

REACTOR COOLANT SYSTEM

SURVEILLANCE REQUIREMENTS (Continued)

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1. All nonplugged tubes that previously had detectable wall penetrations (greater than 20%).
  2. Tubes in those areas where experience has indicated potential problems.
  3. A tube inspection (pursuant to Specification 4.4.5.4.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. Indications left in service as a result of application of the tube support plate voltage-based repair criteria shall be inspected by bobbin coil probe during all future refueling outages.
- c. The tubes selected as the second and third samples (if required by Table 4.4-2) 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.
  2. The inspections include those portions of the tubes where imperfections were previously found.
- Note: Tube degradation identified in the portion of the tube that is not a reactor coolant pressure boundary (tube end up to the start of the tube-to-tubesheet weld) is excluded from the Result and Action Required in Table 4.4-2.
- d. Implementation of the steam generator tube/tube support plate repair criteria requires a 100 percent bobbin coil inspection for hot-leg and cold-leg tube support plate intersections down to the lowest cold-leg tube support plate with known outside diameter stress corrosion cracking (ODSCC) indications. The determination of the lowest cold-leg tube support plate intersections having ODSCC indications shall be based on the performance of at least a 20 percent random sampling of tubes inspected over their full length.
- e. Implementation of the steam generator WEXTEx expanded region inspection methodology (W\*) requires a 100 percent rotating coil probe inspection of the hot leg tubesheet W\* distance.

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.

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#### 4.4.5.4 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. Plugging limit does not apply to that portion of the tube that is not within the pressure boundary of the reactor coolant system (tube end up to the start of the tube-to-tubesheet weld). This definition does not apply to tube support plate intersections if the voltage-based repair criteria are being applied. Refer to 4.4.5.4.a.10 for the repair limit applicable to these intersections. This definition does not apply to service induced degradation identified in the W\* distance. Service induced degradation identified in the W\* distance below the top-of-tube sheet (TTS), shall be plugged on detection.
  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 4.4.5.3.c, 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 excluding the portion of the tube within the tubesheet below the W\* distance, the tube to tubesheet weld and the tube end extension.
  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.

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where:

$V_{URL}$	=	upper voltage repair limit
$V_{LRL}$	=	lower voltage repair limit
$V_{MURL}$	=	mid-cycle upper voltage repair limit based on time into cycle
$V_{MLRL}$	=	mid-cycle lower voltage repair limit based on $V_{MURL}$ and time into cycle
$\Delta t$	=	length of time since last scheduled inspection during which $V_{URL}$ and $V_{LRL}$ were implemented
CL	=	cycle length (the time between two scheduled steam generator inspections)
$V_{SL}$	=	structural limit voltage
Gr	=	average growth rate per cycle length
NDE	=	95-percent cumulative probability allowance for nondestructive examination uncertainty (i.e., a value of 20-percent has been approved by NRC)

Implementation of these mid-cycle repair limits should follow the same approach as in TS 4.4.5.4.a.10.a, 4.4.5.4.a.10.b, and 4.4.5.4.a.10.c.

Note 1: The lower voltage repair limit is 1.0 volt for 3/4-inch diameter tubing or 2.0 volts for 7/8-inch diameter tubing.

Note 2: The upper voltage repair limit is calculated according to the methodology in GL 95-05 as supplemented.  $V_{URL}$  may differ at the TSPs and flow distribution baffle.

11. a) Bottom of WEXTEX Transition (BWT) is the highest point of contact between the tube and tubesheet at, or below the top-of-tubesheet, as determined by eddy current testing.
- b) The  $W^*$  distance is the larger of the following two distances as measured from the top-of-the-tubesheet (TTS): (a) 8 inches below the TTS or (b) 7 inches below the bottom of the WEXTEX transition plus the uncertainty associated with determining the distance below the bottom of the WEXTEX transition as defined by WCAP-14797, Revision 2.
- c)  $W^*$  Length is the length of tubing below the bottom of the WEXTEX transition (BWT), which must be demonstrated to be non-degraded in order for the tube to maintain structural and leakage integrity. For the hot leg, the  $W^*$  length is 7.0 inches which represents the most conservative hot-leg length defined in WCAP-14797, Revision 2.

- 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 4.4-2.

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### SURVEILLANCE REQUIREMENTS (Continued)

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#### 4.4.5.5 Reports

- a. Following each inservice inspection of steam generator tubes, the number of tubes plugged in each steam generator shall be reported to the Commission within 15 days.
- 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.
  3. Identification of tubes plugged.
- c. Results of steam generator tube inspections which fall into Category C-3 shall be reported as a degraded condition pursuant to 10 CFR 50.73 prior to resumption of plant operation. The written followup of this report shall provide a description of investigations conducted to *determine cause of the tube degradation and corrective measures taken to prevent recurrence.*
- d. For implementation of the voltage-based repair criteria to tube support plate intersections, notify the staff prior to returning the steam generators to service should any of the following conditions arise:
  1. Leakage is estimated based on the projected end-of-cycle (or if not practical using the actual measured end-of-cycle) voltage distribution. This leakage shall be combined with the postulated leakage resulting from the implementation of the W\* criteria to tubesheet inspection depth. If the total projected end-of-cycle accident induced leakage from all sources exceeds the leakage limit (determined from the licensing basis dose calculation for the postulated main steam line break) for the next operating cycle, the staff shall be notified.
  2. If circumferential crack-like indications are detected at the tube support plate intersections.
  3. If indications are identified that extend beyond the confines of the tube support plate.
  4. If indications are identified at the tube support plate elevations that are attributable to primary water stress corrosion cracking.
  5. If the calculated conditional burst probability based on the projected end-of-cycle (or if not practical, using the actual measured end-of-cycle) voltage distribution exceeds  $1 \times 10^{-2}$ , notify the NRC and provide an assessment of the safety significance of the occurrence.

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- e. The calculated steam line break leakage from the application of tube support plate alternate repair criteria and W\* inspection methodology shall be submitted in a Special Report in accordance with 10 CFR 50.4 within 90 days following return of the steam generators to service (MODE 4). The report will include the number of indications within the tubesheet region, the location of the indications (relative to the bottom of the WEXTEx transition (BWT) and TTS), the orientation (axial, circumferential, skewed, volumetric), the severity of each indication (e.g., near through-wall or not through-wall), the side of the tube from which the indication initiated (inside or outside diameter), and an assessment of whether the results were consistent with expectations with respect to the number of flaws and flaw severity (and if not consistent, a description of the proposed corrective action).