AmerGen/NRC Phone Conference - October 22, 2001
TMI Unit 1 Outage 1R14 Steam Generator Inspections
Discussion Points

1. **Discuss whether any primary to secondary leakage existed in this unit prior to shutdown.**

   No significant leakage.

2. **Discuss the results of secondary side hydrostatic tests.**

   N/A

3. **For each steam generator, provide a general description of areas examined, including the expansion criteria utilized and type of probe used in each area.**

Region	Scope	Technique	Expansion
Unexpanded Tubing	100% of In-service Tubes	Bobbin	N/A
Kinetic Expansions	~5100 Tubes in OTSG-A and ~5900 Tubes in OTSG-B	MRPC	Required if leakage in excess of FSAR or >1% of the tubes fail structurally. Not required based on data to date
Installed Sleeves	33% of the installed sleeves	Bobbin and Low frequency +point	No detected damage to date
Sleeve Border	One tube border around the installed sleeves (15th TSP and UTS secondary face)	MRPC	No detected damage to date
Lower Tubesheet Crevice	33% of the defined LTS kidney region	MRPC	No detected damage to date
Installed Plugs	33% of Westinghouse upper head I-600 thermally treated plugs, 33% of lower tubesheet explosive plugs, and two I-600 upper head B&W rolled plugs.	MRPC	No detected damage to date
Special Interest	• Bobbin "I", IDC, PLP, PVN, TSD, and TSM codes, 540" bobbin %TW, and BVC indications • All dents at UTS secondary face • 33% of dents above LTS up to UTS • All dents >16 volts in the LTS outside the kidney region • Degraded ID IGA below the kinetic expansion	MRPC	No degradation at dents detected to date. 100% of all other areas are scheduled for examination.

4. **For analyzed eddy current results, describe bobbin indications (those not examined with rotating pancake coil (RPC)) and RPC/Pluss Point/Cecco indications. Include the following information in the discussion: location, number, degradation mode, disposition, and voltages/depths/lengths of significant indications.**

See special interest table from discussion item No. 3 for bobbin coil indications examined with MRPC.

TSP wear indications that were dispositioned as wear with MRPC during the previous outage and were unchanged with the bobbin coil technique were not MRPC examined during the current outage. Other bobbin coil indications are examined with MRPC.

Two upper span groove IGA tubes, axial indications at the 12th TSP of one tube, and one short circumferential indication 0.25" above the UTS secondary face (UTS crevice).

Groove IGA	B 98-1	Five bobbin 0.11 volt to 0.24 volt NQIs – 0.16" to 0.43" long and 36% to 61% TW located between the 15th TSP and UTS – 6 indications
	B 119-2	One 0.44 volt NQI Two indications 0.35" and 0.74" long 38% and 40% TW located between 13th and 14th TSP
	B 133-1	One NQI indication 0.17 volts (bobbin) Two MRPC axial indications 88% TW 0.37" and 0.44" long at 12th TSP
	B 80-31	1.01 volt distorted UTS signal – 90% TW SCI indication 0.26" long 0.25" above UTS secondary face.

Significant Indications (All in the "B" OTSG):

Indication	Row	Tube	Location	Volts*	Length	Estimated Depth
SCI	80	31	UTS+0.26	12.50	0.26"	90%
SAI	98	1	UTS-7.05	0.10	0.43"	44% Longest In Tube
[illegible]I	98	1	UTS-6.19	0.09	0.39"	61% Deepest In Tube
SAI	98	1	UTS-4.16	0.17	0.32"	36% Largest Voltage in Tube
SAI	119	2	14S-4.55	0.21	0.74"	40%
SAI	119	2	14S-5.37	0.29	0.35"	38%

*Voltage is based on MRPC volts with 100% TW notch set to 20 volts.

5. **Describe repair/plugging plans for the SG tubes that meet the repair/plugging criteria.**

No Reroll or Sleeving planned.
All tubes meeting the repair criteria will be plugged.

6. **Discuss the previous history of SG tube inspection results, including any "look backs" performed.**

No growth of ID IGA indications. See attached scatter plot "Growth of ID VOLs below ETL." Preliminary results for growth of ID IGA below the kinetic expansion pass the sign test and the paired t-test.

Look backs
Groove IGA indications were not present in 1999.

7. **Discuss, in general, the new inspection findings.**

   See attached presentation slides.

8. **Describe in-situ pressure test plans and results, if applicable and available, including tube selection criteria.**

   1. EPRI Guidelines for selection of in-situ test candidates will be followed.
   2. Additional ID IGA indications will be tested to satisfy the requirements of the ID IGA Program.
   3. Additional indications which don't meet the EPRI screening criteria may be tested if they are not bounded by previous in-situ test at TMI Unit 1.
   4. Two tubes with damage from the severed tube will be in-situ pressure tested.
   5. Other indications of groove IGA and circumferential IGSCC will also be tested.

9. **Describe tube pull plans and preliminary results, if applicable and available, include tube selection criteria.**

   See attached presentation slides.

10. **Discuss the assessment of tube integrity for the previous operating cycle.**

    To date, there has been no degradation, outside of the severed tube damage that challenges the structural integrity.

11. **Discuss the assessment of tube integrity for the next operating cycle.**

    To be discussed.

12. **Provide the schedule for [illegible] generator-related activities during the remainder of the current outage.**

    To be discussed

13. **Discuss what steps have been taken, or will be taken, in response to the lessons learned from the Indian Point Unit 2 tube failure. In addition, please be prepared to discuss the following:**

    a. **Discuss the actions that are taken in response to identifying a new degradation mechanism.**

       See attached presentation slides.

    b. **Discuss the actions taken to ensure that data noise levels are acceptable, and**

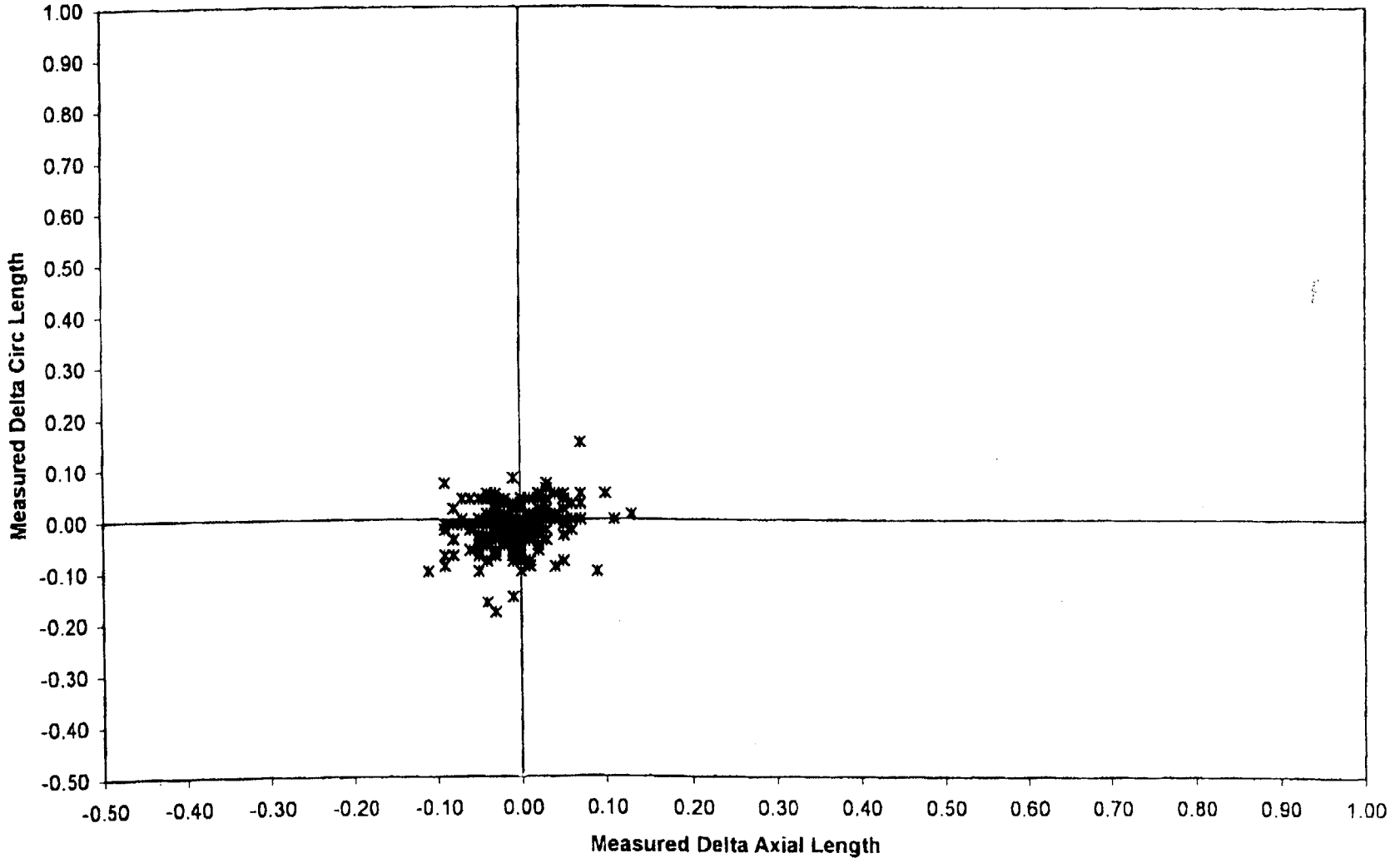
       Outage T1R13 in-steam generator background noise measurements were compared to the applicable Appendix H (ETTS) qualification background noise measurements. These measurements were performed in the LTS crevice, the freespan, above top of tubesheet, at TSP locations, and in the UTS crevice. A total of 1400 in-generator measurements and 415 qualification measurements were used in the evaluation. The ETSS and in-generator background vertical max and peak to peak measurement average and peak values were plotted to compare the qualification data against the

in-generator data. This evaluation determined that the qualification performed is applicable to the TMI Unit 1 OTSGs in all areas based on noise level measurements.

c. **Address data quality issues and the need for criteria to address data quality.**

The data analysis guidelines provide information to judge data quality on both a qualitative and quantitative basis. The quantitative measurements are based on EPRI Examination Guidelines DRAFT guidance. Any data spiking that may have been present was evaluated for frequency and voltage. Undesirable tube noise, such as ID chatter, that could interfere with the examination was reported for evaluation and alternate examination techniques. Adequate digitization rate was monitored using the analysis software monitoring tools for digitization rate monitoring. Signal to noise ratio in the calibration standard was evaluated using software for measuring signal to noise ratio.

Growth of ID VOLs Below ETL
TMI-1 Both SGs



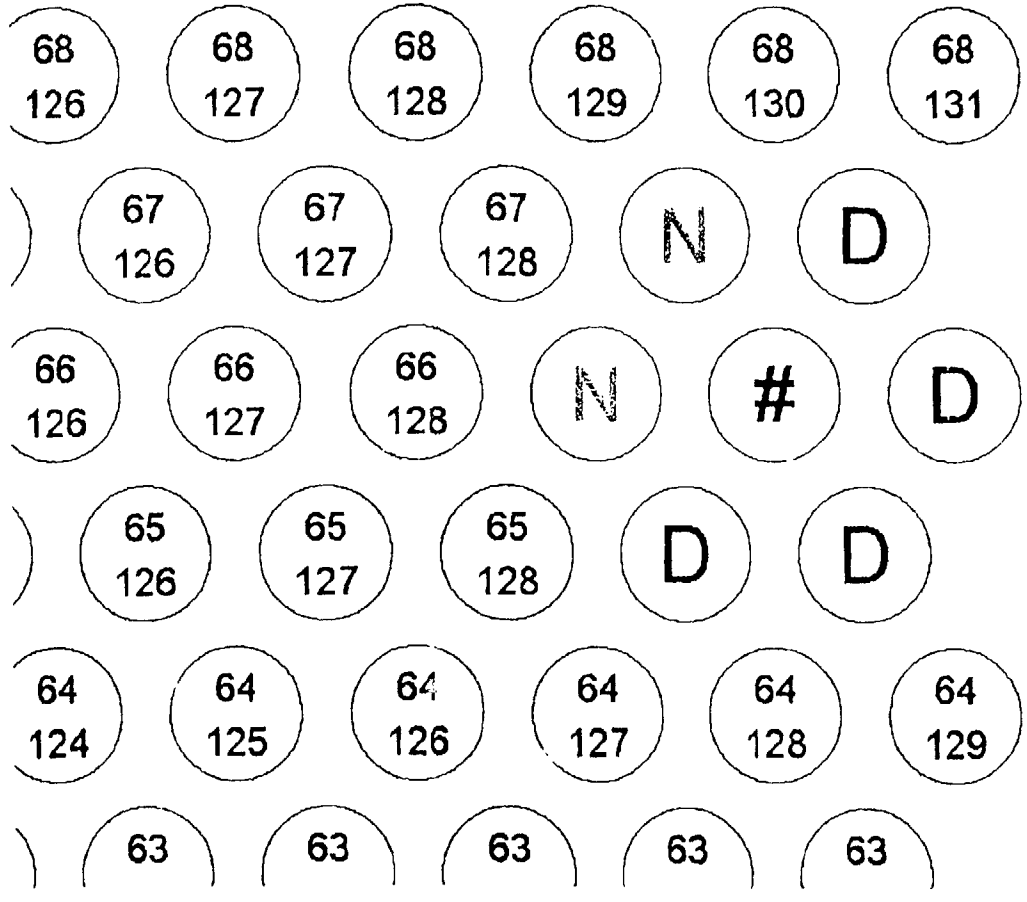
TMI Tube R66-T130 SG B Update

10/22/01

Background

- Bobbin inspection identified 4 tubes with OD wear at secondary face of upper tube sheet, confirmed through Plus Point
- Based on pattern of wear suspected plugged tube R66-T130 (see drwg next page)
- Tube R66-T130
  - Plugged in 1986 (1R5) due to ID/IGA near 5th TSP
  - No degradation identified at UTS based on bobbin and 8x1 probe
  - UTS I-600 plug was replaced in 1997 (1R12)

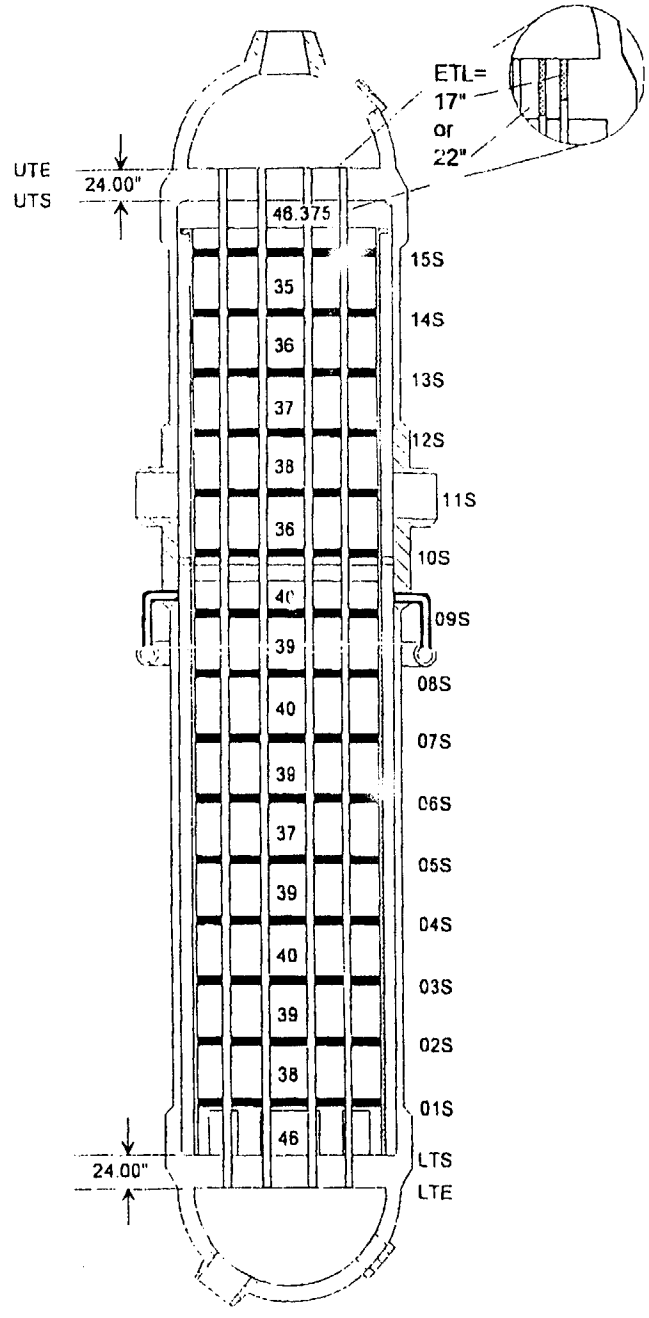
SG B Tubes Affected by R66-T130 Failure



D = Defect found

N = No Defect Found

= Plugged tube severed


ETL=
17"
or
22"
UTE
UTS
24.00"
46.375
35
36
37
38
36
40
39
40
39
37
39
40
39
38
46
24.00"
15S
14S
13S
12S
11S
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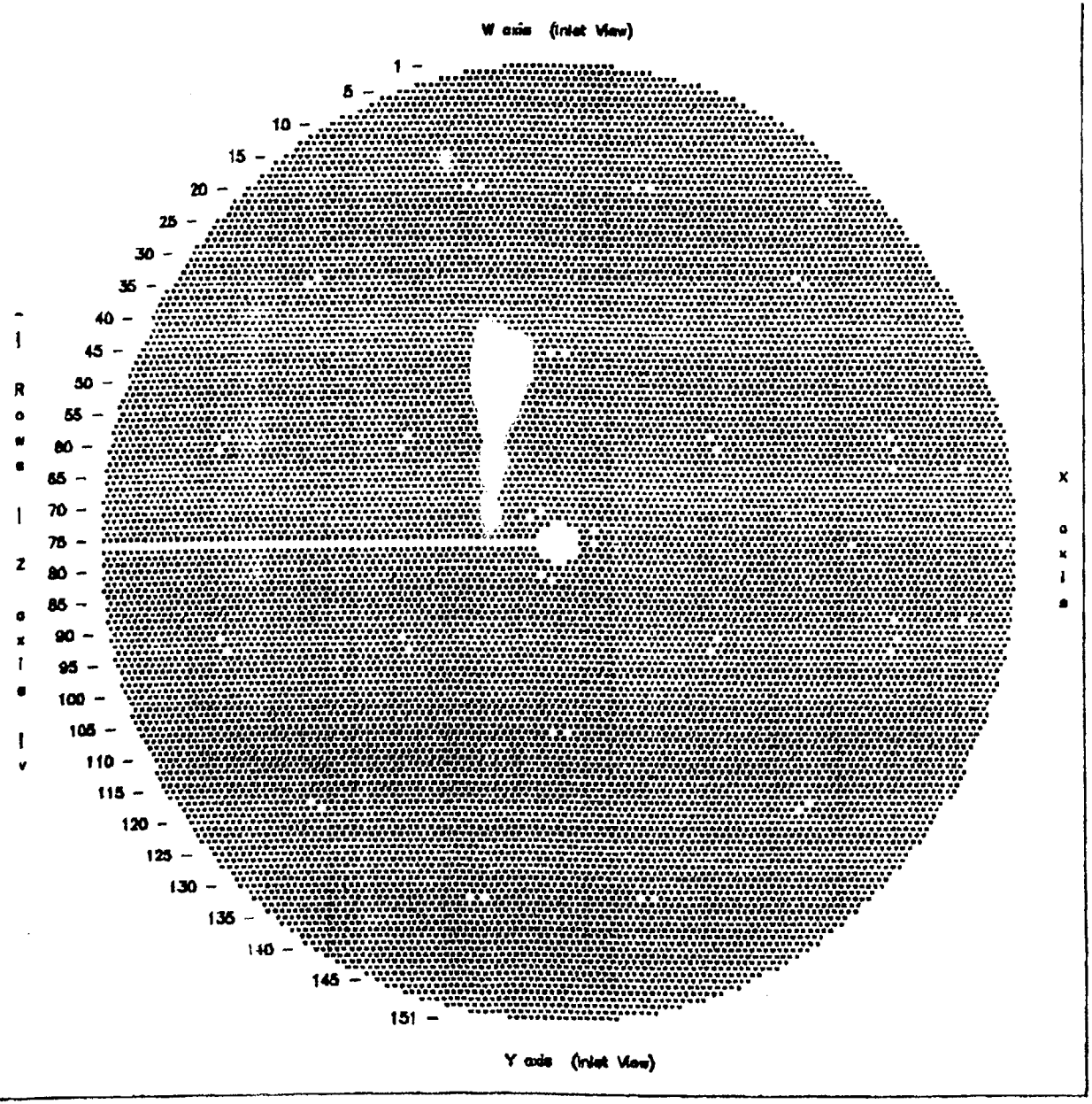
09S
08S
07S
06S
05S
04S
03S
02S
01S
LTS
LTE

OTSG Tube Sheet Map



Video Inspection

- R66-T130 UTS plug removed for video inspection
- Video inspection verified tube severed at secondary face of upper tube sheet

Tube Wear Indications

- Structural Requirements
  - 3 x Dp = 3915 psi

- R65-T129
  - Deepest area 37% TW
  - Average depth 30% TW
  - Overall length ~ 2”
  - Calculated burst pressure

    90/50% 6000 psi

Tube Wear Indications

- R66-T131
  - Deepest area 62% TW
  - Average depth 25% TW
  - Overall length ~ 8.5”
  - Calculated burst pressure
    90/50% 4000 psi
- R67-T130
  - Deepest area 41% TW
  - Average depth 24% TW
  - Overall length ~ 4.6”
  - Calculated burst pressure
    90/50% 5500 psi

Tube Wear Indications

- R65-T130
  - Deepest area 92% TW
  - Average depth 35% TW
  - Overall length ~ 4.6”
  - Calculated burst pressure
    - 90/50% 1800 psi

Future Actions

- In-Situ Pressure Testing
  - R66-T131
  - R67-T130

- Tube Pull
  - R66-T130 (Severed Tube)
  - R66-T131 (Remove for Access)
  - R65-T130 (Largest Indication)

Additional Inspections

- Scheduled I-600 plug removal in SG A allowed eddy current inspection of 26 tubes with Plus Point
  - Tubes in outer periphery "High Velocity Region"
  - Area UTS + - 2"
- Results
  - Minor volumetric ID/IGA
  - Results show no degradation in area which requires stabilization

Summary

- 100% bobbin of in-service tubes shows no other signs of similar condition
- Additional eddy current of unplugged tubes shows no similar condition
- In-Situ pressure testing to verify structural integrity of two tubes
- Tube Pull results will determine root cause and any further actions
- Current Tech Spec P to S leakage limit of 144 gpd coupled with EPRI P to S Leakage Guidelines ensure early shutdown

TMI-1 OTSG B SUMMARIZED RESULTS OF IN-SITU PRESSURE AND LEAK TEST
Refueling Outage 1R14

TUBE AND EDDY CURRENT INFORMATION														IN-SITU TEST RESULTS				
REGION	TUBE INFORMATION			PLUS POINT DATA					BOBBIN DATA			DEGRADATION MECHANISM	GPM @ NOP	GPM @ MSLB	GPM @ 3NODP	MAXIMUM PRESSURE	EXP (Inch)
	ROW	COL	LOCATION	AX LEN	CI LEN	VOLTS	EST %	ORIENTATION	IND	VOLTS	EST %						
Upper TS	80	58	ETL -0.27	0.36	0.24	1.08		ID Volumetric	NDD			ID IGA/SCC	0	0	0	4400	17
			ETL -0.36	0.30	0.19	0.95			NDD				0	0	0	4400	
			ETL -0.36	0.30	0.19	0.82			NDD				0	0	0	4400	
			ETL -0.51	0.36	0.29	0.83			NDD				0	0	0	4400	
Freespan	143	43	06S +6.04	0.11	0.10	0.29		ID Volumetric	NDD			ID IGA/SCC	0	0	0	4400	17
			08S +18.77	0.11	0.10	0.16			NDD				0	0	0	4400	
			08S +21.45	0.16	0.10	1.02			NDD				0	0	0	4400	
			08S +14.76	0.11	0.15	0.17			NDD				0	0	0	4400	
			09S -13.23	0.16	0.10	0.13			BVC	0.25			0	0	0	4400	
			09S -7.23	0.16	0.15	0.13			BVC	0.31			0	0	0	4400	
			09S +1.74	0.10	0.15	0.20			NDD				0	0	0	4400	
			10S +7.91	0.14	0.12	0.36			BVC	0.39			0	0	0	4400	
			11S -11.92	0.10	0.10	0.28			BVC	0.32			0	0	0	4400	
			11S -8.47	0.16	0.15	0.23			NDD				0	0	0	4400	
Freespan	98	1	UTS -7.05	0.43		0.10	44	OD Axial	NQI	0.11		Groove IGA	0	0	0	4400	17
			UTS -8.19	0.39		0.09	61		NDD				0	0	0	4400	
			UTS -5.73	0.34		0.10	49		NQI	0.24			0	0	0	4400	
			UTS -4.82	0.18		0.13	52		NQI	0.21			0	0	0	4400	
			UTS -4.68	0.21		0.15	51		NQI	0.17			0	0	0	4400	
			UTS -4.16	0.32		0.17	36		NDD				0	0	0	4400	
Freespan	86	131	15S +45.55	8.30	0.43	4.87	62	OD Volumetric	NQI	0.65		Mechanical Wear Damage	0	0	3.2	4360	17
	67	130	15S +44.85	6.51	0.38	3.69	41		NQI	0.63			0	0	0	4350	17
Freespan	119	2	14S -5.37	0.35		0.29	38	OD Axial	NDD			Groove IGA	0	0	0	4400	17
			14S -4.55	0.74		0.21	40		NQI	0.44			0	0	0	4400	
Freespan	80	31	UTS +0.26		0.26	12.50	90	OD Circ.	NQI	1.01		OD IGA/SCC	0	0	0	4350	17
Freespan	44	75	15S +1.32	0.21	0.15	0.32		ID Volumetric	BVC	0.31		ID IGA/SCC	0	0	0	4400	17
			15S -2.59	0.16	0.15	0.17			BVC	0.35			0	0	0	4400	
			15S -9.71	0.16	0.15	0.40			IDI	0.44	[illegible]		0	0	0	4400	
			15S -14.07	0.16	0.15	0.41			NDD					0		4400	
			14S [illegible]	0.16	0.15	0.32			IDI	0.46	23		[illegible]	0	0	4400	
			14S +16.12	0.10	0.14	0.30			BVC	0.38			0	0	0	4400	
			14S +9.43	0.16	0.15	0.24			IDI	0.47	27		0	0	0	4400	
			14S +5.84	0.16	0.15	0.14			BVC	0.29			0	0	0	4400	
			14S -13.47	0.16	0.15	0.21			BVC	0.37			0	0	0	4400	
			13S +17.34	0.16	0.15	0.26			NDD				0	0	0	4400	
			13S +12.36	0.16	0.15	0.29			BVC	0.37			0	0	0	4400	
			13S +9.00	0.16	0.13	0.21			IDI	0.35	30		0	0	0	4400	
			13S -18.12	0.16	0.20	0.33			IDI	0.42	27		0	0	0	4400	
			12S +12.45	0.16	0.15	0.24			NDD				0	0	0	4400	
			09S +10.59	0.16	0.15	0.15			NDD				0	0	0	4400	
Upper TS	149	1	ETL +0.00		0.28	0.88	81	ID Circ	NDD			ID IGA/SCC					17
			ETL -1.01	0.17	0.13	0.15		ID Volumetric	NDD			ID IGA/SCC					
Freespan	65	129	UTS -0.60	2.75	0.33	1.24	38	OD Volumetric	NQI	0.55	82	Mechanical Wear Damage	0	0	0	4350	17

Note: Tube 80-31 was tested with axial pull