Enclosure B
L-14-241

Unit #2 – 2R17 Steam Generator F* (F Star) Report
(5 Pages Follow)

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UNIT #2 - 2R17 STEAM GENERATOR F* (F STAR) REPORT

Technical Specification 5.6.6.2.4 requires a report to be submitted to the Nuclear Regulatory Commission (NRC) within 90 days after the initial entry into MODE 4 following an outage in which the F* methodology was applied. For the spring 2014 refueling outage (2R17), the initial entry into MODE 4 occurred on May 17th, 2014.

Per Technical Specification 5.6.6.2.4, the following information is to be submitted to the NRC:

(a) Total number of indications, location of each indication, orientation of each indication, severity of each indication, and whether the indications initiated from the inside or outside surface.

This information can be found in Tables 2RCS-SG21A, 2RCS-SG21B, 2RCS-SG21C.

(b) The cumulative number of indications detected in the tubesheet region as a function of elevation within the tubesheet.

This information can be found in Attachment A: "Unit 2 - Cumulative Listing of Tubesheet Indications (All Outages)".

(c) The projected end-of-cycle accident-induced leakage from tubesheet indications.

This information is provided in the 5th paragraph below.

DISCUSSION:

During 2R17, the Plus Point probe was utilized to inspect the steam generator (SG) top of tubesheet region in both the hot and cold legs. The 2R17 inspection scope included 100 percent of the inservice hot leg tubes in all three steam generators plus a twenty percent random sample of the inservice cold leg tubes in SG B. The inspection distance for either leg was from 6.0 inches above the top of tubesheet to 3.0 inches below the top of tubesheet. This inspection distance bounds the required F* examination distance (that is, the expanded portion of the tube below the bottom of roll expansion transition) of 2.22 inches below the bottom of the expansion transition.

However, there are ten tubes located on the hot leg side of the SGs that have roll expansion transitions at lower than nominal elevations. All of the hot leg tubes with the deeper roll transition locations were inspected to a depth of 5.0 inches below the top of tubesheet to ensure the F* distance was adequately examined. In the cold leg side of SG B, there are seven tubes with lower than nominal roll transition locations. These seven tubes on the cold leg side of SG B were tested to a depth 5.0" below the top of tubesheet to ensure the F* distance was adequately examined.

The morphology for the majority of the indications being reported from the hot leg top of tubesheet region is believed to be outside diameter stress corrosion cracking (ODSCC). This is based on signal recognition and the location of the reported indications. Both axial and circumferentially orientated indications were observed. Circumferential indications located above the top of tubesheet remain bounded by the expansion transition. One tube in the SG B hot leg was reported with a multiple axial primary water stress corrosion cracking (PWSCC) indication.

None of the indications that were reported during the 2R17 SG examinations represented a (Cycle 17) leakage potential at postulated main steam line break (MSLB) conditions.

The projected accident induced leakage from all combined sources (sleeves, plugs, indications left in-service under Generic Letter 95-05 and other degradation within the tube bundle) remains well below the 2.2 gallons per minute (gpm) per SG allowed by the Technical Specifications.

The following information summarizes the degradation observed during the 2R17 top of tubesheet region examinations. The data has been re-analyzed utilizing the Plus Point probe 300 kHz channel. The 300 kHz provides the most accurate sizing technique and is used for assessing the severity of the indications.

Notes for all Tables:

1) 0.00" is located at the secondary side face of tubesheet
2) A negative measurement is the distance into the tubesheet from the secondary side face.
3) * - TSH - Top of tubesheet (Hot Leg)
4) ** - SAI/MAI - Single or multiple axial indications
5) ** - SCI/MCI - Single or multiple circumferential indications
6) *** - Reported using the 300 kHz Plus Point coil
7) The reported arc lengths are taken from the data resolution process. Profile analysis shows these measurements to be generally conservative.

SG A Hot Leg Tubesheet:

There were twenty four indications in twenty three tubes. Twenty indications were located at or slightly below the top of tubesheet (Nineteen were single or multiple circumferential ODSCC indications and one was a multiple axial ODSCC indication). The remaining four indications were located above the top of tubesheet (one was a single circumferential ODSCC indication, three were single axial ODSCC indications).

Table 2RCS-SG21A

Indication Location				Orientation**	Severity***			Initiation Surface/ Degradation	Projected Leakage
SG	Row	Column	Elevation*		Volts	Axial Length	Arc Length (Degrees)		
A	5	23	TSH -0.09"	SCI	0.18		156	ODSCC	None
A	7	45	TSH -0.03"	SCI	0.15		188	ODSCC	None
A	7	61	TSH -0.08"	SCI	0.12		88	ODSCC	None
A	8	22	TSH -0.12"	SCI	0.11		92	ODSCC	None
A	9	22	TSH -0.06"	SCI	0.26		183	ODSCC	None
A	9	39	TSH -0.02"	SCI	0.08		92	ODSCC	None
A	10	41	TSH -0.15"	SCI	0.13		85	ODSCC	None
A	16	22	TSH -0.10"	SCI	0.23		258	ODSCC	None
A	17	48	TSH +0.00"	SCI	0.13		101	ODSCC	None
A	24	26	TSH -0.02"	SCI	0.09		29	ODSCC	None
A	26	34	TSH -0.06"	MCI	0.25		71	ODSCC	None
A	28	28	TSH +0.04"	SAI	0.08	0.17"		ODSCC	None
A	28	68	TSH +0.09"	SAI	0.32	0.12"		ODSCC	None
A	29	63	TSH +0.00"	SCI	0.06		119	ODSCC	None
A			TSH -0.08"	SCI	0.06		84	ODSCC	None
A	31	67	TSH +0.00"	SCI	0.18		48	ODSCC	None
A	33	29	TSH -0.01"	MAI	0.11	0.19"		ODSCC	None
A	35	36	TSH +0.08"	SAI	0.11	0.14"		ODSCC	None
A	36	42	TSH -0.09"	SCI	0.15		140	ODSCC	None
A	39	48	TSH -0.05"	SCI	0.13		77	ODSCC	None
A	40	41	TSH -0.09"	SCI	0.12		140	ODSCC	None
A	40	45	TSH +0.05"	SCI	0.35		238	ODSCC	None
A	40	48	TSH -0.03"	MCI	0.15		145	ODSCC	None
A	41	45	TSH -0.06"	SCI	0.26		321	ODSCC	None

SG B Hot Leg Tubesheet:

There were eight indications in seven tubes. Seven indications were located at or slightly below the top of tubesheet (Six were single circumferential ODSCC indications and one was a multiple axial PWSCC indication). The remaining indication was located above the top of tubesheet and was a multiple axial ODSCC indication.

SG B Cold Leg Tubesheet:

No indications were reported from the 20% random sample inspection of the cold leg tubesheet region.

Table 2RCS-SG21B

Indication Location				Orientation**	Severity***			Initiation Surface/ Degradation	Projected Leakage
SG	Row	Column	Elevation*		Volts	Axial Length	Arc Length (Degrees)		
B	4	34	TSH -0.09"	SCI	0.14		50	ODSCC	None
B	16	42	TSH -0.01"	MAI	0.39	0.23"		PWSCC	None
B			TSH +0.01"	MAI	0.20	0.23"		ODSCC Note 1	None
B	17	33	TSH -0.09"	SCI	0.14		291	ODSCC	None
B	18	34	TSH -0.15"	SCI	0.20		101	ODSCC	None
B	19	41	TSH -0.06"	SCI	0.18		111	ODSCC	None
B	20	45	TSH -0.08"	SCI	0.15		101	ODSCC	None
B	20	59	TSH -0.02"	SCI	0.14		143	ODSCC	None

Note 1: The exact nature of the indication is inconclusive. The phase angle suggests OD initiation however, the influence of the carbon steel tubesheet can cause rotation of small amplitude signals to be drawn into the OD flaw plane (e.g. Belief is this indication is actually PWSCC but the tubesheet influence shows otherwise).

SG C Hot Leg Tubesheet:

There were thirteen indications in thirteen tubes. Eleven indications were located at or slightly below the top of tubesheet (Ten were single circumferential ODSCC indications and one was a single axial indication). The remaining two indications were located above the top of tubesheet and were single axial ODSCC indications.

Table 2RCS-SG21C

Indication Location				Orientation**	Severity***			Initiation Surface/ Degradation	Projected Leakage
SG	Row	Column	Elevation*		Volts	Axial Length	Arc Length (Degrees)		
C	1	18	TSH -0.07"	SCI	0.17		111	ODSCC	None
C	6	38	TSH +0.07"	SAI	0.14	0.14"		ODSCC	None
C	6	52	TSH +0.21"	SAI	0.15	0.25"		ODSCC	None
C	7	38	TSH +0.00"	SAI	0.09	0.14"		ODSCC	None
C	8	52	TSH -0.11"	SCI	0.11		84	ODSCC	None
C	9	4	TSH -0.10"	SCI	0.12		61	ODSCC	None
C	12	87	TSH -0.10"	SCI	0.15		126	ODSCC	None
C	16	36	TSH -0.08"	SCI	0.16		100	ODSCC	None
C	16	76	TSH -0.07"	SCI	0.07		63	ODSCC	None
C	17	36	TSH -0.08"	SCI	0.11		53	ODSCC	None
C	18	38	TSH -0.09"	SCI	0.08		100	ODSCC	None
C	24	60	TSH -0.06"	SCI	0.08		93	ODSCC	None
C	30	63	TSH -0.05"	SCI	0.13		95	ODSCC	None

Attachment A
Unit 2 - Cumulative Listing of Tubesheet Indications (All Outages)
(Updated through 2R17)

SG A	COUNT
Hot Leg Tubesheet	
0.00"	10
- 0.01"	8
- 0.02"	8
- 0.03"	18
- 0.04"	14
- 0.05"	14
- 0.06"	14
- 0.07"	15
- 0.08"	13
- 0.09"	12
- 0.10"	12
- 0.11"	20
- 0.12"	6
- 0.13"	14
- 0.14"	7
- 0.15"	3
- 0.16"	6
- 0.17"	4
- 0.18"	
- 0.19"	1
- 0.20"	1

SG A	COUNT
Cold Leg Tubesheet	
0.00"	
- 0.01"	
- 0.02"	
- 0.03"	
- 0.04"	
- 0.05"	1
- 0.06"	
- 0.07"	
- 0.08"	
- 0.09"	
- 0.10"	
- 0.11"	
- 0.12"	
- 0.13"	
- 0.14"	
- 0.15"	
- 0.16"	1
- 0.17"	
- 0.18"	
- 0.19"	
- 0.20"	

SG B	COUNT
Hot Leg Tubesheet	
0.00"	6
- 0.01"	6
- 0.02"	1
- 0.03"	11
- 0.04"	10
- 0.05"	11
- 0.06"	7
- 0.07"	12
- 0.08"	22
- 0.09"	21
- 0.10"	11
- 0.11"	9
- 0.12"	8
- 0.13"	
- 0.14"	2
- 0.15"	4
- 0.16"	2
- 0.17"	2
- 0.18"	2
- 0.19"	
- 0.20"	
- 0.27"	1
- 0.31"	1

SG B	COUNT
Cold Leg Tubesheet	
0.00"	
- 0.01"	
- 0.02"	
- 0.03"	
- 0.04"	
- 0.05"	
- 0.06"	
- 0.07"	
- 0.08"	
- 0.09"	
- 0.10"	
- 0.11"	
- 0.12"	
- 0.13"	
- 0.14"	
- 0.15"	
- 0.16"	
- 0.17"	
- 0.18"	
- 0.19"	
- 0.20"	
- 16.39"	1

SG C	COUNT
Hot Leg Tubesheet	
0.00"	5
- 0.01"	1
- 0.02"	3
- 0.03"	2
- 0.04"	4
- 0.05"	11
- 0.06"	9
- 0.07"	8
- 0.08"	14
- 0.09"	11
- 0.10"	10
- 0.11"	9
- 0.12"	8
- 0.13"	3
- 0.14"	3
- 0.15"	1
- 0.16"	2
- 0.17"	1
- 0.18"	1
- 0.19"	1
- 0.20"	
- 0.22"	1
- 0.36"	1
- 0.40"	1
- 0.41"	1
- 0.50"	1
- 1.22"	1
- 1.49"	1
- 3.16"	1
- 18.36"	1

SG C	COUNT
Cold Leg Tubesheet	
0.00"	
- 0.01"	
- 0.02"	
- 0.03"	
- 0.04"	
- 0.05"	
- 0.06"	
- 0.07"	
- 0.08"	
- 0.09"	
- 0.10"	
- 0.11"	
- 0.12"	
- 0.13"	
- 0.14"	
- 0.15"	
- 0.16"	
- 0.17"	
- 0.18"	
- 0.19"	
- 0.20"	
- 5.29"	1

The five shaded tube locations were reported as a distorted tubesheet signal from the bobbin coil probe. Rotating pancake coil probes did not confirm any of these signals as real indications.

TOTAL 200 TOTAL 2 TOTAL 149 TOTAL 1 TOTAL 116 TOTAL 1