteria for both leakage and burst. The tube that did burst (40-108), burst at a pressure of 4908 psi. A conservative 450 psi adjustment to the burst pressure is necessary to account for use of a bladder. This results in a final room temperature burst pressure of 4458 psi. The room temperature design value for 3DP for ANO2 is 4369 psi.

2.1.3 Deterministic Analysis

The original OA was based on an operating time of 9.8 EFPM. The actual operating period was 7.8 EFPM. The final operating interval will be a maximum of 1.8 EFPM and the unit will be operated at approximately 603 degree Fahrenheit. Both of these conditions were taken into consideration when developing the OA for the remainder of the cycle. Since all performance criteria were met (3DP and Leakage at MSLB) after operating for ~ 7.8 EFPM, it can be assumed that operating for a much shorter period (1.8 EFPM) will result in the same or better conditions at end of cycle.

A deterministic evaluation using the same inputs as the previous assessment was developed to support operation of the plant. Based on conservative inputs the plant has significant margin over 3DP at the end of the operating interval. The following figure depicts the data:



Since flaw length and depth both contribute to the strength of the axial cracking in the EC's, the best method to evaluate a prediction is by looking at the predicted burst pressure. The predicted mean burst pressure at 2R14 was 4173. For 2P00, the predicted burst pressure was 4280. This confirms that the predictive capabilities were acceptable to ensure operation until 2R14 and still meet the performance criteria of $3\Delta P$, and was well above the MSLB value. Any minor differences are accommodated by the margin of 3 over normal operating pressure differential.

3.0 SUMMARY

The original OA was determined to be valid and operation to 2R14 would have been acceptable. This deterministic evaluation bounds the actual operating period for the axial cracking at the eggcrates. The rest of the degradation mechanisms were addressed in the previous OA for full cycle operation. It is concluded that operation of ANO Unit 2 until 2R14 is considered safe.