

REACTOR COOLANT SYSTEM

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 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 or repair limit. A tube containing a defect is defective.
6. ^{Tube} Plugging or Repair Limit means the imperfection depth at or beyond which the tube shall be repaired (i.e. sleeving) or removed from service by plugging and is equal to 40% of the nominal tube wall thickness. This definition does not apply to the area of the tubesheet region below the F^a distance provided the tube is not degraded (i.e., no indications of cracking) within the F^a distance.

7. Sleeve Plugging or Repair Limit →

- a. For the area in the upper weld joint, any degradation shall be plugged unless it can be clearly demonstrated by a qualified NDE technique that the degradation is less than 40% of the nominal wall thickness of the sleeve for ID imperfections or less than 40% nominal wall thickness of the tube for O.D. imperfections.
- b. For the area of the tube behind the sleeve and above the upper weld joint, tubes with any degradation shall be plugged unless it can be clearly demonstrated by a qualified NDE technique, that the degradation is less than 40% of the nominal wall thickness.
- c. For the area below the upper weld joint, any defect greater than 40% of the nominal sleeve wall thickness shall be plugged.

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SURVEILLANCE REQUIREMENTS (continued)

8. 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.
9. 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.
10. Sleeve Inspection means an inspection of the sleeved portion of the tube. This inspection will include 3 inches of the parent tube directly above the upper weld, the upper weld which forms the new pressure boundary, and the sleeve material below the upper weld.
11. Repaired tube means a tube that has undergone a process that re-establishes its serviceability. One or more of the following will be used when sleeving a steam generator tube:
The Combustion Engineering Inc. weld sleeve process will be used per report CEN-337-P.
The Babcock + Wilcox Kinetic sleeve process will be used per report BAW-2045 P.

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SURVEILLANCE REQUIREMENTS (Continued)

12. ~~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 after the field hydrostatic test and prior to initial POWER OPERATION using the equipment and techniques expected to be used during subsequent inservice inspections.
13. ~~10.~~ F² Distance is the distance into the tubesheet from the face of the tubesheet or the top of the last hardroll, whichever is lower (further into the tubesheet) that has been conservatively chosen to be 1.6 inches.
14. ~~11.~~ F² TUBE is the tube with degradation equal to or greater than 40%, below the F² distance and not degraded (i.e., no indications of cracking) within the F² distance. The application of F² expires at the end of the fifth fuel cycle.

- b. The steam generator shall be determined OPERABLE after completing the corresponding actions (plug or repair all tubes exceeding the plugging limit) required by Table 4.4-2.

4.4.5.5 Reports

- a. Within 15 days following the completion of each inservice inspection of steam generator tubes, the number of tubes plugged or repaired 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.
 3. Identification of tubes plugged or repaired.
- 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 10 CFR 50.72(b)2(1) prior to resumption of plant operation. A report pursuant to 10 CFR 50.73(a)2(1) shall be submitted to provide a description of investigations conducted to determine cause of the tube degradation and corrective measures taken to prevent recurrence.
- d. The results of inspections of F² tubes shall be reported to the Commission in a report to the Director, OHRR, prior to the restart of the unit following the inspection. This report shall include:
1. Identification of F² tubes, and
 2. Location and size of the degradation

NRC approval of this report is not required prior to restart.

ATTACHMENT 2

Description of Amendment Request and Safety Evaluation

Description of Amendment Request:

Technical Specification 4.4.5.4.a.10, "Acceptance Criteria-Repaired Tube," presently allows steam generator tube repair using the Combustion Engineering sleeve process. The requested Technical Specification change will allow the use of B&W sleeves for steam generator tube repair. The change requires referencing B&W topical report BAW-2045P, "Recirculating Steam Generator Kinetic Sleeve Qualification for 3/4 Inch O.D. Tubes," in Technical Specification Section 4.4.5.4.a.10. The topical was submitted to the NRC by a letter dated June 9, 1988, from Mr. James H. Taylor of B&W to Mr. L. C. Shao of the NRC. A supplement to the original B&W submittal was made on December 12, 1988, which contained answers to NRC questions and transmitted a non-proprietary version of the topical. The currently allowed Combustion Engineering sleeve process will be retained in the Technical Specifications as an option.

The basis for steam generator tube surveillance and repair is to ensure that the structural integrity of the tubes is maintained. The sleeving process is one method of dispositioning a degraded tube. The advantage of sleeving versus plugging is that the tube is allowed to remain in service. The structural integrity of the tube is maintained with minimal reduction in flow and heat transfer capabilities. Therefore, the repaired tube functions in essentially the same manner as the original tube.

The proposed Technical Specification change is requested to provide SCE&G with another alternative for handling degraded tubes. The B&W sleeve is qualified for two lengths. The shorter sleeve may be utilized in all steam generator tubes and is therefore more versatile than the currently approved Combustion Engineering sleeve.

Also, an editorial numbering/title revision is being made to Section 4.4.5.4.a.6 to more clearly delineate tube versus sleeve plugging or repair limits by adding item 4.4.5.4.a.7 and renumbering subsequent items.

Safety Evaluation:

Introduction:

The purpose of a sleeve is to repair a degraded steam generator tube in order to maintain the function and integrity of the tube. The sleeve functions in essentially the same manner as the original tube. B&W topical report BAW-2045P describes in detail the analytical methods used for design and qualification of the B&W sleeve. Table 4.1.1, "Summary of RSG Sleeve Requirements," lists the specifications (mainly ASME Boiler and Pressure Vessel code requirements) used in design, procurement and qualification of the sleeve. Table 4.2.2, "Steam Generator Design Transients," summarizes the transients used to establish sleeve loading. Details for key areas covered in the topical report are summarized below.

Justification:

BAW-2045P contains the results of the sleeve design verification which included analysis and confirmatory testing to demonstrate the acceptability of the steam generator sleeving technique for defective tubes. The design and operating conditions specified for the sleeve bound the VCSNS steam generator design conditions. In general, the generic topical (BAW-2045P) was written utilizing VCSNS specific design data.

The sleeve design described in BAW-2045P is qualified for two lengths, eleven inches and seventeen and one half inches. The lower end of each sleeve is located approximately 16 inches from the primary face of the tubesheet. The shorter sleeve may be utilized in all the steam generator tubes (including the peripheral tubes which typically do not permit the introduction of sleeves due to the close proximity of the bowl in that area). The longer sleeve extends further into the tube past the flow distribution baffle.

The sleeve material is thermally treated Alloy 690 Inconel with a specified minimum wall thickness of 0.039 inches. (The required minimum thickness is 0.027 inches based on primary side design pressure). This material has been demonstrated to be much more resistant to corrosion phenomenon as detailed in BAW-2045P. Design and operating conditions listed in Table 4.2.1 of BAW-2045P bound those for VCSNS. The upper sleeve/tube joint is produced by a kinetic weld/expansion which is subsequently stress relieved. The joint is qualified as both a strength and seal weld. The lower joint may consist of either a kinetic weld in the tubesheet or a mechanically sealed joint produced by rolling the sleeve in the tubesheet. The lower joint is qualified for applicable loads without taking credit for the original strength of the tube rolled into the tubesheet. Therefore, the structural integrity of the tube is maintained by the sleeving process.

The adequacy of the sleeve to withstand cyclic loadings was demonstrated using fatigue testing. Fatigue testing consisted of cyclic vibration, pressure, thermal, and axial loading. These tests were performed to demonstrate the structural adequacy of the installed sleeve. In all cases, the results of the tests indicated that the sleeve conformed to the design requirements of the steam generators.

Based on Regulatory Guide 1.121 guidelines for tube degradation limits, a plugging limit of 40% of the original sleeve wall has been established. Eddy current techniques are available to perform necessary sleeve/tube inspections for defect detection and to verify proper installation of the sleeve. The available techniques are capable of providing 20% defect sensitivity in the required areas of the tube/sleeve pressure boundary. The inspection requirements currently contained in the Technical Specifications do not require any changes.

ATTACHMENT 3

Description of Amendment Request and
No Significant Hazards Evaluation

NO SIGNIFICANT HAZARDS EVALUATION

Description of Amendment Request:

Technical Specification 4.4.5.4.a.10, "Acceptance Criteria-Repaired Tube," presently allows steam generator tube repair using the Combustion Engineering sleeve process. The requested Technical Specification change will allow the use of B&W sleeves for steam generator tube repair. The change requires referencing B&W topical report BAW-2045P, "Recirculating Steam Generator Kinetic Sleeve Qualification for 3/4 Inch O.D. Tubes," in Technical Specification Section 4.4.5.4.a.10. The topical was submitted to the NRC by a letter dated June 9, 1988, from Mr. James H. Taylor of B&W to Mr. L. C. Shao of the NRC. A supplement to the original B&W submittal was made on December 12, 1988 which contained answers to NRC questions and transmitted a non-proprietary version of the topical. The currently allowed Combustion Engineering sleeve process will be retained in the Technical Specifications as an option.

The basis for steam generator tube surveillance and repair is to ensure that the structural integrity of the tubes is maintained. The sleeving process is one method of dispositioning a degraded tube. The advantage of sleeving versus plugging is that the tube is allowed to remain in service. The structural integrity of the tube is maintained with minimal reduction in flow and heat transfer capabilities. Therefore, the repaired tube functions in essentially the same manner as the original tube.

The proposed Technical Specification change is requested to provide SCE&G with another alternative for handling degraded tubes. The B&W sleeve is qualified for two lengths. The shorter sleeve may be utilized in all steam generator tubes and is therefore more versatile than the currently approved Combustion Engineering sleeve.

Also, an editorial numbering/title revision is being made to Section 4.4.5.4.a.6 to more clearly delineate tube versus sleeve plugging or repair limits by adding item 4.4.5.4.a.7 and renumbering subsequent items.

No Significant Hazards Evaluation:

The purpose of a sleeve is to repair a degraded steam generator tube in order to maintain the function and integrity of the tube. The sleeve functions in essentially the same manner as the original tube. B&W topical report BAW-2045P describes in detail the analytical methods used for design and qualification of the B&W sleeve. Table 4.1.1, "Summary of RSG Sleeve Requirements," lists the specifications (mainly ASME Boiler and Pressure Vessel code requirements) used in design, procurement and qualification of the sleeve. Table 4.2.2, "Steam Generator Design Transients," summarizes the transients used to establish sleeve loading.

Pursuant to 10CFR50.91, the following analyses provide a determination that the proposed change poses no significant hazard as defined by 10CFR50.92.

- 1) The proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

The steam generator tube rupture accident is the only previously evaluated accident which may have been significantly affected by this change. However, the steam generator sleeve has been analyzed and tested to the operating and design conditions of the original tube as documented in BAW-2045P. The topical report contains the design verification results from the analysis and confirmatory testing performed on the sleeve. The probability or consequences of previously evaluated accidents is not increased by this change since the sleeve meets the original tube design conditions and the structural integrity of the tube is maintained by the sleeving process.

In addition, the sleeve is less susceptible to the identified stress corrosion failure mechanisms of the original tube because of the use of an improved material, Alloy 690 Inconel, and the B&W specified installation process. The continued integrity of the sleeve will be verified by the Technical Specification inspection requirements and the sleeve will be plugged in accordance with Technical Specification 4.4.5.4.a.7 evaluation and acceptance criteria.

The numbering/title revision is purely editorial in nature and has no technical impact.

- 2) The proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

The purpose of the sleeve is to repair a degraded steam generator tube in order to maintain the function and integrity of the tube. The sleeve functions in essentially the same manner as the original tube and has been analyzed and tested for the steam generator design conditions. Repairing the tube to a serviceable condition utilizing this sleeving process does not create the possibility of a new or different kind of accident since the sleeve is a passive component with failure mechanisms that should be similar to the original tube.

- 3) The proposed change does not involve a significant reduction in a margin of safety.

The potential for primary to secondary leakage is reduced by the addition of a steam generator tube sleeve. Also, the structural integrity of the tube is maintained by the sleeve and sleeve/tube weld.

The proposed sleeving technique provides an increased margin of safety over plugging the tube and removing it from service. The effect of sleeve installation on steam generator performance was analyzed for heat transfer, flow restriction and steam generation capacity. The results show that plugging one tube is equivalent to the heat transfer reduction of sleeving 48 tubes, the primary flow reduction of sleeving 20 tubes, and loss of steam generation capacity of sleeving 40 tubes. Therefore,

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sleeving provides additional margin when compared to the plugging alternative.

Based on the preceding analysis, SCE&G has determined that this change does not involve a significant hazards consideration.