

# Prairie Island Unit 2 EOC 20 S/G Inspection Results

## Category C-3 Inspection Results Draft Report to NRC – February 12, 2002

- Steam Generators: Two Westinghouse Model 51 with open tubesheet crevices, Alloy 600 Tubing, Rows 1 and 2 U-bends were heat treated in May 2000.
- There are 1180 reroll repairs in service in Unit 2.
- Cycle 20 length – 603 days, 567 EFPD
- **NRC Item 1:** Primary to secondary leakage during operating cycle was less than 0.5 GPD based on tritium in the SG blowdown. There was no detectable gross activity in liquid SG blowdown samples and no detectable activity at the condenser air ejector discharge during the cycle.
- **NRC Item 2:** Secondary side hydrostatic tests for leakage have not been done since there was no detectable primary to secondary side leakage during the previous operating cycle.
- **NRC Item 3:** The inspection UNIT #2 STEAM GENERATOR INSPECTION PLAN completed is shown in detail on page 3. 100% of the hot leg tubesheet region and rows 1 and 2 u-bends were inspected with rotating coil technology. 100% of the tubing (less rows 1 and 2 u-bends) were inspected with the bobbin coil. No expansions were required.
- **NRC Item 13: New Degradation Mechanisms:** No new degradation mechanisms were found during this inspection. If such an indication is found, the Prairie Island steam generator program implementing procedures require initiation of a Condition Report that insures the new degradation mechanism evaluation will receive a high level of review and investigation.
- **NRC Item 8:** Four indications were tested in 21 SG and no leakage occurred. Four indications were be tested today in 22 SG. Details of the indications are shown on page 4.
- A post maintenance leak check at >100 psig secondary side pressure will be conducted at the end of the rerolling and welded tubesheet plug repairs.

❖ **NRC Item 5:**

- **Repair Criteria**
  - 40 % TWD (<sup>3</sup> 50% Old AVB and wear scar locations) for EPRI Appendix H qualified sizing techniques (cold leg tube support plate thinning and wear)
  - Any Axial, Circumferential, Volumetric (not related to a sizeable degradation or MBM) or Mixed Mode RPC indication
  - F-Star Criteria for Lower Region of Tubesheet with Rerolling and Tube End Indications
  - EF-Star Criteria for Upper Region of Tubesheet with Rerolling
  - Inadequate data quality in a critical area such as the u-bend
  - Voltage Based Repair Criteria is available, but not implemented, yet.
- **Projected Repairs**
  - Tubes are being repaired by rerolling (F\* and EF\* criteria) or plugged.
  - There are no sleeves in Unit 2.
  - Voltage Repair Criteria has not been implemented on Unit 2

<b>Indication or Repair</b>	<b>21 SG</b>	<b>22 SG</b>
AR1	288	164
AR2	17	5
ARE	4	1
F*0	130	108
F*1	696	390
F*2	30	31
plug	12	20
in situ	4	4

❖ **NRC Item 12: Schedule**

- **Inspection:** Started on February 5, 2002; Completed on February 11, 2002
- **Repairs:** Started on February 11; Expected completion is February 14, 2002
- **In Situ Tests:** Completed on 21 SG; In progress on 22 SG

# NRC Item 3 UNIT #2 STEAM GENERATOR INSPECTION PLAN

Rev. 1 - 10/19/2001

## VISUAL

Hot Leg     100% all Plugs for visual signs of leakage – After probed to remove H2O

Cold Leg    100% all plugs for visual signs of leakage – After probed to remove H2O

## BOBBIN

Hot Leg     100% rows 1 through 4     07H TEH     A-720-M/ULC/RF

Cold Leg    100% rows 1 and 2     07C TEC     A-700-SF/RM  
                  100% rows 3 through 4     07H TEC     A-700-SF/RM  
                  100% rows 5 through 46     TEH TEC     A-720-M/ULC/RF  
                  100% PID's ❶     Various     Various

## MRPC

Hot Leg     100% Tube sheets +3"     TSH TEH     +Point-720-115/PP11A/S80  
                  25% ABB I-690 plugs     UPH LPH     .600 PP11A MB  
                  100% Supplemental ❷     Various     +Point-720-115/PP11A/S80  
                  100% PID's ❶     Various     Various

Cold Leg    100% rows 1 and 2 (or HL)     07H 07C     .650 PP11A(MR) +Point  
                  Noisy rows 1 and 2 (or HL)     07H 07C     .650 PP9A(HF) +Point  
                  100% Supplemental ❷     Various     +Point-720-115/36/S80  
                  100% PID's ❶     Various     Various

## REPAIRS

Hot Leg     100% Re-Rolls     Various     Combo Probe  
                  100% Post In-Situ     Various     Various

Cold Leg    100% Post In-Situ     Various     Various

❶ PID =  $\geq 40\%$ , MAI, MCI, MVI, SAI, SCI, SVI, WCI and WVI.

❷ Supplemental MRPC = ADR, CUD, DEP, DNT  $\geq 5.0$  volts at  $\pm 0.5"$  from a TSP or TS (verify minimum 20% sample of entire DNT population), DRI, DSI, DTI, INR  $\geq 1.5$  volts @ TSP, MBM, MRI, NQI, PLP (Bound MRPC PLP's), PSI, Cold Leg Thinning  $\geq 40\%$  or  $< 40\%$  and  $\geq 1.5$  volts.

**Examination of U-Bends** -Mid Range Frequency and, as required, High Range Frequency +Point Coils, all Rows 1 and 2 U-bends, 20% Sample expansion to Row 3 if indications found in Row 2. (No expansion required)

**NRC Item 13 b) and c)** Noise criteria applied for plugging

Prairie Island Unit 2 In Situ Testing: February 2002

Insitu test list						
SG	leg	row	tube	Test Pressure	selection criteria	test results
21	hot	3	17	2816	PWSCC	sat
21	hot	9	18	2816	PWSCC	sat
21	hot	14	28	2816	ODSCC	sat
21	hot	23	31	2816	ODSCC	sat
22	hot	13	29	5256 2816	ODSCC PWSCC	pend
22	hot	2	31	2816	PWSCC	pend
22	hot	14	41	2816	ODSCC	pend
22	hot	19	47	2816 5256	ODSCC	pend

**NRC Item 4: Projected numbers of indications by location:  
Disposition is F\* and EF\* criteria using rerolling or by plugging**

**21 SG Indications by Location**

HL Tube End Axial Indications	62
HL Roll Transition Zone PWSSS Indications, PWSCC	291
Existing HL Additional Rerolls, PWSCC	30
HL Tubesheet Crevice region, Sec. Side IGA/SCC	1
HL Top of Tubesheet, Sec. Side IGA/SCC (axial and volumetric)	1
TSP DSI's	27
TSP Max DSI Voltage	1.46
TSP Indications RPC Confirmed	0
Free Span Unknown	0
Anti-vibration Bar Locations Wear	0
Row 1 U-Bends PWSCC	0
Row 2 U-Bends PWSCC	0
Peripheral Cold Leg Tube Support Plates Wastage	0
Possible Loose Parts	6
TSP Ligament Possible Indications	0
Inadequate Data Quality	1

**22 SG Indications by Location**

HL Tube End Axial Indications	44
HL Roll Transition Zone PWSSS Indications, PWSCC	165
Existing HL Additional Rerolls, PWSCC	11
HL Tubesheet Crevice region, Sec. Side IGA/SCC	5
HL Top of Tubesheet, Sec. Side IGA/SCC (axial and volumetric)	1
TSP DSI's	52
TSP Max DSI Voltage	1.3
TSP Indications RPC Confirmed	0
Free Span Unknown	0
Anti-vibration Bar Locations Wear	0
Row 1 U-Bends PWSCC	0
Row 2 U-Bends PWSCC	0
Peripheral Cold Leg Tube Support Plates Wastage	0
Possible Loose Parts	15
TSP Ligament Possible Indications	2

## **Response to NRC IN 2002-02 (TMI Severed Plugged Tube)**

### **• Planned Inspection**

- Routine: Neighbors to explosively plugged tubes evaluated by Independent QDA for detection of shallow long wear scars. Implemented by procedure and condition monitoring
- Visual examination at top of tubesheet during FOSAR after sludge lancing. Most of the plugged tubes are on the outer periphery.

## **Secondary Side Inspection Plan**

### **• Visual Inspections for Internals Integrity previously done per GL 96-06**

#### **• Standard Inspections in one steam generator each outage**

- Visual inspection of feed ring holes and plugs
- MT inspection of inner radius of feedwater nozzle elbow
- Visual inspection of inner radius of upper shell transition weld
- Visual inspection of feedwater ring hangers
- Visual inspection for cleanliness of drain pots from Chevron separators
- UT inspection for wall thinning of feedwater ring tee

#### **• Analysis of ET data for support plate damage**

- Computerized Data Screening to look at all tubes for significant ligament cracks
- Examine all possible support plate ligament indications from the bobbin results with RPC.

#### **• Foreign Object Search and Retrieval at Tubesheet**

- Possible loose parts identified by eddy current were investigated by remote visual inspection. Small parts removed.
- No indication of wear at locations of possible loose parts
- No eddy current indications of unexpected wear anywhere in the tube bundle