

ATTACHMENT 2 TO AEP:NRC:1129M

HEJ SLEEVED TUBE STRUCTURAL INTEGRITY LIMITS

DONALD C. COOK NUCLEAR PLANT UNIT 1

MARKED UP VERSION OF CURRENT TECHNICAL SPECIFICATION PAGES

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MARKED UP VERSION OF CURRENT TECHNICAL SPECIFICATION PAGES

SURVEILLANCE REQUIREMENTS (continued)

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. Tubes left in service as a result of application of the tube support plate plugging criteria shall be inspected by bobbin coil probe during all future refueling outages.
- c. In addition to the sample required in 4.4.5.2.b.1 through 3, all tubes which have had the F* criteria applied will be inspected in the roll expanded region. The roll expanded region of these tubes may be excluded from the requirements of 4.4.5.2.b.1.
- d. 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 the 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.
- e. Implementation of the steam generator tube/tube support plate plugging criteria for one fuel cycle (Cycle 15) requires a 100 percent bobbin coil inspection for hot-leg tube support plate intersections and cold-leg intersections down to the lowest cold-leg tube support plate with known outside diameter stress corrosion cracking (ODSCC) indications. The determination of 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.
- f. inspection of sleeves will follow the initial sample selection (1" sample) and sample expansion requirements of Table 4.4-2.

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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.

Insert A

- g. HEJ sleeved tubes determined to be operable by application of the Delta-D criterion (per 4.4.5.4.a.14) will be inspected in the upper HEJ region at each refueling outage to determine if new indications are present. Existing indications in these sleeved tubes which initiated the installation of a sleeve may be excluded from the requirements of 4.4.5.2.b.1.

SURVEILLANCE REQUIREMENTS (continued)

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 or sleeve 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 or sleeve.
3. Degraded Tube or Sleeve means an imperfection greater than or equal to 20% of the nominal wall thickness caused by degradation.
4. Percent Degradation means the amount of the tube wall thickness affected or removed by degradation.
5. Defect means an imperfection of such severity that it exceeds the repair limit.
6. Repair/Plugging Limit means the imperfection depth at or beyond which the tube or sleeved tube shall be repaired or removed from service. Any tube which, upon inspection, exhibits tube wall degradation of 40 percent or more of the nominal tube wall thickness shall be plugged or repaired prior to returning the steam generator to service. This definition does not apply to the portion of the tube in the tubesheet below the F* distance for F* tubes. Any sleeve, except laser welded sleeves, which upon inspection exhibits wall degradation of 29 percent or more of the nominal wall thickness, shall be plugged prior to returning the steam generator to service. In addition, any sleeve, except laser welded sleeves, exhibiting any measurable wall loss in sleeve expansion transition or weld zones shall be plugged. This definition does not apply to tube support plate intersections for which the voltage-based plugging criteria are being applied. Refer to 4.4.5.4.a.10 for the plugging limit applicable to these intersections. For a tube that has been sleeved with a laser welded sleeve, through wall penetration of greater than or equal to 23% of sleeve nominal wall thickness requires the tube to be removed from service by plugging.
7. Unserviceable describes the condition of a tube or sleeve 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. Inspection determines the condition of the steam generator tube or sleeve from the point of entry (hot leg side) completely around the U-bend to the top support of the cold leg. For a tube in which the tube support plate elevation interim plugging limit has been applied, the inspection will include all the hot leg intersections and all cold leg intersections down to, at least, the level of the last crack indication.

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B

Insert B

This definition does not apply to HEJ sleeved tubes which may experience degradation in the upper HEJ hardroll lower transition region. Refer to specification 4.4.5.4.a.14 for the plugging limit applicable to these tubes.

SURVEILLANCE REQUIREMENTS (continued)

9. Sleeving a tube is permitted with tube support plate sleeves and with tubesheet sleeves. Tube support plate sleeves are centered about the tube support plate intersection. Tubesheet sleeves start at the primary fluid tubesheet face and extend to the free span region of tube above the tubesheet.
10. Tube Support Plate Repair Limit is used for the disposition of a steam generator tube for continued service that is experiencing outside diameter stress corrosion cracking (ODSCC) confined within the thickness of the tube support plates. At tube support plate intersections, the repair limit is based on maintaining steam generator tube serviceability as described below:
- a. Degradation attributed to ODSCC within the bounds of the tube support plate with bobbin voltage less than or equal to 2.0 volts will be allowed to remain in service.
 - b. Degradation attributed to ODSCC within the bounds of the tube support plate with a bobbin voltage greater than 2.0 volts will be repaired or plugged except as noted in 4.4.5.4.a.10.c below.
 - c. Indications of potential degradation attributed to ODSCC within the bounds of the tube support plate with a bobbin voltage greater than 2.0 volts but less than or equal to 5.6 volts may remain in service if a rotating pancake coil inspection does not detect degradation. Indications of ODSCC degradation with a bobbin voltage greater than 5.6 volts will be plugged or repaired.
11. F* Distance is the distance from the bottom of the hardroll transition toward the bottom of the tubesheet that has been conservatively determined to be 1.11 inches (not including eddy current uncertainty).
12. F* Tube is a tube with degradation, below the F* distance, equal to or greater than 40%, and not degraded (i.e., no indications of cracking) within the F* distance.
13. Tube Repair refers to sleeving as described by the reports listed in 4.4.5.4.c which are used to maintain a tube in service or return a tube to service. Tubes with degradation indications of less than the plugging limit may be preventively sleeved at the Owner's discretion. This includes removal of plugs that were installed as a corrective or preventive measure. A tube inspection per 4.4.5.4.a.8 is required prior to returning previously plugged tubes to service. Further restrictions regarding identified indications and their proximity to the joint areas of various sleeving processes may be applicable.
- b. The steam generator shall be determined OPERABLE after completing the corresponding actions (plugging or sleeving all tubes exceeding the repair limit and all tubes containing through-wall cracks) required by Table 4.4-2.
- c. Steam generator tube repairs may be made in accordance with the methods described in either WCAP-12623, WCAP-13088 (Rev. 3), or CEN-313-P.

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C

Insert C

14. a. HEJ sleeved tubes with circumferential indications located within the upper hardroll lower transition shall be inspected with a non-destructive examination (NDE) technique capable of measuring the sleeve ID difference between the sleeve hardroll peak diameter, and the sleeve ID at the elevation of the parent tube indication (PTI). If this diameter change is ≥ 0.003 " (plus an allowance for NDE uncertainty), the tube may remain in service provided the faulted loop steam line break (SLB) leakage limit from all sources is not exceeded. A SLB allowance of 0.025 gpm shall be assumed for each sleeve tube left in service by application of this criterion, regardless of length or depth of the indication. For tubes where the measured diameter difference is > 0.013 ", SLB leakage can be neglected.
- b. HEJ sleeved tubes with a sleeve ID difference of < 0.003 " (plus an allowance for NDE uncertainty) between the sleeve ID hardroll peak diameter and sleeve ID at the elevation of the PTI shall be plugged or repaired prior to returning the steam generator to service.
- c. HEJ sleeved tubes with axial indications located within the parent tube pressure boundary as defined on Figure B 3/4.4.5-1 shall be plugged or repaired prior to returning the steam generators to service.
- d. HEJ sleeved tubes with parent tube indications located outside of the parent tube pressure boundary (below the upper hardroll region) as defined on Figure B 3/4.4.5-1 may remain in service.



3/4.4.5 STEAM GENERATORS TUBE INTEGRITY (Continued)

Whenever the results of any steam generator tubing inservice inspection fall into Category C-3, these results will be promptly reported to the Commission pursuant to Specification 6.9.1 prior to resumption of plant operation. Such cases will be considered by the Commission on a case-by-case basis and may result in a requirement for analysis, laboratory examinations, tests, additional eddy-current inspection, and revision of the Technical Specifications, if necessary.

Degraded steam generator tubes may be repaired by the installation of sleeves which span the section of degraded steam generator tubing. A steam generator tube with a sleeve installed meets the structural requirements of tubes which are not degraded.

To determine the basis for the sleeve plugging limit, the minimum sleeve wall thickness was calculated in accordance with Draft Regulatory Guide 1.121 (August 1976). In addition, a combined allowance of 20 percent of wall thickness is assumed for eddy current testing inaccuracies and continued operational degradation per Draft Regulatory Guide 1.121 (August 1976).

The following sleeve designs have been found acceptable by the NRC staff:

1. Westinghouse Mechanical Sleeves (WCAP-12623)
2. Combustion Engineering Leak Tight Sleeves (CEN-313-P)
3. Westinghouse Laser Welded Sleeves (WCAP-13088, Rev. 3)

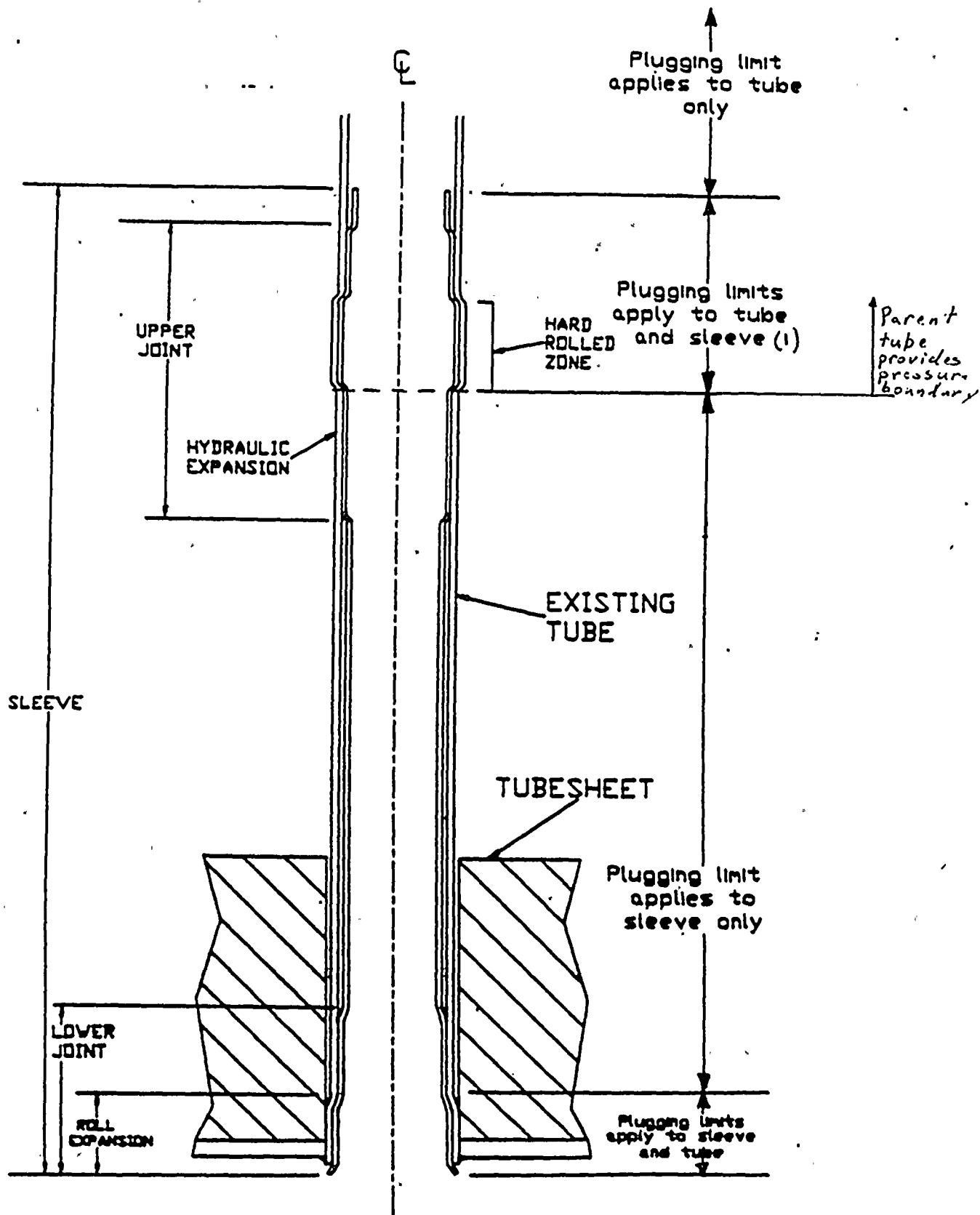
Descriptions of other future sleeve designs shall be submitted to the NRC for review and approval in accordance with 10 CFR 50.90 prior to their use in the repair of degraded steam generator tubes. The submittals related to other sleeve designs shall be made at least 90 days prior to use.

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FIGURE B 3/4.4.5

Insert D

Inspection experience at other plants with HEJ sleeved tubes has indicated that a potential exists for the sleeved tube to develop primarily circumferentially oriented degradation in the upper HEJ hardroll lower transition region. The pressure boundary for HEJ sleeves is shown on Figure B 3/4.4.5-1. The pressure boundary used to disposition parent tube indications (PTIs) detected in the upper joint of HEJ sleeved tubes is discussed in WCAP-14641, "HEJ Sleeved Tube Structural Integrity Criteria: ΔD Diametral Interference at PTIs," April 1996. The pressure boundary will allow PTIs located such that there is a minimum diameter change of 0.003" (plus an allowance for NDE uncertainty) between the peak diameter of the sleeve hardroll, and the diameter at the elevation of the PTI, to remain in service. The 0.003" interference lip is derived from structural and leakage testing. When inspecting and dispositioning the PTIs, the acceptance criterion will be adjusted to account for measurement uncertainties associated with the technique used to measure the relative change in ID sleeve diameters. During field application, the PTI elevation will be measured by comparing the diameter reported at the peak amplitude of the flaw, and the diameter at the center of the coil's field, and using the more conservative of the two diameters to perform the Delta-D determination. Application of the pressure boundary for HEJ sleeved tubes provides allowance for leakage in a faulted loop during a postulated steam line break (SLB) event. A SLB leakage of 0.025 gpm is assumed for each applicable indication. Steam line break leakage from all sources must be calculated to be < 8.4 gpm in the faulted loop. Maintenance of the 8.4 gpm limit ensures off-site doses will remain within a small fraction of the 10 CFR Part 100 guideline for a SLB.



(i): See T/S 4.4.5.4.a.14 for tube plugging requirements

FIGURE B 3/4.4.5-1
Application of HEJ sleeved tube plugging limits

ATTACHMENT 3 TO AEP:NRC:1129M

HEJ SLEEVED TUBE STRUCTURAL INTEGRITY LIMITS

DONALD C. COOK NUCLEAR PLANT UNIT 1

PROPOSED TECHNICAL SPECIFICATIONS

SURVEILLANCE REQUIREMENTS (continued)

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. Tubes left in service as a result of application of the tube support plate plugging criteria shall be inspected by bobbin coil probe during all future refueling outages.
- c. In addition to the sample required in 4.4.5.2.b.1 through 3, all tubes which have had the F* criteria applied will be inspected in the roll expanded region. The roll expanded region of these tubes may be excluded from the requirements of 4.4.5.2.b.1.
- d. 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 the 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.
- e. Implementation of the steam generator tube/tube support plate plugging criteria for one fuel cycle (Cycle 15) requires a 100 percent bobbin coil inspection for hot-leg tube support plate intersections and cold-leg intersections down to the lowest cold-leg tube support plate with known outside diameter stress corrosion cracking (ODSCC) indications. The determination of 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.
- f. Inspection of sleeves will follow the initial sample selection (1st sample) and sample expansion requirements of Table 4.4-2.
- g. HEJ sleeved tubes determined to be operable by application of the ΔD criteria (per 4.4.5.4.a.14) will be inspected in the upper HEJ region at each refueling outage to determine if new indications are present. Existing indications in these sleeved tubes may be excluded from the requirements of 4.4.5.2.b.1.

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.

3/4 LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS
3/4.4 REACTOR COOLANT SYSTEM

SURVEILLANCE REQUIREMENTS (continued)

- 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 or sleeves must exhibit significant (greater than or equal to 10%) further wall penetrations to be included in the above percentage calculations.

4.4.5.3 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 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 following service under AVT conditions, 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 inservice inspection of a steam generator conducted in accordance with Table 4.4-2 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 4.4.5.3.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 4.4-2 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 3.4.6.2.
 2. A seismic occurrence greater than the Operating Basis Earthquake.
 3. A loss-of-coolant accident requiring actuation of the engineered safeguards.
 4. A main steam line or feedwater line break.

SURVEILLANCE REQUIREMENTS (continued)

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 or sleeve 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 or sleeve.
3. Degraded Tube or Sleeve means an imperfection greater than or equal to 20% of the nominal wall thickness caused by degradation.
4. Percent Degradation means the amount of the tube wall thickness affected or removed by degradation.
5. Defect means an imperfection of such severity that it exceeds the repair limit.
6. Repair/Plugging Limit means the imperfection depth at or beyond which the tube or sleeved tube shall be repaired or removed from service. Any tube which, upon inspection, exhibits tube wall degradation of 40 percent or more of the nominal tube wall thickness shall be plugged or repaired prior to returning the steam generator to service. This definition does not apply to HEJ sleeved tubes which may experience degradation in the upper HEJ hardroll lower transition region. Refer to specification 4.4.5.4 a.14 for the plugging limit applicable to these tubes. This definition does not apply to the portion of the tube in the tubesheet below the F* distance for F* tubes. Any sleeve, except laser welded sleeves, which upon inspection exhibits wall degradation of 29 percent or more of the nominal wall thickness, shall be plugged prior to returning the steam generator to service. In addition, any sleeve, except laser welded sleeves, exhibiting any measurable wall loss in sleeve expansion transition or weld zones shall be plugged. This definition does not apply to tube support plate intersections for which the voltage-based plugging criteria are being applied. Refer to 4.4.5.4.a.10 for the plugging limit applicable to these intersections. For a tube that has been sleeved with a laser welded sleeve, through wall penetration of greater than or equal to 23% of sleeve nominal wall thickness requires the tube to be removed from service by plugging.
7. Unserviceable describes the condition of a tube or sleeve 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. Inspection determines the condition of the steam generator tube or sleeve from the point of entry (hot leg side) completely around the U-bend to the top support of the cold leg. For a tube in which the tube support plate elevation interim plugging limit has been applied, the inspection will include all the hot leg intersections and all cold leg intersections down to, at least, the level of the last crack indication.

SURVEILLANCE REQUIREMENTS (continued)

9. Sleeving a tube is permitted with tube support plate sleeves and with tubesheet sleeves. Tube support plate sleeves are centered about the tube support plate intersection. Tubesheet sleeves start at the primary fluid tubesheet face and extend to the free span region of tube above the tubesheet.
10. Tube Support Plate Repair Limit is used for the disposition of a steam generator tube for continued service that is experiencing outside diameter stress corrosion cracking (ODSCC) confined within the thickness of the tube support plates. At tube support plate intersections, the repair limit is based on maintaining steam generator tube serviceability as described below:
 - a. Degradation attributed to ODSCC within the bounds of the tube support plate with bobbin voltage less than or equal to 2.0 volts will be allowed to remain in service.
 - b. Degradation attributed to ODSCC within the bounds of the tube support plate with a bobbin voltage greater than 2.0 volts will be repaired or plugged except as noted in 4.4.5.4.a.10.c below.
 - c. Indications of potential degradation attributed to ODSCC within the bounds of the tube support plate with a bobbin voltage greater than 2.0 volts but less than or equal to 5.6 volts may remain in service if a rotating pancake coil inspection does not detect degradation. Indications of ODSCC degradation with a bobbin voltage greater than 5.6 volts will be plugged or repaired.
11. F* Distance is the distance from the bottom of the hardroll transition toward the bottom of the tubesheet that has been conservatively determined to be 1.11 inches (not including eddy current uncertainty).
12. F* Tube is a tube with degradation, below the F* distance, equal to or greater than 40%, and not degraded (i.e., no indications of cracking) within the F* distance.
13. Tube Repair refers to sleeving as described by the reports listed in 4.4.5.4.c which are used to maintain a tube in service or return a tube to service. Tubes with degradation indications of less than the plugging limit may be preventively sleeved at the Owner's discretion. This includes removal of plugs that were installed as a corrective or preventive measure. A tube inspection per 4.4.5.4.a.8 is required prior to returning previously plugged tubes to service. Further restrictions regarding identified indications and their proximity to the joint areas of various sleeving processes may be applicable.
14. a. HEJ sleeved tubes with circumferential indications located within the upper hardroll lower transition shall be inspected with a non-destructive examination (NDE) technique capable of measuring the sleeve ID difference between the sleeve hardroll peak diameter, and the sleeve ID at the elevation of the parent tube indication (PTI). If this diameter change is ≥ 0.003 " (plus an allowance for NDE uncertainty), the tube may remain in service provided the faulted loop steam line break (SLB) leakage limit from all sources is not exceeded. A SLB allowance of 0.025 gpm shall be assumed for each sleeve tube left in service by application of this criterion, regardless of length or depth of the indication. For tubes where the measured diameter difference is > 0.013 ", SLB leakage can be neglected.

SURVEILLANCE REQUIREMENTS (continued)

- b. HEJ sleeved tubes with a sleeve ID difference of $< 0.003"$ (plus an allowance for NDE uncertainty) between the sleeve ID hardroll peak diameter and sleeve ID at the elevation of the PTI shall be plugged or repaired prior to returning the steam generator to service.
 - c. HEJ sleeved tubes with axial indications located within the parent tube pressure boundary as defined on Figure B 3/4.4.5-1 shall be plugged or repaired prior to returning the steam generators to service.
 - d. HEJ sleeved tubes with parent tube indications located outside of the parent tube pressure boundary (below the upper hardroll region) as defined on Figure B 3/4.4.5-1 may remain in service.
- b. The steam generator shall be determined OPERABLE after completing the corresponding actions (plugging or sleeving all tubes exceeding the repair limit and all tubes containing through-wall cracks) required by Table 4.4-2.
 - c. Steam generator tube repairs may be made in accordance with the methods described in either WCAP-12623, WCAP-13088 (Rev. 3), or CEN-313-P.

4.4.5.5 Reports

- a. Following each inservice inspection of steam generator tubes, if there are any tubes requiring plugging or sleeving, the number of tubes plugged or sleeved 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 included in the Annual Operating Report for the period in which this inspection was completed. This report shall include:
 - 1. Number and extent of tubes and sleeves inspected.
 - 2. Location and percent of wall-thickness penetration for each indication of an imperfection.
 - 3. Identification of tubes plugged or sleeved.
- c. Results of steam generator tube inspections which fall into Category C-3 and require prompt notification of the Commission shall be reported pursuant to Specification 6.9.1 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. If estimated leakage based on the actual measured end-of-cycle voltage distribution would have exceeded the leak limit (for the postulated main steam line break utilizing "Standard Review Plan - NUREG-0800" assumptions) during the previous operating cycle.

3/4 LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS
3/4.4 REACTOR COOLANT SYSTEM

SURVEILLANCE REQUIREMENTS (continued)

2. If circumferential crack-like indications are detected at the tube support plate intersections.
3. If significant indications are identified that extend beyond the confines of the tube support plate.
4. If the calculated conditional burst probability, as calculated per WCAP-14277, exceeds 1×10^{-2} , notify the NRC and provide an assessment of the safety significance of the occurrence.

3/4.4.5 STEAM GENERATORS TUBE INTEGRITY (Continued)

Whenever the results of any steam generator tubing inservice inspection fall into Category C-3, these results will be promptly reported to the Commission pursuant to Specification 6.9.1 prior to resumption of plant operation. Such cases will be considered by the Commission on a case-by-case basis and may result in a requirement for analysis, laboratory examinations, tests, additional eddy-current inspection, and revision of the Technical Specifications, if necessary.

Degraded steam generator tubes may be repaired by the installation of sleeves which span the section of degraded steam generator tubing. A steam generator tube with a sleeve installed meets the structural requirements of tubes which are not degraded.

To determine the basis for the sleeve plugging limit, the minimum sleeve wall thickness was calculated in accordance with Draft Regulatory Guide 1.121 (August 1976). In addition, a combined allowance of 20 percent of wall thickness is assumed for eddy current testing inaccuracies and continued operational degradation per Draft Regulatory Guide 1.121 (August 1976).

The following sleeve designs have been found acceptable by the NRC staff:

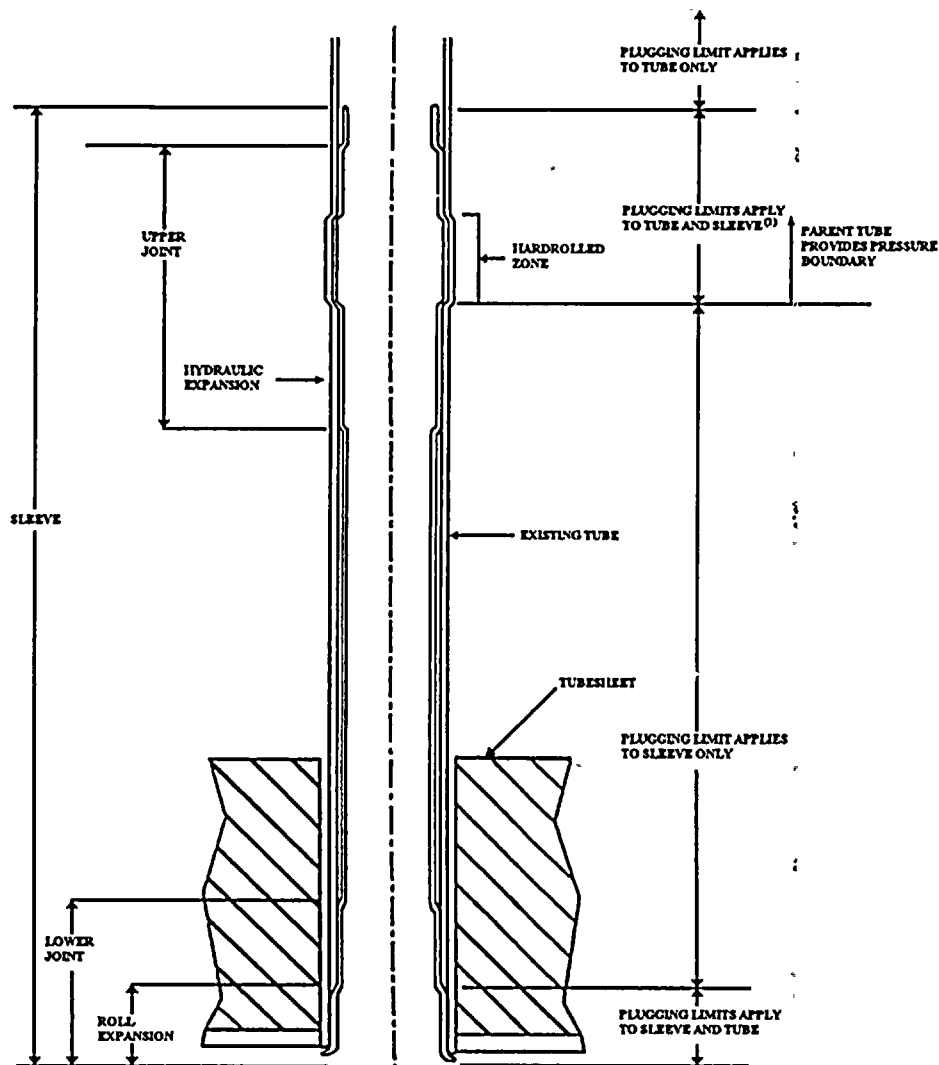
1. Westinghouse Mechanical Sleeves (WCAP-12623)
2. Combustion Engineering Leak Tight Sleeves (CEN-313-P)
3. Westinghouse Laser Welded Sleeves (WCAP-13088, Rev. 3)

Descriptions of other future sleeve designs shall be submitted to the NRC for review and approval in accordance with 10 CFR 50.90 prior to their use in the repair of degraded steam generator tubes. The submittals related to other sleeve designs shall be made at least 90 days prior to use.

Inspection experience at other plants with HEJ sleeved tubes has indicated that a potential exists for the sleeved tube to develop primarily circumferentially oriented degradation in the upper HEJ hardroll lower transition region. The pressure boundary for HEJ sleeves is shown on Figure B 3/4.4.5-1. The pressure boundary used to disposition parent tube indications (PTIs) detected in the upper joint of HEJ sleeved tubes is discussed in WCAP 14641, "HEJ Sleeved Tube Structural Integrity Criteria: 'ΔD' Diametral Interference at PTIs," April 1996. The pressure boundary will allow PTIs located such that there is a minimum diameter change of 0.003" (plus an allowance for NDE uncertainty) between the peak diameter of the sleeve hardroll, and the diameter at the elevation of the PTI, to remain in service. The 0.003" interference lip is derived from structural and leakage testing. When inspecting and dispositioning the PTIs, the acceptance criterion will be adjusted to account for measurement uncertainties associated with the technique used to measure the relative change in ID sleeve diameters. During field application, the PTI elevation will be measured by comparing the diameter reported at the peak amplitude of the flaw, and the diameter at the center of the coil's field, and using the more conservative of the two diameters to perform the Delta-D determination. Application of the pressure boundary for HEJ sleeved tubes provides allowance for leakage in a faulted loop during a postulated steam line break (SLB) event. A SLB leakage of 0.025 gpm is assumed for each applicable indication. Steam line break leakage from all sources must be calculated to be < 8.4 gpm in the faulted loop. Maintenance of the 8.4 gpm limit ensures off-site doses will remain within a small fraction of the 10 CFR Part 100 guideline for a SLB.

3/4 BASES
3/4.4 REACTOR COOLANT SYSTEM

3/4.4.5 STEAM GENERATORS TUBE INTEGRITY (Continued)



(1): See T/S 4.4.5.4.a.14 for tube plugging requirements.

Figure B 3/4.4.5-1
Application of HEJ Sleeved Tube Plugging Limits

ATTACHMENT 4 TO AEP:NRC:1129M

WCAP-14641 - HEJ SLEEVED TUBE STRUCTURAL INTEGRITY CRITERIA:

"AD" DIAMETRAL INTERFERENCE AT PTIS

WESTINGHOUSE NONPROPRIETARY CLASS 3

