

4.17 STEAM GENERATOR TUBING SURVEILLANCE

Applicability

Applies to the surveillance of tubing of each steam generator.

Objective

To define the in-service surveillance program for steam generator tubing.

Specification

4.17.1 Baseline Inspection

The first steam generator tubing inspection performed according to Specifications 4.17.2 and 4.17.3 shall be considered as constituting the baseline condition for subsequent inspections.

4.17.2 Examination Methods

In-service inspection of steam generator tubing shall include non-destructive examination by eddy-current testing or other equivalent techniques. The inspection equipment shall provide a sensitivity that will detect defects with a penetration of 20 percent or more of the minimum allowable as-manufactured tube wall thickness.

4.17.3 Selection and Testing

Selection and testing of tubes from each steam generator shall be made on the basis of the following:

- a. No fewer than 3 percent of the total number of steam generator tubes shall undergo examination during each in-service inspection.
- b. Tubes for the baseline inspection shall be selected on a random basis.
- c. Every inspection subsequent to the baseline inspection shall include all tubes which previously had detectable wall penetration (greater than 20 percent and not including plugged tubes), and shall also consider tubes in those areas where design and experience have indicated potential problems.

If the inspection indicates that more than 10 percent of the inspected tubes have detectable wall penetration or that one or more of the inspected tubes have an indication of an unacceptable defect, an additional 3 percent of the tubes shall be inspected, concentrating on tubes in those areas of the tube sheet array where tubes with defects were found. If the inspection of these additional tubes indicates that more than 10 percent of the inspected tubes have detectable wall penetration or one or more of the inspected tubes has an indication of an unacceptable defect, additional tubes (no less than 3 percent of the total tubes in the steam generator) in the area of the defect shall be inspected.

#### 4.17.4

#### Inspection Intervals

- a. In-service inspection of steam generator tubing shall be performed during each refueling shutdown, (but not less than 10 months after the previous inspection) except that the first scheduled inspection after the baseline inspection need not be performed until the second refueling shutdown following the baseline inspection, provided the baseline inspection results did not indicate any tubes with detectable wall penetration.
- b. If two consecutive inspections, excluding the baseline inspection, result in no additional tubes with detectable wall penetration and no significant (greater than 5 percent) further penetration of tubes which previously had indications, then inspection shall be performed three times every 10 years at approximately equal intervals which may coincide with refueling shutdowns.

#### 4.17.5

#### Acceptance Criteria

- a. If less than 10 percent of the total tubes inspected have detectable wall penetration and no more than three tubes have unacceptable defects, operation may resume after required corrective measures have been taken.
- b. If more than 10 percent of the total tubes inspected have detectable wall penetration or more than three of the tubes inspected have unacceptable defects, operation may resume after required corrective measures have been taken, and the situation and remedial action shall be reported to the Atomic Energy Commission.

#### 4.17.6

#### Corrective Measures

All tubes with unacceptable defects shall be plugged.

#### Bases

The program of periodic in-service inspection of steam generators provides the means of monitoring the integrity of the tubing and to maintain surveillance in the event there is evidence of mechanical damage or progressive deterioration due to design, manufacturing errors, or operating conditions. In-service inspection of steam generator tubing also provides a means of characterizing the nature and cause of any tube degradation so that corrective measures may be taken. In-service inspection includes non-destructive examination using a suitable eddy-current inspection system (or other equivalent techniques), capable of locating and identifying defects due to stress corrosion cracking, mechanical damage, chemical wastage, or other causes.

An unacceptable defect is defined as one which would result in not satisfying the calculated acceptable minimum tube wall thickness that can sustain a loss-of-coolant accident in combination with a safe shutdown earthquake.

The baseline inspection is performed during the first refueling shutdown. In addition to establishing a basis for comparison for subsequent inspections, the baseline inspection also allows evaluation of the steam generator tubing performance during startup testing. If no problems are found, the next inspection is performed during the third refueling shutdown when long-term effects should become detectable.