



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
631 PARK AVENUE
KING OF PRUSSIA, PENNSYLVANIA 19406

April 8, 1982

MEMORANDUM FOR: R. R. Keimig, Chief, Projects Branch No. 2
Division of Project and Resident Programs

THRU: A. N. Fasano, Chief *ANF*
Three Mile Island Section

D. R. Haverkamp, Senior Resident Inspector (TMI-1) *DRH 4/8/82*
Three Mile Island Section

FROM: F. I. Young, Resident Inspector (TMI-1)
Three Mile Island Section

SUBJECT: ONCE THROUGH STEAM GENERATOR (OTSG) EDDY
CURRENT INSERVICE INSPECTION

At present, the TMI-1 Technical Specifications require that Eddy Current Testing (ECT) inservice inspection (ISI) be performed on the portion of the tube that forms the boundary between the primary and secondary coolant systems. In the case at TMI-1 OTSG's, a severe corrosion attack, affecting between 8,000 to 10,000 tubes out of 31,000, has occurred in the upper tube sheet. This is an area not requiring ECT inservice inspection.

Periodic ISI of OTSG tubes are essential to monitor their integrity for safe operation. The primary safety consideration for degraded tubes at any location is that they retain adequate structural integrity without excessive leakage for the full range of normal and postulated accidents. ECT is the primary means for performing tube inspections.

In light of the severity of the problem at TMI-1 (a case where approximately one third of all OTSG tubes are in a degraded mode), the required ISI program for TMI-1 is unacceptable (see enclosure 1 with 6 attachments) since ECT in the tube sheet area is not required. Licensee has been looking at the tube sheet area despite ECT requirements.

Enclosed are the details for the technical concern addressed above. Your review of the recommendations in Enclosure 1 is requested for forwarding to NRR. Further, this information should be forwarded to IE Headquarters for dissemination to all licensees with similar TS in the form of an "Information Notice".

F. I. Young
F. I. Young
Resident Inspector (TMI-1)
Three Mile Island Section

Enclosure: As Stated

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PDR FOIA
DETJEN84-897 PDR

5/17/82

To: SEBASTIAN

SUB- F.I. YOUNG LTR 4/8/82 - TMI - OTSG

EC - ISI

LETTER NOTES THAT TMI-1 TERN SPEC DOES NOT SPECIFICALLY REQUIRE EC ISI OTHER THAN BETWEEN TUBE SHEETS. SINCE OVER 90% OF LEAKS/POTENTIAL LEAKS ARE IN TUBE WITHIN THE UPPER TUBE SHEET HOLES, F.I. YOUNG LETTER AND ATTACHMENTS AS BACKUP DESCRIBE THIS INCOMPLETE CONDITION OF THE TECHNICAL SPECIFICATION.

LETTER AND ATTACHMENTS APPEAR TO BE TECHNICALLY ACCURATE. SUBSEQUENT TESTING AT TMI SUPPORTS THE 4/8/82 F.I.Y. LETTER INTENT.

H. Gray

- 1. (1) TMI Unit 1 Technical Specifications requires that only the area between the lower face of the upper tube sheet and upper face of the lower tube sheet be inspected using standard eddy current testing. Ninety percent of the tube problems found in Unit 1 OTSG's are in the area known as the roll transition in the upper tube sheet (see Attachment 1 and 2). Due to the definition eddy current testing requirement which is standard throughout the industry, the area in question is not addressed in the Technical Specifications (see Attachment 3). In the inspector's judgement this concern should be evaluated to determine if OTSG eddy current program should be redefined and amendment made to Technical Specifications.
- (2) With the use of a standard differential eddy current probe (industry standard), a signal deflection is normally generated in the roll transition zone. This signal from roll transition zone is normally ignored due to the inability of the standard probe to distinguish between roll and/or a fault. In the case of TMI-1, the licensee did take the time to look at this area. GPU with the aid of Conam (Eddy Current Contractor) and Zetec (Eddy Current Vendor) developed a new probe commonly known as 4 by 1 absolute pancake probe. This probe has been very successful in determining faults in the transition zone as compared to metallurgical data obtained. In the inspector's judgement, the roll transition zone is normally overlooked by the standard probe and due to the severity of the problem at TMI-1, this item should be evaluated for its safety significance (see Attachment 4 and 5).

4.19 OTSG TUBE INSERVICE INSPECTION

Applicability

This Technical Specification applies to the inservice inspection of the OTSG tube portion of the reactor coolant pressure boundary.

Objective

The objective of this inservice inspection program is to provide assurance of continued integrity of the tube portion of the Once-Through Steam Generators, while at the same time minimizing radiation exposure to personnel in the performance of the inspection.

Specification

Each steam generator shall be demonstrated OPERABLE by performance of the following augmented inservice inspection program and the requirements of Specification 3.1.6.3.

4.19.1 Steam Generator Sample Selection and Inspection Methods

- a. Each steam generator shall be determined OPERABLE during shutdown by selecting and inspecting at least the minimum number of steam generators specified in Table 4.19.1 at the frequency specified in 4.19.3.
- b. Inservice inspection of steam generator tubing shall include nondestructive examination by eddy-current testing or other equivalent techniques. The inspection equipment shall be calibrated to provide a sensitivity that will detect defects with a penetration of 20 percent or more of the minimum allowable as-manufactured tube wall thickness.

4.19.2 Steam Generator Tube Sample Selection and Inspection

The steam generator tube minimum sample size, inspection result classification, and the corresponding action required shall be as specified in Table 4.19.2. The inservice inspection of steam generator tubes shall be performed at the frequencies specified in Specification 4.19.3 and the inspected tubes shall be verified acceptable per the acceptance criteria of Specification 4.19.4. The tubes selected for

Each inservice inspection shall include at least 3% of the total number of tubes in all steam generators; the tubes selected for these inspections shall be selected on a random basis except:

- a. The first sample of tubes selected for each inservice inspection (subsequent to the preservice inspection) of each steam generator shall include:
 1. All nonplugged tubes that previously had detectable wall penetrations (>20%).
 2. At least 50% of the tubes inspected shall be in those areas where experience has indicated potential problems.
 3. A tube inspection (pursuant to Specification 4.19.4.a.8) shall be performed on each selected tube. If any selected tube does not permit the passage of the eddy current probe for a tube inspection, this shall be recorded and an adjacent tube shall be selected and subjected to a tube inspection.
 4. Tubes in the following groups may be excluded from the first random sample if all tubes in a group in both steam generators are inspected. No credit will be taken for these tubes in meeting minimum sample size requirements.
 - (1) Group A-1: Tubes within one, two or three rows of the open inspection lane.
 - (2) Group A-2: Tubes having a drilled opening in the 15th support plate.
- b. The tubes selected as the second and third samples (if required by Table 4.19.2) during each inservice inspection may be subjected to a partial tube inspection provided:
 1. The tubes selected for these second and third samples include the tubes from those areas of the tube sheet array where tubes with imperfections were previously found.
 2. The inspection includes those portions of the tubes where imperfections were previously found.

The results of each sample inspection shall be classified into one of the following three categories:

<u>Category</u>	<u>Inspection Results</u>
C-1	Less than 5% of the total tubes inspected in a steam generator are degraded tubes and none of the inspected tubes are defective.
C-2	One or more tubes, but not more than 1% of the total tubes inspected in a steam generator are defective, or between 5% and 10% of the total tubes inspected are degraded tubes.

More than 10% of the total tubes inspected in a steam generator are degraded tubes or more than 1% of the inspected tubes are defective.

- NOTES: (1) In all inspections, previously degraded tubes must exhibit significant (>10%) further wall penetrations to be included in the above percentage calculations.
- (2) Where special inspections are performed pursuant to 4.19.2.a.4, defective or degraded tubes found as a result of the inspection shall be included in determining the Inspection Results Category for that special inspection but need not be included in determining the Inspection Results Category for the general steam generator inspection.

4.19.3 Inspection Frequencies

The required inservice inspections of steam generator tubes shall be performed at the following frequencies:

- a. The first (baseline) inspection was performed after 6 effective full power months but within 24 calendar months of initial criticality. The subsequent inservice inspections shall be performed not more than 24 calendar months after the previous inspection. If the results of two consecutive inspections for a given group of tubes* encompassing not less than 18 calendar months all fall into the C-1 category or demonstrate that previously observed degradation has not continued and no additional degradation has occurred, the inspection interval for that group may be extended to a maximum of once per 40 months.
- b. If the results of the inservice inspection of a steam generator conducted in accordance with Table 4.19-2 at 40 month intervals for a given group of tubes* fall into Category C-3, the inspection frequency for that group shall be increased to at least once per 20 months. The increase in inspection frequency shall apply until the subsequent inspections satisfy the criteria of Specification 4.19.3.a; the interval may then be extended to a maximum of once per 40 months.
- c. Additional, unscheduled inservice inspections shall be performed on each steam generator in accordance with the first sample inspection specified in Table 4.19-2 during the shutdown subsequent to any of the following conditions:
 1. Primary-to-secondary tubes leaks (not including leaks originating from tube-to-tube sheet welds) in excess of the limits of Specification 3.1.6.3.

*A group of tubes means: (a) All tubes inspected pursuant to 4.19.2.a.4, or
(b) All tubes in a steam generator less those inspected pursuant to 4.19.2.a.4.

2. A seismic occurrence greater than the Operating Basis Earthquake.
3. A loss of coolant accident requiring actuation of the engineering safeguards, or
4. A major main steam line or feedwater line break.

4.19.4 Acceptance Criteria

a. As used in this Specification:

1. Imperfection means an exception to the dimensions, finish or contour of a tube from that required by fabrication drawing or specifications. Eddy current testing indications below 20% of the nominal tube wall thickness, if detectable, may be considered as imperfections.
2. Degradation means a service-induced cracking, wastage, wear or general corrosion occurring on either inside or outside of a tube.
3. Degraded Tube means a tube containing imperfections >20% of the nominal wall thickness caused by degradation.
4. % Degradation means the percentage of the tube wall thickness affected or removed by degradation.
5. Defect means an imperfection of such severity that it exceeds the plugging limit. A tube containing a defect is defective.
6. Plugging Limit means the imperfection depth at or beyond which the tube shall be removed from service because it may become unserviceable prior to the next inspection and is equal to 40% of the nominal tube wall thickness, unless higher limits are shown to be acceptable by analysis and approved by the NRC.
7. Unserviceable describes the condition of a tube if, it leaks or contains a defect large enough to affect its structural integrity in the event of an Operating Basis Earthquake, a loss of coolant accident, or a steam line or feedwater line break as specified in 4.19.3.c, above.
- * 8. Tube Inspection means an inspection of the steam generator tube from the bottom of the upper tubesheet completely to the top of the lower tubesheet, except as permitted by 4.19.2.b.2, above.