# TMI T1R21 SG Tube In-service Inspection NRC Call

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# Agenda

- Design Overview of TMI-1 Enhanced Once-Through Steam Generator (EOTSG)
- T1R21 Steam Generator (SG) Inspection Overview
- SG Tube Inspection Discussion Points
- Q&A

**Acquisition Status:**

"A" OTSG - Acquired 86.0%, Analyzed 82.9%

"B" OTSG - Acquired 96.0%, Analyzed 95.8%

# TMI-1 EOTSG Overview

## Tube Information

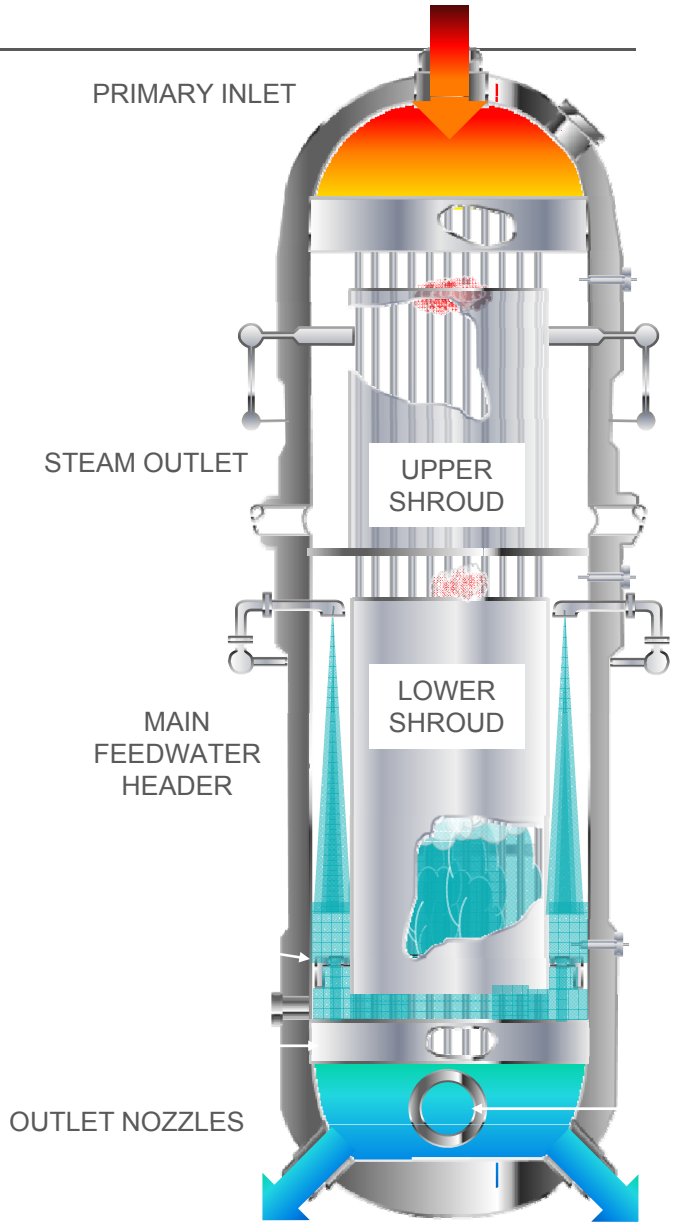
- Number of Tubes: 15,597
- Tube Material: Alloy 690TT
- Nominal OD: 0.625 inch
- Nominal Thickness: 0.037 inch
- Tube Length: 673.375 inch

## Support Information

- TSP Material: SA 240 type 410M SS
- TSP Thickness: 1.18”
- TSPs Trefoil broached (15$^{th}$ TSP drilled on periphery)
- Tubes hydraulically expanded full length of the TS

## Normal Operating Parameters

- NOP (Primary) = 2,155 psig
- NOPD = 1271 psid
- $T_{Hot}$ = 603$^{o}$F



# T1R21 Steam Generator Inspections

## Inspection Scope:

- 100% full-length inspection (bobbin probe)
- 2-Tube Periphery for Loose Parts (combo array probe) TTS to 01S
- Diagnostic Exams and Tube Plugging as needed

## Other Actions Taken:

- Revised plant heat-up procedures to equalize temperatures to mitigate wear
- Met with NRC Region I & Site Residents to achieve alignment on inspection scenarios/strategy

# 1. Primary-to-Secondary Leakage

**No observable primary-to-secondary leakage (PSL) during Cycle 20.**

- RM-A-5/15 monitor PSLR Continuously.
- No observable trends.

# 2. Secondary Side Pressure Tests

**There were no secondary side pressure tests performed during T1R21.**

- A drip or bubble test was not required due to the absence of existing primary-to-secondary leakage.

# 3. EPRI Guideline Exceptions

**TMI-1 has not taken any exceptions or deviations from the EPRI SGMP Guidelines.**

# 4. Detailed Scope Evaluation

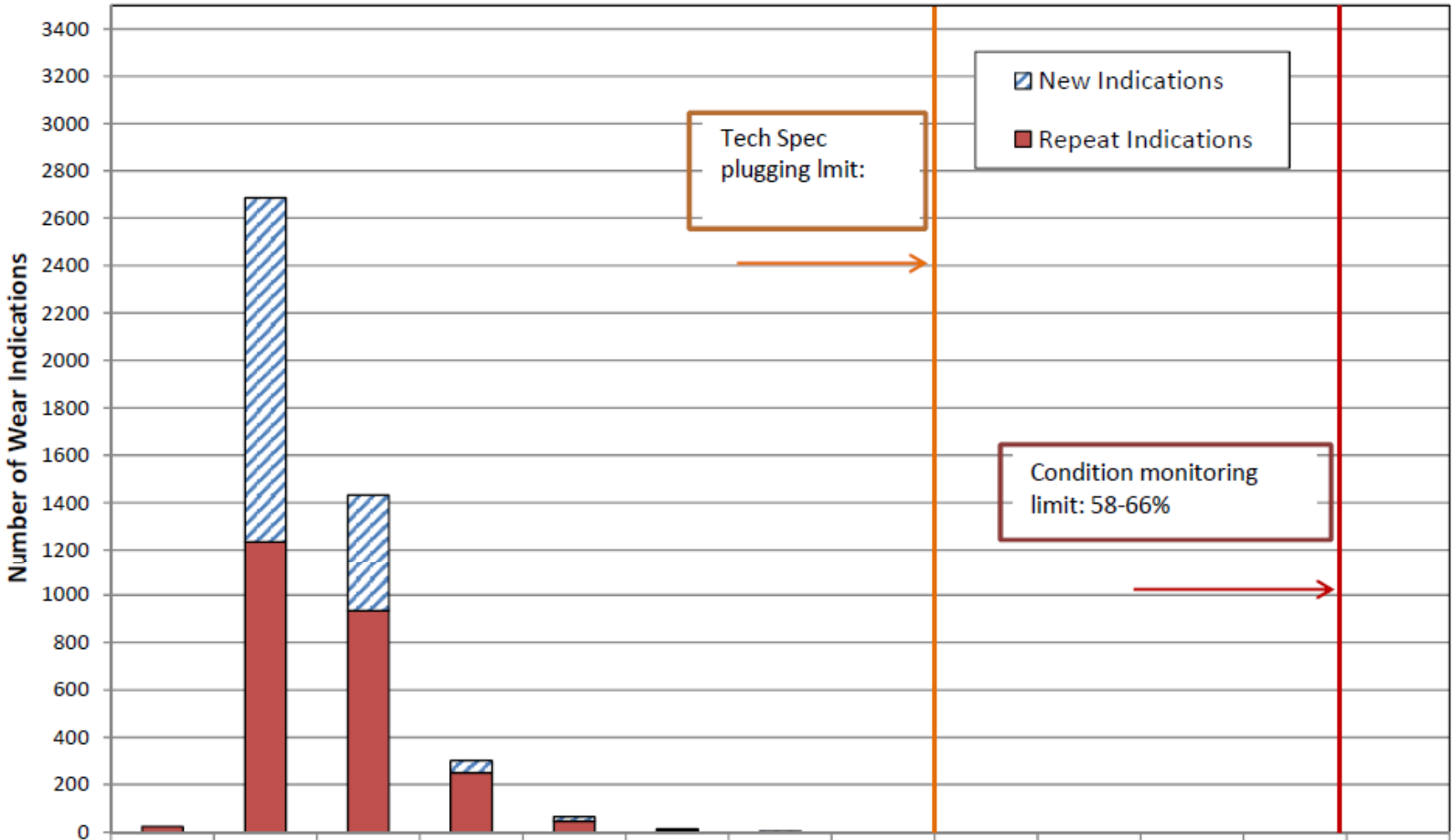
| Base Scope Work Description | EOTSG A Scope | EOTSG B Scope | Head (Upper/ Lower) | Basis / Notes |
|---|---|---|---|---|
| 100% Full length bobbin coil eddy current examination | 15,592 | 15,533 | Upper | **Satisfies Technical Specifications** |
| 100% Remote visual inspection of tube plugs | 5 tubes | 64 tubes | Both | **Required** examination of plugs per EPRI Examination Guidelines (Reference 3) |
| Remote visual inspection of channel head and tubesheet cladding | Primary Bowls | Primary Bowls | Both | **Required** exam per Exelon SG Program Procedures. |
| Array probe examination of periphery tubes (LTS to TSP 01S); Includes a full length bobbin coil examination | 901 | 862 | Upper | **Diagnostic examination** of areas susceptible to loose parts and TSP wear |
| X-Probe examination of tubes with previous indications; Includes a full length bobbin coil examination | ~125 | ~200 | Upper | **Diagnostic examination** of previous indications. Number may be reduced based on previous indications (ex/ new T-T wear, T-TSP ≥ 25%) |
| X-probe special interest exams of tubes based on bobbin results. | 0 | 0 | Upper | **Diagnostic exam** of all Bobbin I-Code indications, new DNG indications ≥ 1.0V, and other indications as necessary. |
| MRPC sizing of indications recorded during bobbin/array coil examinations. | As Needed | As Needed | Upper | **Contingent activity** |
| Rolled Plug Installation (and required stabilization) | As Needed | As Needed | Both | **Contingent activity.** Visual inspection of new plugs and verification of plug installation parameters. |
| Secondary side inspections (SSI) | NONE | NONE | N/A | **Contingent activity.** SSI and/or FOSAR only used with positive indication of loose parts presence. |

- 100% full length exam of both OTSGs with bobbin probe
- 2-tube periphery array combo probe exam from TTS to 01S
- All bobbin "I" codes, PLPs, new DNGs/DNTs >= 1.0V examined with array probe
- Deepest 20 TTW indications in both OTSGs examined with array probe and ≥ sample of new and repeat indications for flaw characterization.
- TSP SI Thresholds:
  - New ≥ 20% TW
  - Repeat ≥ 25% TW
  - Growth ≥ Δ12%TW
- No expansion criteria due to 100% base scope exam.

# 5. Summary of Inspection Results

| | Tube-to-Tube Wear | | TSP Wear | |
|---|---|---|---|---|
| | A | B | A | B |
| Number of New | 6 | 6 | 2023 | 2132 |
| Number of Repeat | 105 | 276 | 2502 | 3282 |
| Total Indications | 111 | 282 | 4525 | 5414 |
| Avg. Growth Rate | 0.19%/EFPY | 0.31%/EFPY | 0.54%/EFPY | 0.83%/EFPY |
| $95^{th}$ Percentile | 1.06%/EFPY | 1.06%/EFPY | 3.17%/EFPY | 4.23%/EFPY |
| Largest New | 10% | 10% | 33% | 35% |
| Largest Repeat | 20% | 17% | 24% | 64% |
| Location of Largest Flaw | 70-100 | 22-63 | 137-1 | 2-4 |

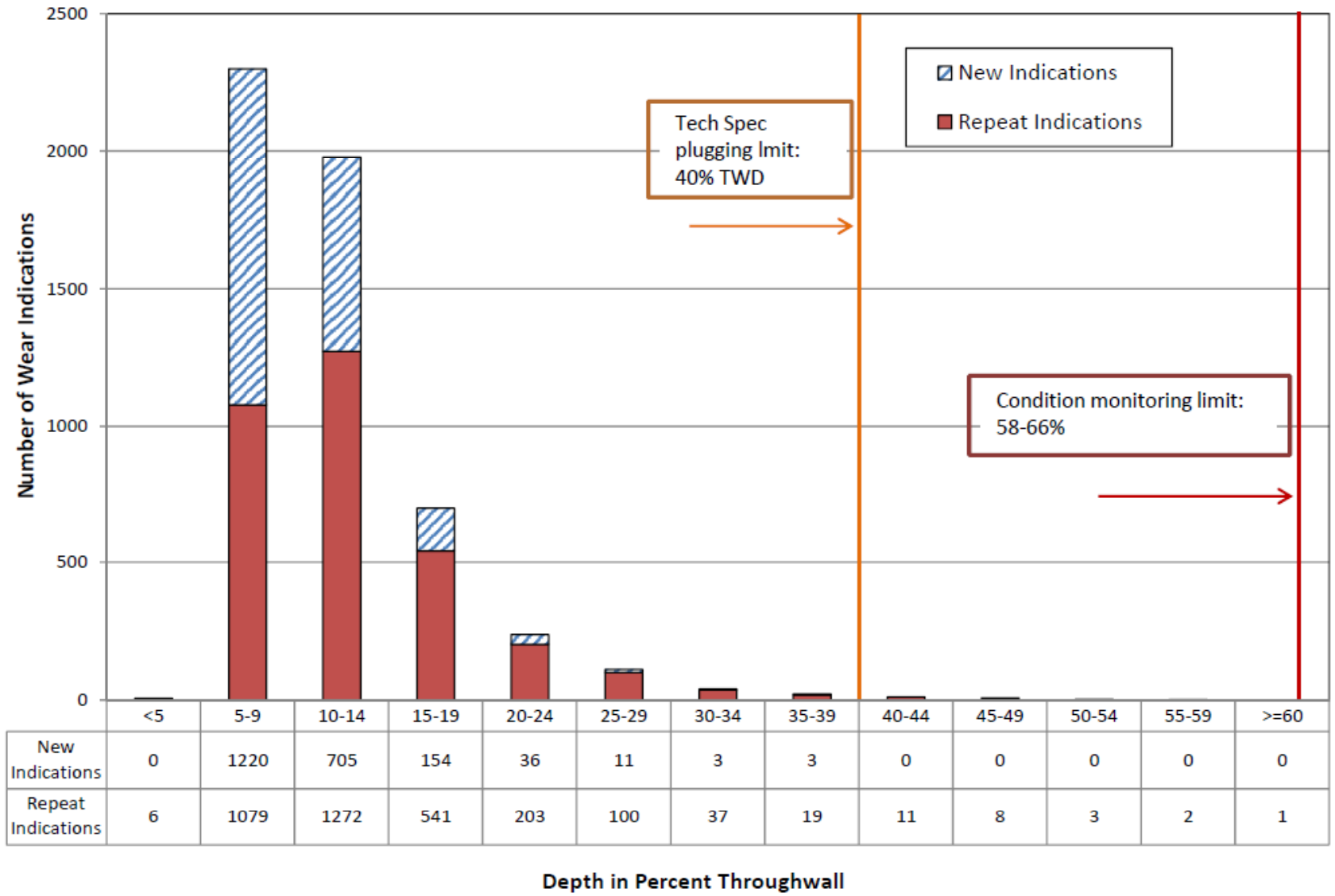
# “A” OTSG TSP Wear Distribution




| | <5 | 5-9 | 10-14 | 15-19 | 20-24 | 25-29 | 30-34 | 35-39 | 40-44 | 45-49 | 50-54 | 55-59 | >=60 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| New Indications | 0 | 1448 | 498 | 51 | 18 | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Repeat Indications | 24 | 1237 | 934 | 250 | 47 | 8 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |

**Depth in Percent Throughwall**

# “B” OTSG TSP Wear Distribution




| | <5 | 5-9 | 10-14 | 15-19 | 20-24 | 25-29 | 30-34 | 35-39 | 40-44 | 45-49 | 50-54 | 55-59 | >=60 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| New Indications | 0 | 1220 | 705 | 154 | 36 | 11 | 3 | 3 | 0 | 0 | 0 | 0 | 0 |
| Repeat Indications | 6 | 1079 | 1272 | 541 | 203 | 100 | 37 | 19 | 11 | 8 | 3 | 2 | 1 |

Exelon Generation.

# 6. Repair/Plugging Plans

- All tubes repaired will be mechanically roll plugged and stabilized in accordance with stabilization criteria.
- All tubes with indications ≥40% through-wall (TW) will be plugged per Tech Specs.
- A total of 25 tubes are currently ≥40% the Tech Spec Plugging Limit.
- The team has developed a base plugging strategy which provides a 99% POS in the W-axis.

# 7. In-situ Pressure Test / Tube Pulls

**There are currently zero indications that exceed the Condition Monitoring limit (e.g., no in situ pressure testing is required).**

# 8. Loose Parts

- Inspections performed to detect loose parts:
  - Two (2) tube periphery with array probe – Approximately 902 tubes/SG
- Loose parts detected to date:
  - NONE
- Loose parts removal plan/damage:
  - N/A – No loose parts to date

# 9. Secondary Inspections/Maintenance

- No secondary inspections or maintenance planned for T1R21 steam generator inspections
- Perform sludge mapping with ECT

# 10. Unexpected or Unusual Results

**There are no unexpected or unusual results from the T1R21 eddy current inspections.**

- **T1R20 Operational Assessment Prediction:**
  - Median deepest projected indication is 69% TW
  - Upper 95$^{th}$ value, max projected depth is 77% TW
  - Number of New Flaws Predicted: 3,000 in B OTSG

- **Results of the T1R21 inspection are within the previous OA projections and bounded by T1R20 results.**

# 11. Schedule

- "A" OTSG – Acquired 86.0%, Analyzed 82.9%
- "B" OTSG – Acquired 96.0%, Analyzed 95.8%
- Expected to complete eddy current inspections 11/10 @ 02:00
- Tube Plugging (as needed) window is 11/10/15 – 11/13/15