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AEP:NRC:7055-07

Docket Nos.: 50-315
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U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop O-P1-17
Washington, DC 20555-0001

Donald C. Cook Nuclear Plant Units 1 and 2
STEAM GENERATOR TUBE INSPECTION REPORT
REQUEST FOR ADDITIONAL INFORMATION

References:

1. Letter from J. N. Jensen, Indiana Michigan Power Company (I&M), to U. S. Nuclear Regulatory Commission (NRC) Document Control Desk, "Donald C. Cook Nuclear Plant Unit 1, Steam Generator Tube Inservice Inspection Report," AEP:NRC:6567, dated October 31, 2006 (ML063130412).

2. Letter from J. N. Jensen, I&M, to NRC Document Control Desk, "Donald C. Cook Nuclear Plant Units 1 and 2, Steam Generator Tube Inspection Report," AEP:NRC:7691, dated February 27, 2007 (ML070660516).

3. Letter from P. S. Tam, NRC, to M. W. Rencheck, I&M, "D. C. Cook Nuclear Plant, Unit 1 (DCCNP-1) – Request for Additional Information on Two Steam Generator Inspection Reports (TAC Nos. MD5944 and MD5945)," dated December 13, 2007 (ML073200204).

In Reference 1, Indiana Michigan Power Company (I&M), the licensee for Donald C. Cook Nuclear Plant Unit 1 and Unit 2, provided the Nuclear Regulatory Commission (NRC) a report of Steam Generator eddy current findings and repairs during the Unit 1 Cycle 21 refueling outage.

In Reference 2, I&M provided the NRC the 2006 Steam Generator Tube Inservice Inspection Report for both Unit 1 and Unit 2.

In Reference 3, the NRC requested additional information regarding I&M's submittals. The attachment to this letter provides I&M's response to the request for additional information.

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This letter contains no new or revised commitments. Should you have any questions, please contact Mr. James M. Petro, Jr., Regulatory Affairs Manager, at (269) 466-2491.

Sincerely,

Joseph N. Jensen
Site Support Services Vice President

SLA/rdw

Attachment:

Steam Generator Tube Inspection Report Request for Additional Information

Enclosures:

1. SG 13 – Bobbin Coil Inspection Map
2. SG 13 – Rotating Coil Expansions Map
3. Secondary Side Inspection and Foreign Object Search and Retrieval Table

c: R. Aben – Department of Labor and Economic Growth
J. L. Caldwell – NRC Region III
K. D. Curry – AEP Ft. Wayne, w/o attachment/enclosures
J. T. King – MPSC, w/o attachment/enclosures
MDEQ – WHMD/RPMWS, w/o attachment/enclosures
NRC Resident Inspector
P. S. Tam – NRC Washington DC

Attachment to AEP:NRC:7055-07

STEAM GENERATOR TUBE INSPECTION REPORT REQUEST FOR ADDITIONAL INFORMATION

In Reference 1, Indiana Michigan Power Company (I&M), the licensee for Donald C. Cook Nuclear Plant (CNP) Unit 1 and Unit 2, provided the Nuclear Regulatory Commission (NRC) a report of Steam Generator eddy current findings and repairs during the Unit 1 Cycle 21 (U1C21) refueling outage.

In Reference 2, I&M provided the NRC the 2006 Steam Generator Tube Inservice Inspection Report for both Unit 1 and Unit 2.

In Reference 3, the NRC requested additional information regarding I&M's submittal. I&M's response to the request for additional information is provided below.

NRC Request 1

Please discuss the root cause of the tube plugging error in 2002 in Steam Generator (SG) 14.

I&M Response to Request 1

A condition evaluation was performed and the mis-plugging issue was attributed to human performance errors and procedural noncompliance as discussed below.

The tube plugging error was identified during the U1C21 (2006) visual tube plug inspection that was performed to confirm that no plug degradation had occurred. This inspection was performed using a video camera per a site-approved contractor procedure.

At the time of the initial repair (2002), tube plugging operations were conducted using a site-approved contractor procedure. A manipulator was installed in the cold leg only for SG 14. In this instance, the target tube was located with the calibrated manipulator by performing a position verification using a minimum of two known tube locations in the same quadrant (other than the calibration points). The target tube was marked, prepped for plug insertion, and then plugged. On the hot leg side where the error occurred, the same general sequence occurred. However, with no calibrated manipulator installed; the procedure required independent remote manual visual position verification by Quality Assurance/Quality Control (QA/QC). This resulted in a properly installed plug in the cold leg side and an improperly installed tube on the hot leg side.

Review of the 2002 tube plugging video tape confirmed that the hot leg plugging crew immediately began looking for the tube location on the wrong side of the stay rod location that they were using as a visual landmark. It is believed that although the crew was working in the hot leg, they were using a cold leg tubesheet map, which projects a mirror image. As evidenced in the video tape, the crew had difficulty in locating the target tube (by counting tube rows and columns from a known landmark location), but they ultimately received QA/QC concurrence of

the targeted location. The location targeted was on the incorrect side of the stay rod in the mirror image location and resulted in a misplugged location due to human error.

Three events during the manual marking process combined such that the incorrect tube was marked and subsequently plugged. Any one of these three events, if performed properly, would have prevented the wrong tube from being plugged.

1) The operator counted tubes in the wrong direction from his selected "known location" and, as a result, directed the platform operator to mark the wrong tube.

2) The next step in the marking process requires an independent verification of the marked location by a second operator. However, this verification step was skipped because the procedure was not being properly utilized.

3) The QA/QC inspector did not identify the correct tube to be marked during his independent verification.

While this same SG was inspected in 2003 (prior to U1C21 in 2006), the condition was not discovered at that time, also due to human error. This inspection is intended to confirm plug degradation has not occurred and is performed per the guidance contained in a site-approved contractor procedure. To that end, the operator panned the camera over the tubesheet and then centered on the plug location (only one plug was installed in this SG at the time). He then proceeded to inspect the plug for signs of leakage, but failed to confirm the targeted location as required by the inspection procedure. These events were entered into the CNP Corrective Action Program.

As a result of this event, all tube plug locations (in both CNP units) were verified and manual tube plug location verification is no longer allowed in either CNP unit.

Note: This issue was discovered during the Fall 2006 NRC Inservice Inspection and was subsequently discussed in the February 12, 2007, NRC inspection report titled "D.C. Cook Nuclear Plant, Units 1 and 2 NRC Integrated Inspection Report 05000315/2006007; 05000316/2006007."

<u>NRC Request 2</u>

In your February 27, 2007 letter, you indicated that, based upon the results from the 2006 (SG) tube inspections, the SGs remain on a maximum inspection interval of 40 calendar months. As a result, you indicated that your next scheduled inservice inspection is in the fall of 2009. Subsequent to the issuance of this letter, your SG technical specification (TS) requirements were modified. These new requirements specify different maximum inspection intervals that are based on effective full power months of operation. In addition, they specify a different inspection scope. As a result, please verify that if your next SG tube inspection is conducted in the fall of 2009, that you will satisfy your current SG TS requirements. Please include the following in this response: for each refueling outage or SG inspection outage since replacement of your SGs, the

cumulative effective full power months (or years) of operation that the SGs had accumulated at the time of the outage.

I&M Response to Request 2

As noted, the inspection requirements have been changed in the TS. Specifically, for periodic inspections, 100 percent (%) of the tubing must be inspected at sequential periods of 144, 108, 72, and, thereafter, 60 effective full power months (EFPM). The first sequential period is considered to begin after the first inservice inspection of the SGs. In addition, 50% of the tubes must be inspected by the refueling outage nearest the midpoint of the period and the remaining 50% by the refueling outage nearest the end of the period. No SG shall operate for more than 72 EFPM months or three refueling outages (whichever is less) without being inspected.

As indicated in the table below, the Unit 1 SGs were replaced prior to the U1C17 refueling outage and have accumulated approximately 70.28 EFPM of operation (thru September 17, 2007, the end of cycle U2C17).

As noted in the TS, the first sequential period is 144 EFPM and starts after the first inservice inspection has been completed (beginning of Cycle 18 for Unit 1). Therefore, in terms of the sequential inspection period, the Unit 1 SGs have accumulated approximately 55.73 EFPM of operating time and remain in the first sequential period.

At the conclusion of the current cycle, the Unit 1 SGs are estimated to have accumulated approximately 72 EFPM of operational time in the first sequential period. Therefore, the outage at the end of this cycle is the midpoint outage. However, the midpoint inspection requirements (inspection of 50% of the tubes) were satisfied by the U1C21 (end of cycle 20) inspection that included 50.5% of the tubing in all SGs. Therefore, CNP currently meets the midpoint inspection requirements of inspecting 50% of the tubes in the Unit 1 SGs. CNP remains on track to complete the 100% interval inspection requirements within the stated TS time period. The 50% TS inspection requirement is complete (as noted above). The requirement to complete the remaining 50% inspection will be complete within the next 72-month interval (a portion of that will complete during the Fall 2009 inspection). As noted in the table below, no SG has operated for more than 72 EFPM without being inspected during this period.

Unit 1 Replacement Steam Generator Cycle History

Cycle	Cycle EFPM	Accumulated SG EFPM	Accumulated SG Interval Time EFPM	Notes:
2000 SGRP				
Cycle 17	14.55	14.55		2002 Inspection – 100%, 4 SGs
Cycle 18	14.15	28.70	14.15	2003 Inspection – 20%, 1 SG
Cycle 19	15.53	44.23	29.68	No Inspections
Cycle 20	16.15	60.38	45.83	2006 Inspection – 50.5%, 4 SGs
Cycle 21	9.9	70.28	55.73	Cycle in progress, EFPM data thru 9/17/07

NRC Request 3

Please discuss whether the wear indications in the tubes in row 69 column 29 (R69C29), R69C27, and R68C28 were detected with the bobbin coil. Please discuss whether the possible loose part (PLP) indications in R84C60 and R85C61 were identified with the bobbin coil. Please clarify which five tubes had PLP indications in SG 13. If the above indications were not detected with the bobbin coil, please discuss the basis for the rotating probe inspection scope at the top of the tubesheet. In this response, discuss the scope and results of any secondary side inspections (including foreign object search and retrieval).

I&M Response to Request 3

Wear indications (R69C29, R69C27, and R68C28):
Tube R69C29 was not in the initial bobbin coil test plan, but was examined and detected as part of a bobbin coil expansion program (discussed below). Tubes R69C27 and R68C28 were in the original bobbin coil test plan; however, no indications of foreign objects/foreign object wear were identified by the bobbin coil probe.

R84C60 and R85C61 (PLP Discovery):
Indications at tube R84C60 and R85C61 were identified during a rotating pancake coil (RPC) expansion program. Bobbin coil inspection of R84C60 did not identify the PLP signal and tube R85C61 was not in the bobbin coil inspection plan. Visual inspection subsequently determined that the PLP indications resulted from a sludge rock and no tube degradation was present.

SG 13 PLP Indications:

R69C29 (Bobbin and RPC)	PLP indication
R68C28 (RPC)	PLP indication
R70C28 (RPC)	PLP indication
R84C60 (RPC)	PLP indication
R85C61 (RPC)	PLP indication

Rotating Coil Inspection Basis (refer to Enclosures 1 and 2):
The basis for the rotating coil examination was to ensure that the identified problem areas were fully inspected and bounded while also inspecting a reasonable number of tubes along the periphery to provide added confidence that there were no additional areas of concern.

The basic evolution of the inspection and expansion programs is as follows:

During the U1C21 inspection, the base bobbin coil examination (blue pattern on Enclosure 1) detected indications of loose part wear affecting four tubes in the cold leg region of SG 13 within an inch of the top of the tubesheet. The four tubes involved were R79C35, R78C34, R77C35, and R76C36 (4 black tubes on Enclosure 1). There was no detection of a foreign object around these tubes from the eddy current examination. When the wear was first detected, the cold leg was not available for rotating coil eddy current examination. Since the bobbin coil had detected the indications, the examination was expanded (orange tubes) to fully bound the region with the

bobbin coil. This expansion detected a PLP indication in tube R69C29 at the top of the cold leg tubesheet and no additional indications.

To gain further insight into the initial indications and to investigate the PLP, a bounding rotating coil examination including the affected tubes and a border along a potential migration path of any potential loose parts was developed and executed once the cold leg was available for rotating coil examination (green tubes on Enclosure 2). This examination resulted in the detection of a second area of foreign object wear in the area of the PLP indication. This area involved tubes R69C29, R69C27, and R68C28 (grey tubes on Enclosure 2). Unlike the first area (R79C35, R78C34, R77C35, and R76C36), a loose part signal was detected in multiple tubes at this position (R70C28, R69C29, and R68C28) by the rotating coil.

The rotating coil examination was then further expanded around the periphery (red tubes on Enclosure 2) to address those cold leg periphery tubes that had not been previously inspected by the bobbin coil during U1C21. No other indications of foreign objects/foreign object wear were detected from these expansions.

In summary, the 50% bobbin coil inspection successfully identified the two largest foreign object wear signals (24% through-wall (TW) and 16% TW), two of the four midrange wear signals (both 12% TW), and the smallest signal indication (3% TW), all of which were well below the repair criteria. Therefore, while the bobbin coil did not detect all of the signals (two additional tubes with 13% TW and 10% TW indications), reasonable assurance was provided that no significant wear indications remain undetected.

In addition, the eddy current examination was complemented by a secondary side visual inspection that successfully identified two foreign objects (R56C54 and R82C40 – no tube wear or PLP signal) on the periphery of the bundle that were not detected by either the rotating coil or bobbin coil probes. Refer to the additional discussion in the next section for further detail on secondary side inspection activities.

Bobbin/rotating coil probes and secondary side visual inspections all played a role in the CNP examination. The use of all three examination techniques together provides heightened confidence that no significant indications or objects were left in the SGs.

Secondary Side Inspections and Foreign Object Search and Retrieval:
Secondary side visual inspections were performed on each SG at the top of the tubesheet. The annulus and divider lane regions were targeted to ensure cleanliness after sludge lancing, acceptable component condition, and the absence of foreign objects. Inner bundle passes (e.g., use of a visual probe to inspect a column of tubes across the top of the tubesheet) were performed in each SG to map the hard-sludge pile and view the interior bundle conditions. In addition, the general lower bundle structure (lower end of the shroud, shroud lugs, shroud pins, support blocks, and lattice bars) was examined. No abnormal conditions were noted during these inspections.

During the course of the secondary side visual examinations and complementary eddy current testing, foreign objects and potential foreign object locations were identified that required investigation in SGs 12 and 13 as summarized in Enclosure 3.

NRC Request 4

You indicated that the tubesheet thickness is 21.25 inches and is clad on the primary side. Please clarify the thickness of the tubesheet with and without the cladding.

I&M Response to Request 4

Nominal tubesheet thickness without cladding	21.25"
Thickness of cladding	0.313"
Nominal tubesheet thickness with cladding	21.56"

References:
1. Letter from J. N. Jensen, I&M, to NRC Document Control Desk, "Donald C. Cook Nuclear Plant Unit 1, Steam Generator Tube Inservice Inspection Report," AEP:NRC:6567, dated October 31, 2006 (ML063130412).

2. Letter from J. N. Jensen, I&M, to NRC Document Control Desk, "Donald C. Cook Nuclear Plant Units 1 and 2, Steam Generator Tube Inspection Report," AEP:NRC:7691, dated February 27, 2007 (ML070660516).

3. Letter from P. S. Tam, NRC, to M. W. Rencheck, I&M, "D. C. Cook Nuclear Plant, Unit 1 (DCCNP-1) – Request for Additional Information on Two Steam Generator Inspection Reports (TAC NOS. MD5944 and MD5945)," dated December 13, 2007 (ML073200204).

DC Cook Unit 1
SG 13 - Bobbin Coil Inspection

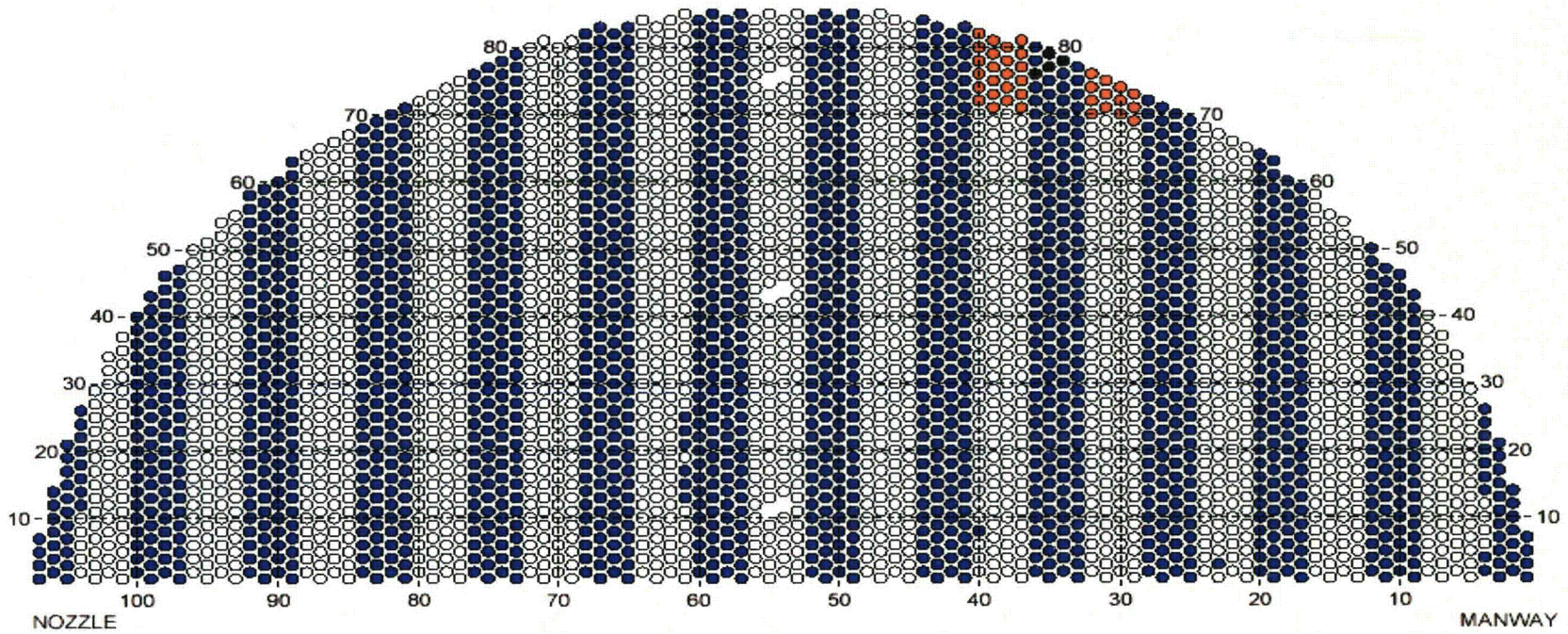
FANP - FDMS map module Version 3.1

GROUP	TUBES
Planned Bobbin	1762
Bobbin Wear Ind	4
BC Bounding Expansion	36

S/G 13
COLD
PRIMARY FACE

TOTAL TUBES: 3496
SELECTED TUBES: 1802
OUT OF SERVICE (#): NA

SCALE: 0.091535 X
Fri Nov 02 12:13:05 2007



DC Cook Unit 1
SG 13 - Rotating Coil Expansions

FANP - FDMS map module Version 3.1

GROUP	TUBES
Bobbin Wear Indications	4
RPC Wear Indications	3
RPC Area Expansion	77
RPC Periphery Expansion	210

S/G 13
COLD
PRIMARY FACE

TOTAL TUBES: 3496
SELECTED TUBES: 294
OUT OF SERVICE (#): NA

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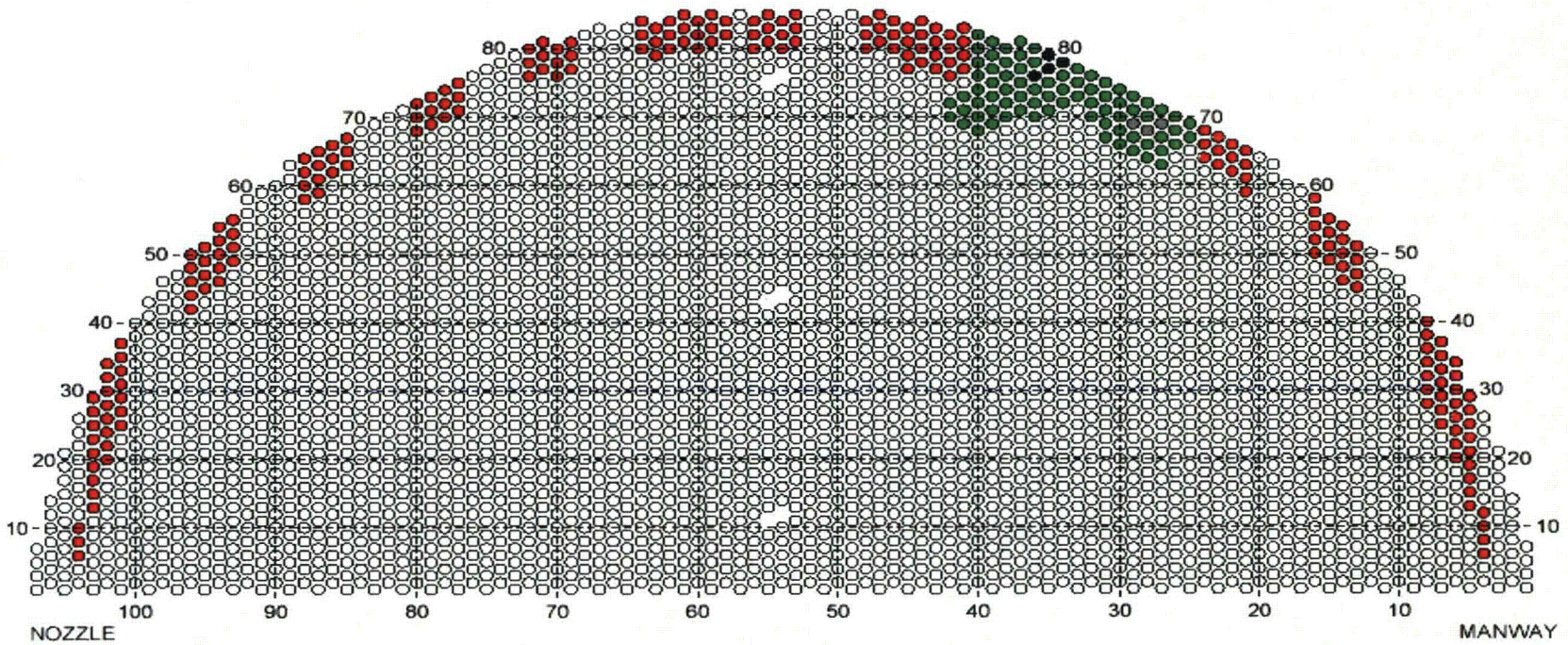
Mon Jan 14 12:46:05 2008



Secondary Side Inspection and Foreign Object Search and Retrieval

Object Description	Location	Probable Source	SG Inspection History	Detection Method	Object Removed?	ECT Indicated Tube Damage?	Final Disposition
Machine turning	SG 12: Cold Leg Annulus	Secondary plant foreign material; specific origin unknown; light material removed by sludge lancing	N/A – no specific location identified	Visual: no ECT, item outside of tube bundle	Yes	No	Item removed, no repairs required***
Machine turning	SG 12: Cold Leg Annulus	Secondary plant foreign material; specific origin unknown; light material removed by sludge lancing	N/A – no specific location identified	Visual: no ECT, item outside of tube bundle	Yes	No	Item removed, no repairs required***
Thin Metal Strip 0.525" W x 0.06" T x 6" L 25.225 g	SG 13: Cold Leg R82C40	Secondary plant foreign material (remnant of welding backing bar); origin unknown; markings indicate item had been in place prior to sludge lancing	NDD** 1999, 2002 No history of foreign objects in SG 13	Visual - no ECT confirmation	Yes	No	Bounding ECT performed No repairs required

Object Description	Location	Probable Source	SG Inspection History	Detection Method	Object Removed?	ECT Indicated Tube Damage?	Final Disposition
Sludge Rock Est. @ 0.25" W x 0.25" H	SG 13: Cold Leg R84C60	Secondary side sludge accumulation; removed by sludge lancing	NDD** 1999, 2002 No history of foreign objects in SG 13	ECT with visual confirmation	No	No	Bounding ECT performed No repairs required
Nothing found by visual examination	SG 13: Cold Leg R79C35 R78C34 R77C35 R76C36	N/A	NDD** 1999,2002 No history of foreign objects in SG 13	ECT – no visual confirmation	N/A	Yes	Bounding ECT performed Plug tubes (4) due to wear
Rectangular shaped object est. @ 0.44" W x 1.5" L	SG 13: Cold Leg R69C29 R69C27 R68C28	Unknown – object could not be removed; appears to be pinned in place	NDD** 1999, 2002 No history of foreign objects in SG 13	ECT with visual confirmation	No	Yes	Bounding ECT performed Plug and stabilize selected tubes (7) due to wear and the inability to remove object

Object Description	Location	Probable Source	SG Inspection History	Detection Method	Object Removed?	ECT Indicated Tube Damage?	Final Disposition
Partial section metallic o-ring 0.063" dia x 0.74" long 0.118g	SG 13: Cold Leg R56C54	Secondary plant foreign material; specific origin unknown; light material removed by sludge lancing	NDD** 1999, 2002 No history of foreign objects in SG 13	Visual - no ECT required	Yes	No	Item removed, no repairs required***
Machine turning 0.1875" W x 0.012" T x125" L 0.168g	SG 13: Cold Leg Annulus	Secondary plant foreign material; specific origin unknown; light material moved by sludge lancing	N/A – no specific location identified	Visual: no ECT, item outside of tube bundle	Yes	No	Item removed, no repairs required***

** No detectable degradation
*** Base 50% bobbin coil inspection and secondary side visual examinations credited with providing assurance no tube damage was present