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5.5.9 Steam Generator (SG) Tube Surveillance Program

Steam generator tube integrity shall be demonstrated by performance of the following augmented inservice inspection program.

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

- a. Steam Generator Sample Selection and Inspection - Steam generator tube integrity shall be determined during shutdown by selecting and inspecting at least the minimum number of steam generators specified in Table 5.5.9-1.
- 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 5.5.9-2. The inservice inspection of steam generator tubes shall be performed at the frequencies specified in Specification 5.5.9.c and the inspected tubes shall be verified acceptable per the acceptance criteria of Specification 5.5.9.d. 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:
 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.d.1.h) 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

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- adjacent tube shall be selected and subjected to a tube inspection.
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.
 4. For Refueling Outage 14, a sample of the SG B and C inservice tubes from the top of the hot leg tubesheet to 10 inches below the top of the tubesheet shall be inspected by rotating probe. This sample shall include a 20% minimum sample of the total population of bulges and overexpansions within the SG from the top of the hot leg tubesheet to 17 inches below the top of the tubesheet.

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.

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

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1. The first inservice inspection shall be performed after 6 Effective Full Power Months but within 24 calendar months of initial criticality. 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;
2. If the results of the inservice inspection of a steam generator conducted in accordance with Table 5.5.9-2 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.c.1. 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 5.5.9-2 during the shutdown subsequent to any of the following conditions:
 - a) Reactor-to-secondary tube leaks (not including leaks originating from tube-to-tube sheet welds) in excess of the limits of Specification 3.4.13; or
 - b) A seismic occurrence greater than the Double Design 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.
- d. Acceptance Criteria
 1. As used in this Specification:

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- a) 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;
- b) Degradation means a service-induced cracking, wastage, wear or general corrosion occurring on either inside or outside of a tube;
- c) Degraded Tube means a tube containing imperfections greater than or equal to 20% of the nominal wall thickness caused by degradation;
- d) % Degradation means the percentage of the tube wall thickness affected or removed by degradation;
- e) Defect means an imperfection of such severity that it exceeds the plugging limit. A tube containing a defect is defective;
- f) 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. During Refueling Outage 14 and the subsequent operating cycle, this criterion does not apply to degradation identified in the portion of the tube below 17 inches from the top of the hot leg tubesheet. Degradation found in the portion of the tube below 17 inches from the top of the hot leg tubesheet does not require plugging. During Refueling Outage 14 and the subsequent operating cycle, all tubes with degradation identified in the portion of the tube within the region from the top of the hot leg tubesheet to 17 inches below the top of the tubesheet shall be removed from service;
- g) 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 a Double Design Earthquake, a loss-of-coolant accident, or a steam line or feedwater line break as specified in 5.5.9.c.3.c, above;

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- h) 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. During Refueling Outage 14 and the subsequent operating cycle, the portion of the tube below 17 inches from the top of the hot leg tubesheet is excluded;
- i) 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 after the field hydrostatic test and prior to initial Power Operation using the equipment and techniques expected to be used during subsequent inservice inspections; and
- j) During Refueling Outage 14 and the subsequent operating cycle:
 - Bulge refers to a tube diameter deviation within the tubesheet of 18 volts or greater as measured by bobbin probe; and
 - Overexpansion refers to a tube diameter deviation within the tubesheet of 1.5 mils or greater as measured by bobbin probe.

- 2. Steam generator tube integrity shall be determined after completing the corresponding actions (plug all tubes exceeding the plugging limit and all tubes containing through-wall cracks) required by Table 5.5.9-2.

e. Reports

The contents and frequency of reports concerning the steam generator tube surveillance program shall be in accordance with Specification 5.6.10.

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TABLE 5.5.9-1
MINIMUM NUMBER OF STEAM GENERATORS TO BE
INSPECTED DURING INSERVICE INSPECTION

Preservice Inspection	No			Yes		
	Two	Three	Four	Two	Three	Four
No. of Steam Generators per Unit						
First Inservice Inspection	All			One	Two	Two
Second & Subsequent Inservice Inspections	One ³			One ¹	One ²	One ³

TABLE NOTATIONS

1. The inservice inspection may be limited to one steam generator on a rotating schedule encompassing 3 N % of the tubes (where N is the number of steam generators in the plant) if the results of the first or previous inspections indicate that all steam generators are performing in a like manner. Note that under some circumstances, the operating conditions in one or more steam generators may be found to be more severe than those in other steam generators. Under such circumstances the sample sequence shall be modified to inspect the most severe conditions.
2. The other steam generator not inspected during the first inservice inspection shall be inspected. The third and subsequent inspections should follow the instructions described in 1 above.
3. Each of the other two steam generators not inspected during the first inservice inspections shall be inspected during the second and third inspections. The fourth and subsequent inspections shall follow the instructions described in 1 above.

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