ATTACHMENT A

Technical Specification
Page Revisions

Consolidated Edison Company of New York, Inc.
Indian Point Unit No. 2
Docket No. 50-247
June 22, 1987

4.13 STEAM GENERATOR TUBE INSERVICE SURVEILLANCE

Applicability

Applies to inservice surveillance of the steam generator tubes.

Objective

To assure the continued integrity of the steam generator tubes that are a part of the primary coolant pressure boundary.

Specification

Steam generator tubes shall be determined operable by the following inspection program and corrective measures.

A. Inspection Requirements

1. Definitions

    a. Imperfection is a deviation from the dimension, finish, or contour required by drawing or specification.

    b. Deformation is a deviation from the initial circular cross-section of the tubing. Deformation includes the deviation from the initial circular cross-section known as denting.

    c. Degradation means service-induced cracking, wastage, pitting, wear or corrosion (i.e. service-induced imperfections).

    d. Degraded Tube is a tube that contains imperfections caused by degradation large enough to be reliably detected by eddy currently inspection. This is considered to be 20% degradation.

    e. Percent Degradation is an estimated percent of the tube wall thickness affected or removed by degradation.

    f. Defect is a degradation of such severity that it exceeds the plugging or repair limit. A tube containing a defect is defective.

g. Plugging or Repair Limit is the degradation depth at or beyond which the tube must be repaired or removed from service by plugging. This is considered to be a degradation depth of 40%.

h. Sleeve Plugging Limit is the sleeve degradation depth at or beyond which the sleeved tube must be repaired or removed from service by plugging. This is considered to be a degradation depth of 40% for tube sleeves.

i. Hot Leg Tube Examination is an examination of the hot leg side tube length. This shall include the length from the point of entry at the hot leg tube sheet around the U-bend to the top support of the cold leg.

j. Cold Leg Tube Examination is an examination of the cold leg side tube length. This shall include the tube length between the top support of the cold leg and the face of the cold leg tube sheet.

2. Extent and Frequency of Examination

a. Subject to the conditions of specification 4.13.C.5 and/or 4.13.C.6, steam generator examinations shall be conducted not later than after sixteen equivalent months of operation (i.e. operation with a primary coolant temperature greater than 350°F) or not later than twenty calendar months from the date of restart after the previous examination, whichever comes first.

b. Scheduled examinations shall include each of the four steam generators in service.

c. Unscheduled steam generator examinations shall be required in the event there is a primary to secondary leak exceeding technical specifications, a seismic occurrence greater than an operating basis earthquake, a loss-of-coolant accident requiring actuation of engineered safeguards, or a major steam line or feedwater line break.

d. Unscheduled examinations may include only the steam generator(s) affected by the leak or other occurrence.

e. In case of an unscheduled steam generator examination, the profilometry tensile strain criterion shall be the same as contained in the approved program of the last scheduled steam generator inspection.

3. <u>Basic Sample Selection and Examination</u>

a. At least 12% of the tubes in each steam generator to be examined shall be subjected to a hot leg examination.

b. At least 25% of the tubes inspected in A.3.a above shall be subjected to a cold leg examination.

c. Tubes selected for examination shall include, but not be limited to, tubes in areas of the tube bundle in which degradation has been reported, either at Indian Point 2 in prior examinations, or at other utilities with similar steam generators.

d. Examination for deformation ("dents") shall be either by eddy current or by profilometry.

e. Examination for degradation other than deformation shall be by eddy current techniques, using a 700 mil diameter probe. If the 700 mil diameter probe cannot pass through the tube, a 610 mil diameter probe shall be used. For examination of the U-bends and cold legs of tubes in rows 2 through 5, a 540 mil diameter probe may be used, provided it is justified by profilometry measurement within the tensile strain criterion.

f. Tubes selected for examination shall include both non-repaired tubes and previously repaired tubes.

4. <u>Additional Examination Criteria</u>

1. <u>Degradation Not Caused by Denting</u>

a. If 5% or more of the tubes examined in a steam generator exhibit degradation or if any of the tubes examined in a steam generator are defective, additional examinations shall be required as specified in Table 4.13-1.

b. Tubes for additional examination shall be selected from the affected area of the tube array and the examination may be limited to that region of the tube where degradation or defective tube(s) were detected.

c. The second and third sample inspections in Table 4.13-1 may be limited to the partial tube inspection only, concentrating on tubes in the areas of the tube sheet array and on the portion of the tube where tubes with imperfections were found.

2. Degradation Caused by Denting

a. Additional examinations, for degradation caused by denting, shall be performed as described in the most recent steam generator examination program approved by the NRC.

B. Acceptance Criteria and Corrective Action

1. Tubes shall be considered acceptable for continued service if:

a. Depth of degradation is less than 40% of the tube wall thickness, and

b. The tube will permit passage of a 0.540" diameter probe and the strain in the tube wall (if measured) is less than the tensile strain criterion as specified in the approved examination program; or the tube will permit passage of a 0.610" diameter probe, in the absence of strain measurement.

2. Tubes that are not considered acceptable for continued service shall be repaired using a NRC approved methodology or plugged.

C. Reports and Review and Approval of Results

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

2. The results of each steam generator examination shall be submitted to NRC within 45 days after the completion of the examination. A significant increase in the rate of denting or significant change in steam generator condition shall be reportable immediately.

3. An evaluation which addresses the long term integrity of small radius u-bends beyond row 1 shall be submitted within 60 days of any finding of significant hourglassing (closure) of the upper support plate flow slots.

4. Restart after the scheduled steam generator examination need not be subject to NRC approval.

5. In any event, NRC staff approval shall be obtained for operating for a period longer than eight equivalent months of operation or one calendar year from the date of restart after examination.

6. In the event of an unscheduled steam generator examination, NRC staff approval shall be obtained in order for the examination to serve as a basis for operation for an additional eight months equivalent operation from the date of the examination.

Basis

Inservice examination of steam generator tubing is essential if there is evidence of mechanical damage or progressive deterioration in order to assure continued integrity of the tubing. Inservice examination of steam generator tubing also provides a means of characterizing the nature and cause of any tube degradation so that corrective measures can be taken.

An essentially 100% tube examination was performed on each tube in each steam generator by eddy current techniques prior to service in order to establish a baseline condition for the tubing. No significant baseline imperfections were identified. In addition, prior to the discontinuance of phosphate treatment and the institution of all volatile treatment (AVT), a baseline inspection was conducted in March, 1975 before the resumption of power operation.

Wastage-type defects are unlikely with the all volatile treatment (AVT) of secondary coolant; however, even if this type of defect occurs, the steam generator tube examination will identify tubes with significant degradation from this effect.

The results of steam generator tube burst and collapse tests have demonstrated that tubes having wall thickness of not less than 0.025 inch have adequate margins of safety against failure due to loads imposed by normal plant operation and design basis accidents. An allowance of 10% for tube degradation that may occur between inservice tube examinations added to the 40% degradation depth provided in the acceptance criteria provides an adequate margin to assure that tubes considered acceptable for continued operation will not have a minimum tube wall thickness less than the acceptable 50% of normal tube wall thickness (i.e., 0.025 inch) during the service lifetime of the tubes. Steam generator tube examinations of other operating plants have demonstrated the capability to reliably detect wastage type defects that have penetrated 20% of the original 0.050 inch wall thickness.

Examination of samples of tubes and support plates removed from steam generators have revealed that "denting" is caused by the accretion of steel corrosion products in the tube/support plate annuli. As these corrosion products are more voluminous than the support plate material from which they are derived, a compressive force is exerted on the tubes in the plane of the support plates, resulting in deformation of the tubes. If the deformation results in an ovalization of the tubes, the resulting strain is low and there is no risk of development of stress corrosion cracking in the tubes. However, if the deformation results in an irregular tube shape, the resulting strain may be high enough for the tube to become susceptible to stress corrosion cracking in service, and it should be preventively repaired. Beginning with the steam generator examination to be conducted during the Cycle 5/6 Refueling Outage, the tensile strain criterion for profilometry shall be 25%. The 25% strain criterion is based on a review of data currently available from operating steam generators, and will be revised as necessary as more experience is gained with the evaluation of this measurement. In the future, this criterion may be revised, either higher or lower, based on steam generator examination results. The profilometry criterion to be used for any steam generator examination shall be established in the most recent program approved by NRC.

A first report on the R&D work leading to the development of profilometry entitled, "Profilometry of Steam Generator Tubes" dated August, 1980 was forwarded to NRC by Con Edison. Additional R&D work has improved the accuracy of the profilometer and the calculation of strain in a deformed tube.

Before the development of profilometry, a minor diameter of 0.610" was established as the criterion for continuing a tube in service. This criterion was used successfully for several years at Indian Point Unit 2 and at other plants, and appears to be sufficiently conservative so that it can be continued in the absence of more accurate strain determination by means of profilometry.

This program for inservice inspection of steam generator tubes exceeds the requirements of Regulatory Guide 1.83, Revision 1, dated July 1975.

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Steam Generator Tube Inspection

	First Sample Inspection		Second Sample Inspection		Third Sample Inspection	
Minimum Size	Result	Action	Result	Action	Result	Action
12% tubes per steam generator hot leg plus 3% tubes per steam generator cold leg	C-1 →					Go to Power
	C-2	Plug or repair defective tubes. Inspect additional 6% tubes in this S.G.	C-1 →			Go to Power
			C-2	Plug or repair defective tubes. Inspect additional 12% tubes in this S.G.	C-1 →	Go to Power
					C-2 →	Plug or repair defective tubes. Go to Power.
					C-3 →	Go to first sample. C-3 action.
			C-3	Go to first sample. C-3 action.		
	C-3	Inspect all tubes this S.G. Plug or repair defective tubes	All other S.G.s C-1 →			Go to Power
			Some S.G.s C-2 but no add'l C-3	Go to second sample. C-2 action.		
		Inspect 6% tubes in each other S.G. if not included in the examination program	Add'l S.G. C-3	Inspect all tubes in all S.G.s. Plug or repair defective tubes. →		Report to NRC. NRC approval req'd prior to startup.

Table 4.13-1 (Page 2 of 2)

Steam Generator Tube Inspection

Category C-1	Less than 5% of the total tubes inspected are degraded tubes and none of them is defective.
Category C-2	One or more of the total tubes inspected is defective but no more than 1% of the tubes inspected; or less than 10% of the tubes inspected are degraded tubes.
Category C-3	More than 10% of the total inspected are degraded or more than 1% of the tubes inspected are defective.

ATTACHMENT B

Safety Assessment

Consolidated Edison Company of New York, Inc.
Indian Point Unit No. 2
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Safety Assessment

Background:

The proposed change will provide the option of repairing a steam generator tube that contains a defect. This repair will take the form of sleeving the affected tubes.

The current Technical Specifications require that any steam generator tube that contains a defect of greater than 40% of nominal tube wall thickness be plugged. The act of placing a plug in both the hot and cold leg tube ends removes the tube from service by terminating reactor coolant flow through the tube.

Sleeving is a process by which a smaller, shorter tube (sleeve) is placed inside of the existing tube. This sleeve extends through and for some length above the tube sheet. It is sealed to the original tube at both ends of the sleeve, effectively forming a new barrier. Thus, if a defect were to exist in the lower region of the tube, the sleeving process just described is a viable alternative to plugging the entire tube.

The obvious advantage to sleeving is that the tube will remain in service since reactor coolant would still be permitted to flow on the inside of the sleeve and throughout the remainder of the existing steam generator tube. Thus the sleeving option will extend the life of the steam generators by allowing tubes which possess defects to remain in service.

The sleeving process to be utilized at Indian Point Unit No. 2 will be submitted for NRC approval prior to its use, if required. The proposed change transmitted with this document simply provides the option of utilizing this process when approved. This change has no effect on the plugging process until the NRC accepts the specific sleeving process we plan to submit.

Basis For No Significant Hazards Determination:

In accordance with the requirements of 10 CFR 50.92, the proposed Technical Specification change is deemed to involve no significant hazards considerations because operation of Indian Point Unit No. 2 in accordance with this change would not:

1) Involve a significant increase in the probability or consequences of an accident previously evaluated, since the integrity of the steam generator tubes after sleeving will be equivalent to that of the original tubes. Thus, since the structural integrity of the tubes will not be affected by this change, there is no increase in the probability of any accident previously evaluated. In addition, the steam generator will remain capable of performing its required heat transfer function. The act of placing a sleeve in the steam generator tube results in a more efficient

steam generator relative to plugging the affected tubes. Thus, the consequences of any accident previously evaluated is unaffected because the heat transfer capability of the steam generators will not be significantly altered.

2) Create the possibility of a new or different kind of accident from any accident previously evaluated, as both the structural integrity and the heat transfer capability of Indian Point 2 steam generators will not be significantly affected by the use of an approved sleeving process. In addition, the steam generator tube sleeves do not interact with any IP2 systems. Thus, there is no potential for a new or different kind of accident due to the use of a sleeving process to repair IP2 steam generators.

3) Involve a significant reduction in a margin of safety. The heat transfer capabilities of IP2 steam generators will be improved by utilizing the sleeving process rather than the currently required plugging. The sleeving process will allow a repaired steam generator tube to remain in service, rather than completely blocking the tubes flow with plugs. Since the structural integrity of the steam generators tubes will be unaltered, the net effect of utilizing a steam generator tube sleeving process, rather than the currently required plugging procedure, will be an increase in the margin of safety. This increase is due to the relatively improved heat transfer characteristics of the steam generator.

The Commission has provided guidance concerning the application of the standards for determining whether a significant hazard consideration exists by providing certain examples in 48 FR 14870 and 51 FR 7744. As the sleeving process will utilized proven techniques, example (IX) in 51 FR 7744 is applicable to the proposed change.

Example (IX) reads as follows:

(IX) A repair or replacement of a major component or system important to safety, if the following conditions are met:

1) The repair or replacement process involves practices which have been successfully implemented at least once on similar component or systems elsewhere in the nuclear industry or in other industries, and does not involve a significant increase in the probability or consequences of an accident previously evaluated or create the possibility of a new or different kind of accident previously evaluated; and

2) The repaired or replacement component or system does not result in a significant change in its safety function or a significant reduction in any safety limit (or limiting condition of operation) associated with the component or system.

Therefore, since the application for amendment satisfies the criteria specified in 10 CFR 50.92 and is similar to examples for which no significant hazards considerations exists, Consolidated Edison Company has made a determination that the application involves a no significant hazards consideration.

The proposed changes have been reviewed by the Station Nuclear Safety Committee and the Consolidated Edison Nuclear Facilities Safety Committee. Both committees concur that these changes do not represent a significant hazards consideration.