February 24, 2000

FROM: JOSEPH E. CARRASCO, ENGINEER, DRS RI
TO: WAYNE D. LANNING, DIRECTOR, DRS RI
SUBJECT: S/G EDDY CURRENT - IP2

Based on May 27-30, 1997 Information collected and assessed during Inspection 97-07

Background

IP2 has four Westinghouse Model 44 steam generators. High temperature mill annealed Alloy 600 tubing. 5.8% of the 13040 tubes have been plugged during the 23 years of service. An additional 2.9% have been plugged prior to service. Current analysis permits plugging 25% of the tubes. The unit has had four forced outages caused by tube leaks. The last inservice event occurred in 1988 as a result of a leaking plug.

S/G Eddy Current

The tube examination program was prepared in accordance with the EPRI steam generator tube inspection guidelines. As a result of early eddy current inspection findings an expansion was made to inspect all support plate intersections with the Cecco-5 probe and all full lengths with the bobbin coil probe.

In terms of the probes being used in this eddy current examination, the inspector noted that the **Cecco-5 transmit-receive eddy current probe** is being used as the primary inspection probe. **Rotating coil probes, primarily Plus Point probes,** are being used to characterize the indications identified by the Cecco-5 probe. **The bobbin coil portion of the Cecco-5 probe** is being used to examine the straight portions of the tube at elevations higher than 20 inches above the tube sheet. The tube sheet area and the lower 20 inches are being examined with the Cecco probe.

<u>Explanation on the Probes</u>

Good for Detection - Cecco 5 probe operate differently from rotating probes. For example, a Cecco 5 probe (Fig. 1) contains multiple transmit and receive coils (rather than just a combined coil) and the Cecco probe is not rotated as it is pulled through the tube. Like the rotating probes, the Cecco probes are sensitive to circumferentially orientated degradation; however, characterization of the degradation is currently limited. A major advantage of the Cecco probes is that they are capable of a much higher inspection speed (i.e., 12 to 15 inches per second) than the rotating probes.

Good for Characterization - The Plus Point Probe is sensitive to both axial and circumferentially orientated degradation. It was originally developed for surface examination for reactor vessel welds and was designed to reduce geometry and permeability effects (Fig. 2).

DD/2

Subsequent Communications Between The Region and NRR (June 27, 1997)

We participated in a conference call between NRR and the licensee to discuss the SGs eddy current activities at IP2. We captured the following highlights: the eddy current testing has identified a new degradation mechanism operational in the steam generator tubes outside diameter stress corrosion cracking. Using Cecco-5 eddy current probes, indications were seen in the support plate crevices, in the sludge pile area above the tube sheet, and the crevice between the tube sheet and the tubes. At least one indication in each of these areas has been characterized by the rotating Plus Point probe. A ten inch long axial indication within the tube sheet crevice is a prime candidate for in-situ pressure testing of the tube.

In the primary side of the SGs to date (June 27 '97) 98 defective tubes have been identified for plugging. Steam Generator will have more than 1% of the inspected tubes plugged. 308 new distorted roll indications (DRIs) have been noted. These indications will be characterized and rerolled. Seven steam generator plugs plug-in-plug (PIPs) and plug-at-plug (PAPs) were surrounded by boron rings. These plugs will be drilled out and replaced with Westinghouse Alloy 690 mechanical plugs. The end of one Westinghouse explosive appears to have broken off. This is a portion that extended past the tube end and is not in the seal area. No boron crystals were present around this plug.

In the secondary side flow slot examination of Steam Generator 22 and 23 showed closure of one flow slot in Steam Generator 23. The flow slots of the other two steam generators will be examined. The Hillside port examined in Steam Generators 22 and 23-flow holes were open, and a small amount of corrosion deposit surrounded about a 1/2 inch of the tube above the support plate.

The licensee has performed a comparison of probes Cecco-5 to Plus Point by examining 124 intersections. Cecco reported 1 tube support plate indication and 5 sludge pile indications Plus Point did not report any indications.

Indian Point 2 Steam Generator Tube Leak Inspection

NOTEBOOK 1

1. **Industry Steam Generator Guidance**
   - A. EPRI SG Inspection Guidance
     1. Rev. 4 - date June 1996
     2. Rev. 5 - date September 1997
   - B. May 1996 - Performance Demonstration data base TSS ETTS #965121 Pwscc_ubend.doc
   - C. PWSCC Predication methods
2. **NEI Input**
   - A. SG Program Guidelines 97-06, dated December 1997
3. **NRC Generic Input**
   - A. Reg Guide 1.83, Rev 1, dated July 1975
   - B. Draft Reg Guide 1.121, PWR Steam Generator Tube Plugging Limits, August 1976
   - C. Draft NURGE 1477 - Voltage -Based Plugging Crireriafor SG Tubes - Dated June 1993
   - D. Generic Letter 95-03: Circumferential Cracking of SG Tubes, dated April 28, 1995
   - E. Generic Letter 95-05 Voltage Based Repair Criteria for Westinghouse Steam Generators Tubes Affected by Outside Diameter Stress Corrosion Cracking (notebook)
   - F. Information Notice 96-38: Results of SG Tube Examinations, Dated June 21, 1996
   - G. SECY 98-248: Proposed GL 98-XX SG Tube Integrity, dated October 28, 1998
   - H. Draft Reg Guide 1074 - Steam Generator Tube Integrity, dated December 1998
   - I. IN 97-26 Degradation in Small Radius U-bends , May 19, 1997
   - J. EGM 96-003, Updated June 2000 SG Tube Inspctions

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NOTEBOOK 2

4. **Industry Steam Generator History**
   - A. Past Steam Generator Primary to Secondary Leakage Events
     1. Farley LER 98-007, Dated December 22, 1999
   - B. Industry Known Steam Generator Degradation Modes
   - C. Past NRC Inspection Reports
     1. NRC Inspection Report -ANO - Unit 1 and 2 - 98-12 ISI program - including violation

5. **IP2 Technical Specifications Input:**
   - A. TS 4.13 SG Tube ISI
   - B. TS Amendments
     1. TS 3.1.E Maximum Reactor Coolant Oxygen, Chloride, and Fluoride Concentration Amendment 152 - dated
     2. 1.F.2.a - Primary to Secondary Leakage Amendment 192 - dated
     3. TS 4.13 Steam Generator Tube Inservice Surveillance (Notebook) All amendment SEs are in the Residents office in a notebook)
     4. Amendment 180 - dated -
     5. Amendment 192 - dated
     6. **Amendment 201 - dated June 9, 1999 - Allowing a one time extension of the steam generator inspection interval. SE is in the notebook**
     7. Amendment 209 - dated April 28, 2000 - allows differing probe sizes.

6. **NRC Input:**
   - A. Pre- 2000
     1. May 29, 1997 Proposed SG Inspection plan approval 1997 - Refueling Outage -
   - B. Post February 2000
     1. March 14, 2000 - RAI Re: Proposed SG Tube Examination Program - six questions.
     2. March 20, 2000 - Lessons -Learned Evaluation - Includes attachments with RES response to Request
     3. March 24, 2000 - RAI Re: Proposed SG Examination Program - 21 questions.
     4. April 28, 2000 - Notice for May 3, 2000, meeting - 17 questions

7. **Con Ed Inputs:**
   - A. 1997 IP2 Spring 1997 Inspection Evaluation - Westinghouse to Con Ed with CMOA as an attachment, dated July 24, 1997
   - B. IP-2 Steam Generator Handbook, through 1997 Outage
   - C. IP-2 Steam Generator Status Report, dated April 22, 1998, based on the results of 1997 outage
   - D. <u>Pre February 2000 Submitals:</u>

1. June 14, 1995 - Inservice Tube Examination 1995 Refueling Outage - TS 4.13.C.2 report
2. January 10, 1997 - RAI - SG Tube Acceptance Criteria TS Amendment Request. (Resident Office File)
3. February 7, 1997 - 1997 SG Inspection Plan
4. April 24, 1997 - Outage Inspection Plan - from NRC meeting
5. May 7, 1997 - Comparison of Cecco-5 and +point performance - (do not have a copy)
6. July 24, 1997 - Response to staff questions (residents office file)
7. July 29, 1997 - SG Tube Inservice Examination 1997 Refueling Outage - TS 4.13.C.2 Submital (Resident Office file)
8. December 7, 1998 - Proposed Amendment to TS Regarding SG Tube Inservice Inspection Frequency
9. May 12, 1999 - Response to RAI - Proposed Amendment to TS Regarding SG Tube ISI Frequency
10. 2000 - Outage Inspection Plan

NOTEBOOK 3

E. Post February 2000 Shutdown Submitals
   1. April 14, 2000 - Root caused Evaluation
   2. April 18, 2000 - Answered Questions 2,7,17 from March 24
   3. May 15, 2000 - Response to Request for Additional Information - proposed SG Tube Examination Program - EPRI Appendix K Report.
   4. June 13, 2000- Response to Staff Question on Root cause Evaluation
   5. June 15, 2000 - Response to the Staff's Questions Regarding the Root Cause Evaluation for SG Tube Rupture
   6. June 15, 2000 - Response to RAI - Proposed SG Examination Program - NRC letters March 14 and 24, 2000
   7. June 16, 2000 - Response RAI
   8. June 19, 2000 - Response to RAI
   9. June 19, 2000 - Response to RAI
   10. June 20, 2000 - Response to RAI

F. LERs
   1. March 17, 2000 - 2000-001 - Manual Trip following SGTR
   2. April 24, 2000 - 2000-003 - SG 21 and 24 in C-3

NOTEBOOK 4

G. Procedure

   1. Purchase Spec - MPE-72217 - Rev 10, Dated Dec 17 , 1996 - ET examination of SG tubes

2. Station Admin Order - 180 Administrative SG Program Plan, Rev 0 April 2000
3. Strategic Water (secondary) Chemistry Plan, Rev 1 March 1999 (Resident Office File)
4. Primary to Secondary leakage, IPC-A-110, Dated 6/4/97
5. SG Inspection Procedures
    1. 1997
    2. 2000

H. SG Program Assessments
1. 1997
2. 2000

I. Corrective Action Program
1. 1997 CR June 122, 1997- #2282 - IN 97-26
2. 2000 CRs
    1. March 9, 2000 - #1623 -Use of probes bigger than 0.610" after 0.700" could not be passed
    2. March 20, 2000 - #1939 - SG 21 1 tube >40 % and SG 24 three tubes >40% rereview of 1997 data.
    3. Macrh 23, 2000 - #2049 - SG 21 and 24 - C3

J. QA
1. Surveillances
    1. 1997
        1. SR 97-056 - May 12, 1997
        2. SR-97-105, May 21, 1997
        3. SR 97-106, Mat 24, 1997
    2. 2000 - February 26 - March 11, 2000
2. Audits
    1. 95-8-01-H, dated 8/31/95
    2. 97-01-H, dated November 7, 1997
    3. 98-01-D , dated 9/25/1998 - Chemistry Surveillance - includes the CRs generated based on the Audit.
    4. 00-01-H, draft dated 6/16/00 - SG Inspection and maintenance
3. Vendor Audits
    1. 2000 - Trip Report and Associated CRs - Paul Deeds
    2. 924-34, dated April 29, 1992 - Based on NUPIC Audit
    3. 941-13, dated January 31, 1994 - Class A Vendor Evaluation
    4. 953-14, dated March 20, 1995 - Review of West. NDE Certifications
4. Risk Assessments
    1. July 19, 2000 - Calc PSA-000717-1
5. July 20, 2000, 11AM meeting notes

K. Independent QDA
1. 1997 -
    1. Jan. 13, 1997 contact ConEd to Corestar - IQDA 1997 Outage

2. letter dated May 29, 1997 - CoreStar to Con ED
2. 2000
   1. March 3, 2000 - contract Con Ed to ABB/CE- IQDA services.

L. INPO Audit Reviewed but not kept

M. Eddy Current Stuff
1. Cal Standard used in 1997
2. Cal Groups
   1. Reel 058 2110 - 2359 date ? With the beginning of reel standard
   2. Reel 060 0243 - 0613 date ?, with the beginning and end of reel standard.
   3. 1997 ANTS
   4.

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NOTEBOOK 5

8. **2000 - CMOA**

NOTEBOOK 6

9. **Westinghouse Inputs**
   - A. Team Generator Primary Side Service Modukle - Contract fro 1997 outage
   - B. SG Tube EC Inspection Techniques
     1. 1997
        1. 1996 - Documentation of Appendix H Compiance and Equivalency DDM-96-009
        2. Eddy Current Low Row U-bend Examination Equivalency Qualification
        3. May 14, 1997 - Eddy Current Ptrobe Authorization List Rev 1
     2. 2000 - May 16, 2000 letter from Westinghouse to ConEd - Use of Appendix H Qualification Techniques at IP2 Spring Inspection - in notebook
   - C. Examination Technique Specification Sheet
     1. 2000 - In notebook

NOTEBOOK 6A

- D. Analyst Training
  1. 1997
     1. Steam Gen Maintenance Services Memo - Copy of log book and Training schedule and information
     2. Site Specific Test Scores
     3. T-list & Summaries from Training & Testing Optical
  2. 2000
- E. Corrective Action Program
  1. 1997
  2. 2000
     1. CAR 00-1076 - Missed indications in previous outages - SG 24 R34C51 in sludge pile above TTS and R2C69 U-bend
     2. CAR 00-1075 - inconsistent implementation of analyst performance tracking.
     3. CAR 00-1113 - tubes left off the plugging list
- F. Analyst Procedures for assessing EC Data
  1. 1997 DAT -IP2-001 Rev 0, date 4/28/87
  2. 2000 DAT-IP2-001, Rev 0 with Field Change 001-003, dated 4/1/00
  3. 2000 - Probe Authorization sheet and Acquisition Technique Specification Sheets
- G. Assessment of NDE Personnel Qualification Assessment - dated May 17, 2000

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NOTEBOOK 7

10. Dominion Engineering SG Life Prediction Analysis
    1. DEI- 442, Draft - Dated October 1995
    2. DEI - 519 - Draft - Dated December 1997
    3. Update to DEI 519 - draft - dated April 10, 2000

11. **NRC/ConEd/Westinghouse Meetings**
    A. May 3, 2000 - Headquarters Handouts (In notebook)
        1. Low Row U-bend Exams - ConEd
        2. U-bend PWSCC Susceptibility Investigation - Altran
        3. Root cause analysis Report Overview - ConEd
        4. Condition Monitoring Operational Assessment Plan - Westinghouse
    B. May 25, 2000 - Waltz Mill Handout (In Notebook)
        1. 2R14 SG Inspection - Westinghouse
    C. June 6, 2000 - Waltz Mill
        1. CMOA POD and Depth Sizing of PWSCC Indications - Westinghouse
        2. 2R14 SG Inspection - Westinghouse