



South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

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South Texas Project
Unit 1
Docket No. STN 50-498
1RE19 Inspection Summary Report for Steam Generator Tubing

Enclosed is the summary report describing the results of the South Texas Project Unit 1 steam generator tube inspection performed during refueling outage 1RE19. The summary report satisfies the reporting requirements of ASME Section XI, Article IWA-6230, and Section 6.9.1.7 of the South Texas Project Technical Specifications. This report provides the information required by Technical Specification 6.8.3.o for maintaining steam generator tube integrity.

There are no commitments in this letter.

If there are any questions regarding this report, please contact either Wendy Brost at (361) 972-8516 or me at (361) 972-7806.

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AD47
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Enclosure: 1RE19 Inspection Summary Report for Steam Generator Tubing (Rev 0) of the South Texas Project Electric Generating Station Unit 1

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**1RE19 INSPECTION SUMMARY REPORT
FOR STEAM GENERATOR TUBING**

(Rev 0)

of the

SOUTH TEXAS PROJECT

ELECTRIC GENERATING STATION

UNIT 1

P.O. BOX 289

WADSWORTH, TEXAS 77483

Commercial Operation: August 25, 1988

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1RE19 INSPECTION SUMMARY REPORT
FOR STEAM GENERATOR TUBING
(Rev. 0)
of the
SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION
UNIT 1

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SOUTH TEXAS PROJECT UNIT 1

1RE19 INSPECTION SUMMARY REPORT FOR STEAM GENERATOR TUBING

Introduction

This summary report describes the inspection of steam generator tubing at South Texas Project (STP) Unit 1 performed during refueling outage 1RE19 beginning 10/17/2015 and ending with breaker closure on 12/20/2015. Eddy current inspection, sludge lancing, and Foreign Object Search and Retrieval (FOSAR) were conducted in steam generators (SGs) 1A, 1B, 1C and 1D. Additional inspections of the secondary side of SGs 1A, 1C and 1D were also performed.

The eddy current inspection performed during 1RE19 completes the first inspection of the Technical Specification (TS) Second Interval for all STP Unit 1 SGs. The outage was performed following 167.3 effective full power months cumulative service with the Delta 94 replacement SGs. This report provides the information required by TS 6.8.3.o for maintaining SG tube integrity and the reporting requirements of TS 6.9.1.7.

Scope of Examination

The 1RE19 outage initial inspection plan, "1RE19 Steam Generator In-Service Outage Plan October 2015", identified the SG tube areas to be examined by eddy current testing and the related procedures to be used during the inservice inspection. The inspection plan was applicable to SGs 1A, 1B, 1C and 1D. A Degradation Assessment written prior to the outage established the following scope of primary and secondary side inspections.

Primary Side Inspection Scope

As required by the Electric Power Research Institute (EPRI) Examination Guidelines, the 1RE19 outage inspection program addressed the known degradation mechanism(s) observed in STP Unit 1 during prior inspections as well as those regarded as potential degradation mechanisms. The primary side inspection included the following elements.

Bobbin Coil Inspection

- Full length bobbin coil inspection of 100% of the outer three peripheral tubes from tube end to tube end, including ten tubes inwards into the no-tube lane from the periphery to aid in foreign object detection
- 50% full length bobbin coil inspection of all non-peripheral tubes
- 20% bobbin probe inspection of the upper tube support plate (TSP) hot leg to upper TSP cold leg (U-Bend) of Rows 1 and 2

Rotating Coil Inspection - Straight Section

- +Point probe inspection of outer three peripheral tubes and divider lane top of tube sheet (TTS)
+6 inches/-3 inches, including hot leg (HL) and cold leg (CL), to aid in foreign object detection
- 20% sample +Point probe inspection of tube sheet hot (TSH) +6 inches/-3 inches
- 20% sample +Point probe inspection of TSH +6 inches/-16 inches in tubes with bulges and over-expansions

Rotating Coil Inspection - Special Interest

- +Point probe inspection of all previously identified dents and dings >5 volts (V)
- +Point probe inspection of all prior and 1RE19 "I-code" and/or non-quantifiable indications as determined by bobbin coil inspection or any previously reported signal that has changed
- +Point probe inspection of possible loose parts (PLPs) in the eddy current database as identified by previous eddy current inspections
- +Point probe inspection of all observed Priority 1 or 2 foreign objects identified during 1RE16 secondary side video inspections and not removed, including a minimum of two tube locations surrounding the object
- +Point probe inspection of a minimum of two tube locations surrounding any newly identified PLP
- +Point probe inspection of a minimum of two tube locations surrounding newly identified foreign objects that are classified as Priority 1 or Priority 2
- +Point probe inspection of all tube-to-tube wear (TTW) indications detected by bobbin coil
- +Point probe inspection of all reportable proximity (PRO) indications
- +Point probe inspection of all manufacturing burnish marks (MBM) bobbin coil indications that have increased by ≥ 0.5 V including both new and changed bobbin coil MBM indications
- +Point probe inspection of prior inspection MBMs that are TTW candidates as evidenced by matching MBMs on adjacent tubes at a common elevation
- +Point probe inspection of wear indications left in service

Other Primary-Side Inspections

- Video inspection of all installed plugs
- Video inspection of hot and cold leg bowl drain area looking for thinning or missing cladding and associated wastage, if any
- Stud hole gauging on SG 1C

Secondary Side Inspection Scope

- TTS FOSAR in all four SGs including annulus and no-tube lane
- TTS in-bundle FOSAR as follows:
 - SG 1A inspect every fourth column both hot leg and cold leg
 - SG 1B inspect every fourth column both hot leg and cold leg
 - SG 1C inspect every fourth column both hot leg and cold leg
 - SG 1D inspect every second column both hot leg and cold leg (Note 1)
- Ultra-sludge lancing on all four SGs
- Steam Drum inspections in SG 1C and SG 1D
- Upper Steam Drum inspection in SG 1C
- Video probe inspection of ninth support plate on SG 1A
- Tube scale profiling and trefoil profiling on SG 1A and SG 1D
- FOSAR of all foreign objects left in service during 1RE16, if reachable by tooling
- FOSAR of all PLPs (previous inspection and 1RE19) identified by eddy current inspection, if reachable by tooling

Note 1: Loose parts tend to accumulate preferentially in SG 1D due to the feedwater header piping configuration. Generally 50% of steam generator loose parts deposit into SG 1D.

Inspection Expansion

As discussed below, a volumetric indication (VOL) was identified in tube D-R30C78 within the hot leg tubesheet hard sludge via the +Point probe. This indication lead to expansion of the top of the tubesheet +Point probe program to include all tubes within the sludge pile region of all four SGs, plus a minimum two tube border. No additional VOL indications were observed in the scope expansion.

The cold leg sides of all STP SGs do not contain a hardened sludge pile nor sludge collars, thus no inspection expansion was performed in cold leg tubes.

Primary Side Examination Results

Table 1 presents a summary of the tube non-destructive examination (NDE) indication results based on available data relevant to evaluating tube integrity. This summary includes redundant indications that may have been detected by multiple inspection programs.

No crack-like indications or indications of foreign object wear were identified during the 1RE19 inspection. One possible new degradation mechanism was found - a volumetric indication under the hard sludge deposits. One new occurrence of TSP wear, an existing degradation mechanism, was also identified during the 1RE19 inspection.

Table 1: STP Unit 1 1RE19 Eddy Current Inspection – Final Indication Listing

| Indication | Condition | Number of Indications | | | | |
|------------|---|-----------------------|-------|-------|-------|-------|
| | | SG 1A | SG 1B | SG 1C | SG 1D | Total |
| DNG | Ding (Freespan Only) | 464 | 30 | 330 | 185 | 1009 |
| DNS | Distorted Ding Indication Not Confirmed | 18 | 11 | 17 | 35 | 81 |
| DSS | Distorted Support Signal | 1 | 1 | 2 | 2 | 6 |
| INF | Indication Not Found | 3 | 2 | 3 | 2 | 10 |
| INR | Indication Not Reportable | 58 | 28 | 36 | 162 | 284 |
| MBM | Manufacturing Burnish Mark | 247 | 226 | 260 | 303 | 1036 |
| NDD | No Detectable Degradation | 8085 | 8321 | 8126 | 9089 | 33621 |
| NDF | No Degradation Found | 155 | 31 | 19 | 10 | 215 |
| NQS | Non-Quantifiable Signal | 35 | 49 | 43 | 27 | 154 |
| PCT | Percent | 1 | 1 | 0 | 1 | 3 |
| PID | Positive Identification | 0 | 1 | 0 | 1 | 2 |
| PLP | Possible Loose Part | 1 | 2 | 0 | 30 | 33 |
| PRC | Previous Rotating Probe Call | 0 | 0 | 0 | 1 | 1 |
| PRO | Tube Proximity Measurement | 16 | 7 | 4 | 0 | 27 |
| PVN | Permeability Variation | 0 | 0 | 0 | 1 | 1 |
| VOL | Volumetric | 1 | 1 | 3 | 8 | 13 |

Inspection Results - Volumetric Indication Under Hard Sludge Deposits

A volumetric indication was identified in tube D-R30C78 as part of the base scope of inspection to perform a +Point probe inspection of two tube locations surrounding Priority 2 foreign object D0028. The indication was located 0.2 inch above the hot leg tubesheet. The 0.08 V indication was sized by Examination Technique Specification Sheet (ETSS) 21998.1 to be 12% through-wall (TW). The dimension of the indication was approximately 0.1 inch in the axial and circumferential direction.

A review of prior inspection +Point probe and pancake coil information showed that a +Point probe signal was discernable, but not reportable, in the 1RE16 inspection data. The indication was not present in inspections performed in 1RE09 (pre-service inspection), 1RE10 and 1RE13.

The +Point probe data showed that the sludge collar was one inch thick at the location of the VOL in 1RE19. A review of prior cycle +Point probe data showed that the sludge collar was also one inch thick at this location in 1RE13 and 1RE16.

The location of the indication was retested with the +Point probe as well as a magnetically-biased +Point probe and a Ghent probe. All three of these probes detected the indication.

The cause of the indication is unknown at this time. Possible causes include:

- a false call,
- loose part wear,
- a manufacturer surface blemish
- a corrosion induced pit, or
- volumetric intergranular attack (IGA)

The single volumetric call in tube D-R30C78 did not require in-situ testing.

Because this volumetric indication could not definitely be associated with mechanical wear, STPNOC decided to plug the tube. In the STPNOC response to Generic Letter 97-05, STP informed the NRC that Eddy Current Testing (ECT) flaw sizing would only be used to leave tubes in-service for wear indications. All potential corrosion related degradation mechanisms are plugged on detection.

A final causal analysis report is expected in June 2016 – A copy of this report will be sent to the NRC.

Inspection Results - Foreign Object Wear - PLPs

Foreign object wear, while not affecting a large population of tubes, is an existing degradation mechanism at STP Unit 1.

A total of eight PLP indications were identified at the TTS, none of which were associated with a wear indication or visible wear. Table 2 lists the PLPs located near the TTS for 1RE19. There were no PLPs in SG 1C. All of the TTS PLPs were associated with an object that had been noted as part of the FOSAR program, except for PLP-A-001. A video probe examination was performed near the reported location of PLP-A-001 and no object or wear was found.

Table 2: 1RE19 PLP Indications at the TTS

| SG | PLP | Row | Col | Leg | Location | Inch | Visually Verified | Comments |
|----|-----------|-----|-----|-----|----------|------|-------------------|--------------------|
| A | PLP-A-001 | 59 | 59 | HL | TSH | 0.12 | Yes | Nothing observed |
| B | PLP-B-001 | 88 | 58 | HL | TSH | 0.12 | Yes | 1RE19 Object B0003 |
| B | PLP-B-002 | 87 | 59 | HL | TSH | 0.09 | Yes | 1RE19 Object B0003 |
| C | No PLPs | | | | | | | |
| D | PLP-D-008 | 122 | 90 | HL | TSH | 0 | Yes | 1RE19 Object D0021 |
| D | PLP-D-009 | 122 | 94 | HL | TSH | 0.07 | Yes | 1RE19 Object D0017 |
| D | PLP-D-013 | 54 | 112 | HL | TSH | 0.17 | Yes | 1RE19 Object D0042 |
| D | PLP-D-014 | 57 | 113 | HL | TSH | 0.09 | Yes | 1RE19 Object D0041 |
| D | PLP-D-018 | 32 | 152 | HL | TSH | 0.11 | Yes | 1RE19 Object D0004 |

A total of 25 PLP indications were identified at locations above the TTS located in the vicinity of the flow distribution baffle (FDB). Table 3 lists the PLPs located near the FDB. All of the FDB PLPs were found in SG 1D. None of these PLPs were associated with a wear indication. Each of the PLPs in Table 3 were present in the 1RE16 inspection. These PLP indications are due to remnants of a section of stabilizer wire that had entered steam generator 1D prior to the 1RE12 outage. A +Point probe inspection of two tube locations surrounding each FDB PLP was conducted. There were no wear indications in any of these surrounding tubes.

Table 3: 1RE19 PLP Indications at the FDB

| SG | PLP | Row | Col | Leg | Location | Inch |
|----|-----------|-----|-----|-----|----------|-------|
| D | PLP-D-001 | 78 | 36 | HL | FBH | -0.65 |
| D | PLP-D-002 | 78 | 36 | HL | FBH | 0.27 |
| D | PLP-D-003 | 87 | 49 | HL | FBH | -0.55 |
| D | PLP-D-004 | 110 | 56 | HL | FBH | 1.06 |
| D | PLP-D-005 | 111 | 57 | HL | FBH | 2.16 |
| D | PLP-D-006 | 126 | 78 | HL | FBH | 0.93 |
| D | PLP-D-007 | 108 | 90 | HL | FBH | 0.76 |
| D | PLP-D-010 | 102 | 98 | HL | FBH | 1.19 |
| D | PLP-D-011 | 75 | 111 | HL | FBH | 0.71 |
| D | PLP-D-012 | 75 | 111 | HL | FBH | 1.12 |
| D | PLP-D-015 | 85 | 119 | HL | FBH | 0.51 |
| D | PLP-D-016 | 76 | 134 | HL | FBH | -0.3 |
| D | PLP-D-017 | 76 | 134 | HL | FBH | 0.16 |
| D | PLP-D-019 | 127 | 71 | CL | FBC | 1.51 |
| D | PLP-D-020 | 44 | 76 | CL | FBC | -0.61 |
| D | PLP-D-021 | 44 | 76 | CL | FBC | 0.28 |
| D | PLP-D-022 | 121 | 91 | CL | FBC | -0.38 |
| D | PLP-D-023 | 121 | 91 | CL | FBC | 0.48 |
| D | PLP-D-024 | 50 | 100 | CL | FBC | -0.11 |
| D | PLP-D-025 | 114 | 110 | CL | FBC | 1.66 |
| D | PLP-D-026 | 116 | 110 | CL | FBC | 1.5 |
| D | PLP-D-027 | 115 | 111 | CL | FBC | 0.18 |
| D | PLP-D-028 | 115 | 111 | CL | FBC | 1.03 |
| D | PLP-D-029 | 80 | 128 | CL | FBC | -0.26 |
| D | PLP-D-030 | 31 | 151 | CL | FBC | -0.64 |

None of the PLP indications required in-situ proof of pressure or leakage testing to demonstrate tube integrity.

All instances of foreign object wear from prior cycles were inspected in 1RE19. In each case, the object that caused the wear has been removed. None of the indications have changed since the 1RE16 inspection.

Inspection Results - TSP Wear

TSP wear is categorized as an existing degradation mechanism. During the STP Unit 1 SG inspections conducted during 1RE16, two tubes were found to have TSP wear. Location A-R126C88-06H had a reported indication of 6% TW at 1RE16, as sized by bobbin. During 1RE19, this same location was sized by bobbin to be 5% TW. Location B-R3C155-06H had a reported indication of 9% TW at 1RE16, as sized by bobbin. At 1RE19, this location was sized by bobbin to be 9% TW.

There was one new location with a TSP wear indication reported for the first time in 1RE19. The indication at location D-R3C41-08C was sized by bobbin to be 10% TW. This tube was not tested in 1RE16. A review of the 1RE13 data showed that this indication was 8% TW at that time. The probability of detection (POD) is low for an 8% TW indication.

All three of these TSP wear indications are located near the periphery or the no-tube lane of the tube bundle. None of the TSP wear indications required in-situ testing or plugging.

During the review of previous cycles' inspection results, STPNOC noted an error in the 1RE16 Inspection Summary Report. The 1RE16 report indicated that three TSP wear indications were observed. A review of the data during 1RE19 revealed that only two TSP wear indications were observed as described above.

Potential Degradation Mechanisms

The Degradation Assessment categorized anti-vibration bar wear and tube-to-tube wear as potential degradation mechanisms. The results are as follows:

Mechanical Wear Indications at Anti-Vibration Bars

There were no tubes in the STP Unit 1 SGs with indications of wear at the anti-vibration bars.

Mechanical Wear Indications due to Tube-to-Tube Contact

There were no tubes in the STP Unit 1 SGs with indications of wear due to tube-to-tube contact. A review of MBM and tube proximity measurement (PRO) indications, with follow-up inspection via +Point probe where applicable, did not indicate the presence of wear.

Volumetric Indications

Table 1, above, indicates that 13 VOL indications were identified in the 1RE19 inspection. They are attributed to the following mechanisms:

- Three are associated with the three TSP wear indications. As discussed above, two of the TSP wear indications were identified in previous inspections and one was reported for the first time in 1RE19.
- One is associated with the sludge pile volumetric indication in tube D-R30C78.
- Nine are associated with foreign object wear from prior cycles. There was no change in these indications from 1RE16.

Non-Degradation Mechanisms

Indications first reported with potential flaw-like characteristics in the STP Unit 1 SGs may include indications initially reported as distortions or pre-existing signals such as manufacturing burnish marks or dents and dings (MBI, MBM, DNI, DNS), benign indications (DFI, DFS, DSI, DSS), anomalous signals at the tubesheet or elsewhere (DTI, DTS), non-quantifiable signals in the sludge pile region (NQI, NQS) and permeability indications (PVN). The character of I-code signals, when observed, is determined by history review, Lead Analyst Review, or by +Point probe examination. All other I-code indications, other than the three TSP wear indications discussed above, were dispositioned as non-flaw conditions. There were no unresolved I-codes for 1RE19.

PVNs are technically not I-code signals but rather interferences that can compromise detection of flaw signals. There were no flaws associated with PVN indications.

MBMs are conditions where shallow volumetric scuffs were introduced into the tubes exterior during the final tube polishing. Of concern are new MBMs that exhibited increasing voltage as such a change may indicate a condition other than a manufacturing anomaly. No new MBMs were identified and no MBM increased by more than 0.5V.

There were 27 tubes with PRO indications (tubes in proximity) in the STP Unit 1 SGs. A review of historical data reveals that these proximity indications were present in previous inservice inspections. Follow-up inspection with +Point indicate that there were no flaw-like indications associated with any PRO indication.

Ding (DNG) is a baseline indication where the tubing inside diameter is less than normal. The dings are fabrication induced and not expected to grow in size. The Degradation Assessment specified that all dings greater than 5V that were reported in the baseline examination would be inspected with a +Point coil. 85 dings greater than 5V were identified in the STP Unit 1 SGs; these dings were inspected with a +Point probe and no degradation was found.

The 1RE16 inspection DNG indication at location B-R127C79 had a 47.94V bobbin signal at tubesheet cold (TSC) +3.21. The tube was dented when the SG was raised to a vertical position during installation when a wedge fell thru the downcomer, striking a peripheral tube. The wedge was removed during replacement of the SGs. The size of this DNG indication did not allow a standard size bobbin probe to pass. This location was inspected with a down sized probe during the 1RE19 inspection and no defect was found (NDF). This tube was administratively plugged in order to reduce future dose associated with probe change out.

Bulge (BLG) is a condition where the tubing outside diameter is greater than normal. An overexpansion (OXF) is a similar condition associated with anomalies in the tubesheet. There were no new BLG/OXP locations identified in 1RE19. Existing BLG/OXP locations were inspected with a +Point probe. The results of the tests were that no defects were found (NDF).

Plug Inspection Results

All installed plugs were confirmed to be present and free from degradation.

Bowl Inspection Results

A visual inspection of the SG channel head bowl was performed in all SGs during 1RE19, based on industry operating experience identified in the Degradation Assessment. Visual inspections of the SG hot leg and cold leg divider plate base, and with particular attention to the bottom 36 inch radius of the bowl, were performed in accordance with Westinghouse NSAL-12-01 using the SG manway channel head bowl cameras. Satisfactory inspection results were observed in all SGs. No degradation was observed.

Stud Hole Gauging

Stud hole go/no-go gauging and stud gauging were performed on SG 1C. All results were satisfactory. Stud holes and studs are gauged to identify thread wear that may occur. No defects were found.

Tube Repair Summary

Two tubes were plugged in 1RE19. Tube D-R30C78 was plugged due to the conservative decision to treat the volumetric indication as a pit. As discussed above, only mechanical wear is left in-service based on indication sizing. Since wear could not definitively be determined to be the cause of the indication, the tube was plugged. Another tube, B-R127C79, was administratively plugged for an abnormally large dent which prevented inspection with a standard size bobbin probe. Table 4 lists the total tubes plugged for each Unit 1 SG.

Table 4: Total Tubes Plugged Per Steam Generator

| Steam Generator | Total Tubes Plugged | SG Percent Plugged |
|-----------------|---------------------|--------------------|
| 1A | 33 | 0.435 |
| 1B | 41 | 0.541 |
| 1C | 26 | 0.343 |
| 1D | 14 | 0.185 |

Summary of Secondary Side Inspection and Maintenance Plan

The following is a summary of the secondary side inspection and maintenance plan:

- TTS FOSAR in all four SGs generators including annulus and no-tube lane
- TTS in-bundle FOSAR as follows:
 - SG 1A inspect every fourth column both hot leg and cold leg
 - SG 1B inspect every fourth column both hot leg and cold leg
 - SG 1C inspect every fourth column both hot leg and cold leg
 - SG 1D inspect every 2nd column both hot leg and cold leg
- Ultra-sludge lancing on all four SGs
- Steam Drum inspections in SG 1C and SG 1D
- Upper Steam Drum inspection in SG 1C
- Video probe inspection of 9th support plate on SG 1A
- FOSAR of all foreign objects left in service during 1RE16, if reachable by tooling
- FOSAR of all PLPs identified by eddy current inspection, if reachable by tooling

Secondary Side Inspection and Maintenance Results

Sludge Lancing

All four STP Unit 1 SGs were sludge lanced. Table 5 provides a summary of the mass of sludge collected from sludge lancing operations.

Table 5: Mass of Sludge Collected During 1RE19

| Steam Generator | 1RE19 Sludge Weight (lbs) |
|------------------------|----------------------------------|
| 1A - Tubesheet | 22.2 |
| 1B - Tubesheet | 45.6 |
| 1C - Tubesheet | 52.2 |
| 1D - Tubesheet | 19.5 |

Post-lance inspections revealed that the top of the tubesheet of all four SGs are generally clean with essentially all sludge removed. No anomalies were noted on any tubesheet location. The kidney region, encompassing the tubes within approximately rows 19-35 from columns 72-84, has hardened collars at the TTS, all less than 1.125 inches in thickness. The hardened sludge pile has not grown measurably since 1RE16.

Steam Drum

STP performed visual observations of the steam drums for SG 1C and SG 1D to assess the condition of the steam drum and to ensure reliable operations until the next inspection period. The steam drums were inspected for erosion, mechanical damage, cracked welds, corrosion, foreign material and any unusual conditions. The upper steam drum was also inspected in SG 1C.

The steam drum inspections revealed no abnormal conditions – No defects were found.

In-Bundle Inspection of the Ninth Tube Support Plate

STP performed an in-bundle inspection of the ninth TSP of SG 1A in order to obtain visual information on the deposit loading in the upper region of the tube bundle. Video probes were deployed from the tube lane using extensions that permitted visual observation of flow slots, tube surfaces, and trefoil ligaments.

The inspection showed a thin layer of magnetite covering the TSP top surface, along with some loose deposits but not to any significant extent. Scale provided a continuous cover of all the tube surfaces with the exception of tubes nearest the no-tube lane. The tubes near the no-tube lane are minimally fouled. No deposit bridging across the trefoil to tube outside diameter (OD) surface nor departures from the expected appearance of the TSP ligaments were observed.

Foreign Object Mapping and Retrieval

FOSAR was performed at the top of the tubesheet, the tube bundle-shell annulus and the tube lane in all four SGs. A total of 81 foreign objects were identified during the top of tubesheet video probe inspections. During the eddy current program, eight PLP calls were reported. As required by EPRI guidelines, coordination between the eddy current and secondary visual inspection results was maintained. Top of the tubesheet tube locations showing PLP signals by eddy current were visually-inspected to identify the source of the signal. In addition, all top of the tubesheet tube locations where foreign objects were identified during visual inspections were included in the top of tubesheet +Point probe inspection program.

There was one Priority 1 object that was not retrievable during the 1RE16 inspection (object 1D039, located at D-R120C68-HL). Object 1D039 was not retrievable because one end was fixed in place in sludge on the top of the tubesheet. This object was evaluated and it was determined that the tubes adjacent to 1D039 could remain in service without exceeding structural and leakage integrity criteria for the operating interval of Unit 1 Cycles 17 through 19. An inspection of this area in 1RE19 showed that the sludge was no longer on the tubesheet and the wire object was no longer present. Wear was not visible, nor was wear detected by ECT. It is likely that the object was sludge lanced out of the SG.

Based on existing wear analyses and top of the tubesheet velocity maps, prioritization criteria were developed and used to assign priorities to each of the identified foreign objects. Foreign objects were assigned priorities based on the characteristics of the object and its location on the tubesheet:

- Priority 1 foreign objects are those which cannot be left in the SGs and justify a three-cycle operational assessment without further evaluation or additional remedial measures.
- Priority 2 foreign objects can be left in and operate for three cycles, but still have the potential for wear and will need to be addressed in future inspection outages.
- Priority 3 foreign objects cannot cause wear of any significance and may be left in the steam generator indefinitely.

Priority 1 and Priority 2 objects, whether they were retrieved or not, were tested and bound by a +Point probe to provide assurance that they had not caused wear, in accordance with the EPRI Integrity Assessment Guidelines.

There were 36 objects that could not be removed from the SGs. This includes 21 Priority 3 objects, 15 Priority 2 objects and zero Priority 1 objects. Each identified foreign object not removed from the respective SG was subjected to a foreign object wear analysis to support the planned operating period through Cycle 22.

Condition Monitoring Conclusion

Based on the Condition Monitoring evaluation, inservice inspection of tubes in service during Cycle 19 confirms that they all meet the structural integrity requirements of Steam Generator Integrity Assessment Guidelines, Revision 3. Neither the small volumetric indication discovered in SG 1D nor the minor tube support plate wear on tube D-R3C41-08C challenge structural integrity limits. Since no degradation mechanisms challenging structural integrity limits were detected during the 1RE19 inspection and no primary-to-secondary leakage was observed prior to the end of Cycle 19, the condition monitoring assessment requirements for SG operation for Cycles 17, 18, and 19 are satisfied. With no significant indications of tube degradation, in-situ tests were not required. No tubes were pulled during 1RE19. No challenges to the SG Performance Criteria were identified; therefore, the condition monitoring requirements for the Unit 1 replacement steam generator tube bundles at the end of Cycle 19 are satisfied. The next Unit 1 SG inspection is scheduled for refueling outage 1RE22.