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June 26, 1995

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

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

SUBJECT: Generic Letter 95-03

The information requested in Generic Letter 95-03 is provided in Attachment A.

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

Very truly yours,

Stephen E. Quinn

Subscribed and sworn to
before me this 26th day
of June, 1995.

Karen L. Lancaster
Notary Public

KAREN L. LANCASTER
Notary Public, State of New York
No. 60-4643659
Qualified In Westchester County
Term Expires 9/30/95

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ATTACHMENT

RESPONSE TO GENERIC LETTER 95 - 03

Consolidated Edison Company of New York, Inc.
Indian Point Unit No. 2
Docket No. 50-247
June, 1995

Background

Indian Point 2 has four Westinghouse model 44 steam generators (SG) manufactured with 7/8 inch nominal OD x 0.050 inch nominal wall thickness, high temperature mill annealed Alloy 600 tubing. The tubing is part depth rolled in the tubesheet for about 2.5 inches. This leaves about 19.5 inches of unexpanded tube in the 22 inch thick tubesheet. They have operated for 13.75 EFPY which represents 22 calendar years to date. The SGs currently operate with a T_{hot} of 589^0F with an AVT-Boron secondary water chemistry. The total number of tubes plugged for the four SGs is 1152, or 8.8%. The number of tubes plugged since startup in 1973 is 768, or 5.9%. Sleeves have not been used.

Requested Actions

Item 1

Evaluate recent operating experience with respect to the detection and sizing of circumferential indications to determine the applicability to their plant.

Circumferential stress corrosion cracking has not been conclusively observed. The first detected event of any stress corrosion cracking in the Indian Point 2 SG tubing occurred during the 1993 refueling outage (RFO) inspection. The inspection conducted was a bobbin coil eddy current examination of 100% of the tubes through the first support plate, both hot and cold legs, and a full length examination of approximately 22% of all tubes in service. Any tube areas found with distorted indications were then examined using a rotating pancake coil probe (RPC). This examination identified 5 tubes (4 in SG 23 and 1 in SG24) with axial primary water stress corrosion cracks at roll transitions.

In preparation for the 1995 RFO SG tube examination Con Edison qualified the CECCO 5 eddy current probe to the EPRI NP-6201 Rev. 3 "PWR Steam Generator Inspection Guidelines", Appendix H requirements for dented and undented tube support locations. The probe demonstrated through this qualification that it was fully capable of detecting circumferential cracking in steam generator tubes.

The recent examination used the CECCO 5 probe to examine all hot leg tubes from the hot leg tube end through the first support plate. All dented tube intersections in the hot legs of SGs 21 and 22 were examined (178 and 243 tubes respectively). In addition, 204 hot leg tubes were examined from the hot leg tube end through the 6^{th} support plate. No circumferential indications were detected or logged above the roll transition regions.

Five hundred ninety four tubes showed primary water stress corrosion cracking type indications at the roll transitions, either at the hard roll, approximately 2.5 inches from the tube end, or at the tack roll, approximately 1.3 inches from the tube end. The vast majority of the tubes with indications were in SG23 with 542; SG21 had 13; SG22 had 2; and SG24 had 37. One hundred fourteen of these were logged as circumferential with 66 tubes having single and 48 with multiple logged circumferential indications. The indications in this area of the tubes were characterized as closely spaced axial indications. The separation between axial indications was in these instances less than the capability of detection of circumferential ligaments and they were therefore logged as circumferential.

The Maine Yankee and other unit circumferential cracking was associated with high roll transition stresses and/or operating in conjunction with a concentrated secondary side chemistry at the top of the tubesheet with full tubesheet thickness tube expansion. The Indian Point 2 steam generator tube roll is at approximately 2.5 inches up from the lower tubesheet face or at approximately 11% of the tubesheet thickness. If the tube were to sever at the roll it would be contained by about 19.5 inches of the tubesheet, precluding a full bore leak. Failure in that area also precludes secondary damage to adjacent tubes.

Item 2

On the basis of the evaluation in Item (a) above, past inspection scope and results, susceptibility to circumferential cracking, threshold of detection, expected or inferred crack growth rates, and other relevant factors, develop a safety assessment justifying continued operation until the next scheduled steam generator tube inspections are performed.

The 1995 RFO examination used a method capable of detecting circumferential cracking (CECCO 5). All areas deemed most susceptible were examined completely. These are the hot leg roll transitions, top of the tubesheet, and the first support plate. All dented tube intersections in the hot legs of SGs 21 and 22 were examined (178 and 243 tubes respectively). A sampling of the full hot legs of 204 tubes was also performed with the CECCO 5 probe. All cold legs of the tubes were examined through the first support plate and 8669 tubes were examined full length using a bobbin coil probe. Any distorted indication signals were examined using a motorized rotating pancake coil probe. No circumferential cracking was seen or logged in any other area than at the embedded tube roll transitions.

All of the tubes in the area where cracking had been previously observed and the areas experiencing the highest operational temperatures (the top of the tube sheet and the first support plate intersections of the hot leg) were examined using a qualified method capable of detecting circumferential cracking. Other areas were examined on a sampling basis. Cracklike defect signals were observed only in the roll transition areas within the tubesheet. No circumferential defects were detected or logged at any other location. Tubes with cracklike indications were either plugged or evaluated using the F* criteria. Tubes which did not meet this criterion were rerolled to meet it.

At Indian Point 2 all tube regions with logged circumferential cracking were deep within the tubesheet and would not cause a full bore leak. Circumferential cracking has not been observed or logged in any other area. With respect to U-bend cracking, the first row tubes were plugged during construction and higher rows were examined as a part of the random sample. The steam generator tubes have a high temperature mill anneal and operate at a T_{hot} of 589°F. This is lower than most other units, and thus has a lower susceptibility to stress corrosion cracking, as the current general condition of the tubes has demonstrated.

Partial depth roll expanded plants are different from full depth expanded plants should postulated severe circumferentially oriented degradation occur in the expansion transition. The elevation of the postulated degradation is approximately 19.5 inches below the top of the tubesheet, and as such, this distance would prevent tube axial mispositioning such that full steam generator tube rupture release rates would not be anticipated. Sludge accumulation in the tube to tubesheet crevice region would also act to restrict any potential leakage. Excluding the presence of sludge in the crevice, the gap between the postulated separated tube to tubesheet is limited. For a postulated tube separation with a 18 inch crevice (1 inch of tube axial displacement is assumed) the expected primary to secondary leak rates for primary to secondary pressure differentials of 1500 and 2600 psi would be expected to be less than the normal makeup capacity of the plant. Also, tubesheet bow effects would act to close any available gap between the tube and tubesheet tube hole.

Item 3

Develop plans for the next steam generator tube inspections as they pertain to the detection of circumferential cracking. The inspection plans should address, but not be limited to, scope (including sample expansion criteria, if applicable), methods, equipment, and criteria (including personnel training and qualification).

We intend to examine the SG tubes during the next refueling outage, currently planned for the spring of 1997, with the CECCO 5 or a similar advanced capability probe which has been qualified to Appendix H requirements of the EPRI PWR Steam Generator Inspection Guidelines. The analysts will be qualified to Appendix G requirements of the Guidelines. At least all hot legs and 20% of the tube cold legs will be examined. If cracking indications are found in the cold leg of a tube, the examination will be expanded to include all tubes in the cold leg of that SG. Distorted indication signals may be examined using another advanced type eddy current probe. Tubes cracked in the tubesheet area may be repaired applying the F* criteria or plugged. Any tubes cracked in other areas will be plugged.