

APPLICABILITY

SURVEILLANCE REQUIREMENTS (Continued)

4.0.6.2.1 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 4.0-2. The inservice inspection of steam generator tubes shall be performed at the frequencies specified in Specification 4.0.6.3 and the inspected tubes shall be verified acceptable per the acceptance criteria of Specification 4.0.6.4. The tubes selected for each inservice inspection shall include at least 3% of all the expanded tubes and at least 3% of the remaining number of tubes in all steam generators; the tubes selected for these inspections shall be selected on a random basis except:

- a. Where experience in similar plants with similar water chemistry indicates critical areas to be inspected, then at least 50% of the tubes inspected shall be from these critical areas;
- b. 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 (greater than 20%),
 - 2) Tubes in those areas where experience has indicated potential problems, and
 - 3) A tube inspection (pursuant to Specification 4.0.6.4a.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.
- c. The tubes selected as the second and third samples (if required by Table 4.0-2) during each inservice inspection may be subjected to a partial tube inspection provided:
 - 1) The tubes selected for these samples include the tubes from those areas of the tube sheet array where tubes with imperfections were previously found, and
 - 2) The inspections include those portions of the tubes where imperfections were previously found.

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APPLICABILITY

SURVEILLANCE REQUIREMENTS (Continued)

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 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 are defective, or between 5% and 10% of the total tubes inspected are degraded tubes.
C-3	More than 10% of the total tubes inspected are degraded tubes or more than 1% of the inspected tubes are defective.

Note: In all inspections, previously degraded tubes must exhibit significant (greater than 10%) further wall penetrations to be included in the above percentage calculations.

4.0.6.2.2 Steam Generator F* Tube Inspection (Unit 1 only) - In addition to the minimum sample size as determined by Specification 4.0.6.2.1, all F* tubes will be inspected within the tubesheet region. The results of this inspection will not be a cause for additional inspections per Tables 4.0-1 and 4.0-2.

4.0.6.3 Inspection Frequencies - The above required inservice inspections of steam generator tubes shall be performed at the following frequencies:

- a. The first inservice inspection shall be performed after 6 Effective Full Power Months (EFPM) and before 12 EFPM and shall include a special inspection of all expanded tubes in all steam generators. Subsequent inservice inspections shall be performed at intervals of not less than 12 nor more than 24 calendar months after the previous inspection. If two consecutive inspections, not including the preservice inspection, result in all inspection results falling into the C-1 category or if two consecutive inspections demonstrate that previously observed degradation has not continued and no additional degradation has occurred, the inspection interval 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 4.0-2 at 40-month intervals fall in Category C-3, the inspection frequency 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 4.0.6.3a.; the interval may then be extended to a maximum of once per 40 months; and

APPLICABILITY

SURVEILLANCE REQUIREMENTS (Continued)

- c. Additional, unscheduled inservice inspections shall be performed on each steam generator in accordance with the first sample inspection specified in Table 4.0-2 during the shutdown subsequent to any of the following conditions:
- 1) Primary-to secondary tube leaks (not including leaks originating from tube-to-tube sheet welds) in excess of the limits of Specification 3.4.5.2, or
 - 2) A seismic occurrence greater than the Operating Basis Earthquake, or
 - 3) A loss-of-coolant accident requiring actuation of the Engineered Safety Features, or
 - 4) A main steam line or feedwater line break.

4.0.6.4 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 drawings 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 greater than or equal to 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 and is equal to 40% of the nominal tube wall thickness. This definition does not apply to that portion of the tubing that meets the definition of an F* tube;

APPLICABILITY

SURVEILLANCE REQUIREMENTS (Continued)

- 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 Specification 4.0.6.3c., above;
 - 8) Tube Inspection means an inspection of the steam generator tube from the point of entry (hot leg side) completely around the U-bend to the top support of the cold leg; ~~and~~
 - 9) Preservice Inspection means an inspection of the full length of each tube in each steam generator performed by eddy current techniques prior to service to establish a baseline condition of the tubing. This inspection shall be performed prior to initial POWER OPERATION using the equipment and techniques expected to be used during subsequent inservice inspections; ~~;~~
 - 10) F* Distance is the distance of the hardroll expanded portion of a tube which provides a sufficient length of non-degraded tube expansion to resist pullout of the tube from the tubesheet. The F* distance is equal to 1.13 inches, plus an allowance for eddy current measurement uncertainty, and is measured down from the top of the tubesheet, or the bottom of the roll transition, whichever is lower in elevation;
 - 11) F* Tube is that portion of the tubing in the area of the tubesheet region below the F* distance with a) degradation below the F* distance equal to or greater than 40%, b) which has no indication of degradation within the F* distance, and c) that remains inservice; and
 - 12) Tube Expansion is that portion of a tube which has been increased in diameter by a rolling process such that no crevice exists between the outside diameter of the tube and the hole in the tubesheet.
- b. The steam generator shall be determined OPERABLE after completing the corresponding actions (plug all tubes exceeding the plugging limit and all tubes containing through-wall cracks) required by Table 4.0-2.

4.0.6.5 Reports

- a. Within 15 days following the completion of each inservice inspection of steam generator tubes, the number of tubes plugged or designated as an F* tube in each steam generator shall be reported to the Commission in a Special Report pursuant to Specification 6.9.2;
- b. The complete results of the steam generator tube inservice inspection shall be submitted to the Commission in a Special Report pursuant to Specification 6.9.2 within 12 months following the completion of the inspection. This Special Report shall include:
 - 1) Number and extent of tubes inspected,
 - 2) Location and percent of wall-thickness penetration for each indication of an imperfection, and
 - 3) Identification of tubes plugged.
- c. Results of steam generator tube inspections which fall into Category C-3 shall be reported to the Commission pursuant to 10CFR50.72(b)(2) within four hours of initial discovery, and in a Special Report pursuant to Specification 6.9.2 within 30 days and prior to resumption of plant operation. This Special Report shall provide a description of investigations conducted to determine cause of the tube degradation and corrective measures taken to prevent recurrence.

APPLICABILITY

BASES

Specification 4.0.6 establishes the Surveillance Requirements for inspection of the steam generator tubes to ensure that the structural integrity of this portion of the RCS will be maintained. The program for inservice inspection of steam generator tubes is based on a modification of Regulatory Guide 1.83, Revision 1. Inservice inspection of steam generator tubing is essential in order to maintain surveillance of the conditions of the tubes in the event that there is evidence of mechanical damage or progressive degradation due to design, manufacturing errors, or inservice conditions that lead to corrosion. Inservice inspection 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.

Selected tubes in the preheater section of each D4 and D5 steam generator have been modified to correct the tube vibration degradation phenomenon experienced by certain Westinghouse steam generators. The modification consisted of expanding these tubes in the vicinity of the support plates and is designed to limit the amplitude of vibration. These expanded tubes are subject to a special inspection whenever the steam generators are opened for inservice eddy current testing.

The plant is expected to be operated in a manner such that the secondary coolant will be maintained within those chemistry limits found to result in negligible corrosion of the steam generator tubes. If the secondary coolant chemistry is not maintained within these limits, localized corrosion may likely result in stress corrosion cracking. The extent of cracking during plant operation would be limited by the limitation of steam generator tube leakage between the Reactor Coolant System and the Secondary Coolant System (reactor-to-secondary leakage = 500 gallons per day per steam generator and a total leakage of 1 GPM to all steam generators). Cracks having a reactor-to-secondary leakage less than this limit during operation will have an adequate margin of safety to withstand the loads imposed during normal operation and by postulated accidents. Operating plants have demonstrated that reactor-to-secondary leakage of 500 gallons per day per steam generator can readily be detected by radiation monitors of steam generator blowdown. Leakage in excess of this limit will require plant shutdown and an unscheduled inspection, during which the leaking tubes will be located and plugged.

An F* tube does not have to be plugged, provided the remainder of the tube within and above the F* distance does not meet the plugging limit criteria. The F* distance is equal to 1.13 inches, plus allowance for eddy current uncertainty measurement, and is measured down from the top of the tubesheet, or the bottom of the roll transition, whichever is lower in elevation. The allowance for eddy current uncertainty is documented in the steam generator eddy current inspection procedure.

Wastage-type defects are unlikely with proper chemistry treatment of the secondary coolant. However, even if a defect should develop in service, it will be found during scheduled inservice steam generator tube examinations. Plugging will be required for all tubes with imperfections exceeding the plugging limit of 40% of the tube nominal wall thickness. Steam generator tube inspections of operating plants have demonstrated the capability to reliably detect degradation that has penetrated 20% of the original tube wall thickness.

ATTACHMENT 4 to TXX-98196

IMPROVED TECHNICAL SPECIFICATION SECTIONS

5.5.9 Steam Generator (SG) Tube Surveillance Program

5.6.10 Steam Generator Tube Inspection Report

5.5.9 Steam Generator (SG) Tube Surveillance Program

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

The provisions of SR 3.0.2 are applicable to the SG Surveillance Program test frequencies.

- a. Steam Generator Sample Selection and Inspection - Each steam generator shall be determined OPERABLE during shutdown by selecting and inspecting at least the minimum number of steam generators specified in Table 5.5-1.
- b. 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 5.5-2. The inservice inspection of steam generator tubes shall be performed at the frequencies specified in Specification 5.5.9.3 and the inspected tubes shall be verified acceptable per the acceptance criteria of Specification 5.5.9.4. The tubes selected for each inservice inspection shall include at least 3% of all the expanded tubes and at least 3% of the remaining number of tubes in all steam generators; the tubes selected for these inspections shall be selected on a random basis except:
 1. Where experience in similar plants with similar water chemistry indicates critical areas to be inspected, then at least 50% of the tubes inspected shall be from these critical areas;
 2. The first sample of tubes selected for each inservice inspection (subsequent to the preservice inspection) of each steam generator shall include:
 - a) All nonplugged tubes that previously had detectable wall penetrations (greater than 20%),
 - b) Tubes in those areas where experience has indicated potential problems, and
 - c) A tube inspection (pursuant to Specification 5.5.9.4a.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.

5.5.9 Steam Generator (SG) Tube Surveillance Program (Continued)

3. The tubes selected as the second and third samples (if required by Table 5.5.9-2 during each inservice inspection may be subjected to a partial tube inspection provided:
 - a) The tubes selected for these samples include the tubes from those areas of the tube sheet array where tubes with imperfections were previously found, and
 - b) The inspections include 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:

Category Inspection Results

- C-1 Less than 5% of the total tubes inspected 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 are defective, or between 5% and 10% of the total tubes inspected are degraded tubes.
- C-3 More than 10% of the total tubes inspected are degraded tubes or more than 1% of the inspected tubes are defective.

Note: In all inspections, previously degraded tubes must exhibit significant (greater than 10%) further wall penetrations to be included in the above percentage calculations.

- c. Steam Generator F* Tube Inspection (Unit 1 only) - In addition to the minimum sample size as determined by Specification 5.5.9.b., all F* tubes will be inspected within the tubesheet region. The results of this inspection will not be a cause for additional inspections per Tables 5.5-1 and 5.5-2.
- de. Inspection Frequencies - The above required inservice inspections of steam generator tubes shall be performed at the following frequencies:
 1. The first inservice inspection shall be performed after 6 Effective Full Power Months (EFPM) and before 12 EFPM and shall include a special inspection of all expanded tubes in all steam generators. Subsequent inservice inspections shall be performed at intervals of not less than 12 nor more than 24 calendar months after the previous inspection. If two consecutive inspections, not including the preservice inspection, result in all inspection results falling into the C-1 category or if two consecutive

5.5.9 Steam Generator (SG) Tube Surveillance Program (Continued)

inspections demonstrate that previously observed degradation has not continued and no additional degradation has occurred, the inspection interval may be extended to a maximum of once per 40 months;

2. If the results of the inservice inspection of a steam generator conducted in accordance with Table 5.5-2 at 40-month intervals fall in Category C-3, the inspection frequency 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 5.5.9.3a.; the interval may then be extended to a maximum of once per 40 months; and

3. Additional, unscheduled inservice inspections shall be performed on each steam generator in accordance with the first sample inspection specified in Table 5.5-2 during the shutdown subsequent to any of the following conditions:
 - a) Primary-to secondary tube leaks (not including leaks originating from tube-to-tube sheet welds) in excess of the limits of Specification 3.4.5.2, or
 - b) A seismic occurrence greater than the Operating Basis Earthquake, or
 - c) A loss-of-coolant accident requiring actuation of the Engineered Safety Features, or
 - d) A main steam line or feedwater line break.

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 drawings 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;

5.5.9 Steam Generator (SG) Tube Surveillance Program (Continued)

- 3) Degraded Tube means a tube containing imperfections greater than or equal to 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 and is equal to 40% of the nominal tube wall thickness. This definition does not apply to that portion of the tubing that meets the definition of an F* tube;
- 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 Specification 5.5.9.3c, above;
- 8) Tube Inspection means an inspection of the steam generator tube from the tube end (hot leg side) completely around the U-bend to the top support of the cold leg;—and
- 9) Preservice Inspection means an inspection of the full length of each tube in each steam generator performed by eddy current techniques prior to service to establish a baseline condition of the tubing. This inspection shall be performed prior to initial POWER OPERATION using the equipment and techniques expected to be used during subsequent inservice inspections—;
- 10) F* Distance is the distance of the hardroll expanded portion of a tube which provides a sufficient length of non-degraded tube expansion to resist pullout of the tube from the tubesheet. The F* distance is equal to 1.13 inches, plus an allowance for eddy current measurement uncertainty, and is measured down from the top of the tubesheet, or the bottom of the roll transition, whichever is lower in elevation;

5.5.9 Steam Generator (SG) Tube Surveillance Program (Continued)

- 11) F* Tube is that portion of the tubing in the area of the tubesheet region below the F* distance with a) degradation below the F* distance equal to or greater than 40%, b) which has no indication of degradation within the F* distance, and c) that remains inservice; and
 - 12) Tube Expansion is that portion of a tube which has been increased in diameter by a rolling process such that no crevice exists between the outside diameter of the tube and the hole in the tubesheet.
- b. The steam generator shall be determined OPERABLE after completing the corresponding actions (plug all tubes exceeding the plugging limit and all tubes containing through-wall cracks) required by Table 5.5-2.

5.6.10 Steam Generator Tube Inspection Report

- a. Within 15 days following the completion of each inservice inspection of steam generator tubes, the number of tubes plugged or designated as an F* tube in each steam generator shall be reported to the Commission;
- b. The complete results of the steam generator tube inservice inspection shall be submitted to the Commission in a report within 12 months following the completion of the inspection. This report shall include:
 - 1) Number and extent of tubes inspected,
 - 2) Location and percent of wall-thickness penetration for each indication of an imperfection, and
 - 3) Identification of tubes plugged.
- c. Results of steam generator tube inspections which fall into Category C-3 shall be reported to the Commission pursuant to 10 CFR 50.72(b)(2) within four hours of initial discovery, and in a report within 30 days and prior to resumption of plant operation. This report shall provide a description of investigations conducted to determine cause of the tube degradation and corrective measures taken to prevent recurrence.

ATTACHMENT 5 TO TXX-98196
AFFECTED FINAL SAFETY ANALYSIS REPORT PAGES
(Pages 5.4-25, 27, 28, 28(continued))

c. The tubes selected as the second and third samples (if required by Table 5.4-18) during each inservice inspection may be subjected to a partial tube inspection provided: 55

1. The tubes selected for these samples include the tubes from those areas of the tube sheet array where tubes with imperfections were previously found, and
2. The inspections include 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:

Category Inspection Results

- C-1 Less than 5% of the total tubes inspected 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 are defective, or between 5% and 10% of the total tubes inspected are degraded tubes.
- C-3 More than 10% of the total tubes inspected are degraded tubes or more than 1% of the inspected tubes are defective.

NOTE: In all inspections, previously degraded tubes must exhibit significant (greater than 10%) further wall penetrations to be included in the above percentage calculations.

In addition to the minimum sample size, all F* tubes will be inspected within the tubesheet region. The inspection findings will not be cause for additional inspections.

2. A seismic occurrence greater than the Operating Basis Earthquake, or
3. A loss-of-coolant accident requiring actuation of the Engineered Safety Features, or
4. A main steam line or feedwater line break.

Acceptance Criteria

a. As used for this inspection:

1. Imperfection means an exception to the dimensions, finish or contour of a tube from that required by fabrication drawings 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 tube containing imperfections greater than or equal to 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 and is equal to 40% of the nominal tube wall thickness. This definition does not apply to that portion of the tubing that meets the definition of an F* tube;

7. Unservicable describes the conditions 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 under Inspection Frequencies, above;
8. Tube Inspection means an inspection of the steam generator tube from the point of entry (hot leg side) completely around the U-bend to the top support of the cold leg; and
9. Preservice Inspection means an inspection of the full length of each tube in each steam generator performed by eddy current techniques prior to service to establish a baseline condition of the tubing. This inspection shall be performed prior to initial POWER OPERATION using the equipment and techniques expected to be used during subsequent inservice inspections;
10. F* Distance is the distance of the hardroll expanded portion of the tube which provides a sufficient length of non-degraded tube expansion to resist pullout of the tube from the tubesheet. The F* distance is equal to 1.13 inches, plus an allowance for eddy current uncertainty, and is measured down from the top of the tubesheet, or the bottom of the roll transition, whichever is lower in elevation. The allowance for eddy current uncertainty is documented in the steam generator eddy current inspection procedure;
11. F* Tube is that portion of the tubing in the area of the tubesheet region below the F* distance with a) degradation below the F* distance equal to or greater than 40%, b) which has no indication of degradation within the F* distance, and c) that remains inservice; and

12. Tube expansion is that portion of a tube which has been increased in diameter by a rolling process such that no crevice exists between the outside diameter of the tube and the hole in the tubesheet.

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- b. The steam generator shall be determined OPERABLE after completing the corresponding actions (plug all tubes exceeding the plugging limit and all tubes containing through-wall cracks) required by Table 5.4-18.

Reports

- a. Within 15 days following the completion of each inservice inspection of steam generator tubes, the number of tubes plugged or designated as an F* tube in each steam generator shall be reported to the Commission in a Special Report pursuant to CPSES Technical Specification 6.9.2.
- b. The complete results of the steam generator tube inservice inspection shall be submitted to the Commission in a Special

5.4-28(continued)

January 15, 1988