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New York Power Authority

June 18, 1985
IPN-85-31

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D.C. 10555

Attention: Hugh L. Thompson, Director
Division of Licensing

Subject: Indian Point 3 Nuclear Power Plant
Docket No. 50-286
Staff Recommended Actions Stemming From NRC
Integrated Program For The Resolution of
Unresolved Safety Issues Regarding Steam
Generator Tube Integrity (Generic Letter 85-02)

Dear Sir:

This letter serves to transmit a description of the overall programs for assuring steam generator tube integrity and for steam generator tube rupture mitigation.

The subject generic letter was issued to obtain information on the NRC overall program for steam generator tube integrity and steam generator tube rupture mitigation. This information will allow the staff to assess the areas of concern addressed by the staff's recommended actions which were developed as part of the integrated program for the resolution Unresolved Safety Issues A-3, A-4, and A-5 regarding steam generator tube integrity. Enclosure 1 to the subject generic letter presents the staff's recommended actions in the following areas:

1. Prevention and Detection of Loose Parts and Foreign Objects.

2. Steam Generator Tube Inservice Inspection

3. Secondary Water Chemistry Program.

4. Condenser Inservice Inspection Program

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5. Primary to Secondary Leakage Limit

6. Coolant Iodine Activity Limit

7. Safety Injection Signal Reset

Attachment I to this letter provides the Authority's response to the staff's recommended actions.

Enclosure 2 to the subject generic letter requests information concerning supplemental tube sample inspections for the case where Category C-2 results are obtained during initial sample inspections. Attachment II to this letter provides the Authority's response to this request.

Should you or your staff have any questions regarding this matter, please contact Mr. P. Kokolakis of my staff.

Very truly yours,

George M. Wilverding

for John C. Brons
Senior Vice President
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cc: Resident Inspector's Office
Indian Point Unit 3
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ATTACHMENT I TO IPN-85-31
AUTHORITY RESPONSE TO STAFF RECOMMEND ACTIONS

NEW YORK POWER AUTHORITY
INDIAN POINT 3 NUCLEAR POWER PALNT
DOCKET NO. 50-286

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1.a PREVENTION AND DETECTION OF LOOSE PARTS (INSPECTIONS)

Staff Recommended Action

Visual inspections should be performed on the steam generator secondary side in the vicinity of the tube sheet, both along the entire periphery of the tube bundle and along the tube lane, for purposes of identifying loose parts or foreign objects on the tubesheet, and external damage to peripheral tubes just above the tubesheet.

These visual inspections should be performed: (1) for all steam generators at each plant at the next planned outage for eddy current testing, (2) after any secondary side modifications, or repairs, to steam generator internals, and (3) when eddy current indications are found in the free span portion of peripheral tubes, unless it has been established that the indication did not result from damage by a loose part or foreign object.

AUTHORITY RESPONSE

Since the Cycle 3/4 refueling outage (1982-1983), the Authority has performed visual inspections of the steam generator secondary sides in the vicinity of the tubesheet as a routine part of periodic steam generator maintenance. Such inspections have now been performed twice at Indian Point 3 and are planned for the Cycle 4/5 refueling outage which commenced on June 7, 1985.

These visual inspections, which utilize a small camera, are usually conducted immediately following sludge lancing operations so that the time during which the steam generator is drained is minimized. Any identified loose parts are subsequently removed. Furthermore, the eddy current testing results of peripheral tubes are evaluated with particular attention to degradation which may have been caused by loose parts. To date, there have been no identified indications which were the result of loose parts at Indian Point 3.

Visual inspections of the steam generator secondary sides will be performed subsequent to secondary side modifications or repairs, as deemed prudent. In light of ALARA concerns, the decision to perform a visual inspection will be based on an assessment of the probability that the modification or repair introduced a loose part or foreign object against the dose to the individual performing the visual inspection. Generally, visual inspections will not be performed subsequent to a modification or repair for which the possibility of introducing a loose part or foreign object is determined to be negligible.

1.b PREVENTION AND DETECTION OF LOOSE PARTS (QUALITY ASSURANCE)

Staff Recommended Action

Quality assurance/quality control procedures for steam generators should be reviewed and revised as necessary to ensure that an effective system exists to preclude introduction of foreign objects into either the primary or secondary side of the steam generator whenever it is opened (e.g., for maintenance, sludge lancing, repairs, inspection operations, modifications). As a minimum, such procedures should include: (1) detailed accountability procedures for all tools and equipment used during an operation, (2) appropriate controls on foreign objects such as eye glasses and film badges, (3) cleanliness requirements, and (4) accountability procedures for components and parts removed from the internals of major components (e.g.,reassembly of cut and removed components.)

Authority Response

An existing Indian Point 3 housekeeping procedure provides the general requirements that are necessary to preclude the introduction of foreign objects into either the primary or secondary side of the steam generators when they are opened. Specific requirements are then developed so as to adequately control the specific work that is to be performed. These specific requirements will address items 1 through 4 above, to the extent warranted by the nature and scope of the work being performed.

2.a INSERVICE INSPECTION PROGRAM (FULL LENGTH TUBE INSPECTION)

Staff Recommended Action

The Standard Technical Specifications (STS) and Regulatory Guide 1.83, Part C.2.f, currently define a U-tube inspection as meaning an inspection of the steam generator tube from the point of entry on the hot-leg side completely around the U-bend to the top support of the cold-leg side. The staff recommends that tube inspections should include an inspection of the entire length of the tube (tube end to tube end) including the hot leg side, U-bend, and cold leg side.

Consistent with the current STS requirement, supplemental sample inspections (after the intial 3% sample) under this staff recommended action may be limited to a partial length inspection provided the inspection includes those portions of the tube length where degradation was found during initial sampling.

Authority Response

In light of the degradation on the cold leg side of the existing steam generators, the Authority will be performing full length tube inspections for the initial 3% sample. Additional inspections which may be required should concentrate on those locations where degradation has been found.

While the Indian Point 3 Technical Specifications currently require sample inspections from the hot leg tubesheet to the top support on the cold leg side, the Authority has performed extensive inspections on the cold leg side. In late 1981, it was determined that the steam generators were subject to cold leg pitting located between the tubesheet and first support plate with a small number of indications just above the first support plate. Subsequent inservice inspections have included eddy current testing of all tubes from the tubesheet to the second support plate on the cold leg side.

During the Cycle 4/5 refueling outage, the Authority will perform the initial sample inspection from tube end to tube end. It should be noted that this initial sample inspection could include separate entries from the hot and cold leg sides and selecting different tubes on the hot and cold leg sides to satisfy the minimum sampling requirements. Additional inspections, should they be required, will concentrate on those locations where degradation has been identified.

2.b INSERVICE INSPECTION PROGRAM (INSPECTION INTERVAL)

Staff Recommended Action

The maximum allowable time between eddy current inspections of an individual steam generator should be limited in a manner consistent with Section 4.4.5.3 of the Standard Technical Specifications, and in addition should not extend beyond 72 months.

Authority Response

The Indian Point 3 Technical Specifications conform to Section 4.4.5.3 of the Standard Technical Specifications. However, the Authority differs with the Recommended Action regarding the 72 calendar month maximum interval between inspections of an individual steam generator. The Authority believes that the inspections should be performed on a refueling outage basis. Predicated upon unit availability, a fuel cycle is approximately 18 months in duration. Hence if the inspections are limited to one steam generator on a rotating basis, the maximum interval should be approximately 72 calendar months. However if a lengthy outage were to occur, four fuel cycles would exceed a 72 calendar month duration. Consequently, an additional costly outage would be required to satisfy the recommended maximum inspection interval requirement. A maximum inspection interval of 72 operating months is more appropriate as it will ensure synchronism for the steam generator inservice inspections and the refueling outages. It should be noted that this maximum inspection interval of 72 operating months is predicated upon an 18 month fuel cycle and that the Authority is currently pursuing longer duration fuel cycles.

This Recommended Action addresses the concern that new degradation mechanisms may develop, which affect the steam generators in a non-uniform manner, and may go undetected for 160 months. The degradation methods that affect the Indian Point 3 steam generator tubes are denting and pitting. The steam generators were all affected by these degradation mechanism. Moreover, steam generator blowdown sampling would identify a non-uniform secondary side chemistry, which may lead to corrosion of the steam generator tubes.

3.a SECONDARY WATER CHEMISTRY PROGRAM

Staff Recommended Action

Licensees and applicants should have a secondary water chemistry program (SWCP) to minimize steam generator tube degradation.

The specific plant program should incorporate the secondary water chemistry guidelines in SGOG Special Report EPRI-NP-2704, "PWR Secondary Water Chemistry Guidelines," October 1982, and should address measures taken to mimimize steam generator corrosion, including materials selection, chemistry limits, and control methods. In addition, the specific plant procedures should include progressively more stringent corrective actions for out-of-specification water chemistry conditions. These corrective actions should include power reductions and shutdowns, as appropriate, when excessively corrosive conditions exist. Specific functional individuals should be identified as having the responsibility/authority to interpret plant water chemistry information and initiate appropriate plant actions to adjust chemistry, as necessary.

Authority Response

In accordance with the Facility Operating License, Indian Point 3 has implemented a secondary water chemistry monitoring program to inhibit steam generator tube degradation. This includes a sampling schedule and control points for critical parameters, methods for recording and management of the data, identification of corrective actions for off normal chemistry, and identification of functional individuals responsible for interpretation of data and initiation of corrective actions. These are clearly specified in plant procedures.

As a further effort to minimize/inhibit steam generator corrosion, the Authority has since mid 1982, embarked upon an ambitious and costly program of Balance of Plant Modifications aimed at improving secondary water chemistry. The ultimate goal of this program is that the plant should meet all "PWR Secondary Water Chemistry Guidelines" as established in the Steam Generator Owners Group (SGOG) Special Report EPRI-NP-2704. The modifications already completed include replacement of moisture separator reheater tube bundles and installation of a makeup water vacuum deaerator and a condensate/feedwater startup cleaning system. Plans for the Cycle 4/5 refueling outage include condenser replacement and replacement of high pressure feedwater heaters. Remaining feedwater heaters will be replaced in a subsequent refueling outage as well as installation of a blowdown recovery system. A condensate polisher is presently being installed and is expected to be operational in mid 1986. Finally, a test program is in progress to optimize water treatment of the plant's makeup water.

With regard to formal implementation of the aforementioned EPRI guidelines for chemistry control, the individual control parameter's recommended guidelines and action level are specified in plant procedures. The procedures identify the SGOG guidelines to plant personnel and set them as the goal to attain. Plant personnel are well aware of the intent of meeting these guidelines and the basis behind them.

Recognizing that these are purely guidelines based on data and judgement and that they must be flexible enough to consider plant specific design features and past system performance, the Authority has established plant specific guidelines and action levels in these procedures. These plant specific guidelines reflect the Authority's commitment to establish achievable limits based upon past performance. They are revised to more stringent action levels as further balance of plant modifications are completed. The latest revision was made in December, 1984.

It is the Authority's judgement that replacement of the condenser and high pressure feedwater heaters and optimization of the makeup water treatment system's ability to minimize ingress of harmful impurities will result in Indian Point 3 meeting all EPRI guidelines. This will allow plant specific operating guidelines and action levels to be revised to the EPRI guidelines and is expected to be achieved by 1986. Indian Point 3 should by that point be in full agreement with this NRC staff recommended action.

3.b CONDENSER INSERVICE INSPECTION PROGRAM

Staff Recommended Action

Licensees should implement a condenser inservice inspection program. The program should be defined in plant specific safety-related procedures and include:

1. Procedures to implement a condenser inservice inspection program that will be initiated if condenser leakage is of such a magnitude that a power reduction corrective action is required more than once per three month period; and

2. Identification and location of leakage sources (s), either water or air;

3. Methods of repair of leakage.

4. Methodology for determining the cause (s) of leakage;

5. A preventive maintenance program.

Authority Response

The Indian Point 3 condenser is non-safety-related. As such the program utilized to ensure condenser integrity need not be defined in safety-related procedures.

While a condenser inservice inspections program is not initiated if condenser leakage is of such magnitude that a power reduction corrective action is required more than once per three month period, eddy current inspections of the condenser tubes are performed as part of the condenser preventative maintenance program.

The Secondary Plant Chemistry Control Procedure, SOP-SG-2, provides for the monitoring of steam generator blowdown chloride concentration which will identify water in-leakage to the condenser. The action levels corresponding to escalating chloride concentration levels include provisions for power reduction and shutdown. The Procedure for Condenser In-leakage Inspection, PFM-35, is utilized to locate the source of water in-leakage once a leak has been verified by the Chemistry Department. The leakage source identification process involves localized spraying of Helium on to the tubes and an assessment of the air ejector exhaust utilizing a Helium mass spectrometer. An indication of Helium in the exhaust signifies that the source of leakage is in the localized spray area. The defective tubes are plugged at both the inlet and outlet ends.

The aforementioned secondary plant chemistry control procedure also provides for the monitoring of condensate dissolved oxygen concentration, which will identify air in-leakage to the condenser. The Condenser Air In-Leakage Detection Program, PFM-18, is employed to locate the source of air in-leakage. This program involves the spraying of specified components in the condensate system with Helium. The location of the air in-leakage is identified utilizing a Helium mass spectrometer in the above described manner. Sulfur hexifloride is also utilized in the air in-leakage location process, as it provides a higher sensitivity than Helium.

As noted above, one method of leakage repair is to plug the defective tube at both the inlet and outlet ends. Repairs previously performed also include the welding of the tube-tube sheet joints and the epoxy coating of the seams.

While a specific methodology for determining the cause of a leakage has not been defined in a procedure, the cause of previously experienced tube failures have been identified. The identified causes include mechanical vibration, thermal stressing and pitting due to corrosion.

The preventative maintenance program for the condenser includes visual inspection, hydrostatic test and eddy current inspection. The visual inspection includes examining the integrity of the manway gasket, vibration clips, and the protective coatings; ensuring that plugged tubes have a plug on both the inlet and outlet side utilizing the plugging maps; and inspecting tube bundles for cracked, bent or damaged tubes. A hydrostatic test of the condenser is performed to assess condenser integrity. Eddy current inspections have been performed in order to identify condenser tube defects. During the Mid-cycle 4 outage, the then applicable tube plugging limit was an indication of 20% degradation. In addition to the above described preventative measures, the condenser seams were sealed with an epoxy coating.

During the Cycle 4/5 refueling outage, the Authority will replace the existing admiralty condensers and waterboxes with titanium condensers and new waterboxes. The existing program to ensure condenser integrity will be revised as appropriate to reflect this replacement.

4. PRIMARY TO SECONDARY LEAKAGE LIMIT

<u>Staff Recommended Action</u>

All PWRs that have Technical Specifications limits for primary to secondary leakage rates which are less restrictive than the Standard Technical Specifications (STS) limits should implement the STS limits.

<u>Authority Response</u>

Indian Point 3 Technical Specification 3.1.F.8 limits the primary to secondary leakage through the steam generator tubes to 0.3 gpm per steam generator and to 1.0 gpm total for all four steam generators. These limits are more restrictive than those provided by STS.

5. COOLANT IODINE ACTIVITY LIMIT

Staff Recommended Action

PWRs that have Technical Specifications limits and surveillance for coolant iodine activity that are less restrictive than the Standard Technical Specification (STS) should implement the STS limits. Those plants identified above that also have low head high pressure safety injection pumps should either: (1) implement iodine limits which are 20% of the STS values, or (2) implement reactor coolant pump trip criteria which will ensure that if offsite power is retained, no loss of forced reactor coolant system flow will occur for steam generator tube rupture events up to and including the design basis double-ended break of a single steam generator tube, and implement iodine limits consistent with the STS.

Authority Response

Indian Point 3 utilizes low head high pressure safety injection pumps. In response to NUREG-0737, Supplement 1, the Authority is revising the plant emergency procedures utilizing the Westinghouse Owners Group Emergency Response Guidelines. These revised procedures will be implemented prior to startup from the Cycle 4/5 refueling outage. The steam generator tube rupture procedure will include a reactor coolant pump trip criteria based on subcooling margin. This criteria will minimize the probability of a reactor coolant pump trip for steam generator tube rupture events up to and including the design basis double-ended break of a single tube, provided offsite power is retained. As such, the staff recommendation to implement iodine limits consistent with the STS applies.

Indian Point 3 Technical Specification 3.1.D provides limits and surveillance for reactor coolant iodine activity. These limits and surveillance are consistent with those provided by the STS.

6. SAFETY INJECTION SIGNAL RESET

Staff Recommended Action

The control logic associated with the safety injection pump suction flow path should be reviewed and modified as necessary, by licensees, to minimize the loss of safety function associated with safety injection reset during an SGTR event. Automatic switchover of safety injection pump suction from the boric acid storage tanks (BAST) to the refueling water storage tanks should be evaluated with respect to whether the switchover should be made on the basis of low BAST level alone without consideration of the condition of the SI signal.

Authority Response

This Recommended Action addresses the concern that the safety injection (SI) pumps would be damaged if manual switchover of SI pump suction from the boric acid storage tank to the refueling water storage tank (RWST) is delayed to the point that SI pump suction is lost. At Indian Point 3, the boron injection tank (BIT) is located on the discharge side of the SI pumps. The SI pump discharge flow into the BIT forces the high boron concentration solution out of the tank and into the RCS. During the course of an SGTR event, SI pump suction is from the RWST. As such, the concern addressed by this Recommended Action does not pertain to Indian Point 3.

ATTACHMENT II to IPN-85 - 31

INFORMATION REGARDING CATEGORY C-2 STEAM GENERATOR TUBE INSPECTIONS

NEW YORK POWER AUTHORITY
INDIAN POINT 3 NUCLEAR POWER PLANT
DOCKET NO. 50-286

Information Requested

The draft NUREG-0844 Section 2.2.1.2 describes certain limitations which the staff believes to be inherent in the present Technical Specification steam generator ISI requirements pertaining to Category C-2 inspection results. Licensees and applicants are requested to provide a description of their current policy and actions relative to this issue and any recommendations they have concerning how existing Technical Specification steam generator ISI requirements pertaining to Category C-2 inspection results could be improved to better ensure that adequate inspections will be performed. This description should include a response to the following questions:

1. What factors do, or would, the licensee or applicant consider in determining (a) whether additional tubes should be inspected beyond what is required by the Technical Specifications, (b) whether all steam generators should be included in the inspection program, and (c) when the steam generators should be reinspected.

2. To what extent do these factors include consideration of the degradation mechanism itself and its potential for causing a tube to be vulnerable to rupture during severe transients or postulated accident before rupture or leakage of that tube occurs during normal operation.

AUTHORITY RESPONSE:

The Authority believes that the current C-2 step progression from a 3% to an intermediate sized sample before requiring a 100% inspection is appropriate. This practice ensures that plants with steam generators with higher levels of degradation are inspected completely, while those with isolated instances of tube degradation have been able to avoid unnecessary additional costs and radiation exposure of a 100% inspection.

Many factors can determine the extent of inspections and the decision to inspect other steam generators. Primary among these factors is knowledge of the degradation mechanism and its potential for causing a steam generator tube rupture. In determining the extent of steam generator inspections beyond Technical Specification requirements, the Authority also considers the extent and rate of tube degradation and its likelihood of causing a primary to secondary tube leak prior to the next scheduled inspection. The impact of a forced outage provides in itself a significant motivating factor in locating all tube degradation which may lead to primary to secondary leakage.