



OCT 18 2016

L-2016-178

10 CFR 50.36

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555-00001

Re: Turkey Point Unit 4
Docket No. 50-251
Steam Generator Tube Inspection Report

The attached Turkey Point Unit 4 Cycle 29 Refueling Outage Steam Generator Tube Inspection Report is submitted in accordance with Turkey Point Technical Specification, 6.9.1.8 and within 180 days after the initial entry to MODE 4 following completion of the inspections performed in accordance with Technical Specification 6.8.4.j, Steam Generator (SG) Program.

Should there be any questions, please contact Mr. Mitch Guth, Licensing Manager, at (305) 246-6698.

Sincerely,

A handwritten signature in black ink, appearing to read 'T. Summers', followed by a horizontal line.

Thomas Summers
Site Vice President
Turkey Point Nuclear Plant

Attachments

cc: Regional Administrator, Region II, USNRC.
Senior Resident Inspector, USNRC, Turkey Point Plant

AD47
NRR

Turkey Point Unit 4 (TP4-29)
Steam Generator Tube Inspection Report
Attachment 1

Background

This report is provided in accordance with Turkey Point Unit 4 Technical Specification Section 6.9.1.8, "Steam Generator Tube Inspection Report" for the inspection conducted in April, 2016 during refueling outage twenty-nine (TP4-29). The TP4-29 outage designator is also commonly referred to as EOC-28 (End of the 28th Fuel Cycle). The TP4-29 inspection was the first inspection (and also the first Refueling Outage) in the 4th Inspection Period. The 4th inspection period length is 72 Effective Full Power Months (EFPM) in accordance with Turkey Point Unit 4 Technical Specification Section 6.8.4.j.d.2.c.

Turkey Point Unit 4 contains three (3) Westinghouse Model 44F steam generators (SGs), which were installed in 1982/83 to replace the original Unit 4 SGs. The hot leg operating temperature (T-Hot) of Turkey Point Unit 4 is currently ~610 degrees F.

Following the TP4-29 refueling outage, Turkey Point Unit 4 initially entered HOT SHUTDOWN (Mode 4) on April 23, 2016, which marked the beginning of Cycle 29 (CY-29). Pursuant to Turkey Point Unit 4 Technical Specification 6.9.1.8, this Steam Generator Tube Inspection Report is required to be submitted to the NRC within 180 days after initial entry into Mode 4.

Turkey Point Technical Specification Section 6.8.4.j.d.2.c contains the fourth inspection period requirements and requires that 100% of the tubes be inspected every 72 effective full power months (for this and all subsequent inspection periods). For the current inspection period of 72 EFPM, the completed and planned inspections for Turkey Point Unit 4 (for the current inspection period of 72 EFPM) are shown below:

- TP4-29 in 2016 (SG Inspection completed in April, 2016)
- TP4-30 in 2017 (SG inspection skip, no inspections planned)
- TP4-31 in 2019 (Planned SG Inspection)
- TP4-32 in 2020 (SG inspection skip, no inspections planned)

Implementation of TSTF-510 (Reference 1) was approved by License Amendments 255 and 251 (Reference 2) on Nov. 6, 2012, and incorporated into the Turkey Point technical specifications to make changes to the sections pertaining to SG tube integrity, the SG program (inspection frequency), and the SG tube inspection report.

The inspection at TP4-29 in 2016 was the first inspection of the fourth inspection period (72 EFPM). The completed inspection at TP4-29 satisfied the condition monitoring criteria of the Turkey Point Plant Technical Specifications. The previous inspection of the Unit 4 SG tubing was completed during the TP4-27 refueling outage in 2012. The cycle lengths for Cycle 27 and Cycle 28 were 1.36 EFPY and 1.39 EFPY, respectively. At the completion of Cycle 28 (CY-28), the Unit 4 replacement SGs have accumulated 25.80 Effective Full Power Years (EFPY) of operation. At the completion of Cycle 28, the Unit 4 SGs have operated for 1.14 EFPY in the fourth inspection period (72 EFPM).

Turkey Point Unit 4 (TP4-29)
Steam Generator Tube Inspection Report
Attachment 1

The next planned refueling outage for Unit 4 is during TP4-30 in Fall, 2017, which will be a skip outage for SG primary side and secondary side inspections. The next scheduled SG inspections will be during TP4-31 in Spring, 2019. That inspection will be the second inspection in the 4th ISI period (72 EFPM).

The examination performed during TP4-29 met the requirements of the following:

- Technical Specification 6.8.4.j "Steam Generator (SG) Program"
- Steam Generator Management Program: Pressurized Water Reactor Steam Generator Examination Guidelines: Revision 7. EPRI, Palo Alto, CA. 2007 TR-1013706.
- EPRI Report 1019038, Steam Generator Management Program (SGMP): Steam Generator Integrity Assessment Guidelines, Revision 3, November, 2009
- The TP4-29 inspection scope and plan were based on the Degradation Assessment that was prepared prior to the inspection.

Steam Generator Tube Inspection Report

Note: The previous SG Tube Inspection Report from TP4-27 is available under NRC Adams Accession # ML13277A358 (Reference 4). Subsequent NRC RAI's (and Nextera Responses) for the TP4-27 report are available under NRC Adams Accession # ML14069A083 (Reference 5).

Following is the Steam Generator Tube Inspection Report for TP4-29:

Each applicable reporting requirement of TS 6.9.1.8 is addressed below in items "a" through "j" for the TP4-29 inspection in 2016.

a. The scope of inspections performed on each steam generator

(All three SGs were examined during TP4-29).

The inspection program for the Unit 4 Steam Generators consisted of:

Bobbin Probe

- 100% full length in rows 3 and higher. Row 1 & 2 examinations limited to the hot leg (HL) and cold leg (CL) straight sections.

+Point™ Probe

- 50% of the hot leg (HL) tubesheet to the extent of TSH +3.00" to TSH-18.11".

Turkey Point Unit 4 (TP4-29)
Steam Generator Tube Inspection Report
Attachment 1

Note 1: TSH-18.11" is the approved H* depth, however, data was recorded from TSH +3.00" down through the HL tube end for ease of data acquisition.

Note 2: This inspection scope included at least 50% of the bulges (BLG) and over-expansions (OXF) in the HL tubesheet down to the H* depth.

- All HL and CL Periphery Expansion Transitions: +3"/-2" from top of tubesheet. "Periphery" Tubes are defined as the two outer-most peripheral tubes exposed to the annulus, and all open row 1 and 2 tubes in columns 1-92.
- 50% of Rows 1 and 2 tight radius u-bends
- 50% of hot leg freespan dings/dents > 5 volts between TSH and 06H + 1.00
- 50% of dings/dents in U-bends ≥ 2 volts
- 50% of dings/dents at HL tube support structures ≥ 2 volts
- 100% of potential high residual stress (2-sigma signature tubes), at the hot leg tubesheet to the extent of TSH +3.00 to TEH.
- 25% of potential high residual stress (2-sigma signature tubes), at TSP & FDB intersections (all HL, and top TSP on CL side).
- All tubes adjacent to previously reported foreign objects using the rotating +Point™ probe.
- Diagnostic rotating probe examinations (Special Interest, SI) as required based on the results of the bobbin coil.
- Selected wear indications were profiled with line-by-line sizing to provide additional information for Condition Monitoring (CM) and Operational Assessment (OA) purposes.

Plug Visual Inspection

- Visual inspection in each SG of all installed tube plugs.

Prior to starting the eddy current examination at TP4-29, all of the previously installed hot-leg and cold-leg plugs in all three steam generators were confirmed to be present in their correct locations and were confirmed to be free from degradation and visible signs of leakage based on the visual examination.

Primary Side Inspections to address Westinghouse NSAL 12-01

- Visual inspection in each SG of the channel heads in response to NSAL 12-1 "Steam Generator Channel Head Degradation" January 5, 2012 (Reference 6).

The channel head bowls of the 4A, 4B, and 4C steam generators were visually scanned to address the Westinghouse NSAL 12-01 letter; no anomalies were observed in any of the three SG channel heads.

Turkey Point Unit 4 (TP4-29)
Steam Generator Tube Inspection Report
Attachment 1

Secondary Side Cleaning and Inspections

The following secondary side work was performed in all three steam generators:

- Upper Bundle Flush
- Sludge Lance
- Foreign Object Search and Retrieval (FOSAR)

The UBF and sludge lancing processes resulted in the removal of the following amounts of sludge:

- 50.5 lbs of sludge from SG 4A
- 43.0 lbs of sludge from SG 4B
- 31.5 lbs of sludge from SG 4C.

Post sludge lancing FOSAR was performed in all three steam generators. One (1) newly-identified foreign object was reported during FOSAR in SG 4C, and that object was retrieved. There was no degradation associated with the retrieved foreign object. In addition to the FOSAR, primary side eddy current inspections using the rotating +Point™ coil were performed on all periphery tubes at the top-of-tubesheet locations (in the hot leg and cold leg of all three SGs). Several historical foreign objects (including sludge scale or hardened sludge fragments) are tracked at each inspection. All foreign objects remaining in the SGs are being tracked, and foreign object evaluations have been completed for those remaining foreign objects. The integrity of the steam generators until the next scheduled inspection is not affected by the foreign object that remain in the SGs. Foreign objects removed from the steam generators during FOSAR examinations are entered into the plant's Corrective Action Program (CAP) for tracking.

Upper Steam Drum Inspections were also performed in two SGs (SG 4A and 4C). The upper internal components inspected included primary separators, secondary separator perforated plates, drain pipes, feeding J-Nozzles and general areas. Ultrasonic thickness measurements were also taken at a sample of locations on the SG 4A feeding T-Box and J-Tubes, and on the SG 4C feeding T-Box. No abnormalities were noted during the upper steam drum inspection in SG 4A or 4C.

An in-bundle tube support visual inspection was also performed in SG 4A, at the top three support structures (04H, 05H, and 06H Broached Tube Support Plates). The inspection included views of the open tube lane and broached tube support openings in both hot and cold legs. The inspection revealed no abnormal conditions or fouling of the areas observed.

Turkey Point Unit 4 (TP4-29)
Steam Generator Tube Inspection Report
Attachment 1

b. Degradation mechanisms found

The TP4-29 examination results for Turkey Point Unit 4 identified mechanical wear at the following locations:

- Anti-vibration bars
- Broached tube support plates
- Hot Leg Baffle Plates (FDBs)
- One location (related to foreign object) above 01H Broached Tube Support Plate

In addition to the wear degradation discussed above, there was one (1) previously reported axial indication reported in SG 4B near the HL tube-end (which is below the H* depth of TTS-18.11"). On November 5th, 2012, the NRC approved License Amendments (Ref. 3) regarding permanent alternate repair criteria for service-induced degradation detected in the tubesheet region.

Reference 3 states: "Tubes with service-induced flaws located greater than 18.11 inches below the top of the tubesheet do not require plugging". Therefore, the tube with the indication below the H* region remained in service.

Since the axial indication was below the H* depth, it was reported as "AOB", which is an acronym for "Axial Indication Outside (H*) Boundary".

Note: During TP4-27 in 2012, there were eleven (11) axial indications reported as "AOB" below the H* depth, near the HL tube ends. The reason only one (1) "AOB" indication was re-reported during TP4-29 is because the locations of the other ten (10) previously reported "AOB" indications were not planned for inspection during TP4-29.

There were no indications of corrosion-related tube degradation detected above the H* depth during the TP4-29 inspection.

Turkey Point Unit 4 (TP4-29)
Steam Generator Tube Inspection Report
Attachment 1

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

Table 1
Turkey Point Unit 4 Examination Techniques for TP4-29

Technique		Industry Qualification (ETSS)	Type of Degradation	Demonstrated Applicability	Extended Applicability	Was the Technique Used for Sizing during TP4-29?
1	Bobbin	96004.1 Revision 13	Wear	Tube Supports (TSPs), Anti-Vibration Bars (AVBs)	None	Yes. Used to size AVB Wear for service.
2	Bobbin	96004.2 Revision 13	Wear	Tube Supports (TSPs), Anti-Vibration Bars (AVBs)	None	No
3	Bobbin	96005.2 Revision 9	Pitting	Freespan in the Presence of Copper	Detection of Pitting in Sludge Pile	No
4	Bobbin	24013.1 Revision 2	Axial ODSCC	Freespan Dings ≤ 5.00 Volts	None	No
5	Bobbin	I-28411 Revision 3	Axial ODSCC	Drilled TSP With or w/o Dents ≤ 2 volts	None	No
6	Bobbin	I-28412 Revision 3	Axial ODSCC	Freespan with or w/o Dents ≤ 2 volts	None	No
7	Bobbin	I-28413 Revision 3	Axial ODSCC	Freespan, Sludge Pile, Broached TSP with or w/o Dents ≤ 2 volts	None	No
8	Bobbin	27091.2 Revision 2	Foreign Object Wear	Foreign Object Wear (with Foreign Object not present)	Detection of Foreign Object Wear (with Foreign Object present)	No
9	+Point™	96511.1/2 Revision 16	Axial/Circ PWSCC	Low Row U-bend	None	No
10	+Point™	I11524 Revision 0	Circ PWSCC	Expansion Transition	Detection of Circ PWSCC at Dent, Dings, Non-Dented Support Structures, Sludge Pile, Tubesheet	No
11	+Point™	20511.1 Revision 8	Axial PWSCC	Expansion Transition	Detection of Axial PWSCC at Non-Dented Support Structures, Sludge Pile, Tubesheet	No

Turkey Point Unit 4 (TP4-29)
Steam Generator Tube Inspection Report
Attachment 1

Table 1
Turkey Point Unit 4 Examination Techniques for TP4-29
continued

Technique		Industry Qualification (ETSS)	Type of Degradation	Demonstrated Applicability	Extended Applicability	Technique Used for Sizing during TP4-29?
12	+Point™	96703.1 Revision 17	Axial PWSCC	Dent/Ding	Detection of Axial PWSCC at Non-Dented Support Structures, Tubesheet, Sludge Pile	No
13	+Point™	22401.1 Revision 4	Axial ODSCC	Dented Support Structures > 2.0 volts	Detection of Axial ODSCC at Tubesheet, Expansion Transition, Freespan, Dents, Dings,	No
14	+Point™	96910.1 Revision 10	Wear	Broached TSP	Detection and Sizing of Wear at Flow Baffle Plate, Foreign Object Wear w/ Foreign Object still present	Yes Used to size Broached TSP Wear and Flow Baffle Plate Wear for Service.
15	+Point™	21998.1 Revision 4	Volumetric	Freespan	None	No
16	+Point™	21410.1 Revision 6	Circ ODSCC	Expansion Transition	Detection of Circ ODSCC at TSP, Freespan, Sludge Pile, Tubesheet, Dents, Dings, U-bend	No
17	+Point™	27901.1 Rev. 1 27902.1 Rev. 2 27903.1 Rev. 1 27904.1 Rev. 2 27905.1 Rev. 2 27906.1 Rev. 1 27907.1 Rev. 2	Wear	Foreign Object Wear Shape Morphology Dependent (with Foreign Object not present)	Freespan Volumetric Degradation Morphology Dependent with Loose Part Present, Possible Loose Parts and TSP wear above and below the support edges (freespan)	Yes 27904.1, was used to size a foreign object wear near the upper edge of a Broached TSP (Row 17, Col 71 in SG4B). (The tube was plugged). 27905.1, was used to size wear above the upper edge of a broached TSP edge. (Row 5, Col 86 in SG4B).

Turkey Point Unit 4 (TP4-29)
Steam Generator Tube Inspection Report
Attachment 1

Table 1
Turkey Point Unit 4 Examination Techniques for TP4-29
continued

Technique		Industry Qualification (ETSS)	Type of Degradation	Demonstrated Applicability	Extended Applicability	Technique Used for Sizing during TP4-29?
18	+Point™	I-28424 Revision 3	Axial ODSCC	Sludge Pile, Drilled TSP with or w/o dents ≤ 2.0 volts	None	No
19	+Point™	I-28425 Revision 3	Axial ODSCC	Freespan, Broached TSP w/o Dents ≤ 2.0 volts	None	No
20	+Point™	I-28431 Revision 2	Axial ODSCC	Sizing - Sludge Pile and Drilled TSP with or w/o Dents ≤ 2 volts	None	No
21	+Point™	I-28432 Revision 2	Axial ODSCC	Sizing - Freespan, Broached TSP with or w/o Dents ≤ 2 volts	None	No
22	+Point™	21409.1 Revision 7	Axial ODSCC	Support Structures, Freespan Region, Sludge Pile and Tubesheet Crevice	Detection of Axial ODSCC at Expansion Transitions	No
23	+Point™	10411.1/2 Revision 0	Axial ODSCC	U-bend Rows 3-5	Detection of Axial ODSCC in all ubends	No
24	+Point™	10908.4 Revision 1	Wear	Anti-Vibration Bars (AVBs)	None	Yes, used to profile selected AVB wear indications

Turkey Point Unit 4 (TP4-29)
Steam Generator Tube Inspection Report
Attachment 1

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

Attachments 2, 3, and 4 contain the indication listings for SG 4A, 4B and 4C respectively.

Note: For AVB wear, the listings provide the depth as measured by the bobbin probe.
For all other wear locations, the listings provide the depth as measured by the +Point™ probe.

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

Table 2
Turkey Point Unit 4 Tube Plugging TP4-29

Reason for Plugging	SG 4A	SG 4B	SG 4C	Total
1) Wear attributed to foreign object above 01H Broached tube support plate	0	1	0	1
2) Preventatively plugged for wear at an anti-vibration bar (AVB) location	0	1	0	1
Total	0	2	0	2

Note: Item 1 in the Table 2 above was reported in SG B / R17 C71 and required plugging per Plant Technical Specifications. Item 2 in Table 2 above was reported in SG B / R35 C54 and was plugged preventatively (plugging was not required per Plant Technical Specifications).

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

No tube repair methods (i.e. sleeving) are approved for Turkey Point Unit 4 that would have an effect on the effective plugging percentages. Therefore, the applicable effective plugging percentage is synonymous with the % Plugged in Table 3 below:

Turkey Point Unit 4 (TP4-29)
Steam Generator Tube Inspection Report
Attachment 1
Table 3

Turkey Point Unit 4 Steam Generator Cumulative Tube Plugging Summary TP4-29		
SG	# Plugged	% Plugged
4A	33	1.03%
4B	23	0.72%
4C	11	0.34%

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

All tubes satisfied the structural integrity and accident-induced leakage performance criteria based on the condition monitoring (CM) evaluation performed at the TP4-29 inspection. No tubes required in-situ pressure testing for either tube burst or leakage. Therefore, all tubes met the structural and leakage integrity requirements of the Turkey Point Technical Specifications.

No tube pulls were required.

Discussion on AVB Wear

Tube wear at AVBs has been the dominant mode of degradation for the Unit 4 steam generators. During TP4-29, the Technical Specification wear repair limit of $\geq 40\%$ TW depth was applied, however, no AVB wear $\geq 40\%$ TW was reported at AVB locations during TP4-29. One tube (R35 C54 in S/G 4B) was preventatively plugged because the detected AVB wear indications reported during TP4-29 exhibited a large depth change since the last inspection at TP4-27. During TP4-29, newly detected indications at AVB 3 and AVB 4 were measured as 24% and 31%TW, respectively. Those two locations had no detectable degradation reported during the TP4-27 inspection.

A total of 80 wear indications at AVB locations were detected and evaluated: 23 in S/G 4A, 30 in S/G 4B, and 27 in S/G 4C. Eighteen AVB wear indications were newly detected at this inspection: 7 in SG 4A, 10 in S/G 4B, and 1 in S/G 4C. The others were wear indications detected in prior inspections, and were allowed to remain in service based on repair-on-sizing strategy acceptance and monitored for growth.

All detected AVB wear indication sizes fell below the condition monitoring limits for both the burst and leakage requirements. Therefore, the AVB wear indications met the CM requirements in NEI 97-06 for burst and leak integrity.

Turkey Point Unit 4 (TP4-29)
Steam Generator Tube Inspection Report
Attachment 1

Discussion on Broached TSP Wear

There were 11 indications detected at broached TSP locations: 2 in S/G 4A, 8 in S/G 4B, and 1 in S/G 4C. Two of the TSP indications were newly detected for the TP4-29 inspection. All detected wear indications fell well below the condition monitoring limits. Therefore, the TSP wear indications met the acceptance criteria of NEI 97-06 structural performance criterion for burst and leak integrity.

Discussion on Baffle Plate Wear

There were 8 indications detected at hot leg baffle plate locations: 2 in S/G 4A, 5 in S/G 4B and 1 in S/G 4C. There were no newly detected indications for the EOC 28 inspection. All detected baffle plate wear indications fell well below the condition monitoring limits. Therefore, the baffle plate wear indications met the acceptance criteria of NEI 97-06 structural performance criterion for burst and leak integrity.

Discussion on Foreign Object Wear Indication

The wear indication at the 01H tube support structure in SG 4B (in R17 C71) was detected with the bobbin probe and confirmed with the +Point™ rotating probe. The wear indication was attributed to a foreign object because of:

- The indication's proximity to a tube that was plugged in TP4-27 in 2012 for foreign object wear
- The indication's morphology is consistent with foreign object wear.

During the TP4-27 inspection in 2012, a possible loose part (PLP) signal was reported (in SGB, R17 C74) coincident with wear at the upper edge of 01H. It was not possible to visually confirm the presence of a foreign object because that area was inaccessible for inspection by the Foreign Object Search and Retrieval (FOSAR) operations. The morphology of the 2012 indication was consistent with foreign object wear. The tube at R17 C74 was plugged and stabilized in 2012.

The foreign object wear indication reported during TP4-29 in 2016 occurred on the top edge of the 01H broached tube support plate in R17 C71, just a few tubes away from the foreign object wear reported in R17 C74 in 2012. Eddy current did not detect the presence of a possible loose part (PLP) in R17 C71 during the 2016 inspection. In addition, the location was tested during TP4-27 in 2012 with the bobbin coil, and no PLPs or degradation were reported for the tube at the R17 C71 location.

FOSAR inspectors were not able to visually confirm the presence or absence of a foreign object at the R17 C71 location during the 2016 inspection, due to its location in the tube bundle. The tubes surrounding R17 C71 were inspected with the +Point™ coil, and no evidence of a foreign object was detected.

Turkey Point Unit 4 (TP4-29)
Steam Generator Tube Inspection Report
Attachment 1

The bobbin technique detected the foreign object wear in R17 C71, and the appropriate +Point™ technique (ETSS 27904.1) for the specific wear shape was used to size the indication. The depth of the wear scar from the suspected foreign object was sized at 77%TW by +Point™ with a length of 0.35 inch.

Comparison of the measured voltage and length sizes with the exemption criteria show the voltage-based screening criteria are met for both leakage and structural requirements for Tube R17 C71.

The tube located at row 17 column 71 was stabilized and plugged during the TP4-29 inspection.

- 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**

No primary to secondary leakage was observed during Cycles 27 and 28.

- i. The calculated accident induced leakage rate from the portion of the tubes below 18.11 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 1.82 times the maximum operational primary to secondary leakage rate, the report should describe how it was determined**

The accident induced leakage rate from the portion of the tubes below 18.11 inches from the top of the tubesheet is calculated from any observed normal operating leakage that cannot be attributed to a source other than the tubesheet expansion region. The technical basis for this calculation is contained in the H* Alternate Repair Criteria (ARC) for the Turkey Point plant. For the operating period preceding the TP4-29 inspection, no operational primary-to-secondary leakage has been observed.

For Turkey Point Unit 4, the maximum operational primary-to-secondary leakage rate from the portion of the tubes below 18.11 inches from the top of the tubesheet is determined by multiplying any normal operating leakage by a factor of 1.82 to determine the accident induced leakage rate. This multiplying factor for leakage is based on H* Alternate Repair Criteria (ARC) methodology. Since no operational primary-to-secondary leakage has been observed, the calculated accident induced leakage rate from the portion of the tubes below 18.11 inches from the top of the tubesheet is zero.

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

Monitoring of tube slippage was completed during the TP4-29 inspections.
No tube slippage was reported.

Turkey Point Unit 4 (TP4-29)
Steam Generator Tube Inspection Report
Attachment 1

ADDITIONAL INFORMATION

The following information is included to assist the staff's review of this report.

Abbreviations and Acronyms

AOB	Axial Indication Outside of Pressure Boundary
ARC	Alternate Repair Criteria
AVB	Anti-Vibration Bar
CL	Cold Leg
CM	Condition Monitoring
EPRI	Electric Power Research Institute
FDB	Flow Distribution Baffle
HL	Hot Leg
ISI	In-service Inspection
ISPT	In Situ Pressure Testing
OA	Operational Assessment
PWSCC	Primary Water Stress Corrosion Cracking
TSP	Tube Support Plate
TSH	Tube Sheet Hot (Hot Leg Top of Tubesheet)
TTS	Top of Tubesheet
%TW	(Percent) Through Wall Depth
WAR	Mechanical Wear

Outage Designators

TP4-27	=	EOC-26
TP4-29	=	EOC-28
TP4-30	=	EOC-29
TP4-31	=	EOC-30
TP4-32	=	EOC-31

Turkey Point Unit 4 (TP4-29)
Steam Generator Tube Inspection Report
Attachment 1

References:

1. NRC Document TSTF-510, Rev 2, "Revision to Steam Generator Program Inspection Frequencies and Tube Sample Selection".
2. NRC License Amendment 255 and 251, Letter dated November 6, 2012 "Turkey Point Nuclear Generating Station Unit Nos. 3 and 4 - Issuance of Amendments Regarding Adoption of TSTF 510, Revision to Steam Generator Program Inspection Frequencies and Tube Sample Selection (TAC NOS. ME9106 and ME9107)." (ADAMS Accession No. ML12297A240).
3. NRC License Amendment 254 and 250, Letter dated November 5, 2012 "Turkey Point Nuclear Generating Station Unit Nos. 3 and 4 - Issuance of Amendments Regarding Permanent Alternate Repair Criteria for Steam Generator Tubes (TAC NOS. ME8515 and ME8516)." (ADAMS Accession No. ML12292A342).
4. Turkey Point Unit 4 Docket No. 50-251 Steam Generator Tube Inspection Report (for TP4-27 Inspection in 2012). (ADAMS Accession No. ML13277A358).
5. Turkey Point Unit 4 Docket No. 50-251 Response to Request for Additional Information Regarding Steam Generator Tube Inspection Report (for TP4-27 Inspection in 2012). (ADAMS Accession No. ML14069A083).
6. Westinghouse Nuclear Safety Advisory Letter (NSAL) 12-01, Steam Generator Channel Head Degradation, 01/05/2012.

**Turkey Point Unit 4 (TP4-29)
Steam Generator Tube Inspection Report
Attachment 2**

SG 4A

SG 4A Indication Listings	
Listing Description	Page No.
Additional Tubes Plugged Listing During TP4-29 (No Tubes Plugged)	2
Bobbin WEAR (WAR) at AVB locations 20-100%TWD	2
Bobbin WEAR (WAR) at AVB locations 1-19% TWD	2
+Point™ WEAR (WAR) 1-100% (Broached Support Plates)	3
+Point™ WEAR (WAR) 1-100% (H/L Baffle Plates)	3

Turkey Point Unit 4 (TP4-29)
Steam Generator Tube Inspection Report
Attachment 2

SG 4A

Turkey Point Unit 4 (TP4-29)
SG 4A

Additional Tubes Plugged Listing during TP4-29

No additional tubes required plugging as a result of the inspections in Steam Generator (SG) 4A.

Turkey Point Unit 4 (TP4-29)
SG 4A

Bobbin Wear (WAR) at AVB's 20-100%TWD

ROW	COL	%TW	LOCATION
=====	=====	=====	=====
29	25	25	AV4 -0.11
37	65	27	AV2 +0.00
		32	AV4 +0.00

Total Tubes : 2
Total Indications: 3

Turkey Point Unit 4 (TP4-29)
SG 4A

Bobbin Wear (WAR) at AVB's 1-19%TWD

ROW	COL	%TW	LOCATION
=====	=====	=====	=====
26	20	6	AV1 +0.30
30	16	6	AV2 +0.00
30	30	10	AV3 -0.02
30	80	9	AV2 +0.18
31	77	12	AV1 +0.27
31	80	10	AV1 +0.27
32	74	12	AV1 +0.05
		10	AV2 +0.23
		10	AV3 +0.20
32	76	10	AV4 -0.14
33	72	19	AV1 +0.23
		13	AV3 -0.25
33	74	9	AV1 +0.11
35	67	11	AV4 -0.16
37	20	12	AV1 +0.28
		13	AV2 +0.28
37	65	17	AV3 +0.00
37	71	18	AV2 +0.48
		12	AV3 +0.34
42	63	9	AV3 +0.62

Total Tubes : 15
Total Indications: 20

Turkey Point Unit 4 (TP4-29)
Steam Generator Tube Inspection Report
Attachment 2

SG 4A

Turkey Point Unit 4 (TP4-29)
SG 4A

+Point™ Wear (WAR) At Broached Supports 1-100%TWD

ROW	COL	IND	%TW	LOCATION
====	====	===	===	=====
4	58	WAR	8	02H +0.55

10	62	WAR	9	04H +0.48

Total Tubes : 2
Total Indications: 2

Turkey Point Unit 4 (TP4-29)
SG 4A

+Point™ Wear (WAR) At H/L Baffle Plates 1-100%TWD

ROW	COL	IND	%TW	LOCATION
====	====	===	===	=====
13	4	WAR	11	BAH -0.25

39	28	WAR	5	BAH +0.05

Total Tubes : 2
Total Indications: 2

**Turkey Point Unit 4 (TP4-29)
Steam Generator Tube Inspection Report
Attachment 3**

SG 4B

SG 4B Indication Listings	
Listing Description	Page No.
Additional Tubes Plugged During TP4-29	2
Bobbin WEAR (WAR) at AVB locations 20-100%TWD	2
Bobbin WEAR (WAR) at AVB locations 1-19% TWD	3
+Point™ WEAR (WAR) 1-100% (Broached Support Plates)	3
+Point™ WEAR (WAR) 1-100% (H/L Baffle Plates)	4
+Point™ WEAR (WAR) 1-100% (Wear due to Foreign Object)	4

Turkey Point Unit 4 (TP4-29)
Steam Generator Tube Inspection Report
Attachment 3

SG 4B

Turkey Point Unit 4 (TP4-29)
SG 4B

Additional Tubes Plugged During TP4-29

Two tubes (shown below) were plugged in SG 4B during TP4-29.

ROW	COL	Degradation Type
====	====	=====
17	71	Foreign Object Wear
35	54	AVB Wear

Note: Row 17 Col 71 in SG4B required plugging because %TW depth of degradation exceeded Tech Spec Plugging criteria. Row 35 Col 54 was preventatively plugged due to AVB wear growth rate.

Turkey Point Unit 4 (TP4-29)
SG 4B

Bobbin Wear (WAR) at AVB's 20-100%TWD

ROW	COL	%TW	LOCATION
====	====	===	=====
27	72	22	AV1 -0.11
34	46	23	AV2 -0.23
35	54	24	AV3 -0.25
		26	AV3 +0.27
		31	AV4 +0.27
38	58	20	AV4 -0.09

Total Tubes : 4
Total Indications: 6

Turkey Point Unit 4 (TP4-29)
Steam Generator Tube Inspection Report
Attachment 3

SG 4B

Turkey Point Unit 4 (TP4-29)
SG 4B

Bobbin Wear (WAR) at AVB's 1-19%TWD

ROW	COL	%TW	LOCATION
=====	=====	=====	=====
13	42	14	AV1 -0.12
21	6	12	AV3 +0.20
23	50	12	AV3 +0.00
23	85	11	AV3 -0.11
26	64	14	AV2 +0.00
		14	AV3 +0.00
26	68	10	AV3 +0.00
26	71	10	AV2 +0.20
26	83	8	AV2 +0.27
27	72	18	AV2 +0.21
27	82	13	AV4 +0.18
30	65	13	AV2 +0.14
		9	AV3 +0.18
30	73	9	AV2 +0.00
		13	AV3 +0.00
		16	AV4 +0.00
31	13	12	AV2 +0.16
		13	AV4 +0.18
33	16	13	AV4 +0.00
33	62	13	AV2 -0.23
33	78	10	AV2 +0.30
		11	AV1 +0.30
34	46	11	AV2 +0.70
38	58	15	AV3 +0.21

Total Tubes : 18
Total Indications: 24

Turkey Point Unit 4 (TP4-29)
SG 4B

+Point™ Wear (WAR) At Broached Support Plates 1-100%TWD

ROW	COL	IND	%TW	LOCATION
=====	=====	=====	=====	=====
5	12	WAR	10	04H +0.40
5	86	WAR	7	01H +0.67
9	80	WAR	4	02H +0.42
28	80	WAR	7	05H -0.50
31	60	WAR	16	02H -0.22
35	49	WAR	8	02H -0.30
40	25	WAR	6	01C +0.32
44	38	WAR	10	04C +0.52

Total Tubes : 8
Total Indications: 8

Turkey Point Unit 4 (TP4-29)
Steam Generator Tube Inspection Report
Attachment 3

SG 4B

Turkey Point Unit 4 (TP4-29)
SG 4B

+Point™ Wear (WAR) At H/L Baffle Plates 1-100%TWD

ROW	COL	IND	%TW	LOCATION
====	====	===	===	=====
19	86	WAR	11	BAH -0.20
		WAR	11	BAH -0.15

35	70	WAR	9	BAH -0.30

40	26	WAR	5	BAH -0.20
		WAR	6	BAH +0.00

Total Tubes : 3
Total Indications: 5

Turkey Point Unit 4 (TP4-29)
SG 4B

+Point™ Wear (WAR) Due to Foreign Objects 1-100%TWD

ROW	COL	IND	%TW	LOCATION
====	====	===	===	=====
17	71	WAR	77	01H +0.68

Total Tubes : 1
Total Indications: 1

Turkey Point Unit 4 (TP4-29)
Steam Generator Tube Inspection Report
Attachment 4

SG 4C

SG 4C Indication Listings	
Listing Description	Page No.
Additional Tubes Plugged Listing for TP4-29 (No tubes plugged)	2
Bobbin WEAR (WAR) at AVB locations 20-100%TWD	2
Bobbin WEAR (WAR) at AVB locations 1-19% TWD	2
+Point™ WEAR (WAR) 1-100% (Broached Support Plates)	3
+Point™ WEAR (WAR) 1-100% (H/L Baffle Plates)	3

Turkey Point Unit 4 (TP4-29)
Steam Generator Tube Inspection Report
Attachment 4

SG 4C

Turkey Point Unit 4 (TP4-29)
SG 4C

Additional Tubes Plugged Listing for TP4-29

No additional tubes required plugging as a result of the inspections in Steam Generator (SG) 4C.

Turkey Point Unit 4 (TP4-29)
SG 4C

Bobbin WAR at AVB's 20-100%TWD

ROW	COL	%TW	LOCATION
=====	=====	=====	=====
32	70	23	AV1 +0.37
35	31	28	AV2 +0.30

Total Tubes : 2
Total Indications: 2

Turkey Point Unit 4 (TP4-29)
SG 4C

Bobbin WAR at AVB's 1-19%TWD

ROW	COL	%TW	LOCATION
=====	=====	=====	=====
12	4	9	AV4 +0.33
13	4	16	AV4 +0.37
22	7	13	AV2 +0.16
22	82	11	AV1 +0.30
22	83	12	AV4 +0.00
24	12	16	AV4 -0.18
26	82	15	AV1 +0.30
27	80	10	AV3 +0.25
27	81	9	AV1 +0.27
		9	AV4 +0.20
30	15	14	AV1 +0.21
30	75	14	AV2 +0.59
31	80	8	AV3 +0.18
32	16	19	AV2 +0.21
32	70	19	AV3 +0.21
33	76	8	AV1 +0.27
34	17	7	AV1 +0.11
34	53	14	AV2 +0.21
		9	AV1 -0.21
34	75	15	AV4 -0.02
36	74	8	AV3 +0.14
37	71	8	AV1 +0.37
37	73	8	AV3 -0.27
39	69	7	AV2 +0.16
40	68	6	AV2 +0.21

Total Tubes : 23
Total Indications: 25

Turkey Point Unit 4 (TP4-29)
Steam Generator Tube Inspection Report
Attachment 4

SG 4C

Turkey Point Unit 4 (TP4-29)
SG 4C

+Point™ Wear (WAR) At Broached Supports 1-100%TWD

ROW	COL	IND	%TW	LOCATION
====	====	===	===	=====
35	75	WAR	10	06H +0.36

Total Tubes : 1
Total Indications: 1

Turkey Point Unit 4 (TP4-29)
SG 4C

+Point™ Wear (WAR) At H/L Baffle Plates 1-100%TWD

ROW	COL	IND	%TW	LOCATION
====	====	===	===	=====
28	82	WAR	7	BAH +0.45

Total Tubes : 1
Total Indications: 1