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SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION (CPSES) Unit 2
DOCKET NOS. 50-446
UNIT 2 FOURTH REFUELING OUTAGE
CONDITION MONITORING REPORT
SPECIAL REPORT 446/00-001-00

Attached is the 12 Month Special Report (SR) 00-001-00 for Comanche Peak Steam Electric Station Unit 2. This report meets the requirements of Special Report as specified in CPSES Technical Specification 5.6.10.b., and NEI 97-06.

Should you require additional information please contact Obaid Bhatty at (254) 897-5839.

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Additionally, this communication does not contain any new commitments pertaining to CPSES license.

Sincerely,

C. L. Terry

By: _____
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Attachment

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TXU ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION - UNIT 2
SPECIAL REPORT NO. 2-SR-00-001-00
UNIT 2, FOURTH REFUELING OUTAGE
STEAM GENERATOR TUBE INSPECTION RESULTS
TECHNICAL SPECIFICATIONS 5.6.10.b

Background

Pursuant to the requirements of Comanche Peak Steam Electric Station (Comanche Peak) Technical Specification (TS) 5.6.10.b and guidance provided via Nuclear Energy Institute's document NEI 97-06, "Steam Generator Program Guidelines". A condition monitoring assessment, which evaluates structural integrity characteristics of steam generator (SG) eddy current inspections, is to be performed following each inspection. This evaluation is "backward looking" and compares the observed SG tube eddy current indication parameters against structural and leakage integrity commensurate with draft RG 1.121. This report documents the condition monitoring assessment of the NDE results from the Comanche Peak fourth refueling outage (2RF04) inspection. The Comanche Peak Unit 2 SGs are Westinghouse Model D5 SGs with thermally treated Alloy 600 tubing, full depth hydraulically expanded tube to tubesheet joints, and stainless steel tube support plates with quatrefoil holes.

Summary

During the Comanche Peak Unit 2 fourth refueling outage (2RF04) SG tube inspection, no indications exceeding the current Technical Specification repair limit of 40% depth (by Non Destructive Examination (NDE)) were detected; therefore, no tubes required repair by plugging. Accordingly, no tubes were identified to contain eddy current indications that could potentially challenge the draft RG 1.121 tube integrity recommendations.

The only tube degradation mechanisms observed at Comanche Peak Unit 2 during the 2RF04 inspection were tube mechanical wear at anti-vibration bar (AVB) intersections and possible loose parts wear observed at the top of the tubesheet and at the top of a Cold Leg (CL) support plate. AVB wear was consistent with historical performance and structural integrity expectations. The wear scars associated with loose parts were determined to have been acceptable to prevent burst under

accident conditions of 3x normal operating pressure differential. No corrosion mechanisms were observed. No tubes were found to have experienced AVB wear above expected levels. As with all previous inspections, the condition of the Comanche Peak Unit 2 SGs, as determined from the evaluation of the 2RF04 inspection data has met all industry and regulatory structural and leakage integrity guidance. Satisfactory operation of the SGs is expected through the end of Cycle 5 (EOC 5), based on the conclusions of the pre-outage degradation assessment and the results of the 2RF04 inspection.

Inspection Plan Scope

The 2RF04 inspection plan exceeded both the Technical Specification minimum requirements as well as the recommendations of EPRI TR-107569-V1R5, PWR Steam Generator Examination Guidelines: Revision 5, Volume 1: Requirements. The 2RF04 initial inspection plan included;

20% full length bobbin inspection in all 4 SGs
20% TTS MRPC in all 4 SGs
20% U-bend RPC of Rows 1 and 2 in all 4 SGs
20% expanded baffle plate MRPC in all 4 SGs

The initial 20% bobbin inspection program contained all tubes with previously identified indications.

20% HL straight section dings ≥ 5 volts with +Point
100% of all dents > 5 volts at H3
Special Interest +Point tests for bobbin possible flaw indications

Additional inspections were performed as required to support characterization and sizing of indications detected with bobbin probes.

Tube Plugging Summary

Five tubes were mechanically plugged in the 2RF04 inspection, 1 in SG 1 and 4 in SG 4; the basis for each case is detailed as follows:

R12C92 in SG 4 was plugged based on bobbin signal identified at the top of CL baffle C6; the indication was associated with a PLP (possible loose part) and characterized as SVI - a volumetric indication to be repaired.

R36C59 and R37C59: Two adjacent tubes in SG 4 were plugged due to wear scars associated with possible loose parts in the first inch above the top of the tubesheet. The +Point examination indicated volumetric indications, which were classified SVI to designate them for repair rather than re-sizing using wear scar calibrations.

R20C106 in SG 4 was plugged because of an obstruction in the tube 31" above the 10H TSP; the 0.610" diameter bobbin probe could not pass. In a previous inspection this tube passed a smaller bobbin probe that detected a large dent at this location.

R34C96 in SG 1: The volumetric signal was attributed to a pit-like indication that was being tracked since 2RF02 (first ISI of that tube) most likely attributed to a manufacturing artifact or loose part impact located 6" above the HL tubesheet.

With the exception of the restricted tube the indications on these tubes were detected with bobbin probes in the routine examination.

Table 1 lists the cumulative tube plugging by refuel outage and Table 2 provides a listing by steam generator of indications found by NDE.

Table 1
Tube plugging by Refuel Outage

Cycle	SG 1	SG 2	SG 3	SG 4	Total	% plugged
Preservice	5	3	3	9	20	0.109%
U2RF01	0	0	0	0	0	0.000%
U2RF02	0	0	0	0	0	0.000%
U2RF03	3	5	0	0	8	0.044%
U2RF04	1	0	0	4	5	0.027%
Total tubes	9	8	3	13	33	0.181%
Total % per SG	0.20%	0.18%	0.07%	0.28%		

Table 2
Percent Thru-wall by Steam Generator

Steam Generator 1

Row	Column	Indication	Percent	Location	Inch1
28	9	PCT	11	AV4	0
30	11	PCT	15	AV1	0
30	11	PCT	22	AV3	0
31	11	PCT	13	AV1	0
31	11	PCT	14	AV3	0
31	11	PCT	14	AV4	0
30	12	PCT	25	AV2	0
31	12	PCT	19	AV3	0
32	12	PCT	23	AV2	0
33	12	PCT	8	AV2	0
33	12	PCT	15	AV4	0
34	13	PCT	28	AV2	0
35	14	PCT	17	AV2	-0.16
35	16	PCT	15	AV2	0
36	16	PCT	22	AV3	0
37	16	PCT	24	AV2	0
38	16	PCT	35	AV2	0
37	17	PCT	35	AV2	0
38	17	PCT	17	AV4	0
39	17	PCT	24	AV2	0
39	17	PCT	17	AV3	0
39	17	PCT	15	AV4	0
39	18	PCT	32	AV2	0
39	18	PCT	13	AV3	0
39	18	PCT	19	AV4	0
40	18	PCT	22	AV1	0
40	18	PCT	39	AV2	0
40	18	PCT	18	AV4	0
39	20	PCT	30	AV2	0
41	20	PCT	16	AV2	0
41	20	PCT	25	AV3	0
44	23	PCT	12	AV1	0
44	23	PCT	12	AV2	0

Row	Column	Indication	Percent	Location	Inch1
44	23	PCT	11	AV3	0
44	23	PCT	11	AV4	0
45	25	PCT	12	AV1	0
45	26	PCT	28	AV2	0
46	26	PCT	8	AV1	0
44	27	PCT	16	AV2	0
46	27	PCT	14	AV2	0
46	27	PCT	7	AV4	-0.11
45	29	PCT	17	AV1	0
45	29	PCT	12	AV2	0
45	29	PCT	12	AV3	0
40	30	PCT	19	AV2	0
40	30	PCT	17	AV3	0
48	30	PCT	10	AV1	-0.22
40	31	PCT	17	AV2	0
40	31	PCT	17	AV3	0
46	31	PCT	21	AV2	0
46	31	PCT	18	AV3	0
46	31	PCT	13	AV4	0
35	34	PCT	13	AV2	0
35	34	PCT	11	AV3	0
36	56	PCT	6	AV1	0.11
36	56	PCT	14	AV3	0
45	56	PCT	19	AV4	0
46	56	PCT	24	AV3	0
47	56	PCT	24	AV2	0
47	56	PCT	21	AV3	0
48	56	PCT	14	AV2	0
48	56	PCT	21	AV3	0
48	56	PCT	29	AV4	0
48	56	PCT	10	AV2	-0.14
48	56	PCT	25	AV3	0.03
48	56	PCT	27	AV4	0.2
48	56	PCT	2	C5	-0.34
49	56	PCT	5	C5	-0.48
40	71	PCT	11	AV1	0
43	77	PCT	15	AV4	0
43	81	PCT	19	AV1	0
43	81	PCT	22	AV2	0

Row	Column	Indication	Percent	Location	Inch1
43	81	PCT	26	AV3	0
45	82	PCT	15	AV2	0
46	82	PCT	19	AV1	0
46	82	PCT	30	AV2	0
46	82	PCT	32	AV3	0
46	82	PCT	17	AV4	0
46	83	PCT	27	AV2	0
45	84	PCT	15	AV2	0
33	86	PCT	17	AV2	0
46	86	PCT	14	AV1	0
46	86	PCT	23	AV2	0
46	86	PCT	11	AV3	0
43	87	PCT	17	AV1	0
43	87	PCT	22	AV2	0
42	88	PCT	16	AV3	0
45	88	PCT	28	AV2	0
38	89	PCT	26	AV2	0
46	89	PCT	27	AV4	0
41	90	PCT	20	AV2	0
38	91	PCT	14	AV1	0
39	91	PCT	13	AV1	0
44	91	PCT	21	AV2	0
44	91	PCT	21	AV3	0
44	91	PCT	26	AV4	0
44	92	PCT	11	AV2	0.27
44	92	PCT	13	AV3	0.19
44	92	PCT	11	AV4	-0.31
41	93	PCT	19	AV2	0
41	93	PCT	21	AV3	0
41	94	PCT	27	AV2	0
41	94	PCT	14	AV3	0
42	94	PCT	26	AV2	0
40	95	PCT	12	AV3	0
41	95	PCT	19	AV3	0
39	96	PCT	17	AV4	0
33	97	PCT	12	AV1	0
40	97	PCT	13	AV2	0
40	97	PCT	19	AV3	0

Row	Column	Indication	Percent	Location	Inch1
36	98	PCT	17	AV3	0
38	98	PCT	17	AV1	0
38	98	PCT	15	AV2	0
38	98	PCT	20	AV3	0
38	98	PCT	14	AV4	0.06
39	98	PCT	18	AV3	0
36	99	PCT	30	AV3	0
37	99	PCT	17	AV3	0
38	99	PCT	15	AV1	0
38	99	PCT	22	AV3	0
38	99	PCT	17	AV4	0
33	100	PCT	14	AV3	0
34	100	PCT	19	AV3	0
35	100	PCT	18	AV3	0
35	101	PCT	22	AV2	0
35	101	PCT	17	AV3	0
35	101	PCT	22	AV4	0
33	102	PCT	18	AV1	0
33	102	PCT	25	AV2	0
34	102	PCT	13	AV1	0
34	102	PCT	18	AV2	0
34	102	PCT	26	AV4	0
31	103	PCT	21	AV3	0
32	103	PCT	18	AV2	0
33	103	PCT	15	AV2	0

Steam Generator 2

Row	Colum	Indication	Percent	Location	Inch1
26	9	PCT	16	AV2	0
30	10	PCT	21	AV1	0
30	10	PCT	22	AV2	0
30	10	PCT	24	AV3	0
30	10	PCT	17	AV4	0
30	11	PCT	16	AV2	0
30	11	PCT	19	AV3	0
31	11	PCT	18	AV1	0
34	13	PCT	25	AV2	-0.03
39	18	PCT	27	AV2	0
39	18	PCT	24	AV3	0
32	56	PCT	13	AV2	0.14
48	56	PCT	15	AV2	0
47	59	PCT	20	AV1	0
47	59	PCT	11	AV3	0
47	59	PCT	32	AV4	0
48	69	PCT	21	AV4	0
37	76	PCT	13	AV2	0
33	86	PCT	16	AV2	-0.26
33	86	PCT	17	AV3	0
40	86	PCT	19	AV2	0
40	86	PCT	12	AV3	0
47	88	PCT	16	AV4	0
45	91	PCT	23	AV3	0
45	91	PCT	25	AV4	0
36	99	PCT	33	AV2	0

Steam Generator 3

Row	Column	Indication	Percent	Location	Inch1
32	12	PCT	24	AV2	-0.03
49	35	PCT	15	AV4	0
49	36	PCT	10	AV4	0
49	36	PCT	10	AV4	0
49	38	PCT	15	AV1	0
49	38	PCT	12	AV4	0
49	42	PCT	14	AV4	0
49	43	PCT	12	AV1	0.03
49	46	PCT	14	AV4	0
49	47	PCT	15	AV1	0
49	49	PCT	14	AV1	0
49	49	PCT	14	AV4	0.17
17	56	PCT	20	AV4	0
48	62	PCT	13	AV1	0
49	62	PCT	12	AV1	0
49	64	PCT	15	AV1	-0.16
43	68	PCT	17	AV2	0
49	68	PCT	16	AV1	0
39	84	PCT	21	AV2	0
39	84	PCT	20	AV3	0
39	84	PCT	16	AV4	0
41	85	PCT	17	AV3	0
33	87	PCT	20	AV4	0
41	87	PCT	13	AV1	0
41	87	PCT	16	AV2	0
41	87	PCT	12	AV3	0
40	95	PCT	14	AV1	0
40	95	PCT	14	AV2	0
38	98	PCT	26	AV2	0
38	98	PCT	14	AV3	0
38	99	PCT	13	AV1	0
34	101	PCT	30	AV2	0
35	101	PCT	16	AV1	0
35	101	PCT	15	AV4	0
31	103	PCT	21	AV1	0

Row	Column	Indication	Percent	Location	Inch1
33	103	PCT	17	AV1	0
33	103	PCT	14	AV2	0
33	103	PCT	16	AV4	0
30	105	PCT	26	AV2	0
26	107	PCT	21	AV2	0

Steam Generator 4

Row	Column	Indication	Percent	Location	Inch1
39	19	PCT	10	AV2	-0.14
45	24	PCT	9	AV4	-0.08
49	33	PCT	13	AV4	-0.19
33	56	PCT	13	AV2	0
33	56	PCT	28	AV3	0
47	59	PCT	14	AV4	0
45	68	PCT	24	AV1	0
45	68	PCT	28	AV2	0
45	68	PCT	34	AV3	0
38	71	PCT	13	AV2	0
38	71	PCT	13	AV3	0
37	84	PCT	24	AV3	0
23	93	PCT	13	AV2	0
40	97	PCT	11	AV4	0

Current Degradation Mechanisms:

The results of this inspection identified 2 types of signals that pertain to the condition of the tubing. Tube wear was identified in conjunction with AVB locations and the top of the tubesheet (TTS) or the cold leg (CL) preheater baffle plate (C6). The other type was a volumetric freespan indication 6" above the HL tubesheet, attributed to a pit-like manufacturing artifact and plugged since the sizing basis for pit-like indications is inadequate.

The following Table 1 presents a summary of the NDE results obtained upon final disposition, representing data relevant to the condition of the tubes. The AVB percent throughwall wear indications and the volumetric indications (VOL/SVI) are representative of tube degradation processes (AVB and loose parts wear).

Relevant Degradation Mechanisms

Table 3 summarizes the extent if any of the evidence for degradation modes which, though not previously observed in Comanche Peak Unit 2, have been observed in plants with similar design or tubing configuration.

Table 3
Comanche Peak 2Rf04
Relevant Degradation Mechanisms

Mechanism	Observations
Tube Wear (loose parts)	3 tubes repaired for wear signals
OD Pitting (sludge zone)	No indications reported
Transition Zone PWSCC/ODSCC	No indications reported

Possible loose parts signals were observed on 2 tubes in SG 1and on 10 tubes in SG 4.

Possible loose parts wear indications were associated with the plugging of 3 tubes in SG 4:

R12C92 in SG 4 was plugged based on bobbin signal identified at the top of CL baffle C6; the indication was associated with a PLP (possible loose part) and characterized as SVI - a volumetric indication to be repaired. The surrounding tubes were examined and no further evidence of wear or loose parts was observed. For the purpose of the Condition Monitoring evaluation, axial and circumferential profiles were generated from the +Point data; these data were used to support structural assessment. However, the signal to noise character of the data was inadequate to support sizing by RPC. Therefore the structural analysis was based on through wall crack behavior. It was determined that the tube had a calculated burst pressure based on an a through wall crack model in excess of 5000 psi, well above the draft RG 1.121 limits for pressure transients up to 3X the Normal Operating Pressure Differential (3XNOΔP =3765 psi). Sizing based on the bobbin signal phase angle behavior suggests this volumetric indication calibration is less than

40%, implying even greater margins against SLB leakage and burst at 3XNOΔP. The loose part responsible for the wear could not be identified and removed; therefore the tube was stabilized to prevent damage to adjacent tubes should post-repair damage occur.

Two adjacent tubes in SG 4, R36C59 and R37C59, were plugged due to wear scars associated with loose parts in the first inch above the top of the tubesheet. The +Point examination indicated volumetric indications, which were classified SVI to designate them for repair rather than re-sizing using wear scar calibrations. As in the evaluation of R12C92, both tubes were determined to have sufficient remaining tubewall to preserve adequate margin against leakage as well as against burst under 3XNOΔP loading (3765 psi), using structural calculations based on through wall cracking.

There were no instances of loose parts wear for SGs 1, 2, and 3.

Preheater Baffle Plate Wear: Three tubes were identified as exhibiting preheater baffle plate wear indications. The maximum depth associated with the 3 locations was 5%; therefore the baffle plate wear indications do not satisfy the EPRI definition for active degradation

Manufacturing artifacts such as scratches, MBMs, dings, grooves, gouges, and asymmetric expansions have produced signals that have caused plugging in several plants with Alloy 600 TT tubing; in 5 separate cases tube pulls have been performed for suspected flaws, but none has been confirmed as tube degradation. This information supports the conclusion that the Top of Tubesheet and C6 VOL/SVI signals are consistent with wear-related processes rather than a cracking mechanism.

Potential Degradation Mechanisms

The following degradation mechanisms have not been observed in similar SGs but are regarded as potentially likely to occur; the table summarizes the 2RF04 findings that reflect no initial occurrence of any of these mechanisms.

Table 4 Comanche Peak 2RF04 Potential Degradation Mechanisms	
Mechanism	**Observations**
U-bend PWSCC	None reported
Ding SCC	None reported
Sludge Pile ODSCC	None confirmed

U-bend PWSCC, ODSCC related to the presence of freespan dings or support plate level dents, and sludge pile ODSCC are degradation mechanisms that have not been observed in similar SGs but are considered on a contingency basis should such indications be detected. Potential degradation mechanisms have the lowest likelihood of initiation for a particular SG design. There were no indications attributable to any of these mechanisms at Comanche Peak Unit 2 during the 2RF04 inspection. The 20% sample examination of the local tube profile variations (DNG locations) with rotating probes was performed for dings on the hot leg in straight tube sections. 100% of the dents >5 volts at H3 were examined with rotating probes.

Miscellaneous Repair: One tube - R20C106 in SG 4 was plugged because of an obstruction in the tube 31" above the 10H TSP; the 0.610" diameter bobbin probe could not pass. Re-testing with smaller probes was not attempted, since this behavior had been encountered in the previous outage; at that time a smaller probe did pass the location, identifying a dent with a ~15V signal. Since this tube was regarded as uninspectable with a MRPC probe, it was administratively plugged.

Ding/Dent +Point Examination

Twenty percent of the straight leg (at or below 11H) HL dings ≥ 5 volts in all 4 SGs were examined with +Point probes; all of the locations tested were reported as NDD. The dings and dents in Model D5 SGs do not result from TSP corrosion, because the 405 stainless plate quatrefoil tube hole design is unlikely to support in-service denting.

Condition Monitoring Conclusion

Based on the evaluations of this report, all indications found in the 2RF04 inspection satisfy condition monitoring requirements for structural and leakage integrity. The tubes plugged were all based on conservative, administrative judgment, since it is demonstrable that the pertinent indications were all < 40% maximum through wall depth; further, the indications that were sized and left in service with qualified techniques were all below the 40% Technical Specification repair limit.