

## ANO-1 STEAM GENERATOR TUBE INSPECTION DISCUSSION POINTS

May 10, 2013

The following discussion points have been prepared to facilitate the conference call arranged with the licensee to discuss the results of the steam generator tube inspections conducted during the upcoming spring 2013, Unit 1 refueling outage (1R24). This conference call is scheduled to occur towards the end of the planned SG tube inspections, but before the unit completes the inspections and repairs.

The NRC staff plans to document a summary of the conference call as well as any material that is provided in support of the call.

**1. Discuss any trends in the amount of primary-to-secondary leakage observed during the recently completed cycle.**

No indication of primary-to-secondary leakage present prior to the current refueling outage (1R24). (Less than 1 gpd)

**2. Discuss whether any secondary side pressure tests were performed during the outage and the associated results.**

No secondary side pressure tests have been performed or scheduled for 1R24.

**3. Discuss any exceptions taken to the industry guidelines.**

No exceptions were taken to NEI 97-06 and EPRI Steam Generator Guidelines.

**4. For each steam generator, provide a description of the inspections performed including the areas examined and the probes used (e.g., dents/dings, sleeves, expansion-transition, U-bends with a rotating probe), the scope of the inspection (e.g., 100% of dents/dings greater than 5 volts and a 20% sample between 2 and 5 volts), and the expansion criteria.**

ANO-1R24 Tube Inspection Scope and Expansion Requirements

UTE – Upper Tube End

LTE – Lower Tube End

TTW – Tube-to-tube Wear

PRX – Prior Proximity Signal

**5.2.1 Eddy Current Bobbin Probe Examinations (Both SGs)**

All 1 tube deep periphery tubes from 09S to UTE

- 454 tubes in SG A
- 446 tubes in SG B

### 5.2.2 Eddy Current Array Probe (X-probe) Examinations (Both SGs)

1. All in-service tubes bounding each tie rod location, full length (UTE to LTE)
  - 304 tubes in SG A (includes 17 proximity tubes)
  - 308 tubes in SG B (includes 14 proximity tubes)
2. All in-service tubes with tube-to-tube (TTW), full length (UTE to LTE)
  - 48 tubes in SG A
  - 74 tubes in SG B
3. All in-service tubes with prior proximity signals (PRX), full length (UTE to LTE)
  - 51 tubes in SG A
  - 17 tubes in SG B

### 5.2.4 Primary Side Visual Inspections (Both SGs)

All plugs in the inlet and outlet channel heads (currently installed and new in 1R24) will be visually inspected to verify tube plug locations, potential leaking plugs and possible degradation.

### 5.2.5 Secondary Side Visual Inspections

There are no secondary side visual inspections planned for 1R24

### 5.2.6 Potential Additional Inspections

A frequency test will be performed on a sample of tubes in SGB to evaluate the extent of compression in the tubes.

- Sample of approximately 39 tubes,
- Each tube will be go through pre and post test ECT inspection to ensure no degradation was introduced during the test
- Tubes will be tracked in a test plan which outlines the procedures used for testing

The Frequency Test was not performed. The test was attempted but the frequency probe became stuck when insertion was attempted. This was entered into the Entergy Corrective Action Program as CR-ANO-1-2013-01260. The probe was successfully removed and the tube was re-examined resulting in no adverse indications.

## Expansion Criteria

There are three possible expansions.

1. The first is associated with tie rod bowing. If the extent of the bowing has increased, additional tubes will need to be inspected to bound the condition.

Tied rod bowing is consistent with the projections prepared. Some additional tubes were examined.

2. The second possible expansion would be associated with loose part damage or identification of parts. This would require either secondary side visual inspections or possibly a periphery Array probe testing of the lower tube sheet from -2 to + 3.

There were no loose parts identified. No expansion

3. The third possible expansion is related to the tube to tube wear (TTW) indications. If measured indications have both growth rates greater than those used in the prior CMOA (4.07 %TW/EFPY)] and exceed the EOC 26 structural limit of 58.3% then increase expansion to 100% of in-service tubes.

TTW indications - No scope expansion was required.

One tube, SG B Row 25 Tube 72, exhibited multiple TTW indication, surrounding tubes were examined to confirm there were corresponding TTW on the adjacent tubing.

5. **For each area examined (e.g., tube supports, dent/dings, sleeves, etc), provide a summary of the number of indications identified to-date for each degradation mode (e.g., number of circumferential primary water stress corrosion cracking indications at the expansion transition). For the most significant indications in each area, provide an estimate of the severity of the indication (e.g., provide the voltage, depth, and length of the indication). In particular, address whether tube integrity (structural and accident induced leakage integrity) was maintained during the previous operating cycle. In addition, discuss whether any location exhibited a degradation mode that had not previously been observed at this location at this unit (e.g., observed circumferential primary water stress corrosion cracking at the expansion transition for the first time at this unit).**

Responses are broken out into three segments.

**For each area examined (e.g., tube supports, dent/dings, sleeves, etc), provide a summary of the number of indications identified to-date for each degradation mode (e.g., number of circumferential primary water stress corrosion cracking indications at the expansion transition).**

Exams were conducted full-length surrounding tie rods and 9S-UTE in the periphery.

The only degradation identified was wear at TSPs and wear due to tube-to-tube contact.

	SG A	SG B
TSP Wear	161	356
Tube-to-tube Wear	55	93

No crack-like or corrosion-related degradation was detected

**For the most significant indications in each area, provide an estimate of the severity of the indication (e.g., provide the voltage, depth, and length of the indication). In particular, address whether tube integrity (structural and accident induced leakage integrity) was maintained during the previous operating cycle.**

TSP Wear:

SG A					SG B			
Voltage	%TWD	Elevation	Length		Voltage	%TWD	Elevation	Length
0.73	26	10S	Bounded by TSP thickness (1.18")		1.18	35	11S	Bounded by TSP thickness (1.18")
0.55	24	10S			1	32	10S	
0.52	23	12S			1	32	11S	
0.44	20	10S			0.93	30	11S	
0.43	19	13S			0.91	30	10S	

Tube-to-Tube Wear:

SG A					SG B			
Voltage	%TWD	Elevation	Length		Voltage	%TWD	Elevation	Length
1.31	14	08S	19.13		2.75	22	07S	20.28
1.22	13	08S	19.06		2.57	21	07S	20.15
1.28	13	08S	18.26		2.18	19	08S	18.93
1.2	13	08S	18.32		1.8	17	08S	19.01
1.1	12	07S	19.15		1.36	14	07S	19.9

Comparing flaw sizes to CM limits demonstrated that structural and accident-induced leakage integrity was maintained during the previous operating cycle.

Although not defined as a degradation mode. This inspection was targeted at Tie Rod bowing. The following indication counts were identified in each SG

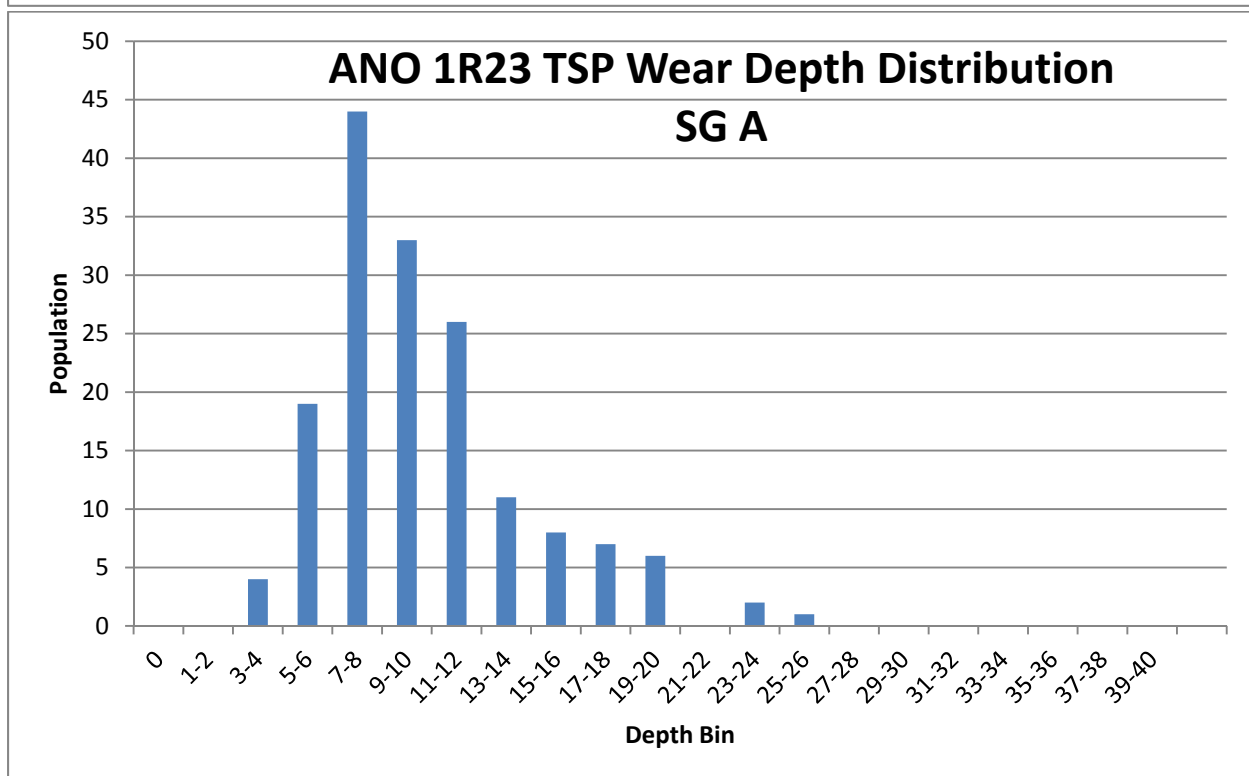
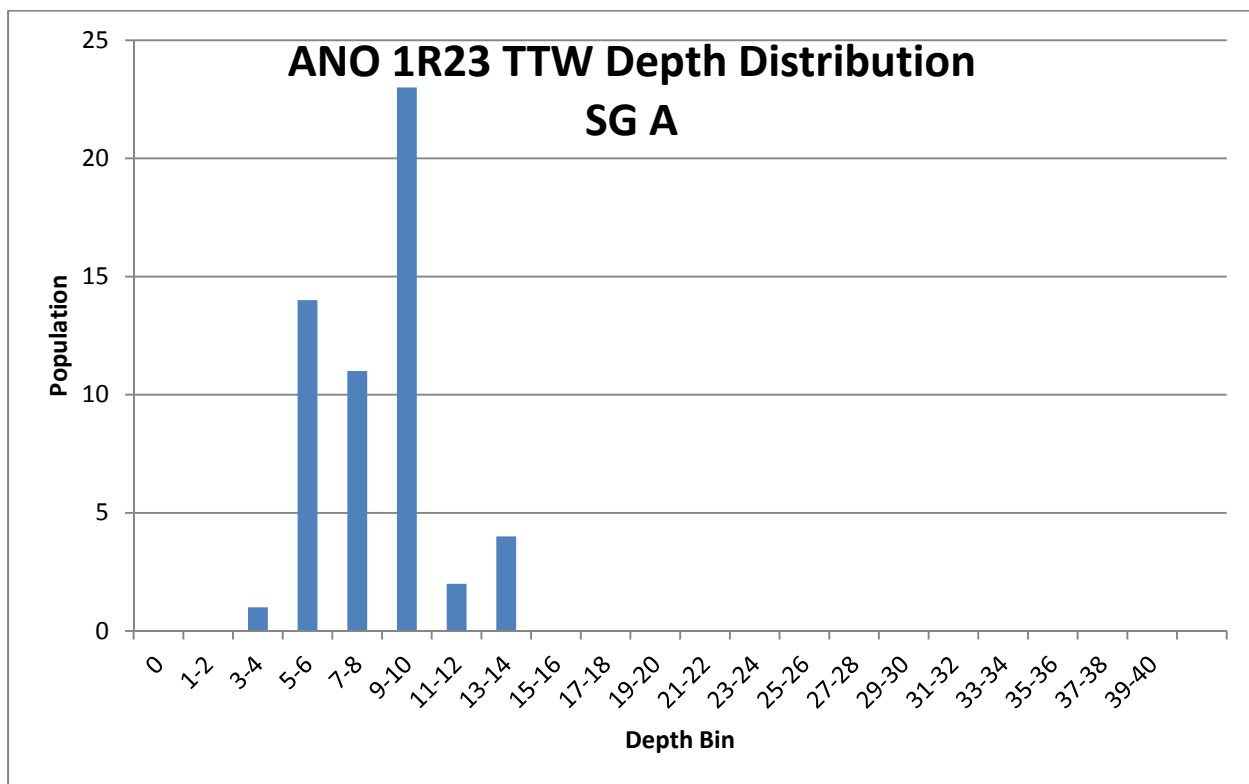
	SG A	SG B
PTB (prox. to tube and tie rod)	11	5
PTU (prox. to tube)	30	9
PTR (prox. to tie rod)	35	17

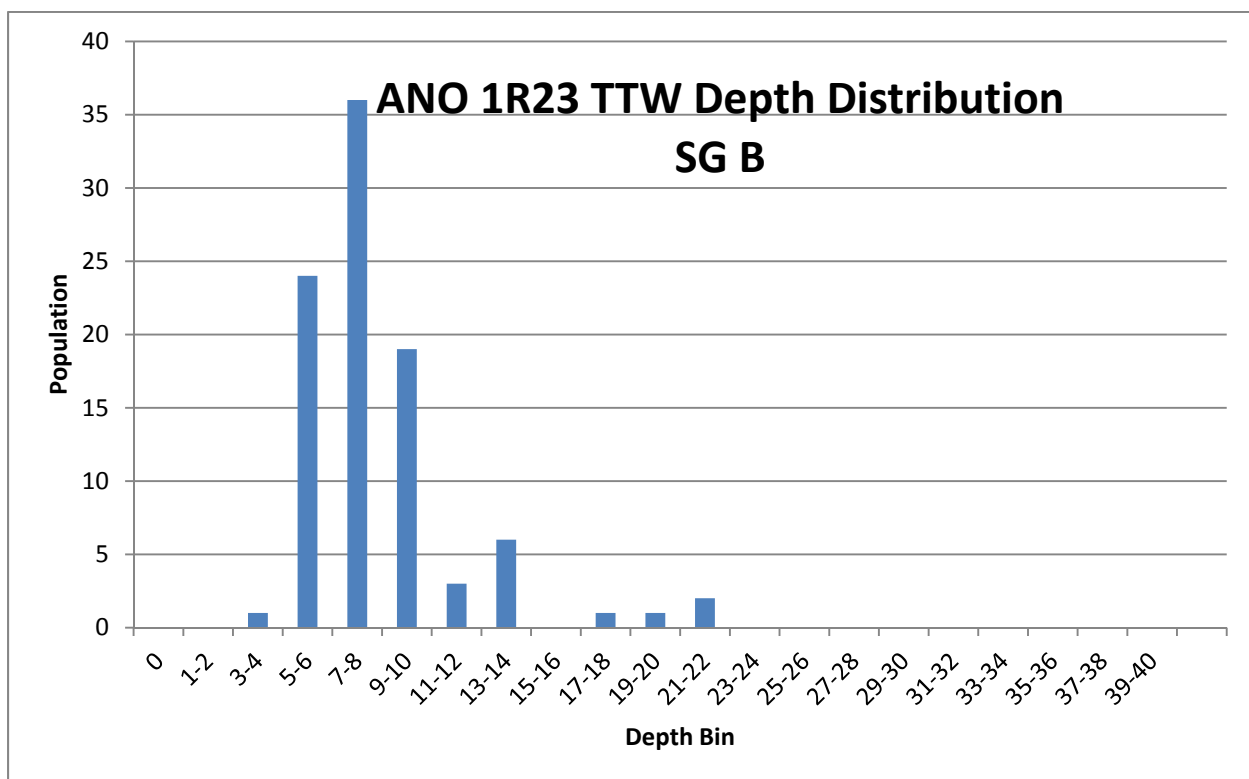
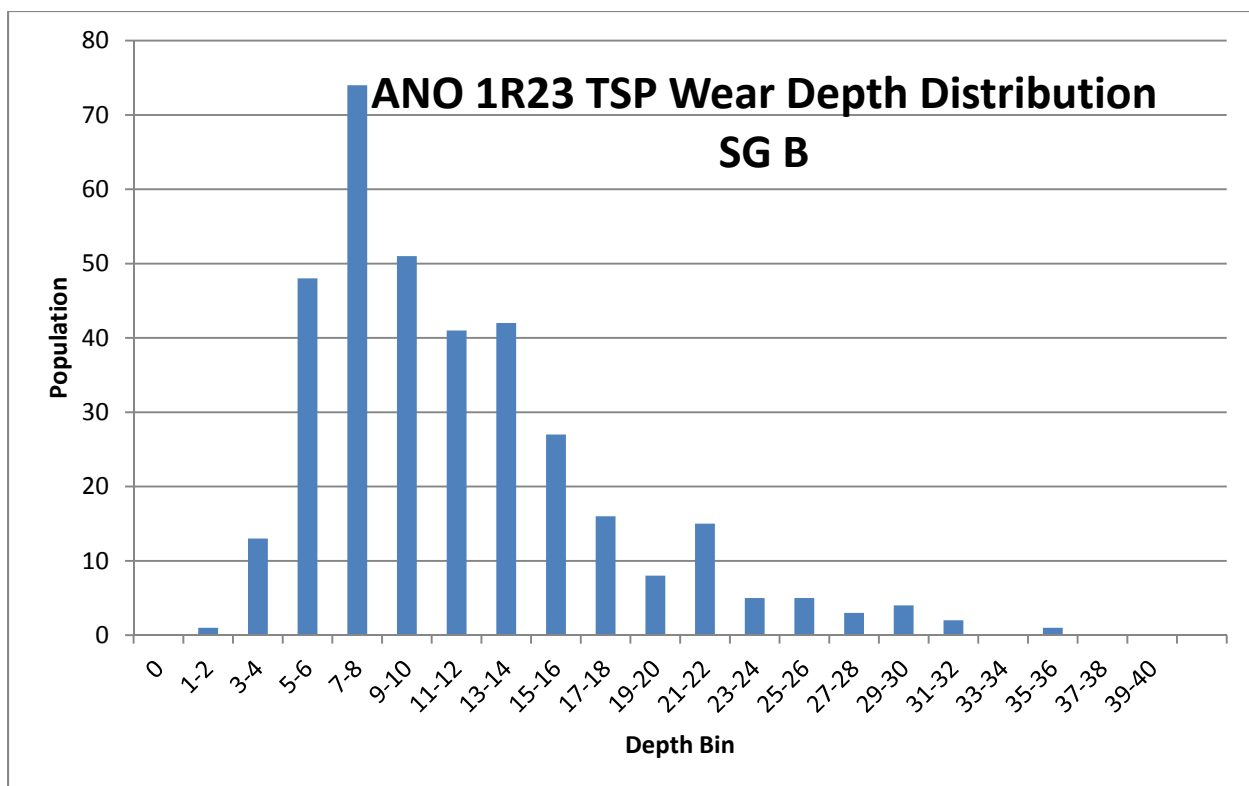
See Attachments for Tie Rod Extents and Tubesheet Maps

**In addition, discuss whether any location exhibited a degradation mode that had not previously been observed at this location at this unit (e.g., observed circumferential primary water stress corrosion cracking at the expansion transition for the first time at this unit).**

Tube-to-tube wear was not identified during the last in-service inspection of the ANO-1 OTSGs (1R23). However, after the 1R23 inspection in the fall of 2011, tube-to-tube wear was identified at TMI-1. With this knowledge, ANO 1R23 data were reviewed and tube-to-tube wear was identified going back multiple cycles and entered into the inspection results after the fact. Thus, although tube-to-tube wear was not previously identified during an in-service inspection, tube-to-tube wear was known to exist in the ANO 1 SGs prior to conducting this inspection.

No other mode of degradation was newly-observed in the ANO-1 steam generators.





**6. Describe repair/plugging plans.**

Preventive Plugging and stabilization was performed in SG A.  
A total of seven tubes were plugged and Stabilized Full Length associated with Tie Rod Bowing.

Preventive Plugging and stabilization was performed in SG B.  
A total of nine tubes were plugged and Stabilized Full Length.  
One for tube support plant wear.  
Eight for Tie Rod Bowing.

The stabilizers installed (except for 2) do not currently meet all of the ANO Specification Design Requirements. This was entered into the Entergy Corrective Action Program as CR-ANO-1-2013-01335.

**7. Describe in-situ pressure test and tube pull plans and results (as applicable and if available).**

None - No indications exceeded screening criteria have been identified to date.

**8. Discuss the following regarding loose parts:**

**what inspections are performed to detect loose parts**

None / Bowl visual on primary

**a description of any loose parts detected and their location within the SG  
(including the source or nature of the loose part, if known)**

None

**if the loose parts were removed from the SG**

None

**indications of tube damage associated with the loose parts**

None

**9. Discuss the scope and results of any secondary side inspection and maintenance activities (e.g., in-bundle visual inspections, feeding inspections, sludge lancing, assessing deposit loading, etc).**

During 1R24 there were no secondary side inspection activities planned or conducted.



**10. Discuss any unexpected or unusual results.**

A single tube in SG B, Row 31 Tube 1, experienced wear from 13% during 1R23 to 30% at 1R24. This location was plugged and stabilized preventively. Additionally, the condition was evaluated by the Integrity Engineers at AREVA.

**11. Provide the schedule for steam generator-related activities during the remainder of the current outage.**

5/7 – Complete SG B Examinations.

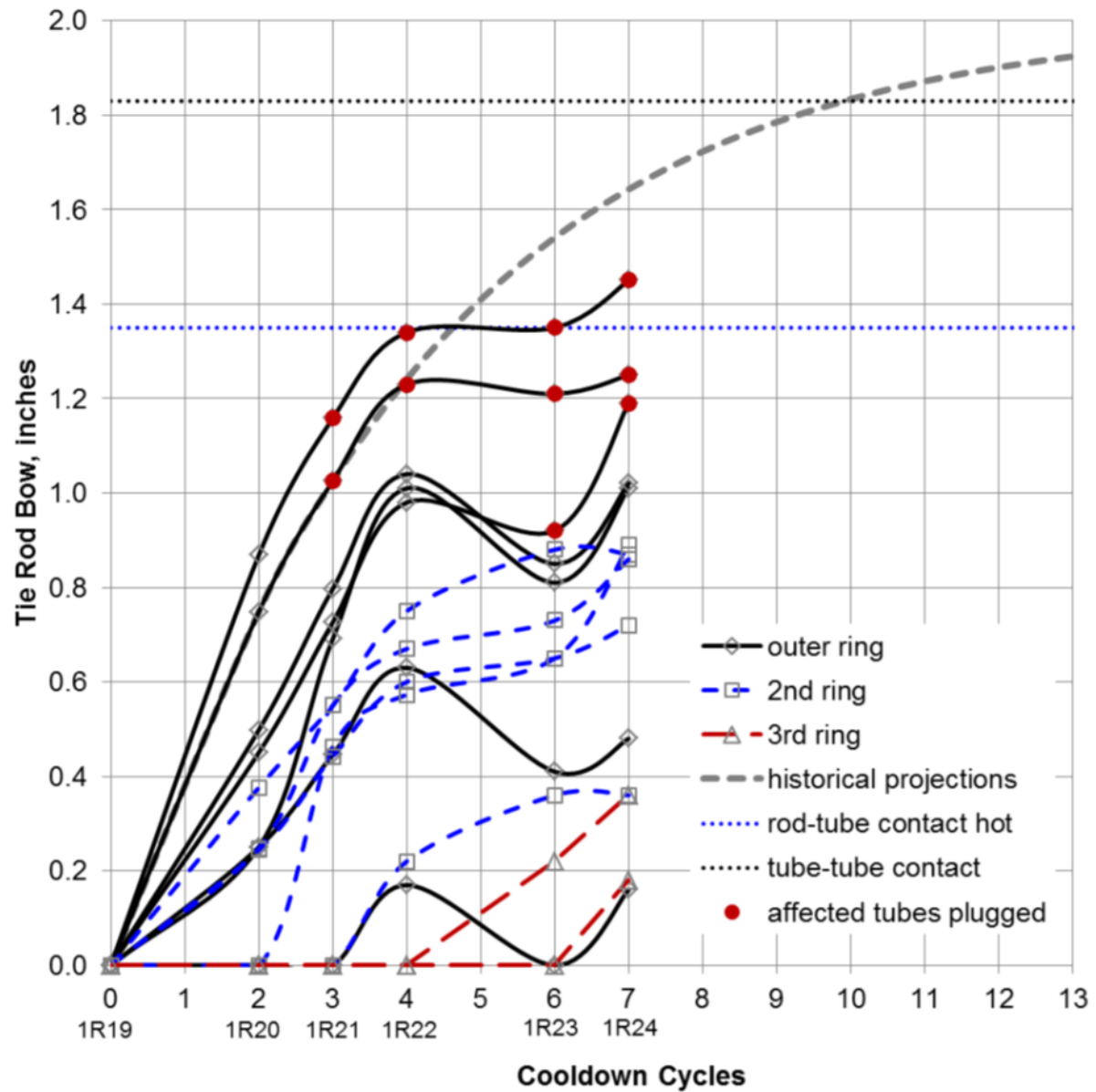
5/8 – Commence Repairs

5/10 – Bowl Close Out SG A / SG B

5/11 – Equipment Off Load

## ATTACHMENTS

# **SG A - First Span Tie Rod Bow Projections (14 tie rods, 1 span, 3 rings)**



### SG B - First Span Tie Rod Bow Projections (8 tie rods, 1 span, 2 rings)

