Stephen E. Quinn
Vice President

Consolidated Edison Company of New York, Inc.
Indian Point Station
Broadway & Bleakley Avenue
Buchanan, NY 10511
Telephone (914) 734-5340

July 29, 1997

Re: Indian Point Unit No. 2
Docket No. 50-247

Document Control Desk
US Nuclear Regulatory Commission
Mail Station P1-137
Washington, DC 20555-0001

SUBJECT: Steam Generator Tube Inservice Examination 1997 Refueling Outage

Enclosed is a report of the Steam Generator Tube Inservice Examination conducted during the 1997 refueling outage, submitted pursuant to Technical Specification 4.13.C.2.

Should you have any questions regarding this matter, please contact Mr. Charles W. Jackson, Manager, Nuclear Safety and Licensing.

Very truly yours,

Attachment

cc: Mr. Hubert J. Miller
Regional Administrator-Region I
US Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

Mr. Jefferey F. Harold, Project Manager
Project Directorate I-1
Division of Reactor Projects I/II
US Nuclear Regulatory Commission
Mail Stop 14B-2
Washington, DC 20555

Senior Resident Inspector
US Nuclear Regulatory Commission
PO Box 38
Buchanan, NY 10511

A047 1/1

110028

9708110077 970729
PDR ADOCK 05000247
P PDR

STEAM GENERATOR EXAMINATION
1997 REFUELING OUTAGE

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
INDIAN POINT UNIT NO. 2
DOCKET NO. 50-247
JULY 1997

Indian Point 2
Steam Generator Examination Program
1997 Refueling Outage

1. Examination Program Description

Details of the Indian Point Unit No. 2 steam generator tube inservice examination program to be conducted during the thirteenth refueling outage were submitted to the NRC via Con Edison letter dated February 7, 1997. The original examination scope is described in Section 2 below. This original scope was subsequently expanded during the outage, to include full length examination of all steam generator tubes. This change was primarily due to the indications discovered at the hot leg and cold leg upper support plate locations. The results and conclusions of the full examination scope are provided in Sections 3 and 4, respectively.

2. Original Examination Scope

a. Steam Generator Tube Eddy Current Examination

A combination Cecco-5/bobbin probe was utilized for the majority of the eddy current testing. The Cecco-5/bobbin probe is qualified to the EPRI PWR Steam Generator Examination Guidelines. As part of the Cecco-5 (Cecco) qualification program, a C-Scan or topographical presentation graphics package was developed and incorporated into the Cecco-5 data analysis guidelines. This data presentation graphics is an enhancement to the post eddy current data analysis. The 1997 full length examination program presented completes the full length tube examination in a three cycle examination period. The cycle consists of the 1993, 1995, and 1997 examinations.

A 700 mil diameter probe was used to perform the initial eddy current testing. Any tube that did not permit passage of the 700 mil diameter probe was tested with progressively smaller probes. Tubes that did not pass the 610 mil bobbin probe would be plugged. Furthermore, tubes immediately adjacent to any tube that did not pass the 610 mil probe were also subject to an eddy current examination.

The examination was conducted from either the hot or cold leg side of the channel head. All tubes requiring full length inspection were examined from the mouth of the tube through the tubesheet, around the U-bend, to the mouth of the tube on the opposite side. The examination program, as a minimum, was as follows:

- One hundred percent of the hot leg tubes were examined from the mouth of the tubesheet up through the first support plate in Steam Generators 21, 22, 23, and 24 with the Cecco-5/bobbin probe.

- One hundred percent of the U-bends of Rows 2 and 3 in Steam Generators 21, 22, 23, and 24 were examined to the extent possible with the Cecco-5/bobbin probe. A Rotating Pancake Coil (RPC) probe was utilized to examine the bends if the narrow radii of the bends precluded passage of the Cecco-5/bobbin probe.

- A minimum of 33 percent of the active tubes in Steam Generators 21, 22, 23, and 24 were selected for eddy current examination for both dents and defects over their full length with the Cecco-5/bobbin probe. Full length tube data was collected by the bobbin coil probe and all tube support plate data was collected by the bobbin coil and Cecco-5 probes.

- The balance of the cold leg tube ends were examined from the mouth of the cold leg tubesheet up through the first support plate in Steam Generators 21, 22, 23, and 24 with the bobbin coil probe.

The tubes selected for full length examination were previously submitted as Tables 1 through 4. In Steam Generator 21, 995 tubes, or 33 percent of all active tubes were examined. In Steam Generator 22, 1380 tubes, or 47 percent of all active tubes were examined. In Steam Generator 23, 1002 tubes, or 33 percent of all active tubes were examined. In Steam Generator 24, 996 tubes, or 33 percent of all active tubes were examined.

Any locations with distorted bobbin coil signals were resolved by the Cecco-5 coils. A Rotating Pancake Coil probe was utilized for further characterization of an indication as required. The selection of tubes for the full length examination were as follows:

- tubes which were not full length examined during the 1993 or 1995 refueling outages, or

- located in the periphery of the tube bundle, or
- tubes with degradation located above the first support plate found during previous examinations, or
- tubes randomly selected, or
- previously restricted passage of a 680 mil diameter probe.

The 1997 full length examination program presented completes the full length tube examination in a three cycle examination period. The cycle consists of the 1993, 1995, and 1997 examinations.

b. Steam Generator Tube Plugs

Due to concerns with cracking of the Westinghouse Alloy 600 mechanical plugs, the cold leg plugs from Steam Generators 22 and 23 were replaced. A sample of Babcock & Wilcox Alloy 600 rolled plugs manufactured from both susceptible and less susceptible heats were examined.

c. Flow Slot and Lower Support Plate Examinations

Using the handholes above the tubesheet on Steam Generators 21, 22, 23 and 24, video examinations of the flow slots in the lower support plates were performed. Where possible, higher support plates were also examined through the flow slot openings of the lower support plates.

The "hillside" inspection port, located just above the top support plate, in Steam Generators 22 and 23 were used to conduct video examinations of the flow slots in the uppermost support plate.

d. Secondary Side Examination

During an outage in February 1997, a video camera with a grabbing tool was passed around the annulus between the tube bundle and the shell, and also down the tube lane between the hot and cold legs to search for and retrieve foreign objects in the steam generators.

e. Steam Generator Sludge

The sludge removed from the steam generator tubesheets in February 1997 by lancing operations is being analyzed.

3. **1997 Examination Results**

a. Steam Generator Tube Eddy Current Examination Results

1. Blind Cecco-5 to +Point Probe Comparison Tests

The steam generator tube examination began with Cecco-5 probe to +Point probe Blind Comparison Samples, as stated in our letter to the NRC dated May 6, 1997.

Analysis of the Comparison Sample was done with a blind primary/secondary and resolution process. The analysis for the +Point and Cecco data was done by different and independent crews. The tubes were selected from a single review of the March 1995 data using the Cecco C-Scan technique. The Blind Comparison consisted of thirty two tubes with 138 tube support plate (TSP) intersections analyzed by the Cecco-5 probe and +Point probe.

Approximately two weeks after the start of the eddy current examination, a second Blind Comparison Test was conducted. The sample consisted of twenty tubesheet crevice locations and forty locations that included the top tubesheet and tube support plate intersections. The results of the Blind Comparison Testing sets are summarized on Table 1. Prior to the start of the 1997 outage, Con Edison made a decision to conservatively use the Cecco-5 probe as the probe-of-record. The +Point probe was used for characterizing indications, as needed.

2. Steam Generator Tube Examination

The original examination program submitted to the NRC was expanded to include full length examination of all steam generator tubes. This scope expansion was made because of the Cecco indications found at the hot leg and cold leg upper support plate locations. Additionally, all sludge pile pit indications were characterized by the +Point probe to determine if linear-like indications could be associated with the pits. Sludge pile pitting and AVB wear were dispositioned by the bobbin analysis in the

absence of a +Point linear indication. All other indications were dispositioned based on the Cecco.

Tubes with indications evaluated at 40 percent or larger of the wall thickness, linear indications (axial or circumferential), Cecco-5 indications at tube support plate intersections (both characterized by +Point and not confirmed by the +Point probe), and tube roll transition cracks that were not rerolled, or did not meet F* were plugged. Other tubes were plugged due to passage restrictions of the 610 mil diameter probe (twenty tubes). There were seventeen tubes administratively plugged because the restriction(s) permitted passage of a 610 or 640 mil diameter bobbin probe, but did not permit characterization of the restriction location by the Zetec +Point Dent Inspection Probe (gimbaled +Point probe); eighteen tubes were preventively plugged based upon an Indian Point 2 tube support plate study. The listing tubes plugged are provided in Tables 3 through 6.

The 1993 tube examination revealed Primary Water Stress Corrosion Cracking (PWSCC) of the tubes in the roll transition region. Before the 1995 outage, Con Edison qualified an F* distance and a rerolling procedure. In the 1995 outage, roll transition cracking was found in the four steam generators in varying amounts. All the prior rerolls were examined in the 1997 outage to verify the F* distance. From the 1995 reroll population of 580 tubes, there were four of those tubes that did not meet F*; those tubes did meet the F* distance after a second reroll. In 1997, there were 126 new F* rerolled tubes. There were eighteen tubes in Steam Generator 21; three tubes in Steam Generator 22; ninety-seven tubes in Steam Generator 23, and eight tubes in Steam Generator 24. All rerolls were on the hot leg side of the tubes.

3. In-Situ Tube Testing

A Condition Monitoring assessment was conducted for the just completed Cycle 13. In addition to the eddy current examinations, tubes were screened for in-situ hydrostatic testing. Both EPRI and Westinghouse have established criteria for testing defective tubes based upon fracture mechanics considerations. Four tubes in the tube sheet crevice area were found to have exceeded the screening criteria and were subsequently in-situ tested. Another two tubes were tested, even though they had indications that were below the screening criteria requirements. These tubes were selected because one was typical of tube roll transition cracking, and the other

because it was an axial indication above the top of the tubesheet, i.e. freespan location. The other tubes tested had axial indications in the tubesheet crevice. No leakage from any of the six in-situ tested tubes was detected. The indications were characterized with the +Point probe. Pressures of 1710 psi, 2500 psi, 2840 psi, and 5075 psi were the testing requirements for axial indications under normal operating differential pressure, intermediate pressure, steam line break pressure, and proof testing (three times operating differential pressure), respectively. Each pressure requirement was met and held for two minutes. The results of the in-situ testing are provided in Table 2.

4. Steam Generator Tube Plugs and Trends

Due to concerns with cracking of Westinghouse Alloy 600 mechanical plugs, Con Edison removed all remaining unrepaired Westinghouse Alloy 600 plugs from the hot legs in the 1995 outage. All Westinghouse explosive plugs and Babcock & Wilcox (B&W) Alloy 600 rolled plugs were also removed from the hot legs in the 1995 outage. Subsequent to the 1995 outage activities, Westinghouse issued an update of their Alloy 600 mechanical plug algorithm, *WCAP-12245, Revision 3, Addendum 4, May 1995*, to cover remedial actions of both hot and cold leg plugs by the year 2000. In response, Con Edison removed all Westinghouse Alloy 600 mechanical plugs from the cold legs of Steam Generators 22 and 23 in 1997. The balance of these plugs will be addressed in upcoming steam generator maintenance plans. Eddy current examination sampling of the Babcock & Wilcox (B&W) cold leg rolled Alloy 600 plugs during the 1997 outage consisted of forty-seven plugs (55 percent) from the susceptible heats and eighteen plugs (22 percent) from less susceptible heats from a total population of 168 plugs. One B&W cold leg rolled Alloy 690 plug was also examined. No cracked plugs were found. Replacement of B&W cold leg Alloy 600 roll plugs is not anticipated at this time. There was one roll plug removed and replaced during the outage because it interfered with the tooling used for removal of an adjacent mechanical plug.

During the normal scanning examination of the tubesheet, it was noted that an explosive plug (SG 23 CL Row 2 Column 5) was missing the "skirt" portion of the plug. The "skirt" region is the portion of the plug located below the plug's pressure sealing surface. Westinghouse stated that this was a first-time occurrence. This explosive plug was installed in 1978. Based upon remote video examination of the fracture, Westinghouse believes that this

the failure was due to crack initiation and propagation under the influence of residual manufacturing/installation stresses. A safety evaluation was performed and concluded that the plant components and safety systems will not be adversely affected during normal operation and accident conditions due to the presence of the loose part and the situation does not represent an unreviewed safety question. This plug was removed and replaced with a Westinghouse Alloy 690 mechanical plug.

The tubesheet scans also revealed excessive boric acid crystals or moisture around seven Westinghouse PIPs in Steam Generator 21 and five Babcock & Wilcox PAPs in Steam Generators 22 and 23 (three and two, respectively). A secondary side hydrostatic test was performed on the three steam generators after these plugs were replaced and no leakage was observed. A summary of the plugs removed is shown in Table 7 and the present plugging status is shown in Table 8.

Summaries of the examination program trends and plugging trends for the current (1997) and previous (1995) refueling outages are presented in Tables 9 and 10, respectively. A summary of plugged tubes is listed in Table 11.

b. Flow Slot and Lower Support Plate Examination Results

Video tapes of the lower support plate flow slots in Steam Generators 21, 22, 23 and 24, accessed by the lower handholes, showed essentially no change in "hour-glassing" of the flow slots in the lower support plates when compared to photographs taken during previous steam generator examinations. Current video and previous photographs also revealed cracks in the tube support plates at some flow slots. The current video quality was able to show small cracks at upper support plates previously not observed. Although one flow slot at the second support plate showed closure, there was no change in the general flow slot cracking previously observed. This flow slot closure condition was evaluated and determined to be acceptable. A baseline measurement of the height of the wrapper above the tubesheet was taken.

The uppermost support plates in Steam Generators 22 and 23 were visually examined, as was done during previous examinations. The examination used a videoscope inserted through the "hillside" ports in the steam generator shells. No significant "hour-glassing" of the flow slots in the upper most support plates was observed. The wedge locations were also sampled in the examination, and the wedges were

found intact. The condition of the tube surfaces appeared unchanged, flow holes were open and the support plates appeared sound.

c. Secondary Side Examination Results

A Foreign Object Search And Retrieval (FOSAR) was conducted in the steam generators around the annulus and within the tube bundle during February 1997. The FOSAR resulted in the removal of several items which previously could not be removed. The remaining items were evaluated for wear rates on adjacent tubes. The growth of eddy current indications from the previous outage were also reviewed and compared to determine if objects found on the secondary side of the steam generators contributed to localized external tube wear. The evaluation concluded that the Indian Point 2 steam generators could be returned to service with the identified items, and that operation during Cycle 14 with these foreign objects will not involve a change to any Technical Specification, and would not represent an unreviewed safety question in accordance with 10CFR 50.59.

d. Steam Generator Sludge

Sludge was removed from each of the steam generators in February 1997 by lancing. The quantities are listed in Table 12. The sludge is being analyzed.

4. Conclusions

The 1997 steam generator tube inservice examination demonstrates that the Indian Point Unit No. 2 steam generators are acceptable for continued service at full power. A Condition Monitoring assessment performed for Indian Point Unit No. 2 has established the end of cycle structural and leakage integrity of the steam generator tubing. Since the upcoming Cycle 14 is essentially equal to Cycle 13, Cycle 14 would be bounded by the acceptable End of Cycle 13 conditions, as demonstrated by in-situ testing and the eddy current examination.

Based on the results of the above examinations and assessments, the next steam generator examination will be performed during the next refueling outage, which is currently scheduled for 1999.

TABLE 1
Blind Comparison Testing*

Test Sampling	Cecco-5	+Point
Set 1 - 32 Tubes		
Support Plate Indications (138 Locations)	1	0
Sludge Pile Indications	8	2
Roll Transition Indications (32 TS Locations)	10	10
Deposit Indications (16 Locations)	0	0
Set 2 - 20 Locations		
Crevice Indications	20	20
Set 3 - 40 Locations		
Top of Tubesheet Indications	6	1 (4#)
Support Plate Indications	4	0

Notes:
1. * Analyzed by independent teams using the production Analysis Technique Procedure with 80% Probability Of Detection/90% Confidence Level by +Point as "Ground Truth"
2. TSP = Tube support plate intersection; TS = Tubesheet
3. # Additional 4 indications found when the data was evaluated with greater than Analysis Technique Procedure sensitivities

TABLE 2
In-Situ Hydrostatic Testing Summary

SG Tube	Test Location	Maximum Depth	Length Orientation	Maximum Pressure
SG 22 R35 C54	Freespan @ Top of TS*	49%	0.55 inch axial	5075 psi
SG 22 R32 C55	TS Crevice	75%	6.70 inch axial	2900 psi
SG 22 R23 C68	TS Crevice	88%	5.94 inch axial	2900 psi
SG 22 R24 C77	Roll Transition Cracking (typ.)*	ND	ND axial	2925 psi
SG 24 R27 C33	TS Crevice	88%	5.31 inch axial & circ.	2900 psi
SG 24 R27 C34	TS Crevice	98%	5.02 inch axial	2950 psi

Note: * Tubes were in-situ tested (indications did not meet test selection criteria)
ND = Not determined

TABLE 3
Steam Generator 21 - Locations of Indications Plugged

Row	Column	Location	Comments*
8	3	Within TSP 1C	Cecco SPI (MAI)
14	3	Within TSP 1C	Cecco SPI
21	6	Within TSP 3C	Cecco SPI
2	7	14.10 inches above TEC	Cecco PI (SAI)
2	9	U-bend RST	610 bobbin restricted
20	11	0.29 inch above TSH	Cecco TSI
30	16	Within TSP 3C	Cecco SPI
2	23	U-bend RST	610 bobbin restricted
30	37	3.54 inches above TEH	Roll transition indic.
16	39	2.88 inches above TEH	Roll transition indic.
17	39	Within TSP 1H	Cecco SPI
24	39	Within TSP 1H	Cecco SPI
43	40	Within TSP 6H	Cecco SPI
18	42	1.67 inch above TEH	Roll transition indic.
30	42	0.65 inch above TSH	Cecco TSI
39	44	Within TSP 5C	Cecco SPI
21	45	0.20 inch above TSH	Cecco TSI
21	51	1.45 inch above TEH	Roll transition indic.
44	51	Top of TSC	Cecco TSI
2	53	U-bend RST	610 bobbin restricted
2	54	U-bend RST	610 bobbin restricted
17	54	Within TSP 1H	Cecco SPI
4	55	U-bend RST	610 bobbin restricted
44	57	Top of TSC	Cecco TSI
21	58	Within TSP 4H	Cecco SPI
43	59	Within TSP 2H	Cecco SPI
4	60	Within TSP 1H	Cecco SPI
33	60	Within TSP 2H	Cecco SPI
2	62	610 +Point RST @ 1H	Admin/Plug
21	62	Within TSP 6H	Cecco SPI
2	63	Within TSP 1H	Cecco SPI
2	70	U-bend RST	610 bobbin restricted
13	89	610 +Point RST @ 6H	Admin/Plug
8	90	610 +Point RST @ 6H	Admin/Plug

Note: * Notation in parenthesis indicates a characterization by +Point

TABLE 4
Steam Generator 22 - Locations of Indications Plugged

Row	Column	Location	Comments*
8	1	4.11 inches above TEH	Cecco PI (VOL)
21	6	1.48 inches above TEH	Roll transition indic.
17	9	0.19 inch above TSC	Cecco TSI
10	10	Top of TSC	Cecco TSI
2	12	U-bend RST	610 bobbin restricted
2	13	640 +Point BDA @ 6H, 6C	Admin/Plug
9	16	4.48 inches above TEH	Cecco PI (SAI)
8	17	4.56 inches above TEH	Cecco PI (MAI)
21	17	0.51 inch above TSH	Cecco TSI
2	18	640 +Point BDA @ 6H, 6C	Admin/Plug
10	20	0.13 inch below TSC	Cecco TSI
2	21	U-bend RST	610 bobbin restricted
31	21	Top of TSC	Cecco TSI
2	22	U-bend RST	610 bobbin restricted
3	22	U-bend RST	610 bobbin restricted
4	22	640 +Point BDA @ 6C	Admin/Plug
16	23	0.01 inch below TSC	Cecco TSI
29	23	Top of TSC	Cecco TSI
34	23	0.29 inch above TSC	Cecco TSI
2	26	U-bend RST	610 bobbin restricted
2	28	640 +Point BDA @ 6H	Admin/Plug
4	28	8.58 inches above TEH	Cecco PI (MAI)
4	29	10.53 inches above TEH	Cecco PI (SAI)
43	36	0.08 inch below TSC	Cecco TSI
3	37	U-bend RST	610 bobbin restricted
41	37	0.02 inch above TSC	Cecco TSI
43	37	0.23 inch below TSC	Cecco TSI (PIT)
41	44	Within TSP 5H	Cecco SPI
2	48	5.65 inch above TEH	Cecco PI (MAI)
34	49	0.39 inch above TSH	Cecco PI (MAI)
34	50	0.62 inch above TSH	Cecco PI (MAI)
2	52	U-bend RST	610 bobbin restricted
35	54 In-Situ Tested	4.59 inches above TEH	Cecco PI (SAI)
32	55 In-Situ Tested	7.51 inches above TEH	Cecco PI (MAI)
33	57	4.92 inches above TEH	Cecco PI (MAI)
4	58	8.77 inches above TEH	Cecco PI (SAI)
29	59	3.90 inches above TEH	Cecco PI (SAI)
9	60	7.42 inches above TEH	Cecco PI (MAI)
2	62	U-bend RST	610 bobbin restricted
2	63	U-bend RST	610 bobbin restricted

Note: * Notation in parenthesis indicates a characterization by +Point Continued

TABLE 4 Steam Generator 22 (Continued)

Row	Column	Location	Comments
22	64	0.30 inch below TSH	Cecco TSI
3	65	8.53 inches above TEH	Cecco PI (MAI)
20	66	0.30 inch below TSH	Cecco TSI
23	68 In-Situ Tested	6.67 inches above TEH	Cecco PI (MAI)
4	71	7.55 inches above TEH	Cecco PI (MAI)
21	71	4.50 inches above TEH	Cecco PI (MAI)
23	71	4.02 inches above TEH	Cecco PI (MAI)
36	71	Within TSP 2H	SAI
38	72	Within TSP 6C	Cecco SPI
15	73	6.62 inches above TEH	Cecco PI (SAI)
27	73	7.35 inches above TEH	Cecco PI (SAI)
4	75	7.41 inches above TEH	Cecco PI (MAI)
4	77	0.22 inch above TSH	Cecco TSI
7	77	8.68 inches above TEH	Cecco PI (MAI)
21	77	3.36 inches above TEH	Cecco DRI (SAI)
24	77 In-Situ Tested	1.31 inches above TEH	Roll transition indic.
7	80	4.70 inches above TEH	Cecco PI (MAI)
13	81	0.04 inch below TSH	Cecco TSI
8	83	0.11 inch below TSH	Cecco TSI
2	85	U-bend RST	610 bobbin restricted
2	89	U-bend RST	610 bobbin restricted

TABLE 5
Steam Generator 23 - Locations of Indications Plugged

Row	Column	Location	Comments*
3	2	Support plate study	Admin/Plug
3	3	Support plate study	Admin/Plug
3	4	Support plate study	Admin/Plug
3	5	Support plate study	Admin/Plug
3	6	Support plate study	Admin/Plug
3	7	Support plate study	Admin/Plug
3	8	Support plate study	Admin/Plug
3	9	Support plate study	Admin/Plug
3	10	Support plate study	Admin/Plug
3	11	Support plate study	Admin/Plug
28	11	Within TSP 6C	SAI
3	12	Support plate study	Admin/Plug
3	13	Support plate study	Admin/Plug
3	14	Support plate study	Admin/Plug
33	15	0.87 inch above TSH	Cecco TSI (VOL)
33	16	0.02 inch below TSH	Cecco TSI (VOL)
35	19	0.56 inch above TSH	Cecco PI/49%
36	21	0.63 inch above TSH	Cecco TSI (PIT)
12	23	Within TSP 1C	Cecco SPI
26	27	0.71 inch above TEC	Roll transition indic.
2	29	Support plate study	Admin/Plug
2	30	Support plate study	Admin/Plug
3	31	U-bend RST	610 bobbin restricted
2	33	Support plate study	Admin/Plug
40	33	Top of TSH	Cecco TSI (VOL)
7	35	0.45 inch below TSC	Cecco PI (PIT)
44	36	610 +Point BDA @ 3C	Admin/Plug
44	37	610 +Point BDA @ 3C, 5C	Admin/Plug
31	38	0.44 inch above TSH	Cecco TSI (PIT)
44	40	Within TSP 3H	Cecco SPI
2	43	Support plate study	Admin/Plug
21	43	0.90 inch above TSH	Cecco 35 (VOL)
29	47	0.80 inch above TSH	Cecco PI/51% (SAI)
2	49	U-bend RST	610 bobbin restricted
31	49	Within TSP 3H	Cecco SPI
44	54	Transition roll region	Adj. PAP obstruction
10	55	13.38 inches above TEH	Cecco PI (SAI)
43	57	Within TSP 6H	Cecco SPI
23	58	Within TSP 4C	Cecco SPI

Note: * Notation in parenthesis indicates a characterization by +Point Continued

TABLE 5 Steam Generator 23 (Continued)

Row	Column	Location	Comments
9	59	11.62 inches above TEH	Cecco PI (SAI)
40	59	610 +Point RST @ 2C	Admin/Plug
2	60	Support plate study	Admin/Plug
38	71	610 +Point RST @ 6C	Admin/Plug
30	72	Within TSP 1H	Cecco SPI
4	81	610 +Point BDA @ 4C	Admin/Plug

TABLE 6
Steam Generator 24 - Locations of Indications Plugged

Row	Column	Location	Comments*
7	2	0.06 inch above TSH	Cecco TSI
4	6	Center of 6C	VOL
2	7	610 +Point RST @ 6C	Admin/Plug
10	15	1.09 inch above TEC	Roll transition indic.
29	15	Restriction at 6H	610 bobbin restricted
31	15	1.32 inches above TSC	41%
13	17	3.37 inches above TEH	Cecco PI (48%, MAI)
26	17	Within TSP 6C	Cecco SPI
9	25	5.96 inches above TEH	Cecco PI (MAI)
4	26	Top of TSC	Cecco TSI (PIT)
5	28	0.10 inch below TSC	Cecco TSI (PIT)
10	29	5.88 inches above TEH	Cecco PI (MAI)
16	29	2.62 inches below TSH	Cecco PI (VOL)
27	30	9.64 inches above TEH	Cecco PI (MAI)
2	31	Within TSP 5H	Cecco SPI
36	31	Within TSP 3H	Cecco SPI
27	33 In-Situ Tested	5.77 inches above TEH	Cecco PI (MAI, SCI)
27	34 In-Situ Tested	3.00 inches above TEH	Cecco PI (98%, MAI)
44	35	Within TSP 5H	Cecco SPI
35	36	0.14 inch below top of TSH	Cecco TSI
13	40	2.60 inches above TEH	Roll transition indic.
27	43	Within TSP 6H	Cecco SPI
42	47	0.08 inch below TSC	Cecco TSI
16	48	Within TSP 4H	Cecco SPI
4	55	0.30 inch above TSC	Cecco TSI
40	59	610 +Point BDA @ 2H	Admin/Plug
41	63	610 +Point BDA @ 6H	Admin/Plug
2	66	0.8 inch below TSH	Cecco TSI
23	66	Within TSP 6H	Cecco SPI
2	67	Apex of U-bend	SAI
2	76	610 +Point RST @ 5C, 6C	Admin/Plug
8	78	Within TSP 3H	Cecco SPI
8	90	610 +Point BDA @ 2H	Admin/Plug

Note: * Notation in parenthesis indicates a characterization by +Point

TABLE 7
Alloy 600 Plugs Removed During 1997 RFO

SG Leg	(W) A-600 Mechanical[1]	(W) A-600 Explosive	(W) A-600 Mechanical PIP/PAP[2]	B&W A-600 Rolled
21 Hot	-	-	7 PIPs	-
21 Cold	-	-	-	-
22 Hot	-	-	3 PAPs	-
22 Cold	121	-	-	-
23 Hot	-	-	2 PAPs	-
23 Cold	109	1[3]	-	1[4]
24 Hot	-	-	-	-
24 Cold	-	-	-	-
Total	230	1	12	1

Notes:
1. Per Westinghouse recommendation
2. Leakage
3. Missing "skirt"
4. Removed to facilitate replacement of adjacent mechanical plug

TABLE 8
Steam Generator Tube Plug Types/Quantities After 1997 RFO

	SG21H	SG21C	SG22H	SG22C	SG23H	SG23C	SG24H	SG24C	H Leg Total	C Leg Total	Totals
Clad Repr	92	92	92	92	92	92	92	92	368	368	736
A600Weld	1	1	7	3	2	2	10	11	20	17	37
A600Expl	-	3	-	20	-	19	-	-	-	42	42
A600Roll	-	48	-	67	-	10	-	42	-	167	167
A600Mech	-	101	-	-	-	-	-	84	-	185	185
A600PIP	40	-	34	-	-	-	-	-	74	-	74
A600PAP	49	-	58	-	50	-	-	-	157	-	157
A600Sent	-	2	10	-	1	-	11	-	22	2	24
A600Sent PAP	2	-	-	-	-	-	-	-	2	-	2
A600Stab PAP	5	-	-	-	-	-	-	-	5	-	5
A690Weld	1	-	1	-	1		3	4	6	4	10
A690Roll	8	1	18	-	-		-	-	26	1	27
A690Mech	115	65	185	223	155	178	190	73	645	539	1184
Total	313	313	405	405	301	301	306	306	1325	1325	2650

Notes:

Clad Repr	Cladding weld overlay repair prior to operation
A600Weld	Westinghouse (W) welded plug fabricated from Alloy 600
A690Weld	(W) welded plug fabricated from Alloy 690
A600Expl	(W) explosive plug fabricated from Alloy 600
A600Roll	B&W rolled mechanical plug fabricated from Alloy 600
A690Roll	B&W rolled mechanical plug fabricated from Alloy 690
A600Mech	(W) mechanical plug fabricated from Alloy 600
A600PIP	(W) mechanical plug fabricated from Alloy 600 with PIP repair
A600PAP	(W) mechanical plug fabricated from Alloy 600 with PAP repair
A600Sent	(W) sentinel mechanical plug fabricated from Alloy 600
A600SentPAP	(W) sentinel mechanical plug fabricated from Alloy 600 with PAP
A600StabPAP	(W) stabilizer mechanical plug fabricated from Alloy 600 with PAP
A690Mech	(W) mechanical plug fabricated from Alloy 690

TABLE 9
Steam Generator Tube Examination Program Trend Comparison - 1997-1995

1997 - Inspection Program	SG 21	SG 22	SG 23	SG 24
1997 FL/Total	2981/2981	2916/2916	3004/3004	2987/2987
FL Inspected	100%	100%	100%	100%

1995 - Inspection Program	SG 21	SG 22	SG 23	SG 24
1995 FL/Total	2065/2990	1371/2922	2024/3005	2992/2992
FL Inspected	69.1%	46.9%	67.4%	100%
1SP Inspected	100%	100%	100%	100%

Notes: FL Full Length examination from tube end to tube end.
1SP Examination from tube end (hot and cold legs) to the first support plate.

TABLE 10
Steam Generator Tube Plugging Summary Comparison - 1997-1995

1997 Tube Plugging	SG 21	SG 22	SG 23	SG 24	Totals
Tube Roll Transition Cracking	4	2	2	2	10
Tubesheet Crevice Indications	1	31	4	11	47
Sludge Pile Indications	5	10	7	4	26
Support Plate Indications	15	3	7	9	34
U-bend Cracking	-	-	-	1	1
610 Probe Restrictions	6	11	2	1	20
Others	3	4	23	5	35
Total Plugged	34	61	45	33	173

1995 Tube Plugging	SG 21	SG 22	SG 23	SG 24	Totals
≥40% Indications (Sludge Pile)	8	2	0	2	12
Tube Roll Transition Cracking	0	2	0	0	2
610 Probe Restrictions	0	0	0	1	1
Others	1	2	1	2	6
Total Plugged	9	6	1	5	21

TABLE 11
Summary of Plugged Tubes

SG	Plugged in 1997	Previously Plugged	Total Plugged	Percent Plugged
21	34	279	313	9.6%
22	61	344	405	12.4%
23	45	256	301	9.2%
24	33	273	306	9.4%
Total	173	1152	1325	10.2%

TABLE 12
Sludge Removed (February 1997)

SG	1997	1995
21	314 lbs	460 lbs
22	642 lbs	654 lbs
23	394 lbs	699 lbs
24	491 lbs	686 lbs
Total	1841 lbs	2499 lbs

Eddy Current Data Acronyms

BDA	Bad data
DRI	Distorted roll indication
MAI	Multiple axial indication
PI	Possible indication
PIT	Pit
RST	Restriction
SAI	Single axial indication
SCI	Single circumferential indication
SPI	Support plate indication
TEH	Tube end hot
TS	Tubesheet
TSC	Tubesheet cold
TSH	Tubesheet hot
TSI	Tubesheet indication
TSP	Tube support plate
VOL	Volumetric indication