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South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

NUCLEAR QUALITY & LICENSING DEPARTMENT

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RE: MARKED-UP TS
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ADD

REACTOR COOLANT SYSTEM**NO CHANGES
ON THIS PAGE****3/4.4.5 STEAM GENERATOR****LIMITING CONDITION FOR OPERATION**

3.4.5 Each steam generator shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTION:

With one or more steam generators inoperable, restore the inoperable generator(s) to OPERABLE status prior to increasing Tavg above 200°F.

SURVELLANCE REQUIREMENTS

4.4.5.0 Each steam generator shall be demonstrated OPERABLE by performance of the following augmented inservice inspection program and the requirements of Specification 4.0.5.

4.4.5.1 Steam Generator Sample Selection and Inspection - Each steam generator shall be determined OPERABLE during shutdown by selecting and inspecting at least the minimum number of steam generators specified in Table 4.4-1.

4.4.5.2 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 4.4-2 and Table 4.4-3. The inservice inspection of steam generator tubes shall be performed at the frequencies specified in Specification 4.4.5.3 and the inspected tubes shall be verified acceptable per the acceptance criteria of Specification 4.4.5.4. When applying the exceptions of 4.4.5.2.a through 4.4.5.2.c, previous defects or imperfections in the area repaired by sleeving are not considered an area requiring reinspection. The tubes selected for each inservice inspection shall include at least 3% of the total number of nonrepaired tubes in all steam generators and (for Model E steam generators only) 20% of the total number of repaired tubes in all steam generators; the tubes selected for these inspections shall be selected on a random basis except:

- a. 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;
- b. The first sample of tubes selected for each inservice inspection (subsequent to the preservice inspection) of each steam generator shall include:
 - 1) All nonplugged tubes that previously had detectable wall penetrations (greater than 20%),
 - 2) Tubes in those areas where experience has indicated potential problems, and

REACTOR COOLANT SYSTEMSTEAM GENERATORSSURVEILLANCE REQUIREMENTS (Continued)

- 3) A tube inspection (pursuant to Specification 4.4.5.4a.9) 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) For Model E steam generators only, 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 or Table 4.4-3) 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, and
 - 2) The inspections include those portions of the tubes where imperfections were previously found.
- d. For Model E steam generators only, implementation of the steam generator tube/tube support plate repair criteria requires a 100-percent bobbin coil inspection for the flow distribution baffle plate intersections, for the hot-leg tube support plate intersections, and for the 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.

NRC Editorial

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- 1) All intersections with mechanically induced dent signals greater than 5 volts identified by bobbin coil inspection shall be inspected by rotating pancake coil (or equivalent).
- 2) All intersections with large mixed residuals that could potentially mask flaw responses at or above the voltage repair limits shall be inspected by rotating pancake coil (or equivalent).
- 3) At the flow distribution baffle intersections, at the cold leg support plate intersections, and at the hot leg support plate intersections with support plates N, L through R (as identified in Figure 5.1 of WCAP-15163, Revision 1), all distorted support plate indications (DSIs) with a bobbin voltage greater than the lower voltage repair limit (defined in 4.4.5.4.a.11) shall be inspected by rotating pancake coil (or equivalent).

Bounding calculation

Info
added
from
WCAP
Table
2-2
at
NRC
request

REACTOR COOLANT SYSTEMSTEAM GENERATORSSURVEILLANCE REQUIREMENTS (Continued)

Info added
from
WCAP
Table 2-2

- 4) At the hot leg support plate intersections with support plates C, F, and J (as identified in Figure 5.1 of WCAP-15163, Revision 1), all DSIs greater than 3 volts shall be examined by rotating pancake coil (or equivalent) eddy current probe. An additional 100 intersections with support plates C, F, and J with DSIs less than 3 volts (100 total over all steam generators, not necessarily selected at random) shall be inspected by rotating pancake coil (or equivalent).

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.

REACTOR COOLANT SYSTEM**NO CHANGES
ON THIS PAGE**STEAM GENERATORSSURVEILLANCE REQUIREMENTS (Continued)

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 following steam generator replacement shall be performed after 6 Effective Full Power Months but within 24 calendar months of initial criticality after the steam generator replacement. 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;

Note: Inservice inspection is not required during the steam generator replacement outage.

- b. If the results of the 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 4.4.5.3a.; the interval may then be extended to a maximum of once per 40 months; and
- 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 tube leaks (not including leaks originating from tube-to-tube sheet welds) in excess of the limits of Specification 3.4.6.2, or
 - 2) A seismic occurrence greater than the Operating Basis Earthquake, or
 - 3) A loss-of-coolant accident requiring actuation of the Engineered Safety Features, or
 - 4) A main steam line or feedwater line break.

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REACTOR COOLANT SYSTEM

STEAM GENERATORS

SURVEILLANCE REQUIREMENTS (Continued)

4.4.5.4 Acceptance Criteria

a. As used in this specification:

- 1) Tubeing or Tube means that portion of the tube or sleeve which forms the primary system to secondary system pressure boundary;
- 2) 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;
- 3) Degradation means a service-induced cracking, wastage, wear, or general corrosion occurring on either inside or outside of a tube;
- 4) Degraded Tube means a tube containing imperfections greater than or equal to 20% of the nominal wall thickness caused by degradation;
- 5) % Degradation means the percentage of the tube wall thickness affected or removed by degradation;
- 6) Defect means an imperfection of such severity that it exceeds the plugging or repair limit. A tube containing a defect is defective;
- 7) Plugging Limit or Repair Limit means the imperfection depth at or beyond which the tube shall be removed from service by plugging or (for Model E steam generators only) repaired by sleeving in the affected area because it may become unserviceable prior to the next inspection. The plugging or repair limit imperfection depths are specified in percentage of the nominal wall thickness as follows:

| | |
|--|-----|
| a. original tube wall | 40% |
| b. Westinghouse laser welded sleeve wall | 40% |

For Model E steam generators, this definition does not apply to tube support plate intersections for which the voltage-based repair criteria are being applied. Refer to 4.4.5.4.a.11 for the repair limit applicable to these intersections.

- 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 Specification 4.4.5.3c., 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;

REACTOR COOLANT SYSTEM

STEAM GENERATORS

SURVEILLANCE REQUIREMENTS (Continued)

- 10) 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.
- 11) For Model E steam generators only, Tube Support Plate Plugging Limit is used for the disposition of a mill annealed alloy 600 steam generator tube for continued service that is experiencing predominately axially oriented outside diameter stress corrosion cracking confined within the thickness of the tube support plates.

Bounding calculation

NRC
Editorial

At the flow distribution baffle intersections, at the cold leg support plate intersections, and at the hot leg support plate intersections with support plates N L through R (as identified in Figure 5.1 of WCAP-15163, Revision 1), the plugging (repair) limit is based on maintaining steam generator tube serviceability as described in a), b), c) and d) below:

- a) Steam generator tubes, whose degradation is attributed to outside diameter stress corrosion cracking within the bounds of the tube support plate with bobbin voltage less than or equal to the lower voltage repair limit (Note 1), will be allowed to remain in service.
- b) Steam generator tubes, whose degradation is attributed to outside diameter stress corrosion cracking within the bounds of the tube support plate with a bobbin voltage greater than the lower voltage repair limit (Note 1), will be repaired or plugged, except as noted in 4.4.5.4.a.11.c below.
- c) Steam generator tubes, with indications of potential degradation attributed to outside diameter stress corrosion cracking within the bounds of the tube support plate with a bobbin voltage greater than the lower voltage repair limit (Note 1) but less than or equal to the upper repair voltage limit (Note 2), may remain in service if a rotating pancake coil inspection does not detect degradation. Steam generator tubes, with indications of outside diameter stress corrosion cracking degradation with bobbin voltage greater than the upper voltage repair limit (Note 2) will be plugged or repaired.

REACTOR COOLANT SYSTEM

STEAM GENERATORS

SURVEILLANCE REQUIREMENTS (Continued)

- d) If an unscheduled mid-cycle inspection is performed, the mid-cycle repair limits apply instead of the limits identified in 4.4.5.4.a.11.a, 4.4.5.4.a.11.b, and 4.4.5.4.a.11.c. The mid-cycle repair limits will be determined from the equations for mid-cycle repair limits of NRC Generic Letter 95-05, Attachment 2, page 3 of 7. Implementation of these mid-cycle repair limits should follow the same approach as in TS 4.4.5.4.a.11.a, 4.4.5.4.a.11.b, and 4.4.5.4.a.11.c.

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

Note 2: The upper voltage repair limit (V_{URL}) is calculated for each inspection according to the methodology in Generic Letter 95-05 as supplemented. V_{URL} may differ at the TSPs and flow distribution baffle. Voltage growth rate shall be the larger of the average growth rates experienced in the two prior cycles, but not less than 30% per effective full power year.

Info added from WCAP Table 2-2

NRC comment

Bounding calculation

NRC Editorial

NRC Editorial

For Unit 2 Cycle 9 only, at the hot leg support plate intersections with support plates C, E, and J, L, and M (as identified in Figure 5.1 of WCAP-15163, Revision 1), the plugging (repair) limit is based on maintaining steam generator tube serviceability as described in e) and f) below:

- e) Steam generator tubes, whose degradation is attributed to axially oriented outside diameter stress corrosion cracking within the bounds of the tube support plate with a bobbin voltage less than or equal to 3.0 volts may remain in service.
- f) Steam generator tubes, whose degradation is attributed to axially oriented outside diameter stress corrosion cracking within the bounds of the tube support plate with a bobbin voltage greater than 3.0 volts shall be plugged or repaired regardless of whether or not a rotating pancake coil inspection detects degradation.

- 12) Tube Repair refers to a process that reestablishes tube serviceability for Model E steam generators only. Acceptable tube repair will be performed in accordance with the methods described in Westinghouse Reports WCAP-13698, Revision 2, "Laser Welded Sleeves for 3/4 Inch Diameter Tube Feeding-Type and Westinghouse Preheater Steam Generators," April 1995 and WCAP-14653, "Specific Application of Laser Welded Sleeves for South Texas Project Power Plant Steam Generators," June 1996, including post-weld stress relief;

Tube repair includes the removal of plugs that were previously installed as a corrective or preventive measure. A tube inspection per 4.4.5.4.a.9 is required prior to returning previously plugged tubes to service.

REACTOR COOLANT SYSTEMSTEAM GENERATORSSURVEILLANCE REQUIREMENTS (Continued)

- b. The steam generator shall be determined OPERABLE after completing the corresponding actions [plug or (for Model E steam generators only) repair all tubes exceeding the plugging or repair limit and all tubes containing through-wall cracks] required by Table 4.4-2 and Table 4.4-3.

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, and
 - 3) Identification of tubes plugged or repaired.
- c. Results of steam generator tube inspections which-fall into Category G-3 shall be reported in a Special Report to the Commission pursuant to Specification 6.9.2 within 30 days and prior to resumption of plant operation. 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 Model E steam generators, 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 projected end-of-cycle (or if not practical, using the actual measured end-of-cycle) voltage distribution exceeds the leak limit (determined from the licensing basis dose calculation for the postulated main steam line break) for the next operating cycle. The calculation(s) shall be done using:

Info added
from WCAP
Table 2-2

Bounding calculation

- a) The methodology of Generic Letter 95-05 for intersections at the flow distribution baffles, at the applicable cold leg support plates, and at the hot leg support plates N L through R; and

REACTOR COOLANT SYSTEM

STEAM GENERATORS

SURVEILLANCE REQUIREMENTS (Continued)

Info added from
WCAP
Table 2-2

b) The methodology of Generic Letter 95-05 modified for potential overpressurized tubes as described in WCAP-15163, Revision 1, for hot leg intersections at support plates C, F, and J.

- 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 1×10^{-2} , notify the NRC and provide an assessment of the safety significance of the occurrence. The calculation(s) shall be done using:

Bounding calculation

a) The methodology of Generic Letter 95-05 for intersections at the flow distribution baffles, at the applicable cold leg support plates, and at the hot leg support plates N, L through R; and

b) A total main steam line break tube burst probability of 1×10^{-5} ~~1.7×10^{-4}~~ for hot leg intersections at support plates C, F, and J.

Info added from
WCAP
Table 2-2

NRC
comment

6) If cracking is observed in the tube support plates.

7) If steam generator internals inspections are conducted and if indications detrimental to the integrity of the load path necessary to support the 3-volt alternate repair criteria are found, notify the NRC and provide an assessment of the safety significance of the occurrence.

Info added from
WCAP
Table 2-2

e. For Model E steam generators, submit a report to the Staff that addresses "Information to be Provided Following Each Restart" per Generic Letter 95-05, 6.b, within 90 days following outage breaker closure.

**NO CHANGES
ON THIS PAGE**REACTOR COOLANT SYSTEMBASESRELIEF VALVES (Continued)

- C. Manual control of the block valve to: (1) unblock an isolated PORV to allow it to be used for manual control of reactor coolant system pressure (Item A), and (2) isolate the PORV with excessive seat leakage (Item B).
- D. Manual control allows a block valve to isolate a stuck-open PORV.

3/4.4.5 STEAM GENERATORS

The Surveillance Requirements for inspection of the steam generator tubes ensure that the structural integrity of this portion of the RCS will be maintained. The program for inservice inspection of steam generator tubes is based on a modification of Regulatory Guide 1.83, Revision 1. Inservice inspection of steam generator tubing is essential in order to maintain surveillance of the conditions of the tubes in the event that there is evidence of mechanical damage or progressive degradation due to design, manufacturing errors, or inservice conditions that lead to corrosion. Inservice inspection of steam generator tubing also provides a means of characterizing the nature and cause of any tube degradation so that corrective measures can be taken.

The plant is expected to be operated in a manner such that the secondary coolant will be maintained within those chemistry limits found to minimize corrosion of the steam generator tubes. If the secondary coolant chemistry is not maintained within these limits, localized corrosion may likely result in stress corrosion cracking. The extent of cracking during plant operation would be limited by the 3.4.6.2.c limitation of steam generator tube leakage between the Reactor Coolant System and the Secondary Coolant System. Cracks having a primary-to-secondary leakage less than this limit during operation will have an adequate margin of safety to withstand the loads imposed during normal operation and by postulated accidents. Operating plants have demonstrated that primary-to-secondary leakage as low as 150 gallons per day per steam generator can readily be detected. Leakage in excess of this limit will require plant shutdown and an unscheduled inspection, during which the leaking tubes will be located and plugged or (for Model E steam generators only) repaired. Defective tubes in Model E steam generators may be repaired by a Westinghouse laser welded sleeve. The technical bases for sleeving repair are described in Westinghouse Reports WCAP-1 3698, Revision 2, "Laser Welded Sleeves for 3/4 - Inch Diameter Tube Feeding-Type and Westinghouse Preheater Steam Generators, April 1995 and WCAP-14653, "Specific Application of Laser Welded Sleeves for South Texas Project Power Plant Steam Generators," June 1996.

Wastage-type defects are unlikely with proper chemistry treatment of the secondary coolant. However, even if a defect should develop in service, it will be found during scheduled inservice steam generator tube examinations. Except as discussed below, plugging or (for Model E steam generators only) repair will be required for all tubes with imperfections exceeding the plugging or repair limit of 40% of the original tube nominal wall thickness. If a tube contain's a Westinghouse laser welded sleeve with imperfection exceeding 40% of nominal wall thickness, it must be plugged. The basis for the sleeve plugging limit for Model E steam generators is based on Regulatory Guide 1.121 analysis, and is described in the Westinghouse sleeving technical reports listed above. Steam generator tube inspections of operating

REACTOR COOLANT SYSTEM

BASES

STEAM GENERATORS (Continued)

plants have demonstrated the capability to reliably detect degradation that has penetrated 20% of the original tube wall thickness. Repaired tubes are also included in the inservice tube inspection program.

For Model E steam generators only, the voltage-based repair limits of SR 4.4.5 implement the guidance in GIL 95-05 and are applicable only to Westinghouse-designed steam generators (SGs) with outside diameter stress corrosion cracking (ODSCC) located at the tube-to-tube support plate intersections. The criteria of GIL 95-05 are also applicable to the Unit 2 flow distribution plate intersections. The voltage-based repair limits are not applicable to other forms of SG tube degradation nor are they applicable to ODSCC that occurs at other locations within the SG. Additionally, the repair criteria apply only to indications where the degradation mechanism is dominantly axial ODSCC with no significant cracks extending outside the thickness of the support plate. Refer to GIL 95-05 for additional description of the degradation morphology.

Implementation of SR 4.4.5 for Model E steam generators requires a derivation of the voltage structural limit from the burst versus voltage empirical correlation and then the subsequent derivation of the voltage repair limit from the structural limit (which is then implemented by this surveillance).

The voltage structural limit is the voltage from the burst pressure/bobbin voltage correlation, at the 95-percent prediction interval curve reduced to account for the lower 95/95-percent tolerance bound for tubing material properties at 650°F (i.e., the 95-percent LTL curve). The voltage structural limit of the tube at flow distribution baffle intersections, (which have large tube to plate clearances) is based on a $3\Delta P_{NO}$ structural margin. For tubes at the cold leg tube support plate intersections and the hot leg intersections at plates ~~N~~_L through R for which the small clearances provide constraint against tube burst during normal operation, the structural limit is based on a $1.43\Delta P_{SLB}$ structural margin. For the hot leg intersections at plates C, F, and ~~J~~_L and ~~M~~ with the limited displacement of the lower tube support plates demonstrated by analyses in WCAP-15163, Rev. 1, the constraint of the tube support plate reduces the burst probability of those tubes having axially oriented ODSCC indications that are confined within the tube support plate to negligible levels and the tube repair limit is not required to prevent tube burst. The need for tube repair is dictated by the need to satisfy allowable steam line break leakage limits.

Bounding calculation

For those intersections where the possibility of tube burst must be considered (i.e., at the flow distribution baffle, at cold leg intersections, and at the hot leg intersections at plates ~~N~~_L through R), the voltage structural limit must be adjusted downward to obtain the upper voltage repair limit to account for potential flaw growth during an operating interval and to account for NDE uncertainty. The upper voltage repair limit; V_{URL} , is determined from the structural voltage limit by applying the following equation:

$$V_{URL} = V_{SL} - V_{GR} - V_{NDE}$$

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REACTOR COOLANT SYSTEM

BASES

STEAM GENERATORS (Continued)

where V_{GR} represent the allowance for flaw growth between inspections and V_{NDE} represents the allowance for potential sources of error in the measurement of the bobbin coil voltage. Further discussion of the assumptions necessary to determine the voltage repair limit are discussed in GL 95-05.

The mid-cycle equation in SR 4.4.5.4.a. 11.e should only be used during unplanned inspections of Model E steam generators in which eddy current data is acquired for indications at the tube support plates.

SR 4.4.5.5 implements several reporting requirements for Model E steam generators recommended by GL 95-05 for situations which the NRC wants to be notified prior to returning the SGs to service. For the purpose of this reporting requirement, leakage and conditional burst probability can be calculated based on the as-found voltage distribution rather than the projected end-of-cycle voltage distribution (refer to GL 95-05 for more information) when it is not practical to complete these calculations using the projected EOC voltage distributions prior to returning the SGs to service. Note that if leakage and conditional burst probability were calculated using the EOC voltage distribution for the purposes of addressing the GL section 6.a.1 and 6.a.3 reporting criteria, then the results of the projected EOC voltage distribution should be provided per the GL section 6.b.(c) criteria.

Whenever the results of any steam generator tubing inservice inspection fall into Category C-3, these results will be promptly reported to the Commission in a Special Report pursuant to Specification 6.9.2 within 30 days -and 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.

3/4.4.6 REACTOR COOLANT SYSTEM LEAKAGE

3/4.4.6.1 LEAKAGE DETECTION SYSTEMS

The RCS Leakage Detection Systems required by this specification are provided to monitor and detect leakage from the reactor coolant pressure boundary. These Detection Systems are consistent with the recommendations of Regulatory Guide 1.45, "Reactor Coolant Pressure Boundary Leakage Detection Systems," May 1973.

3/4.4.6.2 OPERATIONAL LEAKAGE

PRESSURE BOUNDARY LEAKAGE of any magnitude is unacceptable since it may be indicative of an impending gross failure of the pressure boundary. Therefore, the presence of any PRESSURE BOUNDARY LEAKAGE requires the unit to be promptly placed in COLD SHUTDOWN.

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REACTOR COOLANT SYSTEM

BASES

OPERATIONAL LEAKAGE (Continued)

Industry experience has shown that while a limited amount of leakage is expected from the RCS, the unidentified portion of this leakage can be reduced to a threshold value of less than 1 gpm. This threshold value is sufficiently low to ensure early detection of additional leakage.

The leakage limits incorporated into SR 4.4.6 are more restrictive than the standard operating leakage limits and were implemented in conjunction with the application of voltage-based repair criteria and laser-welded sleeving to Model E steam generators. They were intended to provide an additional margin to accommodate a crack which might grow at a greater than expected rate or unexpectedly extend outside the thickness of the tube support plate. Hence, the reduced leakage limit, when combined with an effective leak rate monitoring program, provides additional assurance that should a significant leak be experienced in service, it will be detected, and the plant shut down in a timely manner. The additional margin provided by the reduced leakage limit will be retained with the D94 steam generators.

The steam generator tube leakage limit of 150 gpd for each steam generator not isolated from the RCS ensures that the dosage contribution from the tube leakage will be limited to a small fraction of 10 CFR Part 100 dose guideline values in the event of either a steam generator tube rupture or steam line break. The 150 gpd limit per steam generator is conservative compared to the assumptions used in the analysis of these accidents. The 150 gpd leakage limit per steam generator ensures that steam generator tube integrity is maintained in the event of a main steam line rupture or under LOCA conditions.

The 10 gpm IDENTIFIED LEAKAGE limitation provides allowance for a limited amount of leakage from known sources whose presence will not interfere with the detection of UNIDENTIFIED LEAKAGE by the Leakage Detection Systems.

The specified allowed leakage from any RCS pressure isolation valve is sufficiently low to ensure early detection of possible inseries check valve failure. It is apparent that when pressure isolation is provided by two inseries check valves and when failure of one valve in the pair can go undetected for a substantial length of time, verification of valve integrity is required. Since these valves are important in preventing overpressurization and rupture of the ECCS low pressure piping which could result in a LOCA that bypasses containment, these valves should be tested periodically to ensure low probability of gross failure.

The Surveillance Requirements for RCS pressure isolation valves provide added assurance of valve integrity thereby reducing the probability of gross valve failure and consequent intersystem LOCA. Leakage from the RCS pressure isolation valve is IDENTIFIED LEAKAGE and will be considered as a portion of the allowed limit.

3/4.4.7 CHEMISTRY

The limitations on Reactor Coolant System chemistry ensure that corrosion of the Reactor Coolant System is minimized and reduces the potential for Reactor Coolant System leakage or failure due to stress corrosion. Maintaining

Table 4.4-2

STEAM GENERATOR TUBE INSPECTION

| 1ST SAMPLE INSPECTION | | | 2ND SAMPLE INSPECTION | | 3RD SAMPLE INSPECTION | |
|-------------------------------|--------|--|---|--|---|--------------------------------|
| Sample Size | Result | Action Required | Result | Action Required | Result | Action Required |
| A minimum of 5 Tubes per S.G. | C-1 | None | N.A. | N.A. | N.A. | N.A. |
| | C-2 | Plug or repair defective tubes and inspect additional 2S tubes in this S.G. | C-1 | None | N.A. | N.A. |
| | | | C-2 | Plug or repair defective tubes and inspect additional 4S tubes in this S.G. | C-1 | None |
| | | | C-2 | Plug or repair defective tubes | C-2 | Plug or repair defective tubes |
| | | | C-3 | | Perform action for C-3 result of first sample | |
| | C-3 | Perform action for C-3 result of first sample | N.A. | N.A. | | |
| | C-3 | Inspect all tubes in this S.G., plug or repair defective tubes and inspect 2S tubes in each other S.G. Notification to NRC pursuant to 50.72 (b)(2) of 10 CFR Part 50. Notify NRC pursuant to 10CFR50.72(3)(ii) | All other S.G.s are C-1 | None | N.A. | N.A. |
| | | | Some S.G.s C-2 but no additional S.G. are C-3 | Perform action for C-2 result of second sample | N.A. | N.A. |
| | | | Additional S.G. is C-3 | Inspect all tubes in each S.G. and plug or repair defective tubes. Notification to NRC pursuant to 50.72 (b)(2) of 10 CFR Part 50. Notify NRC pursuant to 10CFR50.72(3)(ii) | N.A. | N.A. |

where N is the number of steam generators in the Unit, and n is the number of steam generators inspected during an inspection:

$$S = 3 \frac{N}{n}$$

Notify NRC pursuant to 10CFR50.72(3)(ii)

Table 4.4-3

MODEL E STEAM GENERATOR REPAIRED TUBE INSPECTION

| 1ST SAMPLE INSPECTION | | | 2ND SAMPLE INSPECTION | |
|---|--------|---|--|---|
| Sample Size | Result | Action Required | Result | Action Required |
| A minimum of 20% of repaired tubes ⁽¹⁾ | C-1 | None | N.A. | N.A. |
| | C-2 | Plug defective repaired tubes and inspect 100% of the repaired tubes in this S.G. | C-1 | None |
| | | | C-2 | Plug defective repaired tubes |
| | | | C-3 | Perform action for C-3 result of first sample |
| | C-3 | Inspect all repaired tubes in this S.G., plug defective repaired tubes and inspect 20% of the repaired tubes in each other S.G. Notification to NRC pursuant to 50.72 (b)(2) of 10 CFR Part 50. Notify NRC pursuant to 10CFR50.72(3)(ii) | All other S.G.s are C-1 | None |
| | | | Some S.G.s C-2 but no additional S.G. are C-3 | Perform action for C-2 result of first sample |
| Additional S.G. is C-3 | | | Inspect all repaired tubes in each S.G. and plug defective repaired tubes. Notification to NRC pursuant to 50.72 (b)(2) of 10 CFR Part 50. Notify NRC pursuant to 10CFR50.72(3)(ii) | |

⁽¹⁾ Each repair method is considered a separate population for determination of scope expansion.