Followup Questions From February 12, 2002 Phone Call With Prairie Island Unit 2

"Information provided is reasonably accurate, but has not been validated using the normal NMC procedure for correspondence to the NRC"

1) Provide more details (SG location, plug type, damage mechanism, etc.) on the tube(s) with leaking explosive plugs.

GEN	LEG	ROW	COL	RC	VOLTS	DEGREE	MecCode	%Value	PERCENT	CHANNEL	LOCATION	EOC	Date
2	C	33	79	R33C79			CLTSP	46	46	M	01C + 0.0	4	8001
2	C	43	37	R43C37			CLTSP	47	47	M	02C + 0.0	4	8001

2) Provide the results of the indications related to AVB wear, e.g. number of indications, estimation of the deepest wear scar, etc.

SG	ROW	COL	LOCATION	PCT- 2002	PCT 2002	Growth
21	19	6	NV1	23	22	1
21	34	28	NV3	23	23	0
21	34	31	NV1	21	13	8
21	34	31	NV2	27	21	6
21	34	31	NV3	32	25	7
21	34	31	NV4	23	14	9
21	25	32	NV2	25	28	-3
21	34	32	NV2	21	22	-1
21	17	38	NV2	11	13	-2
21	28	45	NV2	32	33	-1
21	34	56	NV3	16	16	0
21	21	61	NV4	15	16	-1
21	23	61	NV4	24	24	0

SG	ROW	COL	PCT - 2002	PCT - 2000	Growth
22	11	56	9	7	2
22	16	71	17	15	2
22	19	34	21	20	1
22	25	49	17	11	6
22	32	67	17	16	1
22	32	67	27	22	5
22	32	67	30	25	5
22	32	67	18	17	1
22	32	72	11	9	2
22	33	41	13	11	2
22	36	33	31	31	0
22	36	33	41	39	2
22	36	33	34	31	3
22	36	33	25	25	0
22	36	69	28	25	3
22	38	39	9	8	1
22	38	39	9	8	1
22	38	48	15	8	7
22	38	50	20	15	5
22	38	50	27	20	7
22	39	45	17	11	6
22	40	41	18	19	-1
22	40	41	23	25	-2
22	40	41	16	15	1
22	41	29	22	22	0
22	41	48	20	20	0
22	42	38	11	14	-3
22	42	38	17	19	-2
22	43	57	24	26	-2
22	43	58	18	17	1

3) Provide the results of the indications related to loose parts, e.g., location of indication, visual confirmation, final number of confirmed loose parts, etc.

Map Label	SG	Location Column	Location Row	Description	Tube Wear (%)	Retrieved	Remarks	Resolution
A	21H	38-39	38-39	sludge rock	0	no	smooth edges, light weight	allowed
B	21H	50-51	31-32	approximately 1 inch long metal strip	0	no	adhered to tube and tubesheet	not a loose part
C	22H	20	23-24	sludge rock	0	no	smooth edges, light weight	allowed
D	22H	22	28-29	2.5 inch by 3/16 inch metal strip	0	yes	either grinding shaving or weld seal ring	removed
E	22H	22-23	23	none	0	no	couldn't access due to sludge	history
F	22H	45-46	30-31	sludge rock	0	no	smooth edges, light weight	allowed
G	22H	47	32-33	none	0	no	couldn't access due to sludge	history
H	22H	55	31	3/8 inch dia. X 1/2 inch long cylindrical metal object	0	yes	on H25 list - AVB retainer bar end	removed
I	22H	54	31	3/8 inch dia. X 1 inch long machine curl	0	yes	machining remnant, crumbled on retrieval	removed
J	22H	50-51	34	none	0	no	nothing seen at this site	inspected clear
K	22H	38	9	hard sludge	0	no	hard sludge or object captured in sludge	not a loose part

4) Discuss the previous history of SG tube inspection results, including any look backs performed.

Previous history look backs are performed in the following instances:

A bobbin coil DSI indication at TSP's greater than 2.0 volts, MRPC roll transition I code indication greater than 1.5 volts, MRPC tubesheet crevice I code indication greater than 0.5 volts, any MRPC I code freespan indication greater than 0.3" long and all MRPC TSP I code indications not reported in the previous examination. In addition to these requirements May 2000 data was reviewed on all the in situ pressure test tubes along with any requests from the Steam Generator Integrity engineers to supplement information for the condition monitoring and operational assessment.

A look back on the PLP in both steam generators was performed. The following table summarizes the results of that review.

SG	Row	Col	2001	2000	1998	1997	1995
21	31	50	PLP	PLP	N/A	PLP	NDD
21	32	50	PLP	PLP	N/A	NDD	-
21	32	51	PLP	PLP	N/A	NDD	-
21	38	38	PLP	NDD	-	-	-
21	38	39	PLP	NDD	-	-	-
21	39	38	PLP	NDD	-	-	-
22	23	20	PLP	PLP	PLP	-	PLP
22	23	22	PLP	PLP	PLP	-	PLP
22	23	23	PLP	PLP	PLP	-	PLP
22	24	20	PLP	PLP	N/A	-	PLP
22	28	22	PLP	NDD	NDD	-	PLP
22	29	22	PLP	NDD	NDD	-	NDD
22	30	45	PLP	PLP	PLP	-	PLP
22	30	46	PLP	PLP	PLP	-	PLP
22	31	46	PLP	PLP	PLP	-	PLP
22	31	54	PLP	PLP	PLP	-	NDD
22	31	55	PLP	NDD	NDD	-	NDD
22	32	47	PLP	PLP	PLP	-	PLP
22	33	47	PLP	PLP	PLP	-	PLP
22	34	50	PLP	PLP	PLP	-	NDD
22	34	51	PLP	PLP	PLP	-	NDD

N/A = Data not available

- = Data wasn't reviewed

4) Provide the results of the in-situ pressure tests in SG 22.

SG	Row	Col	Indication	Location	Voltage	Reason	Length Inch	Width Degree	Leakage Result	Max Pressure	Eddy Current Change
21	3	17	SAI	TRH+0.07to+0.13	0.38	RTZ PWSCC	0.06		0	2816	No
21	9	18	MAI	TRH+0.14to+0.24	0.46	RTZ PWSCC	0.10		0	2816	No
21	14	28	SAI	1BH+16.67to+16.86	0.35	Crevice ODSCC	0.19		0	2816	Yes
21	23	31	MAI	1BH+16.79to+17.29	0.66	Crevice ODSCC	0.50		0	2816	Yes
22	13	29	SAI	TSH+0.25to+0.75	0.09	Free Span ODSCC	0.50		0	5256	Yes
22	2	31	SAI	TRH+5.86to+6.24	0.34	Crevice PWSCC	0.38		0	2816	No
22	14	41	MAI	1BH+17.29to+17.75	0.08	Crevice ODSCC	0.46		0	2816	Yes
22	19	47	MAI	TRH+17.82to+18.38	0.14	Crevice ODSCC	0.56		0	2816	Yes

6) What are the plans, if any, for implementing the voltage-based criteria for Unit 2?

The implementation of the voltage based repair criteria is not required this outage. The results of bobbin coil inspections and rotating coil inspections at the tube support plates, for other than cold leg tube support plate thinning are:

SG	Number of Distorted Support Plate Indications	Maximum Voltage of Distorted Support Plate Indications	Number/Type of Confirmed RPC Indications (All DSI were examined by RPC)
21	27	1.46	0
22	52	1.3	0

7) During a phone call with the licensee for Prairie Island Unit 2 on February 12, 2002, the NRC staff inquired about the actions being taken to ensure that any significant flaws in the U-bends of low row tubes, including the apex and tangent point locations, will be detected. Significant flaws are considered those that fail or may fail to satisfy the NEI 97-06 tube integrity performance criteria prior to the next scheduled inspection. Specific questions aimed at addressing this issue are:

a. What procedures are being implemented to ensure adequate data quality in the U-bend region of low row tubes, including apex and tangent point locations?

Upon completion of resolution on all low row u-bend examinations (both mid range and high frequency) the resolution analyst(s) shall calibrate, perform and record noise measurements in accordance with Reference 2.9 at 300 kHz and 400 kHz for the mid range probe and 600 kHz and 800 kHz for the high frequency probe. If any measurement on the mid range data exceeds the average of the EPRI qualification, the resolution analyst will report the run as RHF with a Quality code of QEN. If any measurement on the high frequency data exceeds the average of the EPRI qualification, the resolution analyst will measure the noise of the mid range data with a band pass filter (BPF) set at 23 Coefs., low cut at .0433 x RPM and high cut at .267 x RPM applied to the 300 kHz raw channel. If the results are less than the average of the EPRI qualification, both the primary and secondary resolution analysts will re-evaluate the mid range data using the BPF on the 300 kHz raw and process channels. If the results of the re-evaluation is NDD, report the high frequency data as NDD with a Quality code of QEN. If the results are in excess of the EPRI qualification, report the high frequency data as TBP with a Quality code of QEN.

What are the acceptance standards for data quality in these areas?

Prairie Island Unit 2 2002 U Bend Noise Criteria

EPRI ETSs # 99997.1	*Apex V p-p*	*Apex V v-m*	*Tangent V p-p*	*Tangent V v-m*
800 kHz Average	1.56	0.54	2.50	0.88
600 kHz Average	1.27	0.37	2.04	0.62

EPRI ETSS # 96511.2	*Apex V p-p*	*Apex V v-m*	*Tangent V p-p*	*Tangent V v-m*
400 kHz Average	1.22*	0.41	1.62	0.62
300 kHz Average	1.09*	0.40	1.49	0.65
300 kHz Band Pass Filter Average	1.09	0.40	1.49	0.65

* Based on the ability to find a structural significant flaw in noise with a Vp-p of greater than 2.0 volts, the criteria used at Prairie Island for this outage is 2.0 volts

b. What are the noise levels present in the U-bend region of low row tubes, including the apex and tangent point locations? Please provide average and

maximum values as well as a measure of the variability of the noise level about these averages.

The attached cumulative distribution plots **(only fax copies for 21 SG are available for the phone call)** show the average and spread in noise levels in Row 1 and Row 2 U-Bends at Prairie Island Unit 2. The population of noise levels at Prairie Island Unit 2 is equal to or less than the noise population in the EPRI data set in industry use for qualification of detection of degradation in low row U-Bends. Use of multiple probes and frequencies essentially limited the maximum noise level in each tube to less than (or equal to) the average noise level in the EPRI qualification data set. As discussed in 7a, the maximum peak to peak noise at 300khz and 400 khz was relaxed to 2 volts based on updated "must detect" signal requirements, noise phase angle studies and noise injection evaluations

c. What signal to noise ratio is necessary to ensure a flaw in the U-bend region of a low row tube will be reliably detected and how has this been determined?

Flaw detection is not just a simple matter of signal to noise ratio. The type of noise must be considered. High frequency random noise may obscure a flaw signal of equal or greater amplitude and in this case a 2 to 1 signal to noise ratio may be required for reliable flaw detection. The noise in Prairie Island U-Bends is low frequency cyclic noise that is very repeatable from one scan line to the next. It is primarily associated with tube ovality. Heat treatment increased noise levels somewhat but a comparison of pre and post heat treatment noise shows that the fundamental shape of the noise signals are unchanged. The amplitude of the low frequency noise signal was somewhat increased by heat treatment. In the case of flaw signals in the Prairie Island noise, a signal to noise ratio of 0.5 or less still remains detectable

d. Figure 5 of the licensee's letter dated February 28 indicates that for crack lengths of 0.8 and 1.5 inches, the "should detect" voltages are approximately 1.6 and 1.4 volts, respectively, with the plus point at 400 KHz (using the "measured burst pressures" curve). Assess the detectability of such hypothetical voltage responses for the range of noise levels present at the apex and tangent point locations of the low row u-bends at Prairie Island Unit 2.

Two methods were used to verify that the "must detect" flaw voltage was easily detected in the worst case low row U-Bend noise at PI2. The EPRI noise widget was used to increase the noise background to levels in excess of the worst tube at PI2. Setttings were adjusted to match PI2 noise characteristics and then the nosie amplitude was increased. The must detect flaw remained detectable beyond the noise level in the worst case tube. This approach was verified by adding a "must detect" flaw signal to the noise backgrounds of PI2 U-Bends. The must detect flaw was easily detected in the most severe noise present at PI2.