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TS 5.6.8

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United States Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261/RENEWED LICENSE NO. DPR-23

REFUELING OUTAGE 28 STEAM GENERATOR TUBE INSPECTION REPORT

Ladies and Gentlemen:

In accordance with the H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2, Technical Specifications (TS) Section 5.6.8, "Steam Generator Tube Inspection Report," Duke Energy Progress, Inc., submits the attached report.

The attachment to this letter provides the steam generator tube inspection report information for Refueling Outage 28 (RO28) required by TS Section 5.6.8.

There are no regulatory commitments made in this submittal. If you have any questions regarding this submittal, please contact Mr. R. Hightower at (843) 857-1329.

Sincerely,

Sharon W. Peavyhouse

Sharon W. Peavyhouse
Director – Nuclear Organization Effectiveness

SWP/msc

Enclosure

Attachment

cc: Mr. V. M. McCree, NRC, Region II
Mr. S. P. Lingam, NRC Project Manager, NRR
NRC Resident Inspector, HBRSEP, Unit No. 2

A001
NRR

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

REFUELING OUTAGE 28 STEAM GENERATOR TUBE INSPECTION REPORT

Pursuant to H. B. Robinson Technical Specification 5.6.8 the following information is provided:

a. The scope of inspections performed on each SG

The SG Tube Inspection Program included the use of multi-frequency Bobbin Coil Rotating Pancake (PAN), Rotating Plus Point (+Pt) and Array X-Probe (XP) probes.

Bobbin Probe Examination

Full length examination with bobbin probe of 50% of in-service tubes, including:

- *Tubes adjacent to plugged tubes*
- *Tubes with prior bobbin/RPC PLP above HTS/CTS*
- *Tubes with bobbin indications from the prior inspection (R026)*
- *2-Sigma tubes identified in the Degradation Assessment*
- *Tubes planned in the Rows 1-2 and Row 9 U-bend array inspection*
- *Tubes planned to be preventatively plugged*
- *Additional tubes to make up a 50% sample*

Array Probe Examination

Examination with array probe (X-probe) of the following:

- *Hot leg tubesheet to 1st TSP (HTE-01H) of 100% of in-service tubes*
- *Cold leg tubesheet to 1st TSP (CTE-01C, or CTE-FBC for tubes in the FBC cutout region) of tubes in a two-tube pattern around the periphery and adjacent to the no-tube lane (i.e. rows 1-2)*
- *U-bend (06H-06C) of 50% of the in-service tubes in rows 1 and 2*
- *U-bend (06H-06C) of 20% of the in-service tubes in row 9*
- *Bobbin dent indications > 4.0 volts (called in RFO26 or the current outage)*
- *Special interest (bobbin I-codes, PLP)*
- *Bounding of confirmed PLP (1 tube bounding)*
- *Array exams not required for secondary side loose parts (per Duke Energy steam generator engineer)*

MRPC Probe Examination

Examination with MRPC probe:

- *U-bend (06H-06C) for tubes in rows 1-2 not able to be inspected due to availability of array probes.*
- *Selected Indications for technology bridging.*

Visual Inspections

- *All Plugs were visually inspected*
- *Primary bowl cladding was visually inspected for all steam generators*

b. Degradation mechanisms found

a) Anti-vibration Bar (AVB) wear
b) Transient foreign object damage (loose part not present)
c) Circumferential Primary Water Stress Corrosion Cracking (PWSCC) at hot-leg tube ends

c. Non-destructive examination techniques utilized for each degradation mechanism

The Non-destructive examination techniques utilized bobbin coil for the detection of AVB wear and the X probe was utilized to characterize the wear indications.

d. Location, orientation (if linear), and measured sizes (if available) of service induced indications

The complete listing for service-induced indications is attached.

e. Number of tubes plugged during the inspection outage for each active degradation mechanism

A total of four tubes were plugged. The four tubes had been identified for plugging due to previously identified manufacturing imperfections as required to support the H licensing requirements. No tubes were recommended for repair due to current inspection results.*

f. The number and percentage of tubes plugged to date, and the effective plugging percentage in each steam generator

The HBRSEP, Unit No. 2, steam generators were replaced in 1984 with Westinghouse Model 44F steam generators with alloy 600 thermally treated tubes. The current analysis supports up to 6% tube plugging. Prior to RO-28 there were 44 plugged tubes. With the 4 tubes plugged in RO-28 there are a total of 48 plugged tubes out of a population of 9642 for the three steam generators. This brings the total plugging to 0.5% as compared to the analysis limit of 6%.

*Steam Generator**	*A*	*B*	*C*	*Total*
Plugs present prior to EOC 28	*7*	*21*	*16*	*44*
Plugs added in EOC 28	*2*	*2*	*0*	*4*
Total Plugs	*9*	*23*	*16*	*48*
% Plugged	*0.3*	*0.7*	*0.5*	*0.5*

** There are 3214 tubes per generator.*

g. The results of condition monitoring, including the results of tube pulls and in-situ pressure testing

The condition monitoring report describes a condition monitoring and operational assessment evaluation for Robinson Unit 2 at RO28. The evaluation was performed according to NEI 97-06 using the recommended practices of the EPRI Steam Generator Integrity Assessment Guidelines. The degradation forms evaluated at RO28 were wear at AVB locations and wear due to foreign objects at the top of tubesheet and near tube support plates. PWSCC degradation near HL tube ends was detected and is covered separately in an NRC-approved alternate repair criterion.

The worst case AVB wear Non-destructive Examination (NDE)depth projected for RO28 in the RO26 Condition Monitoring and Operational Assessment (CMOA) was 35 %TW. The deepest AVB wear indication actually seen during RO28 was 28 %TW. Foreign object wear was predicted to grow minimally in the

RO26 CMOA. This was true of wear indications that were detected during RO26. But as expected, several new instances of foreign object wear were detected at RO28. The largest foreign object wear indication detected at RO28 was 34 %TW. No foreign objects remain at locations with wear. Therefore, the previous operational assessment was conservatively bounding for all wear types observed in RO26 and RO28.

All condition monitoring requirements were met. Projected End of Cycle (EOC) 30 worst case burst pressures meet the limiting structural integrity performance requirement of three times normal operating pressure of 4,350 psi with at least 0.95 probability with 50% confidence. There is no leakage projected at normal operating pressure or accident conditions at RO30. Operational assessment structural and leakage integrity requirements are demonstrated.

Primary bowl cladding inspections identified no abnormal conditions.

Plug visual inspections identified no abnormal conditions.

No in-situ pressure testing was required. No tube pulls were performed.

h. Evaluation of Primary to Secondary Leakage Rate

There was no leakage within detectable limits.

i. The calculated accident induced leakage rate from the portion of the tubes below 18.11 inches from the top of the tubesheet for the most limiting accident in the most limiting SG.

There was no leakage within detectable limits and no calculated leakage.

j. The results of monitoring for tube axial displacement (slippage). If slippage is discovered, the implications of the discovery and corrective action shall be provided.

No tube slippage was identified.

SG - A Service Induced Degradation

H.B. Robinson 2 RFO28 RNP 20131001 11/11/2013 10:09:52

ROW	COL	VOLTS	DEG	IND	PER	CHN	LOCN	INCH1	INCH2	CIRC	LENGTH	BEGT	ENDT	PDIA	PTYPE	CAL	L
15	6	.68	105	PCT	20	Q9	01H	-.72	-.53	0.37	0.19	01H	HTE	.720	ZYAXA	32	H
23	14	.73	113	PCT	21	Q10	HTS	-.07	.16	0.37	0.23	01H	HTE	.720	ZYAXA	26	H
31	21	.64	80	PCT	20	Q7	HTS	-.09	.14	0.37	0.23	01H	HTE	.720	ZYAXA	26	H
37	24	.24	47	PCT	14	Q19	CTS	19.41	19.61	0.37	0.20	FBC	CTE	.720	ZYAXA	29	C
31	30	.47	113	PCT	18	Q8	HTS	-.02	.16	0.37	0.18	01H	HTE	.720	ZYAXA	32	H
8	40	3.28	39	SCI		2	HTE	.00				01H	HTE	.720	ZYAXA	20	H
33	41	.86	82	PCT	22	Q9	HTS	-.09	.12	0.37	0.21	01H	HTE	.720	ZYAXA	26	H
27	42	.90	97	PCT	23	Q15	03H	-.86	-.65	0.37	0.21	03H	03H	.720	ZYAXA	33	H
27	44	.61	99	PCT	20	Q18	05C	-.88	-.67	0.37	0.21	05C	05C	.720	ZYAXA	25	C
45	47	.25	155	PCT	14	Q6	CTS	11.51	11.69	0.37	0.18	FBC	CTE	.720	ZYAXA	29	C
41	53	.73	64	PCT	21	Q6	HTS	-.07	.14	0.37	0.21	01H	HTE	.720	ZYAXA	26	H
24	54	.82	86	PCT	22	Q19	03H	-.79	-.55	0.45	0.23	03H	03H	.720	ZYAXA	33	H
40	68	.56	161	PCT	19	Q6	CTS	.44	.74	0.45	0.31	FBC	CTE	.720	ZYAXA	29	C
1	86	.39	60	PCT	16	Q12	CTS	.61	.81	0.37	0.20	FBC	CTE	.720	ZYAXA	29	C
1	87	.17	92	PCT	12	Q4	CTS	1.03	1.21	0.30	0.18	FBC	CTE	.720	ZYAXA	29	C
18	88	.62	78	PCT	20	Q19	FBH	.21	.44	0.37	0.23	01H	HTE	.720	ZYAXA	26	H

ROW	COL	VOLTS	DEG	IND	PER	CHN	LOCN	INCH1	INCH2	UTIL1	UTIL2	BEGT	ENDT	PDIA	PTYPE	CAL	L

Tubes: 16 Records: 16
ST Max

SG - B Service Induced Degradation

H.B. Robinson 2 RFO28 RNP 20131001 11/11/2013 10:13:24

ROW	COL	VOLTS	DEG	IND	PER	CHN	LOCN	INCH1	INCH2	CIRC	LENGTH	BEGT	ENDT	PDIA	PTYPE	CAL	L
7	5	.28	45	PCT	13	P23	HTS	.23		0.30	0.27	01H	HTE	.720	ZYAXA	23	H
25	11	.34	80	PCT	16	Q12	04C	-.83	-.65	0.37	0.19	04C	04C	.720	ZYAXA	36	C
14	13	.88	77	PCT	23	Q4	HTS	.29		0.52	0.37	01H	HTE	.720	ZYAXA	23	H
21	17	.72	98	PCT	19	P22	02H	-.46		0.37	0.29	02H	02H	.720	ZYAXA	23	H
1	21	1.06	57	PCT	24	Q5	04C	-.81	-.58	0.45	0.23	04C	04C	.720	ZYAXA	36	C
41	28	.58	60	PCT	19	Q5	03H	-.47		0.45	0.23	03H	03H	.720	ZYAXA	23	H
41	30	.47	68	PCT	11	P2	02A	.04				HTE	CTE	.720	ZBAGB	20	C
38	33	2.43	93	PCT	34	Q4	HTS	.12		0.59	0.31	01H	HTE	.720	ZYAXA	23	H
35	36	.57	101	PCT	13	P2	03A	-.24				HTE	CTE	.720	ZBAGB	20	C
44	38	.47	156	PCT	11	P2	04A	-.11				HTE	CTE	.720	ZBAGB	20	C
2	41	.21	120	PCT	13	Q3	CTS	.72	.86	0.37	0.14	01C	CTE	.720	ZYAXA	36	C
3	43	.31	113	PCT	15	Q13	CTS	.68	.88	0.30	0.20	CTS	CTE	.720	ZYAXA	36	C
4	43	.96	61	PCT	23	Q19	03C	-.76	-.55	0.45	0.21	03C	03C	.720	ZYAXA	36	C
34	44	1.20	106	PCT	26	Q5	HTS	.04		0.52	0.23	01H	HTE	.720	ZYAXA	23	H
10	46	.74	86	PCT	21	Q12	HTS	3.21		0.52	0.33	01H	HTE	.720	ZYAXA	23	H
16	46	1.12	101	PCT	25	Q4	02H	-.62		0.52	0.23	02H	01H	.720	ZYAXA	23	H
4	47	.20	111	PCT	13	Q16	CTS	.70	.84	0.30	0.14	CTS	CTE	.720	ZYAXA	36	C
5	48	.34	111	PCT	16	Q13	03H	51.00		0.45	0.27	04H	03H	.720	ZYAXA	23	H
5	48	.30	136	PCT	15	Q9	CTS	.94	1.14	0.37	0.20	CTS	CTE	.720	ZYAXA	36	C
5	49	.51	67	PCT	18	Q9	CTS	.85	1.05	0.37	0.20	CTS	CTE	.720	ZYAXA	36	C
34	52	.79	65	PCT	22	Q6	HTS	.02		0.45	0.23	01H	HTE	.720	ZYAXA	23	H
10	53	.65	117	PCT	18	P24	04A	.70	.97	0.22	0.27	06C	06H	.720	ZYAXA	27	H
11	53	.56	89	PCT	19	Q16	CTS	.76	1.10	0.45	0.35	CTS	CTE	.720	ZYAXA	36	C
34	61	.72	86	PCT	21	Q14	05C	-1.06	-.88	0.37	0.18	05C	05C	.720	ZYAXA	36	C
27	65	.33	122	PCT	15	Q15	03H	.08		0.37	0.27	03H	03H	.720	ZYAXA	23	H
8	89	.99	110	PCT	24	Q2	HTS	-.02	.19	0.45	0.21	01H	HTE	.720	ZYAXA	27	H

ROW	COL	VOLTS	DEG	IND	PER	CHN	LOCN	INCH1	INCH2	UTIL1	UTIL2	BEGT	ENDT	PDIA	PTYPE	CAL	L

Tubes: 25 Records: 26
ST Max

SG - C Service Induced Degradation

H.B. Robinson 2 RFO28 RNP 20131001 11/11/2013 10:16:29

ROW	COL	VOLTS	DEG	IND	PER	CHN	LOCN	INCH1	INCH2	CIRC	LENGTH	BEGT	ENDT	PDIA	PTYPE	CAL	L
18	7	.50	99	PCT	18	Q5	05C	-.71	-.52	0.37	0.19	05C	05C	.720	ZYAXA	30	C
30	13	.50	117	PCT	18	Q10	04H	-.78	-.56	0.37	0.22	04H	04H	.720	ZYAXA	26	H
25	15	1.40	75	PCT	27	Q16	03C	-.77	-.58	0.45	0.19	03C	03C	.720	ZYAXA	30	C
6	27	2.10	95	PCT	32	Q15	02H	-.62	-.42	0.45	0.20	02H	02H	.720	ZYAXA	26	H
2	31	.64	132	PCT	20	Q9	01C	-.96		0.45	0.29	01C	CTE	.720	ZYAXA	33	C
4	31	38.92	26	SCI		157	HTE	.00				01H	HTE	.720	ZYAXA	14	H
39	41	.96	88	PCT	23	Q5	03H	-.61	-.40	0.45	0.22	03H	03H	.720	ZYAXA	26	H
45	42	.75	128	PCT	15	P2	02A	.02				HTE	CTE	.720	ZBAGB	19	C
11	43	.66	108	PCT	20	Q6	03H	-.64		0.52	0.28	03H	03H	.720	ZYAXA	31	H
15	45	.28	122	PCT	14	Q16	02H	-.75		0.52	0.26	02H	02H	.720	ZYAXA	31	H
37	45	1.88	69	PCT	28	P2	03A	.00				HTE	CTE	.720	ZBAGB	19	C
37	45	1.69	34	PCT	27	P2	04A	.00				HTE	CTE	.720	ZBAGB	19	C
10	49	.72	86	PCT	21	Q16	05C	-.98	-.79	0.37	0.19	05C	05C	.720	ZYAXA	30	C
34	50	1.99	71	PCT	31	Q2	HTS	.03	.26	0.45	0.23	01H	HTE	.720	ZYAXA	26	H
40	52	.38	143	PCT	9	P2	04A	.00				HTE	CTE	.720	ZBAGB	19	C
28	61	.86	100	PCT	20	P25	01A	-1.33	-1.02	0.22	0.31	06H	06C	.720	ZYAXA	26	C
35	61	.27	167	PCT	6	P2	01A	-.15				HTE	CTE	.720	ZBAGB	19	C
35	61	1.32	142	PCT	23	P2	02A	.00				HTE	CTE	.720	ZBAGB	19	C
35	61	1.42	53	PCT	24	P2	03A	.23				HTE	CTE	.720	ZBAGB	19	C
35	61	.12	13	PCT	2	P2	04A	-.02				HTE	CTE	.720	ZBAGB	19	C
36	63	.57	76	PCT	19	Q8	04H	-.72	-.48	0.37	0.24	04H	04H	.720	ZYAXA	26	H
30	69	.35	87	PCT	16	Q11	02H	-.78	-.66	0.30	0.13	02H	02H	.720	ZYAXA	26	H
30	71	.63	68	PCT	20	Q6	03H	-.56	-.44	0.45	0.12	03H	03H	.720	ZYAXA	26	H
30	72	.86	86	PCT	22	Q15	03H	-.58	-.42	0.37	0.16	03H	03H	.720	ZYAXA	26	H
35	73	.61	87	PCT	13	P2	04A	.00				HTE	CTE	.720	ZBAGB	19	C
33	75	.56	73	PCT	19	Q6	03H	-.76	-.58	0.37	0.18	03H	03H	.720	ZYAXA	26	H
8	76	1.12	96	PCT	25	Q17	04H	-.85	-.66	0.37	0.20	04H	04H	.720	ZYAXA	26	H
32	78	.44	133	PCT	10	P2	03A	.00				HTE	CTE	.720	ZBAGB	19	C
19	82	.92	94	PCT	23	Q1	02H	-.50	-.32	0.30	0.18	02H	02H	.720	ZYAXA	26	H
8	85	.52	73	PCT	18	Q14	03H	-.54	-.42	0.37	0.12	03H	03H	.720	ZYAXA	26	H
3	91	.69	65	PCT	21	Q6	HTS	.20	.48	0.30	0.28	01H	HTE	.720	ZYAXA	26	H

ROW	COL	VOLTS	DEG	IND	PER	CHN	LOCN	INCH1	INCH2	UTIL1	UTIL2	BEGT	ENDT	PDIA	PTYPE	CAL	L

Tubes: 27 Records: 31
ST Max