

May 26, 1999

MEMORANDUM TO: S. Singh Bajwa, Chief  
Project Section 1-1  
Division of Licensing Project Management

FROM: Edmund J. Sullivan, Chief  
NDE & Metallurgy Section  
Materials and Chemical Engineering Branch

SUBJECT: SAFETY EVALUATION REGARDING STEAM GENERATOR TUBE  
INSPECTION INTERVAL FOR INDIAN POINT STATION UNIT 2 (TAC  
NO. MA4526)

By letter dated December 7, 1998, as supplemented by letter dated May 12, 1999, Consolidated Edison Company of New York, Inc. (the licensee), proposed to amend the technical specifications (TSs) for the Indian Point Station Unit 2 (IP-2). The proposed amendment would allow a one-time extension of the steam generator (SG) inspection interval in TS 4.13A.2.a. The amendment would also remove the requirement of receiving NRC concurrence on the licensee's proposed SG examination program in TS 4.13C.1.

The Materials and Chemical Engineering Branch has reviewed the licensee's proposed amendment request and supporting documentation. The staff finds the proposed amendment to be acceptable, because the modification will not impact the IP-2 SGs' ability to safely operate for the entire fuel cycle and receiving formal NRC concurrence on the licensee's proposed SG examination program is not necessary.

Our safety evaluation is attached. This completes our review for TAC number MA4526.

Docket No.: 50-247

Attachment: As stated

CONTACT: Andrea T. Keim, EMCB/DE  
415-1671

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UNITED STATES  
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

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**SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
STEAM GENERATOR TUBE INSPECTION INTERVAL  
INDIAN POINT STATION UNIT 2  
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.  
DOCKET NUMBER 50-247**

## **1.0 INTRODUCTION**

By letter dated December 7, 1998, as supplemented by letter dated May 12, 1999, Consolidated Edison Company of New York, Inc. (the licensee), submitted a request to modify the technical specifications (TSs) for Indian Point Station Unit 2 (IP-2). The proposed amendment would allow a one-time extension of the steam generator (SG) inspection interval in TS 4.13A.2.a. The amendment involves adding a statement allowing the SG inspection interval to coincide with the year 2000 refueling outage (the units 14th refueling outage) and no later than June 3, 2000. The amendment would also remove the requirement of receiving NRC concurrence on the licensee's proposed SG examination program in TS 4.13C.1.

IP-2 is a Westinghouse four-loop pressurized water reactor with Model 44 SGs. Each SG contains 3260 mill-annealed (MA), Inconel 600 tubes.

## **2.0 BACKGROUND**

The applicable surveillance requirement for IP-2 at this time is TS 4.13A.2.a. This requirement specifies that the SG inspections are to occur at intervals not exceeding 24 calendar months. The licensee's last surveillance was performed during the 13th refueling outage and was completed on June 13, 1997. The licensee did not perform an inspection during the unscheduled maintenance outage commencing on October 25, 1997, because a minimum interval of 12 months (as stated in Surveillance 4.13A.2.a) is required before taking credit for a subsequent inservice inspection. IP-2 was shut down for an unscheduled maintenance outage from October 1997 until August 1998.

## **3.0 EVALUATION**

The objective of the staff's evaluation is to determine the impact of the proposed extended inspection interval on the structural and leakage integrity of the tubes, considering the extended period that the plant was shut down. The staff has focused its evaluation on the licensee's evaluations of 1) SG tube integrity for the previous and current operating cycles, 2) SG lay-up in accordance with industry guidelines and the present cycle (cycle 14) chemistry control, and 3) leakage monitoring and leakage guidelines.

### **3.1 June 1997 SG Inspection**

The licensee performed an extensive eddy current inspection in June 1997 (end of cycle 13). The inspection included 100 percent examination using a bobbin probe on all inservice tubes. If the tight-radius U-bends in rows two and three precluded passage of the Cecco-5/bobbin probe,

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a rotating pancake coil (RPC) was utilized. Row one tubes were previously preventively plugged. Any locations with distorted bobbin coil signals were resolved by the Cecco-5 coils. An RPC probe was utilized for further characterization of indications as necessary.

Tubes with indications evaluated at 40 percent of the wall thickness or larger, linear indications (axial or circumferential), Cecco-5 indications at tube support plate intersections, and tube roll transition cracks that were not rerolled, or indications that did not meet the F\* distance were plugged. Twenty tubes were plugged due to passage restrictions of the 610 mil diameter bobbin probe. Seventeen tubes were administratively plugged due to passage restrictions of the Zetec +point dent inspection probe (gimbaled +point probe). These tubes were examined by the Cecco-5/bobbin probe but did not allow access of the +point probe. Eighteen tubes were preventively plugged based upon an IP-2 study of tube support plate deformation.

Prior to tube plugging, the licensee performed in-situ pressure testing on selected tubes exceeding EPRI/Westinghouse screening criteria. Four tubes in the tubesheet crevice area were found to have exceeded the screening criteria and were subsequently in-situ tested. Two additional tubes were in-situ tested even though they were below the screening criteria. Those two tubes were selected because one was typical of tube roll transition cracking, and the other was an axial indication above the top of the tubesheet. No leakage was detected from the six tubes that were in-situ tested. Test pressures of 1710 psi, 2500 psi, 2840 psi, and 5075 psi were used to simulate indications under normal operating differential pressure, intermediate pressure, steam line break pressure, and three times normal operating pressure, respectively. Each pressure was met and held for two minutes. The in-situ pressure tests showed that the SG tubes have maintained adequate structural integrity in accordance with Regulatory Guide (RG) 1.121. The in-situ pressure tests demonstrated that RG 1.121 margins were met over the past operating cycle (cycle 13). On the basis of the licensee's assessment, the staff finds that the structural and leakage integrity of tubes during cycle 13 was acceptable.

The licensee assessed the SG tube integrity for the remainder of the present operating cycle (cycle 14) on the basis of the end of cycle 13 inspection and testing results. The severity of degradation at the end of cycle 14 was projected considering BOC degradation status, degradation growth rates, and EOC allowable degradation. The severity of degradation at the EOC 14 was projected to determine if required structural and leakage integrity margins would be maintained. The scope of the licensee's evaluation included the following forms of degradation: 1) top of tubesheet (TTS) pitting, 2) outer diameter stress corrosion cracking (ODSCC) in the TTS sludge pile region, 3) ODSCC in the tubesheet crevice, 4) primary water stress corrosion cracking (PWSCC) at the roll transition region, 5) PWSCC at dented TSP intersections, 6) ODSCC at dented TSP intersections, 7) PWSCC at row two U-bends, and 8) wear. The licensee's evaluation determined that the forms of degradation listed above did not present a challenge to the 3ΔP structural margin criteria for the expected operating cycle length of 21.4 effective full power months (EFPM). Based on a review of this portion of the licensee's assessment the staff expects the steam generator tubes will continue to satisfy structural and leakage integrity requirements under normal and accident conditions through the end of the current operating cycle (cycle 14). This conclusion is based on: 1) the licensee's comprehensive eddy current examination and plugging practice at EOC 13, 2) the growth rates of the degradation mechanisms are expected to be similar to what was seen for cycle 13 operation, and 3) the licensee's acceptable in-situ testing results on the limiting EOC 13 indications.

### 3.2 Chemistry Assessment for the SG During Shutdown and the Present Operating Cycle

After the June 13, 1997, inspection, IP-2 commenced operation. The Unit was subsequently shut down for an extended maintenance outage. During the outage the Unit remained in cold shutdown condition for 304 days prior to restart on August 5, 1998. The licensee maintained the SG in wet lay-up conditions in accordance with EPRI guidelines by adding the appropriate quantities of ammonium hydroxide and carbohydrazide. The ammonium hydroxide was added to control pH and the carbohydrazide was added as an oxygen scavenger. For one hour each day, when conditions permitted, each of the steam generators were sparged with nitrogen for one hour. This was done to drive off any air that may have entered the SG gas space.

The licensee performed routine sampling and analysis of the lay-up solution. The licensee determined that the lay-up solution was maintained at acceptable alkaline and reducing conditions during the outage. However, the licensee did detect a slight depression of the pH which was attributed to dissolved carbon dioxide in the lay-up solution. The carbon dioxide was due to the reaction of the carbohydrazide and oxygen. The samples taken during the outage indicated that no detectable dissolved oxygen (less than 10 ppb) was identified in any of the SGs.

The concentrations of other potentially corrosive impurities in the lay-up solution were routinely monitored during the outage period. The concentrations of chloride, sulfate and sodium were each maintained well below the 1000 ppm maximum that the EPRI guidelines recommend.

The staff believes that the SG lay-up was maintained in accordance with industry guidelines which were designed to minimize the potential for corrosion during wet lay-up conditions. Based on the above, the staff concludes that, during shutdown, the SG were maintained at reduced temperatures and with water chemistry conditions that should have prevented further degradation of the SG tubes.

#### Chemistry Control During Operation of Cycle 14 (August 1998 - April 1999)

Each of the SG were drained and refilled with condensate quality water prior to exceeding 200°F during startup for resuming cycle 14. SG chemistry has been maintained in accordance with EPRI guidelines for the present operating period (August 1998 - April 1999). SG impurities have been maintained well below EPRI recommended action levels. No intrusions of impurities into the secondary plant have been observed that would indicate a condenser tube leak (chloride, sulfate, or sodium). Iron and copper corrosion products during this operating period have been below the EPRI guideline recommended action levels for these corrosion products.

The staff finds the licensee's water chemistry monitoring and procedures provide assurance that corrosion during the operation period of August 1998 - April 1999 has been minimized.

### 3.3 Leakage Monitoring and Leakage Guidelines

The licensee stated that should unforeseen circumstances cause SG tube leakage, there are multiple methods available to monitor primary-to-secondary leakage through the SGs. They employ radiation monitors in the condenser air ejector, the SG blowdown line, and the main

steamline (MSL). In addition, MSL N-16 monitors are installed, which significantly enhance monitoring of MSL activity. In addition, TS 3.1.F.2.a.(1) limits the primary-to-secondary leakage to 0.3 gallons per minute (gpm) for any one SG. However, the licensee maintains an administrative limit of 0.1 gpm. This administrative limit provides added assurance that, should a leak develop during the operating cycle, it would be quickly detected to allow immediate mitigating actions to be taken.

The staff finds the licensee's leakage monitoring program provides assurance that should a leak develop during the operating cycle it would be quickly detected allowing immediate mitigating actions to be taken before tube rupture occurs.

#### 4.0 MODIFICATION OF THE PLANT TSs

The licensee proposes to add the following footnote to page 4.13-2:

\*Examinations scheduled for 1999 only, shall be conducted during the 2000 refueling outage which will commence no later than June 3, 2000. The scheduled examinations will be completed prior to return to service from the 2000 Refueling Outage.

The licensee proposes to modify TS 4.13C.1. to state:

The proposed steam generator examination program shall be submitted for NRC staff review at least 60 days prior to each scheduled examination.

The modification will require the licensee to submit for staff review their proposed SG examination program 60 days prior to the scheduled examination. The licensee will no longer be required to get formal NRC approval for their proposed SG examination program. The 60 days notice of the licensee's proposed SG examination program provides time for the NRC to review the examination program and determine if there are any concerns to be addressed.

Modifications to TSs Sections 4.13A.2.e, 4.13A.4.2.a, and Bases Section 4.13 will be modified to be consistent with other licensees regarding NRC approval of the proposed SG examination program.

The staff has reviewed the proposed modifications and finds them acceptable.

#### 5.0 SUMMARY

Based on the above evaluation, the staff finds that conducting TS 4.13A.2.a during a mid-cycle surveillance in June 1999 to be unnecessary. NRC staff concludes that the licensee's proposal to allow a one time extension to the SG tube inspection interval is acceptable and that there is reasonable assurance that SG tubes will maintain structural and leakage integrity for the entire cycle 14 operation. The staff also finds that since the licensee is required to submit their proposed SG examination program 60 days prior to the scheduled outage, receiving formal NRC concurrence is not necessary.