VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

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United States Nuclear Regulatory Commission
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**VIRGINIA ELECTRIC AND POWER COMPANY**
**SURRY POWER STATION UNIT 2**
**STEAM GENERATOR TUBE INSPECTION REPORT**
**FOR THE FALL 2021 REFUELING OUTAGE**

Technical Specification 6.6.A.3 for Surry Power Station Units 1 and 2 requires the submittal of a Steam Generator Tube Inspection Report to the NRC within 180 days after $T_{avg}$ exceeds 200°F following completion of an inspection performed in accordance with Technical Specification 6.4.Q, Steam Generator Program. Attached is the Surry Unit 2 report for the Fall 2021 refueling outage.

If you have any questions concerning this information, please contact Mr. Michael M. True, Jr. at (757) 365-2446.

Very truly yours,

Fred Mladen
Site Vice President

Attachment: Surry Unit 2 Steam Generator Tube Inspection Report for the Fall 2021 Refueling Outage

Commitments made in this letter: None

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# ATTACHMENT 1

## SURRY UNIT 2
## STEAM GENERATOR TUBE INSPECTION REPORT
## FOR THE FALL 2021 REFUELING OUTAGE

VIRGINIA ELECTRIC AND POWER COMPANY
(DOMINION ENERGY VIRGINIA)

# SURRY UNIT 2
# STEAM GENERATOR TUBE INSPECTION REPORT
# FOR THE FALL 2021 REFUELING OUTAGE

The following satisfies the Surry Power Station Technical Specification (TS) reporting requirement section 6.6.A.3. During the Surry Unit 2 Fall 2021 End-Of-Cycle 30 (EOC30) refueling outage, Steam Generator (SG) inspections were completed in accordance with TS 6.4.Q for all three SGs, designated as SG-A, SG-B, and SG-C. Unit 2 exceeded 200°F on November 27, 2021; therefore, this report is required to be submitted by May 26, 2022.

SG-A and SG-C were last inspected during the Fall 2018 refueling outage (EOC28) and had operated for 366.0 EFPM prior to that outage. SG-B was last inspected during the Spring 2017 refueling outage (EOC27) and had operated for 349.6 EFPM preceding that outage. At the time of this inspection, the Unit 2 SGs had operated for 398.4 EFPM since the first in-service inspection. Consequently, SGs A and C had operated for 32.4 EFPM since the last inspection of those SGs and SG-B had operated for 48.8 EFPM since that SG was last inspected. An inspection for SG-B was planned for the spring 2020 outage, but it was deferred to fall 2021 in accordance with License Amendment No. 299.

The three Surry Unit 2 steam generators are replacement Model 51F lower assemblies (i.e., tube bundle, lower shell, and channel head) and primary moisture separator assemblies (F-type). They were replaced in 1980. The moisture separators were subsequently upgraded to support a core power up-rate implemented in 1995. The feedrings were replaced in 2011.

Each of the three SGs were fabricated with 3,342 Thermally Treated Alloy 600 tubing, with nominal 0.875" OD x 0.050" wall thickness. The seven broached quatrefoil support plates are fabricated from 405 Stainless Steel. Figure 5 contains a schematic depicting the general arrangement of the steam generators without dimensions. Figures 6 and 7 contain a photo of the Disk Stack and an illustration of its position in the Feedwater Regulating Valve respectively. The Disk Stack provides an effective barrier against foreign objects in the feedwater entering the steam generators. However, it is believed that the legacy foreign material on the top of the tubesheet had been introduced into the steam generators from the previously mentioned maintenance activities performed in the steam drums. During the Fall 2021 outage, significant effort was expended on the removal of legacy foreign material located on the top of the tubesheet in all three SGs.

The Unit 2 steam generators have experienced no reportable primary to secondary leakage since the forced shutdown of June 1986 and operate with a nominal hot leg temperature of 604°F.

Each of the Surry Unit 2 SGs was screened to identify any low row indications of improper heat treatment. None were identified. All of the SGs were also screened for long row indications of improper heat treatment (-2 sigma tubes) and associated high residual stress. This evaluation identified 0, 2, and 14 tubes in SGs A, B, and C, respectively, which may have been improperly heat treated. Table 1 provides a listing of tubes that have been identified through screening as possibly containing high residual stress due to an improper heat treatment. These tubes were examined full length with array probes and closely scrutinized during the analysis process.

There were no deviations taken from Mandatory and/or Needed (Shall) requirements important to tube integrity from the EPRI Guidelines referenced by NEI 97-06 during the examination or the cycles preceding the EOC30 examination.

**Table 1: Tubes with Potentially High Residual Stress**

| SG | Row | Column | No. Tubes |
|---|---|---|---|
| A | None | | 0 |
| B | 17 | 71 | 2 |
| B | 17 | 78 | |
| C | 14 | 7 | 14 |
| C | 23 | 10 | |
| C | 23 | 31 | |
| C | 23 | 87 | |
| C | 24 | 15 | |
| C | 24 | 16 | |
| C | 25 | 11 | |
| C | 25 | 30 | |
| C | 26 | 10 | |
| C | 27 | 15 | |
| C | 27 | 16 | |
| C | 27 | 77 | |
| C | 32 | 15 | |
| C | 32 | 24 | |

In the discussion below ***Bold Italicized*** wording represents TS verbiage and the required information is provided directly below each reporting requirement. A list of acronyms is contained in Table 12 at the end of this report.

***A report shall be submitted within 180 days after Tavg exceeds 200°F following completion of an inspection performed in accordance with the Specification 6.4.Q, "Steam Generator (SG) Program." The report shall include:***

***a. The scope of inspections performed on each SG***

Primary Side

The tubing in each SG was inspected with bobbin coil probes over their full length except for the Row 1 and 2 U-bends, which were examined with a +Point™ rotating probe. An array probe examination was conducted on 100% of the tubes at the hot leg and cold leg tubesheets. The extent of the array probe tubesheet examinations was from the first support structure located above the tubesheet down to the H-star dimension.

Note that the permanent alternate repair criteria (PARC), Technical Specification (TS 6.4.Q), eliminates the need to analyze the Surry SG tubing for degradation in the region below the H-star dimension which is 17.89 inches below the top of the tubesheet. It also eliminates the need to plug tubes if the only repairable degradation is located below the H-star dimension.

All high residual stress (HRS) tubes in SGs B and C (SG-A does not have HRS tubes) were examined full length with both Bobbin and Array probes due to the increased susceptibility of Stress Corrosion Cracking.

In addition to the base scope, a preplanned special interest scope was developed for the EOC30 inspection, which includes a sample of previously identified dents, dings, manufacturing burnish marks, volumetric indications, and wear (excluding AVB wear). The only departure from the EOC28 preplanned special interest strategy and the preplanned EOC30 special interest scope was the sample plan for the inspection of dents/dings.

As a result of concerns for possible degradation at dent/ding locations, the special interest scope of dents/dings with a +Point™ probe was increased significantly. The specific dent/ding scope performed during the EOC28 inspection included fifty percent of previously identified dents/dings >2 Volts located in hot-leg straight sections (TSH+0.00 to 07H+1.00"), plus any additional indications required to ensure that the five largest voltage dents/dings in hot-leg straight sections were included in the sample. Also, the five largest voltage dents/dings located between the cold-leg tubesheet and the straight section of the hot-leg, (between TSC+0.00 and 07H+1.01") were included in the preplanned scope. The specific dent/ding scope performed during the EOC30 inspection included 100% of all dents/dings ≥ 2 Volts located in the hot leg straight section and 100% of all dents/dings ≥ 5 Volts in the U-bend and cold-leg sections of the tubes.

It should be noted that both terms Dent and Ding refer to a plastic deformation of the tube that results in a reduction in the tube diameter. The two different terms were used to differentiate between the location of the signals. Historically (early generation designs) the term dent referred to local tube diameter reductions due to corrosion products from carbon steel (typically, drilled carbon steel tube support plates). The term ding referred to local tube diameter reductions due to mechanical means (manufacturing, vibration, incidents during maintenance activities, or impact from foreign objects). Since the eddy current signals from both dents and dings are similar, the location of the indication was used to differentiate which term was used (dent for indications at supports and ding for all free span indications).

At Surry Power Station, the referenced dent signals do not represent the same phenomena as classical denting on older generation units caused by drilled carbon steel support plate corrosion damage. Since the Surry units are not similar in design (i.e., quatrefoil stainless steel tube support plate design vs. drilled hole carbon steel tube support plate design) these same "denting" issues do not directly apply to the Surry units. Tube support plate areas are not susceptible to denting caused by corrosion of the tube support plates. However, the historical nomenclature assigned to these signals has existed in the database since the steam generators were installed and has remained unchanged since that time.

No scope expansions were required; however, the base scope was augmented with additional rotating probe (including magnetically bias probes) to resolve ambiguous indications consistent with the special interest criteria.

The primary side work scope also included video / visual examinations (as-found / as-left) of all channel heads specifically including:

- All plugs
- Tube-to-tubesheet welds

- Stub runner and divider plate
- Stub runner to divider plate welds
- Stub runner to tubesheet clad weld
- Divider plate-to-channel head clad weld
- Tubesheet cladding
- Closure ring welds
- Entire bowl cladding with the bowl effectively dry

All primary side visual examinations were completed satisfactorily with no degradation or anomalies reported.

Secondary Side

During the EOC30 examination, the following secondary side activities were performed in all three SGs:

- Pre-lance raking of foreign material at the top of the tubesheet to improve cleanliness in the tie rod shadow zones
- Top of tubesheet water lancing
- Post-lancing visual examination of the tube bundle from the entire periphery
- Visual examination of historical foreign object-related locations
- Visual investigation of any accessible locations having eddy current signals potentially related to foreign objects, and removal of retrievable foreign objects.
- Visual examination of the following to assess material condition and cleanliness:
  - All accessible steam drum components and structures including the feedring exterior
  - The upper tube bundle and 7th TSP via probe insertions through primary moisture separators
  - The primary separators to identify any potential FAC in the riser barrels, flow holes, and tangential nozzles similar to what has been seen in other Westinghouse SGs

***b. Degradation mechanisms found***

During the EOC30 examination, anti-vibration bar (AVB) wear, tube support plate (TSP) wear, flow distribution baffle (FDB) wear, foreign object wear, and stress corrosion cracking (SCC) were detected during the SG tube examination.

Cracking of secondary separator perforated plate welds in SG-A were detected and repaired during the steam drum examination.

***c. Nondestructive examination techniques utilized for each degradation mechanism***

The inspection program focused on the degradation mechanisms listed in Table 2 and utilized the referenced eddy current techniques.

**Table 2 – Inspection Method for Applicable Degradation Mechanism**

| Classification | Degradation Mechanism | Location | Probe Type |
|---|---|---|---|
| Existing | Wear | Anti-Vibration Bars | Bobbin - Detection and Sizing |
| Existing | OD Pitting | Top-of-Tubesheet (TTS) | Bobbin and Array - Detection<br>+Point™ - Sizing |
| Existing | Wear | Tube Support Plate | Bobbin - Detection<br>+Point™ - Sizing |
| Existing | Tube Wear (Foreign Objects) | Freespan and TTS | Bobbin and Array - Detection<br>+Point™ - Sizing |
| Existing | PWSCC | Tubesheet Overexpansions (OXP) | Array - Detection<br>+Point™ - Sizing |
| Existing | PWSCC | Tube Ends | N/A* |
| Existing | Wear | Flow Distribution Baffle (FDB) | Bobbin - Detection<br>+Point™ - Sizing |
| Potential | ODSCC, PWSCC | Bulges, Dents, Manufacturing Anomalies, and Above Tubesheet Overexpansions (OVR) | Array - Detection<br>+Point™ - Sizing |
| Potential | ODSCC | Tubesheet Crevice in Tubes With NTE | N/A** |
| Potential | Tube Slippage | Within Tubesheet | Bobbin - Detection |
| Existing | ODSCC, PWSCC | Hot Leg TTS | Array - Detection<br>+Point™ - Sizing |
| Potential | ODSCC, PWSCC | Row 1 and 2 U-bends | +Point™ - Detection and Sizing |
| Potential | ODSCC | Freespan and Tube Supports | Bobbin - Detection<br>+Point™ - Sizing |
| Existing | ODSCC, PWSCC | High Residual Stress Tubes | Bobbin and Array - Detection<br>+Point™ - Sizing |

* Inspection not required per technical specification alternate repair criteria
** All tubes with no tubesheet expansion (NTE) have previously been plugged

***d. Location, orientation (if linear), and measured sizes (if available) of service induced indications***

As stated in the (b) response above, anti-vibration bar (AVB) wear, tube support plate (TSP) wear, flow distribution baffle (FDB) wear, foreign object wear, and stress corrosion cracking (SCC) were detected during the EOC30 SG tube inspection.

AVB Wear

In total, 124 AVB wear indications in 86 tubes were identified among all three SGs during EOC30. Of these, 94 indications in 75 tubes were sized <20%TW. None of the identified flaws exceeded the Technical Specification plugging limit (40%TW) and none were plugged. The maximum reported depth was 33%TW. A listing of all 30 indications of AVB Wear ≥ 20% TW is contained in Table 3.

**Table 3: Surry 2 EOC30 Inspection Summary – AVB Wear Indications ≥20%TW**

| SG | Row | Col | AVB No. | Amplitude (Volts) | Wear Depth (%TW) ETSS 96041.1 | |
|---|---|---|---|---|---|---|
| | | | | | Previous | Current |
| A | 25 | 57 | AV2 | 0.91 | 15 | 20 |
| A | 26 | 86 | AV3 | 1.18 | 20 | 23 |
| A | 36 | 62 | AV2 | 1.60 | 26 | 28 |
| A | 36 | 62 | AV4 | 2.40 | 29 | 33 |
| A | 38 | 72 | AV4 | 1.45 | 25 | 27 |
| A | 38 | 74 | AV4 | 1.03 | 20 | 23 |
| A | 40 | 65 | AV2 | 1.28 | 21 | 25 |
| B | 26 | 64 | AV2 | 1.16 | 13 | 20 |
| B | 38 | 74 | AV2 | 1.12 | 14 | 20 |
| B | 38 | 74 | AV4 | 1.36 | 16 | 23 |
| C | 25 | 27 | AV2 | 3.18 | 32 | 33 |
| C | 25 | 29 | AV3 | 1.62 | 23 | 24 |
| C | 26 | 26 | AV4 | 1.14 | 18 | 20 |
| C | 31 | 69 | AV2 | 1.30 | 22 | 21 |
| C | 33 | 59 | AV3 | 1.14 | 21 | 20 |
| C | 33 | 68 | AV1 | 1.20 | 21 | 21 |
| C | 33 | 68 | AV2 | 1.35 | 22 | 22 |
| C | 33 | 70 | AV3 | 1.08 | 20 | 20 |
| C | 34 | 29 | AV4 | 1.13 | 19 | 21 |
| C | 37 | 73 | AV3 | 1.14 | 18 | 20 |
| C | 38 | 28 | AV3 | 1.16 | 17 | 21 |
| C | 38 | 30 | AV2 | 1.19 | 15 | 21 |
| C | 39 | 53 | AV3 | 2.33 | 30 | 30 |
| C | 39 | 55 | AV3 | 1.61 | 25 | 26 |
| C | 39 | 55 | AV4 | 1.58 | 24 | 25 |
| C | 40 | 33 | AV2 | 1.79 | 26 | 26 |
| C | 40 | 33 | AV3 | 1.76 | 26 | 25 |
| C | 40 | 63 | AV4 | 1.10 | 21 | 21 |

| SG | Row | Col | AVB No. | Amplitude (Volts) | Wear Depth (%TW) ETSS 96041.1 | |
|---|---|---|---|---|---|---|
| | | | | | Previous | Current |
| C | 41 | 66 | AV3 | 1.09 | 19 | 20 |
| C | 43 | 61 | AV1 | 1.56 | 25 | 23 |

Non-AVB Wear

Bobbin probe or array probe inspections of in-service tubes identified 67 indications of volumetric tube degradation not related to AVB wear, in 60 tubes among all three SGs. The measured flaw depths range from 5%TW to 35%TW. Sizing of these indications was performed with a +Point™ rotating coil. Table 4 lists the 51 Non-AVB Wear indications that recorded wall losses ≥ 20% TW. The sizing techniques used to determine the dimensions of the flaws are also identified in the table.

Sixty-five of the 67 indications were reported during previous inspection outages, meaning that two indications were newly reported during EOC30 (23%TW TSP wear in SG-B R10 C58, and 26%TW TSP wear in SG-B R42 C40). Review of historical ECT data for these locations confirmed that neither indication was previously detectible. None of the 65 repeat indications exhibited signal change indicative of wear growth.

Nine of the indications resulted from support structure wear (TSP or baffle plate) and all of the remaining 58 indications are attributed to foreign object wear, with no foreign object remaining in the vicinity of the wear indication.

Figure 1 through Figure 4 provide the 95/50 CM limit curves for flaws sized with ETSS 27901.1, 27902.1, 27905.1, and 96910.1 respectively. The CM curves represent the structural performance criteria derived by conservatively accounting for material property uncertainties, model uncertainties, and NDE depth sizing uncertainties. The uncertainties were combined using Monte Carlo techniques.

Because each flaw plotted in Figure 1 through Figure 4 lies below the CM limit curve, each flaw satisfies the structural integrity performance criterion.

## Table 4: Summary of Non-AVB Wear Volumetric Degradation

| SG | Row | Col | Volts | Location | ETSS | Max Depth (%TW) | Axial Length (in) | Circ Length (in) | Initially Reported | Cause | Foreign Object Remaining? | In Situ Tested? | Plugged & Stabilized? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 4 | 37 | 0.12 | TSC +0.62" | 27901.1 | 21 | 0.33 | 0.42 | 2015 | Foreign Object | No | No | No |
| | | | 0.20 | TSC +1.5" | 27901.1 | 26 | 0.36 | 0.37 | 2015 | Foreign Object | No | No | No |
| A | 11 | 45 | 0.18 | TSH +0.98" | 27901.1 | 24 | 0.30 | 0.37 | 2012 | Foreign Object | No | No | No |
| A | 15 | 16 | 0.18 | TSH +0.25" | 27901.1 | 24 | 0.22 | 0.34 | 2012 | Foreign Object | No | No | No |
| A | 17 | 16 | 0.21 | TSH -0.10" | 27901.1 | 26 | 0.31 | 0.45 | 2002 | Foreign Object | No | No | No |
| A | 18 | 16 | 0.18 | TSH -0.12" | 27901.1 | 24 | 0.30 | 0.42 | 2002 | Foreign Object | No | No | No |
| A | 33 | 27 | 0.16 | TSC -0.04" | 27901.1 | 23 | 0.25 | 0.37 | 2006 | Foreign Object | No | No | No |
| A | 42 | 52 | 0.11 | TSC +0.18" | 27901.1 | 20 | 0.24 | 0.37 | 2009 | Foreign Object | No | No | No |
| A | 43 | 61 | 0.14 | BPH +0.53" | 27901.1 | 22 | 0.30 | 0.45 | 2009 | Foreign Object | No | No | No |
| A | 43 | 64 | 0.17 | BPH +0.66" | 27901.1 | 24 | 0.30 | 0.29 | 2009 | Foreign Object | No | No | No |
| B | 10 | 58 | 0.45 | 03H-0.66" | 96910.1 | 23 | 0.34 | 0.37 | 2021 | TSP Wear | No | No | No |
| B | 18 | 81 | 0.15 | TSC + 0.01" | 27901.1 | 22 | 0.17 | 0.31 | 2017 | Foreign Object | No | No | No |
| | | | 0.11 | TSC + 0.26" | 27901.1 | 20 | 0.17 | 0.37 | 2017 | Foreign Object | No | No | No |
| B | 23 | 82 | 0.13 | TSH - 0.18" | 27901.1 | 21 | 0.25 | 0.32 | 2003 | Foreign Object | No | No | No |
| B | 34 | 66 | 0.15 | TSC + 0.18" | 27901.1 | 23 | 0.28 | 0.42 | 2017 | Foreign Object | No | No | No |
| B | 36 | 26 | 0.76 | TSC + 0.04" | 27905.1 | 25 | 0.24 | 0.47 | 2008 | Foreign Object | No | No | No |
| B | 37 | 27 | 0.19 | TSC - 0.01" | 27901.1 | 25 | 0.28 | 0.34 | 2008 | Foreign Object | No | No | No |
| B | 42 | 40 | 0.56 | 03H-0.55" | 96910.1 | 26 | 0.39 | 0.32 | 2021 | TSP Wear | No | No | No |
| B | 42 | 42 | 0.22 | TSC-0.18" | 27901.1 | 26 | 0.28 | 0.42 | 2014 | Foreign Object | No | No | No |
| C | 28 | 22 | 0.26 | TSH +0.14" | 27901.1 | 29 | 0.25 | 0.39 | 2014 | Foreign Object | No | No | No |
| C | 28 | 23 | 0.21 | TSH +0.55" | 27901.1 | 26 | 0.19 | 0.47 | 2014 | Foreign Object | No | No | No |

| SG | Row | Col | Volts | Location | ETSS | Max Depth (%TW) | Axial Length (in) | Circ Length (in) | Initially Reported | Cause | Foreign Object Remaining? | In Situ Tested? | Plugged & Stabilized? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0.24 | TSH +0.25" | 27901.1 | 28 | 0.20 | 0.42 | 2014 | Foreign Object | No | No | No |
| C | 28 | 71 | 0.16 | TSH +0.17" | 27901.1 | 23 | 0.25 | 0.47 | 2009 | Foreign Object | No | No | No |
| C | 30 | 48 | 0.13 | BPH +0.50" | 27901.1 | 21 | 0.19 | 0.42 | 2015 | Foreign Object | No | No | No |
| C | 34 | 18 | 0.12 | TSH +1.00" | 27901.1 | 20 | 0.38 | 0.37 | 2005 | Foreign Object | No | No | No |
| C | 34 | 20 | 0.23 | TSH +0.92" | 27901.1 | 27 | 0.31 | 0.26 | 2005 | Foreign Object | No | No | No |
| C | 34 | 74 | 0.23 | TSH -0.03" | 27901.1 | 27 | 0.31 | 0.42 | 2005 | Foreign Object | No | No | No |
| C | 35 | 19 | 0.22 | TSH +0.29" | 27901.1 | 27 | 0.31 | 0.42 | 2005 | Foreign Object | No | No | No |
| C | 35 | 22 | 0.23 | TSH +1.04" | 27901.1 | 27 | 0.33 | 0.47 | 2005 | Foreign Object | No | No | No |
| C | 35 | 30 | 0.37 | TSH -0.08" | 27901.1 | 35 | 0.25 | 0.42 | 2005 | Foreign Object | No | No | No |
| C | 36 | 32 | 0.13 | BPH +0.65" | 27901.1 | 21 | 0.30 | 0.37 | 2015 | Foreign Object | No | No | No |
| C | 36 | 68 | 0.63 | TSH -0.06" | 27902.1 | 26 | 0.36 | 0.52 | 2005 | Foreign Object | No | No | No |
| C | 37 | 31 | 0.15 | TSH +0.02" | 27901.1 | 22 | 0.25 | 0.37 | 2011 | Foreign Object | No | No | No |
| C | 37 | 32 | 0.13 | TSH +0.03" | 27901.1 | 21 | 0.17 | 0.37 | 2011 | Foreign Object | No | No | No |
| C | 37 | 33 | 0.19 | TSH +0.04" | 27901.1 | 25 | 0.27 | 0.42 | 2011 | Foreign Object | No | No | No |
| C | 37 | 34 | 0.19 | TSH +0.03" | 27901.1 | 24 | 0.28 | 0.42 | 2009 | Foreign Object | No | No | No |
| C | 37 | 35 | 0.28 | BPH +0.64" | 27901.1 | 30 | 0.27 | 0.48 | 2005 | Foreign Object | No | No | No |
| C | 37 | 54 | 0.19 | TSH +0.04" | 27901.1 | 25 | 0.20 | 0.52 | 2005 | Foreign Object | No | No | No |
| C | 37 | 73 | 0.46 | 07C -0.67" | 96910.1 | 22 | 0.46 | 0.43 | 2005 | TSP Wear | N/A | No | No |
| C | 38 | 32 | 0.18 | BPH +0.63" | 27901.1 | 24 | 0.28 | 0.37 | 2011 | Foreign Object | No | No | No |
| C | 38 | 53 | 0.15 | TSH +0.04" | 27901.1 | 23 | 0.19 | 0.63 | 2005 | Foreign Object | No | No | No |
| C | 39 | 32 | 0.15 | BPH +0.57" | 27901.1 | 22 | 0.19 | 0.42 | 2011 | Foreign Object | No | No | No |
| | | | 0.16 | BPH +0.60" | 27901.1 | 23 | 0.21 | 0.42 | 2011 | Foreign Object | No | No | No |
| C | 39 | 34 | 0.18 | BPH +0.63" | 27901.1 | 24 | 0.30 | 0.40 | 2011 | Foreign Object | No | No | No |
| C | 40 | 34 | 0.13 | BPH +0.65" | 27901.1 | 21 | 0.30 | 0.42 | 2011 | Foreign Object | No | No | No |
| C | 44 | 42 | 0.16 | TSH -0.03" | 27901.1 | 23 | 0.25 | 0.37 | 2005 | Foreign Object | No | No | No |

| SG | Row | Col | Volts | Location | ETSS | Max Depth (%TW) | Axial Length (in) | Circ Length (in) | Initially Reported | Cause | Foreign Object Remaining? | In Situ Tested? | Plugged & Stabilized? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | 44 | 43 | 0.19 | TSH +0.04" | 27901.1 | 25 | 0.31 | 0.42 | 2005 | Foreign Object | No | No | No |
| C | 44 | 47 | 0.20 | TSH -0.09" | 27901.1 | 25 | 0.36 | 0.43 | 2005 | Foreign Object | No | No | No |
| C | 45 | 43 | 0.16 | TSH +0.16" | 27901.1 | 21 | 0.20 | 0.42 | 2005 | Foreign Object | No | No | No |
| | | | 0.19 | TSH +0.13" | 27901.1 | 24 | 0.31 | 0.42 | 2005 | Foreign Object | No | No | No |
| C | 45 | 47 | 0.11 | TSH +0.01" | 27901.1 | 20 | 0.30 | 0.42 | 2005 | Foreign Object | No | No | No |

Stress Corrosion Cracking

One circumferential PWSCC indication was identified at the hot leg top of tubesheet (TTS) in tube SG-C R6 C48 (TSH-0.25") during the EOC30 array probe examination. This indication was sized with a +Point™ Probe. The maximum measured amplitude was 1.18 Volts. The maximum measured depth of the indication was 47%TW, the measured circumferential extent was 30 degrees, and the measured Percent Degraded Area (PDA) was 2.2.

One axial PWSCC indication was identified within the tubesheet in tube SG-B R21 C21 (TSH-0.95") during the EOC30 array probe examination. This indication was sized with a +Point™ probe. The maximum measured amplitude was 0.29 Volts. The maximum measured depth of the indication was 66%TW, the measured length was 0.20 inches, the structurally equivalent depth was sized at 53.6%TW, and the structurally equivalent length was sized at 0.14 inches.

Foreign Objects

As stated earlier, a significant effort was expended on the removal of legacy foreign objects from the secondary side of all three SGs during the EOC30 outage. It is believed that the legacy foreign material on the top of the tubesheet had been introduced into the SGs from the maintenance activities performed in the steam drums many years before.

In previous outages, multiple small pieces of wire had been detected, which had migrated into low flow areas forming localized entangled wire masses. These wire masses had been present in some of the SGs for more than 10 years without causing any tube wall degradation. The wires were evaluated and determined to be made of 304 stainless steel approximately 0.5" long and 0.012" in diameter. This is a diameter common for wire bristles associated with cleaning tools such as small wire brush wheels. Individually, these small wires don't present a threat to tube integrity because they lack the mass required to penetrate the tube wall and therefore considered to be benign.

During the EOC30 outage an enhanced tubesheet cleaning process was performed in all three steam generators to remove debris and legacy foreign objects. The as-left condition also provided a known baseline to positively identify any new foreign object intrusion during future operational cycles.

The foreign objects identified in Table 5 below include all foreign objects removed during the EOC30 FOSAR and water lancing activities and the foreign objects known to be remaining at the conclusion of the EOC30 outage.

Sludge removed during the water lance process was:

SG-A = 23 lbs.
SG-B = 12 lbs.
SG-C = 15 lbs.

## Table 5: Foreign Object Highlights

| SG-Item # | Description | Affected Tubes | Configuration | 2021 ECT Results | Estimated Size | Fixity | 2021 Disposition |
|---|---|---|---|---|---|---|---|
| A-1 | Flexitallic Gasket | R18-C46<br>TSC +0.10 | 2012 piece of flexitallic gasket embedded in sludge formation and fixed to tube/ tubesheet | PLP | ~0.6" | Fixed | During 2021 a legacy tube (adjacent to a piece of flex) and its associated bounding tubes were examined by ECT. The only reported PLP was a legacy PLP from 2012. No tube wear indications were reported. FOSAR confirmed that the object was still embedded in the sludge formation and affixed to the tube / tubesheet. At the next ISI continue to monitor the affected and bounding tubes using ECT and SSI. |
| | | | | | | | |
| B-1 | Bolt Like Object | R21-C10, R22-C10<br>R22-C11, R21-C11<br>02C+0.65 | 2003 bolt like object. Four affected tubes plugged | NDD | 1/2" x 1.5" | Remains in SG | During 2003 four tubes were plugged for a bolt like foreign object. During 2021, the tubes bounding the four plugged tubes were examined by ECT. No PLP or tube wear indications were reported. FOSAR was not able to access the location. At the next ISI continue to monitor the bounding tubes using ECT. |

| SG-Item # | Description | Affected Tubes | Configuration | 2021 ECT Results | Estimated Size | Fixity | 2021 Disposition |
|---|---|---|---|---|---|---|---|
| B-2 | Irregular Object / Piece of wire | R38-C47, R38-C48<br>R37-C47<br>TSC +0.10 | 2021 irregular object and piece of wired removed by FOSAR during pre-lance inspection | NDD | ~1.7" length<br>~0.4" wide<br>~0.1" thick<br><br>Wire<br>~1" length | Removed by FOSAR | During 2021 an irregular shaped objected and a piece of wire was detected by FOSAR (pre-lance inspection) and removed from the SG. Subsequent ECT inspections of the affected and bounding tubes detected no PLP or tube wear indications. This item is considered closed out and no action is required at the next ISI. |
| | | | | | | | |
| C-1 and C-2 | Entangled Wire Mass (EWM) | R41-C44, R42-C44,<br>R41-C45, R42-C45<br>R43-C46<br>TSC +0.13 | 2017 and 2018 Entangled Wire Mass (EWM) | PLP | ~16 tubes by 2 tubes | Removed by lancing | During 2021 the ECT PLP aligned with the location of the legacy EWM. ECT reported that no tube wear was detected. After lancing FOSAR reported that no part was present. At the next ISI continue to monitor the PLP locations using ECT. |
| C-3 | Sludge Rock / Disc Shaped Object | R5-C88, R6-C88<br>R6-C89<br>TSC +0.00 | 2017 sludge rock and 2018-disc shaped object affixed to the tubesheet | LPS | ~0.4" | Fixed | During 2021 the legacy sludge rock and disc-shaped object were both detected by ECT and FOSAR. No tube wear was detected. FOSAR confirmed that the rock/object are still fixed in place. At the next ISI continue to monitor the affected and bounding tubes using ECT and SSI. |

| SG-Item # | Description | Affected Tubes | Configuration | 2021 ECT Results | Estimated Size | Fixity | 2021 Disposition |
|---|---|---|---|---|---|---|---|
| C-4 and C-5 | Small wire / Entangled Wire Mass (EWM) | R37-C57, R38-C57<br>R36-C56, R36-C57<br>TSH +0.00 | 2017<br>Small wires / EWM embedded in hard sludge | LPM | ~3 tubes by 2 tubes | Removed by lancing | During 2021 the legacy wire (item #5 at R19-C57) was moved by lancing to location #4 (row 36). After the second lancing, FOSAR did not detect the presence of the wire or EWM. No tube wear was detected. Item is considered closed out and no action is required at the next ISI. |
| C-6 | Bar / sludge formation | R34-C66<br>R35-C66, R35-C67<br>TSH +0.26 | 2014<br>Bar / sludge formation | PLP | The bar spans tube gap of ~0.4" | Fixed | During 2021 ECT detected PLPs on tubes (35-67, 35-66, 34-66). No tube wear was detected. The PLPs result from a legacy fixed part. At the next ISI continue to monitor the affected and bounding tubes using ECT and SSI. |
| C-7 | Metal Nut | R28-C68, R28-C69<br>R29-C68, R29-C69<br>TSH +0.23 | 2009 metal nut embedded in hard deposit formations | PLP | 0.36" length<br>0.25" depth<br>0.36" width | Fixed | During 2021 the legacy metal nut was detected by both ECT and FOSAR. No tube wear was detected. FOSAR confirmed the metal nut is still fixed in place. At the next ISI continue to monitor the affected and bounding tubes using ECT and SSI. |

| SG-Item # | Description | Affected Tubes | Configuration | 2021 ECT Results | Estimated Size | Fixity | 2021 Disposition |
|---|---|---|---|---|---|---|---|
| C-8 | Entangled Wire Mass (EWM) | R24-C63, R24-C62<br>R29-C62, R29-C63<br>TSH +0.00 | 2009 EWM of wires that in 2018 was pushed from row-24 to row-29 | LPM | ~0.5" diameter | Fixed and Loose<br><br>Loose removed by lancing | During 2021 the majority of the legacy EWM (loose) was removed by lancing. The remaining part of the EWM is fixed to the TTS. No tube wear was detected. At the next ISI continue to monitor the affected (R29-C62, R29-C63) and bounding tubes using ECT and SSI. |
| C-9 | Metal Object that caused tube Wear | R31-C28<br>R32-C28<br>TSH +0.17 | 2005 metal object wedged between two tubes that caused tube wear. The two affected tubes were subsequently plugged | 56%TW<br>52%TW<br>depth with +Point™ | ~0.61" axial extent both indications | Removed by lancing | During 2005 two tubes were plugged for FO wear (affected tubes). During 2021, the tubes bounding the affected tubes were examined by ECT. No PLP or tube wear indications were reported. FOSAR confirmed that the metal object was no longer present. Item is considered closed out and no action is required at the next ISI. |
| C-10 | Wire Like Object | R31-C48, R32-C48<br>TSH +0.15 | 2021<br>Wire like object detected by FOSAR near 90-degree handhole | NDD | ~1.25" | Removed by FOSAR | During 2021 a wire like object was found by FOSAR (during pre-lance inspection) and subsequently removed from the SG. ECT reported no PLP or tube wear indications. Item is considered closed out and no action is required at the next ISI. |

| SG-Item # | Description | Affected Tubes | Configuration | 2021 ECT Results | Estimated Size | Fixity | 2021 Disposition |
|---|---|---|---|---|---|---|---|
| C-11 | Wire Like Object | R36-C48, R37-C48<br>TSH +0.00 | 2021<br>Wire like object detected by FOSAR | NDD | ~1.5" | Removed by FOSAR | During 2021 a wire like object was found by FOSAR (during pre-lance inspection) and subsequently removed from the SG. ECT reported no PLP or tube wear indications. Item is considered closed out and no action is required at next ISI. |
| C-12 | Partial Nut | R40-C51, R39-C51<br>R39-C52, R40-C52<br>TSH +0.20 | 2021 partial metallic nut detected by FOSAR during post-lance inspection | PLP / LPM | 1.38" length<br>0.10" depth<br>0.07" width | Removed by FOSAR | During 2021 multiple ECT PLP indications were investigated by FOSAR and revealed the presence of a partial metallic nut. The nut was subsequently removed by FOSAR. Item is considered closed out and no action is required at the next ISI. |
| C-13 | Entangled Wire Mass (EWM) | R7-C49, R7-C50<br>TSH +0.20 | 2021<br>Entangled Wire Mass (EWM) | NDD | ~0.5" diameter | Removed by FOSAR and lancing | During 2021 a EWM was identified during FOSAR and subsequently broken apart and manually removed from the SG. Any remnants remaining on the TTS were removed by lancing. ECT reported no PLP or tube wear indications. Item is considered closed out and no action is required at the next ISI. |

| SG-Item # | Description | Affected Tubes | Configuration | 2021 ECT Results | Estimated Size | Fixity | 2021 Disposition |
|---|---|---|---|---|---|---|---|
| C-14 | Entangled Wire Mass (EWM) | R31-C42, R31-C43<br>R29-C42<br>TSH +0.83 | 2021<br>Entangled Wire Mass (EWM) | PLP | ~3 tubes by 2 tubes | Removed by lancing | During 2021 multiple ECT PLPs were investigated by FOSAR and determined to originate from an EWM. The mass was manually broken apart and subsequently removed by lancing. ECT reported no associated tube wear indications. Item is considered closed out and no action is required at the next ISI. |
| C-15 | Entangled Wire Mass (EWM) | R36-C51, R35-C51<br>R34-C51, R36-C52<br>R35-C52, R34-C52<br>TSH +0.50 | 2021<br>Entangled Wire Mass (EWM) | NDD | ~3 tubes by 2 tubes | Partially Fixed in Place | During 2021 FOSAR identified a EWM. FOSAR broke the mass apart for subsequent removal by lancing. Some remnants of the EWM still remain on the TTS but is not considered a threat to tube integrity. ECT reported no associated PLP or tube wear indications. At the next ISI continue to monitor the affected and bounding tubes using ECT. |
| C-16 | Embedded Wire | R34-C51, R34-C50<br>TSH +0.25 | 2021<br>Wire like object embedded in hard sludge | NDD | 1.50" length<br>0.12" depth<br>0.12" width | Fixed | During 2021 a wire like object was found by FOSAR. Subsequent removal attempts showed the wire to be embedded in hard sludge at the TTS. ECT reported no PLP or tube wear indications. At the next ISI continue to monitor the affected and bounding tubes using ECT. |

| SG-Item # | Description | Affected Tubes | Configuration | 2021 ECT Results | Estimated Size | Fixity | 2021 Disposition |
|---|---|---|---|---|---|---|---|
| C-17 | Hard Bar-Like Object | R32-C45, R33-C45<br>R33-C44<br>TSH +0.15 | 2021<br>Hard bar-like object | LPS | 2.50" length<br>0.15" width | Removed by FOSAR | During 2021 a bar-like object was identified during FOSAR and subsequently removed. ECT reported a LPS and no tube wear indications. Item is considered closed out and no action is required at the next ISI. |
| C-18 | Entangled Wire Mass (EWM) | R43-C56, R43-C55<br>TSC +0.10 | 2021<br>Entangled Wire Mass (EWM) | NDD | ~0.5" diameter | Removed by lancing | During 2021 a EWM was identified during FOSAR and subsequently broke apart and removed from the SG. Any remnants remaining on the TTS were removed during lancing. ECT reported no PLP or tube wear indications. Item is considered closed out and no action is required at the next ISI. |

**Table 6: Summary of Prior OA Validation**

| Degradation Mechanism | Fall 2018, EOC28 Operational Assessment (SGs A & C) | Spring 2020, EOC29 COVID Deferral Operational Assessment (SG B) | Observed During the Fall 2021 Outage (EOC30) |
|---|---|---|---|
| **AVB Wear** | Maximum 44.1 %TW | Maximum 38.8 %TW | Maximum depth of 33%TW detected |
| **Volumetric Degradation** | Maximum 40.8 %TW | Maximum 41.5 %TW | Maximum depth of 35%TW detected; no growth of previously reported flaws was observed. |
| **Circumferential ODSCC at top of tubesheet** | Not detected or evaluated | 37.1 PDA and 73.1 %TW maximum depth | No indications detected |
| **Circumferential PWSCC tubesheet region** | 39 PDA and 71 %TW maximum depth | 45.4 PDA and 88 %TW maximum depth | One indication detected: 47%TW x 30°, 2.2 PDA |
| **Axial ODSCC at TSPs** | Not detected or evaluated | Lower 95/50 burst pressure: 5,546 psi | No indications detected |
| **Axial PWSCC tubesheet region** | Not detected or evaluated | Lower 95/50 burst pressure: 5,342 psi | One 0.29Volt indication detected; 53.6%TW struct depth x 0.14 in. struct length; SIPC and AILPC satisfied |
| **Operational Leakage** | Projected: <150 GPD | Projected: <150 GPD | No measurable leakage during Cycles 28, 29, or 30 |

***e. Number of tubes plugged during the inspection outage for each degradation mechanism***

One tube in SG-B was plugged for an axial PWSCC indication and one tube in SG-C was stabilized and plugged for a circumferential PWSCC indication.

***f. The number and percentage of tubes plugged to date, and the effective plugging percentage in each steam generator.***

Table 7 provides the plugging totals and percentages to date.

**Table 7 – Tube Plugging Summary**

| Steam Generator | SG-A | SG-B | SG-C | Total |
|---|---|---|---|---|
| Prior to EOC-30 | 30 | 19 | 50 | 99 |
| EOC-30 | 0 | 1 | 1 | 2 |
| Total | 30 | 20 | 51 | 101 |
| % Plugged | 0.9% | 0.6% | 1.5% | 1.0% |

Since no sleeving has been performed in the Surry Unit 2 steam generators, the effective plugging percentage is the same as the actual plugging percentage.

***g. The results of condition monitoring, including the results of tube pulls and in-situ testing***

None of the tube degradation identified in Surry Unit 2 SGs during the EOC28 outage violated the structural integrity performance criteria; thereby providing reasonable assurance that none of these flaws would have leaked during a limiting design basis accident. Therefore, tube pulls and in-situ pressure testing were not necessary.

The Condition Monitoring (CM) Assessment for each detected degradation mechanism was determined using the methodology described below.

**Table 8 – CM Methodology**

| CM (Mechanism) | Methodology | Structural Limit | Note |
|---|---|---|---|
| AVB Wear | Mixed Arithmetic/Monte Carlo | Structural Limit (64%TW) | 1 |
| Vol (Non AVB) | Monte Carlo | CM Curve | 2 |
| Circ PWSCC (TTS) | Mixed Arithmetic/Monte Carlo | Structural Limit (63.2 PDA) | 1 |
| Axial PWSCC (TS) | +Point Voltage (0.29 Volts) | In-situ GL Voltages (Table 4-7) | 3 |

Notes;

1) For CM, three uncertainties must be considered (NDE, burst relationship, and material properties). The Mixed Arithmetic/Monte Carlo methodology accounts for these uncertainties as follows. The Arithmetic part accounts for NDE uncertainty by using the ETSS depth sizing regression equation together with a 95/50 value (of the ETSS standard deviation) to arrive at the limiting upper bound %TW value. The Monte Carlo part accounts for uncertainty, from burst relationship and material properties, for determining the structural limit. If the upper bound %TW value is less than the structural limit, CM is met.
2) The CM curve, itself, has built into it the three uncertainties using Monte Carlo methods. Therefore, no arithmetic correction for NDE sizing is required since it's accounted for by the CM curve.
3) CM for Axial PWSCC (TS) was determined by comparing the flaw's +Point voltage to the values in Table 4-7 of the In-Situ Guidelines.

AVB Wear

A mixed Arithmetic/Monte Carlo methodology was used for CM of AVB wear.

| Degradation Mechanism (wear) | Maximum Depth | 95%/50% Upper Bound Depth | CM Limit Depth |
|---|---|---|---|
| AVB Wear | 33% | 39.7% | 64% |

Since this upper bound estimate does not exceed the conservative structural limit of 64%TW, it is concluded that none of the AVB wear flaws exceeded the structural limit. Note that the 64%TW structural limit was developed under the guidance of Regulatory Guide 1.121 which considers both pressure and non-pressure loads.

Volumetric (Non-AVB Wear)

As indicated above, a Monte Carlo methodology was used for CM of the volumetric indications not attributed to AVB wear. Figure 1 through Figure 4 provide the 95/50 CM limit curves for flaws sized with ETSS 27901.1, 27902.1, 27905.1, and 96910.1 respectively.

**Figure 1: CM Curve for Flaws Sized w/ETSS 27901.1 – Model: Axial Thinning w/Limited Circumferential Extent**

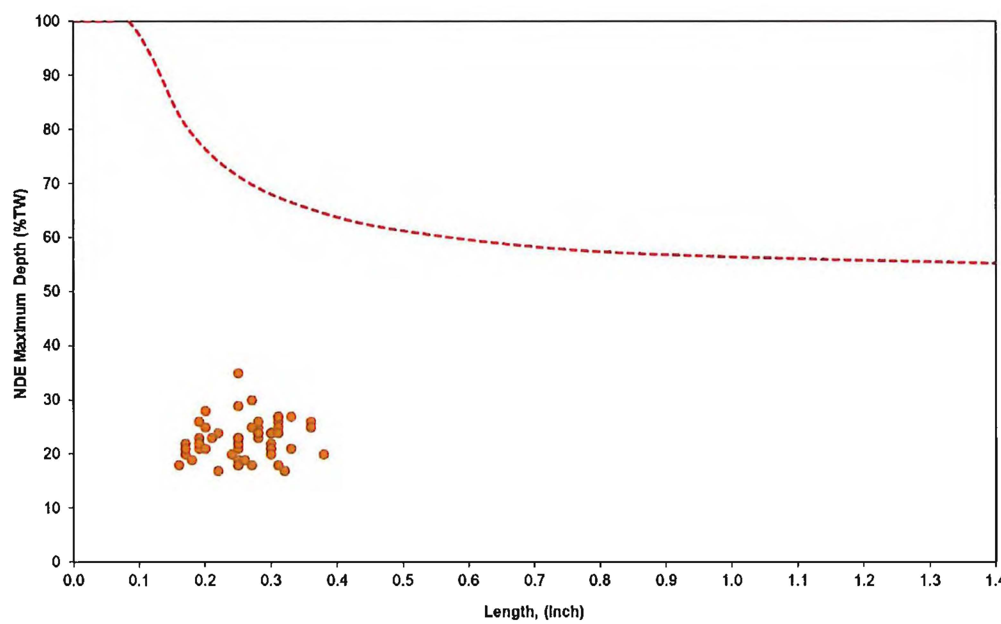


**Figure 2: CM Curve for Flaws Sized w/ETSS 27902.1 – Model: Axial Thinning w/Limited Circumferential Extent**

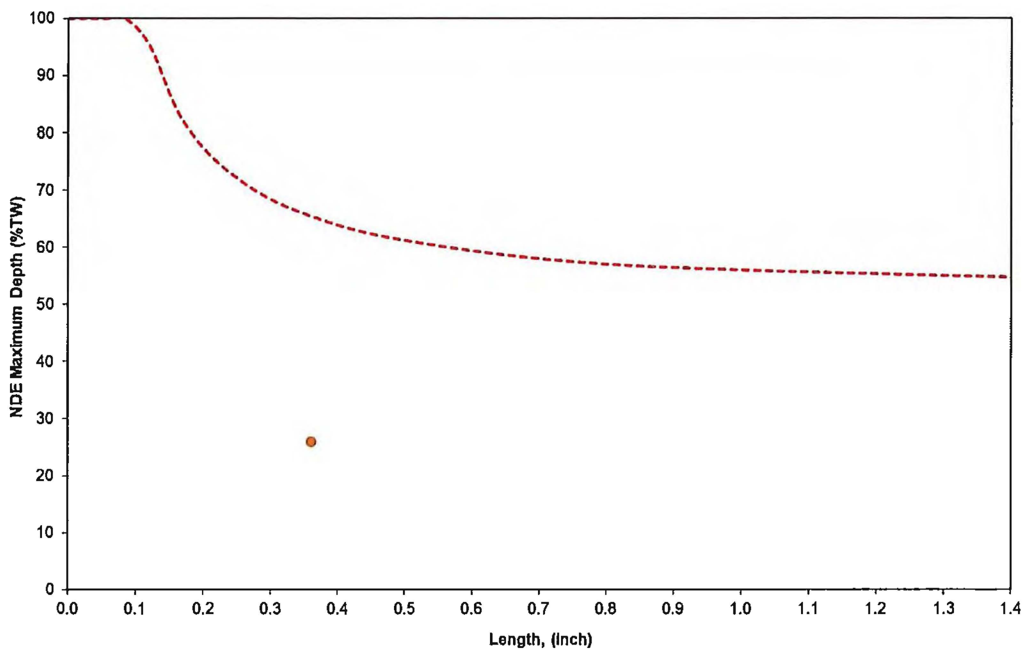



**Figure 3: CM Curve for Flaws Sized w/ETSS 27905.1 – Model: Axial Thinning w/Limited Circumferential Extent**

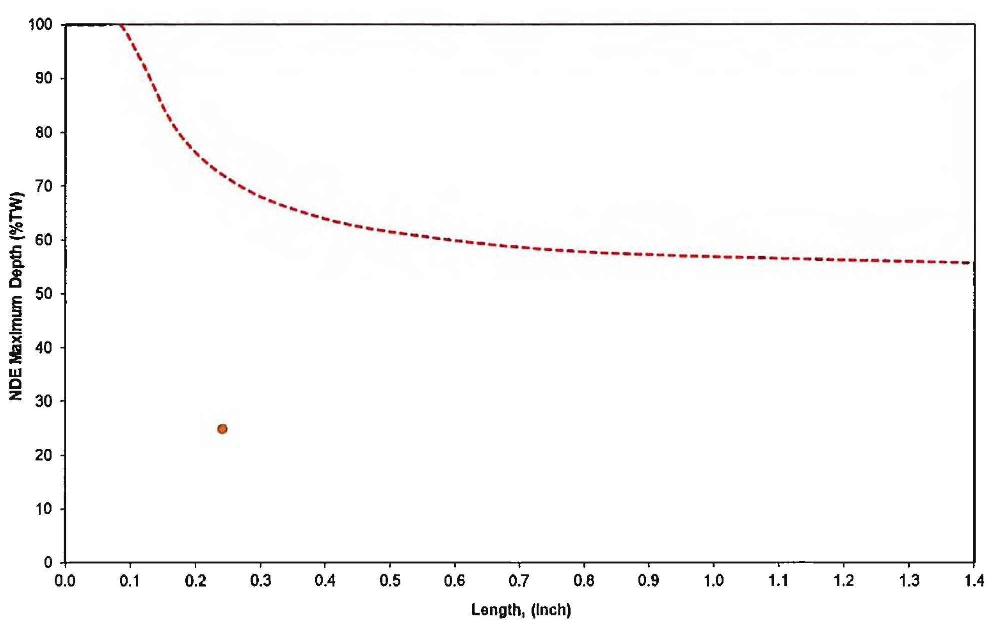
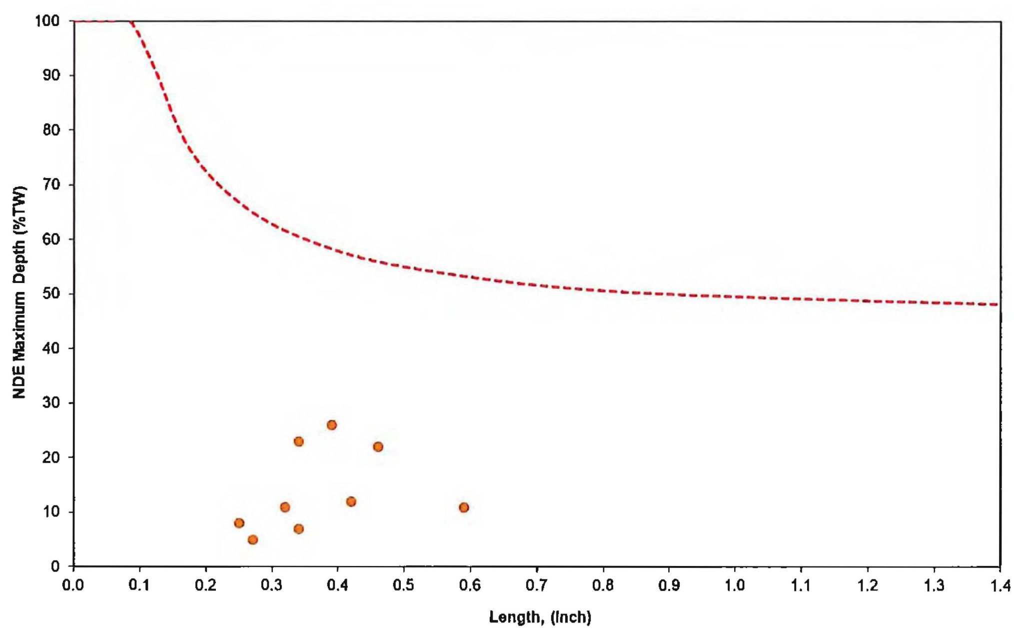


**Figure 4: CM Curve for Flaws Sized w/ ETSS 96910.1 – Model: Axial Thinning w/Limited Circumferential Extent**




<u>Stress Corrosion Cracking</u>

The circumferential PWSCC indication in was sized using ETSS 96701.1. The ETSS 96701.1 PDA uncertainty parameters are applied to determine the upper 95/50 PDA as follows:

ETSS 96701.1 PDA uncertainty parameters:

- Slope = 1.01
- Intercept = 8.55
- StdErr = 7.53

Upper 95/50 = (EOC30 PDA)(Slope)+(intercept)+(1.645)(StdErr)

Upper 95/50 = (2.2 PDA)(1.01)+(8.55)+(1.645)(7.53)

Upper 95/50 = 23 PDA

Since the upper 95/50 PDA (23 PDA) does not exceed the conservative structural limit of 63.2 PDA, it is concluded that the circumferential PWSCC indication satisfied the SIPC.

Tube SGC R6 C48 was stabilized and plugged.

The axial PWSCC indication was sized using ETSS 96703.1 and the maximum measured amplitude was 0.29 Volts. CM for this indication was determined by comparing the flaw's +Point voltage to the values provided in the In-Situ Guidelines.

**Table 9: In-Situ Screening Values for Axial PWSCC**

| | *Values* |
|---|---|
| ***SIPC*** | ***0.5 Volts*** |
| ***AILPC Threshold*** | ***2.5 Volts*** |

Since the maximum measured +Point$^{TM}$ signal amplitude (0.29 Volts) does not exceed the SIPC value (0.5 Volts) and does not exceed the AILPC threshold (2.5 Volts), it is concluded that the axial PWSCC indication satisfied both the SIPC and AILPC requirements.

**Table 10 – OA Methodology**

| **OA (Mechanism)** | **Methodology** | **Structural Limit** | Note |
|---|---|---|---|
| AVB Wear | Mixed Arithmetic/Monte Carlo | Structural Limit (64%TW) | 1 |
| FO Wear | Plant Operating History | | |
| TSP/FDB Wear | Mixed Arithmetic/Monte Carlo | Structural Limit (56.6%TW) | 1 |
| Circ PWSCC (TTS/TS) | Fully Probabilistic Multi-Cycle OA | Lower 95/50 Burst Pressure > 3ΔP | 2 |
| Axial PWSCC (TTS/TS) | Fully Probabilistic Multi-Cycle OA | Lower 95/50 Burst Pressure > 3ΔP | 2 |
| Circ ODSCC (TTS) | Fully Probabilistic Multi-Cycle OA | Lower 95/50 Burst Pressure > 3ΔP | 2 |
| Axial ODSCC (TSPs) | Fully Probabilistic Multi-Cycle OA | Lower 95/50 Burst Pressure > 3ΔP | 2 |
| Axial ODSCC (DNT/DNG) | Fully Probabilistic Multi-Cycle OA | Lower 95/50 Burst Pressure > 3ΔP | 2 |

1) For OA (plug on NDE sizing), four uncertainties must be considered (NDE, growth, burst relationship, and material properties). The Mixed Arithmetic/Monte Carlo methodology accounts for the four uncertainties as follows. The Arithmetic part accounts for NDE uncertainty by using the ETSS depth sizing regression equation together with a 95/50 value (of the ETSS standard deviation) to arrive at the limiting BOC %TW value. The limiting BOC %TW value is adjusted upward for growth allowance/uncertainty (to arrive at the EOC %TW value) and compared to the structural limit. The structural limit has been adjusted for burst relationship and material properties uncertainties using Monte Carlo methods. If the EOC %TW value is less than the structural limit, OA is projected to be met.
2) For the Fully Probabilistic Multi-Cycle OA, the lower 95/50 burst pressure must be greater than three times the primary-to-secondary differential pressure (3ΔP).

**Table 11 – OA Projected Condition During EOC33***

| Degradation Mechanism | Structural Integrity Performance Criteria | | Accident Induced Leakage Performance Criteria | |
|---|---|---|---|---|
| | Limit | EOC33 Projection | Limit | EOC33 Projection |
| AVB Wear | 64% | 48.1%TW Maximum Depth | 470 GPD | Zero Leakage |
| Foreign Object Wear | 72% | 35%TW Maximum Depth | 470 GPD | Zero Leakage |
| TSP/FDB Wear | 56.6% | 52.8%TW Maximum Depth | 470 GPD | Zero Leakage |
| Pitting | Dormant. No projected pitting. | | | |
| Circumferential PWSCC within tubesheet expansion | 4470 psi | 7502 psi | 470 GPD | Zero Leakage |
| Circumferential ODSCC @ TTS | 4470 psi | 7364 psi | 470 GPD | Zero Leakage |
| Axial PWSCC @ TTS | 4470 psi | 4605 psi | 470 GPD | Zero Leakage |
| Axial ODSCC @ TSPs | 4470 psi | 5502 psi | 470 GPD | Zero Leakage |
| Axial ODSCC @ (DNT/DNG) | 4470 psi | 4933 psi | 470 GPD | Zero Leakage |

*Although the Operational Assessment is projected to EOC33, an inspection is required to be performed during EOC31 due to the detection of stress corrosion cracking during EOC30.

***h. The primary to secondary LEAKAGE rate observed in each SG (if it is not practical to assign the LEAKAGE to an individual SG, the entire primary to secondary LEAKAGE should be conservatively assumed to be from one SG) during the cycle preceding the inspection which is the subject of the report,***

Routine primary-to-secondary leak monitoring is conducted in accordance with station procedures. During the cycle preceding EOC30, no measurable primary-to-secondary leakage was observed in any Unit 2 SG.

***i. The calculated accident induced LEAKAGE rate from the portion of the tubes below 17.89 inches from the top of the tubesheet for the most limiting accident in the most limiting SG. In addition, if the calculated accident induced LEAKAGE rate from the most limiting accident is less than 1.80 times the maximum operational primary to secondary LEAKAGE rate, the report should describe how it was determined,***

The permanent alternate repair criteria (PARC) requires that the component of operational leakage from the prior cycle from below the H-star distance be multiplied by a factor of 1.8 and added to the total accident leakage from any other source and compared to the allowable accident induced leakage limit. Since there is reasonable assurance that no tube degradation identified during this outage would have resulted in leakage during an accident, the contribution

to accident leakage from other sources is zero. Assuming that the prior cycle operational leakage is <1 GPD originated from below the H-star distance and multiplying this leakage by a factor of 1.8 as required by the PARC, yields an accident induced leakage value of <1.8 GPD. This value is well below the 470 GPD limit for the limiting SG and provides reasonable assurance that the accident induced leakage performance criteria would not have been exceeded during a limiting design basis accident.

***j. The results of the monitoring for tube axial displacement (slippage). If slippage is discovered, the implications of the discovery and corrective action shall be provided.***

No indications of tube slippage were identified during the evaluation of bobbin probe examination data from any SG during EOC30.

**Table 12 – Acronyms**

| | | | |
|---|---|---|---|
| AILPC | Accident Induced Leakage Performance Criteria | NDD | No Degradation Detected |
| ARC | Alternate Repair Criteria | NOPD | Normal Operating Pressure Differential |
| AVB | Anti-Vibration Bar | NTE | No Tube Expansion |
| BLG | Bulge | OA | Operational Assessment |
| BOC | Beginning Of Cycle | OD | Outside Diameter |
| BPC | Baffle Plate Cold | ODSCC | Outer Diameter Stress Corrosion Cracking |
| BPH | Baffle Plate Hot | OVR | Over Roll |
| CM | Condition Monitoring Assessment | OXP | Over Expansion |
| DNG | Ding | PARC | Permanent Alternate Repair Criteria |
| DNT | Dent | PDA | Percent Degraded Area |
| ECT | Eddy Current Test | PLP | Possible Loose Part |
| EFPM | Effective Full Power Months | POD | Probability Of Detection |
| EOC | End Of Cycle | PWSCC | Primary Water Stress Corrosion Cracking |
| ETSS | Examination Technique Specification Sheet | SCC | Stress Corrosion Cracking |
| EWM | Entangled wire mass | SG | Steam Generator |
| FAC | Flow Assisted Corrosion | SIPC | Structural Integrity Performance Criteria |
| FDB | Flow Distribution Baffle | SSI | Secondary Side Inspection |
| FO | Foreign Object | TS | Technical Specification |
| FOSAR | Foreign Object Search And Retrieval | TSC | Tube Sheet Cold |
| GPD | Gallons Per Day | TSH | Tube Sheet Hot |
| HRS | High Residual Stress | TSP | Tube Support Plate |
| ISI | In-Service Inspection | TTS | Top of Tubesheet |
| LPM | Loose Part Monitoring | TW | Through Wall |
| LPS | Loose Part Signal | VOL | Volumetric |
| MBM | Manufacturing Burnish Mark | WAR | Wear |

**Figure 5 - General Arrangement**

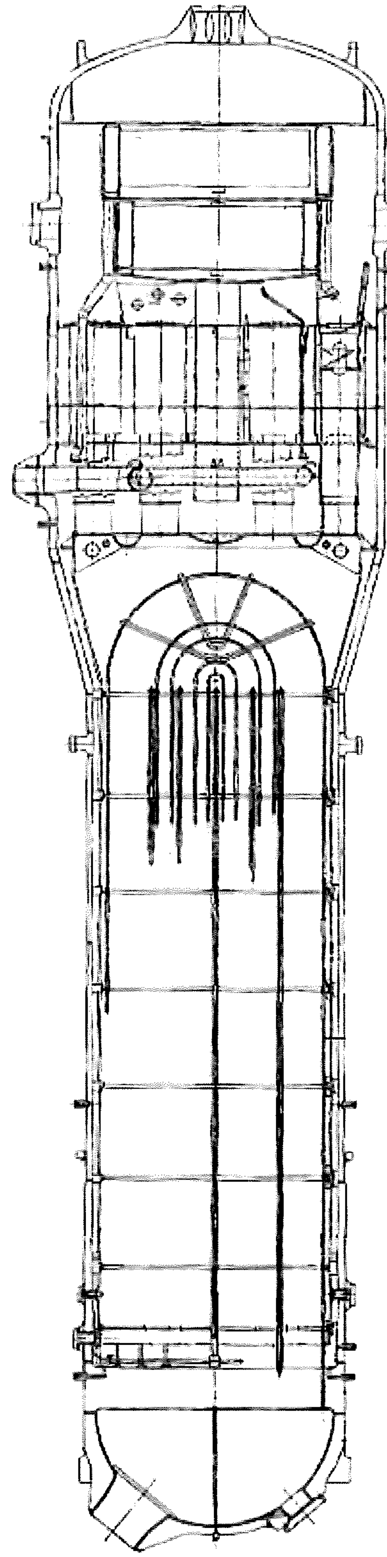


**Figure 6 – Disk Stack**

**Figure 7 – Disk Stack Location in Feed Regulating Valve**