Tennessee Valley Authority, Post Office Box 2000, Soddy-Daisy, Tennessee 37384-2000

February 15, 2005

TVA-SQN-TS-03-06 10 CFR 50.90

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555-0001

Gentlemen:

In the Matter of)
Tennessee Valley Authority)

Docket No. 50-328

SEQUOYAH NUCLEAR PLANT (SQN) - UNIT 2 - TECHNICAL SPECIFICATIONS (TS) CHANGE 03-06 - CHANGE INSPECTION SCOPE FOR STEAM GENERATOR (SG) TUBES - REVISED REQUEST

Reference: TVA letter to NRC dated December 2, 2004, "Sequoyah Nuclear Plant (SQN) - Unit 2 - Technical Specifications (TS) Change 03-06 - Change Inspection Scope for Steam Generator (SG) Tubes"

TVA is submitting a revised request for TS change 03-06 to license DPR-79 for Unit 2. The enclosed partially addresses questions provided by the technical staff from their review of the referenced letter. The changes to the TSs include deletion of the type of probe to be used in the inspections of the W* distance, correct the reference to Generic Letter 95-05, change the definition of the W* distance, and include specific reporting requirements for the 90-day report.

A001

The description and technical justification sections, as well as the proposed TS and associated bases changes, are included in their entirety. A revision bar in the right-hand margin will identify the location of the changes.

The Regulatory Safety Analysis, including the no significant hazard determination, and Environmental Considerations were not affected by the changes; therefore, they are not included in this submittal.

The remaining staff questions regarding the referenced submittal are being addressed in separate submittals being prepared in parallel. TVA previously requested approval of this TS change by March 1, 2004. A revised approval date of early April 2005 is requested to support the next Unit 2 refueling outage scheduled to start later in April 2005. There are no commitments contained in this submittal.

If you have any questions about this change, please contact me at (423) 843-7170 or Jim Smith at (423) 843-6672.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 15th day of February 2005.

Sincerely,

Paul Pace
Manager, Site Licensing and
Industry Affairs

Enclosures
1. TVA Evaluation of the Proposed Changes
2. Proposed Technical Specifications Changes (mark-up)
3. Changes to Technical Specifications Bases Pages (Optional)

cc: See page 3

Enclosures
cc (Enclosures):

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ENCLOSURE 1

TENNESSEE VALLEY AUTHORITY
SEQUOYAH NUCLEAR PLANT (SQN)
UNIT 2

1.0 DESCRIPTION

This letter is a request to amend Operating License DPR-79 for Sequoyah Unit 2. The proposed changes revise Unit 2 Technical Specification (TS) 3/4.4.5, "Steam Generators," to change the scope of the steam generator (SG) tube sheet inspections required in the SG tubesheet region using the W* methodology (W* is defined in WCAP-14797, Revision 2). Specifically, the proposed change will revise the Unit 2 TS definition for SG tube inspection included in SQN TS Surveillance Requirement (SR) 4.4.5.4.a.8 to revise the definition to exclude the portion of the tube within the tubesheet below the W* distance. The proposed change will revise SR 4.4.5.4.a.6 on SG tube repair criteria, add SR 4.4.5.2.e to require a 100 percent inspection of the hot-leg tubesheet W* distance, add new W* terminology definitions in SR 4.4.5.4.a.11, and add new reporting criteria for W* inspection information in SRs 4.4.5.5.d.1 and 4.4.5.5.e. The SQN Unit 2 proposed change requires that any tube identified with service induced degradation in the W* distance below the top-of-tube sheet (TTS), will be plugged. The change requires an account for postulated indications below the W* distance and their contribution to leakage. SQN proposes to plug any service induced degradation within the W* distance. This proposal is a conservative limited scope application of the complete W* methodology as described in WCAP-14797, Revision 2.

We are also removing the previously approved primary water stress corrosion cracking (PWSCC) alternate repair criteria (ARC) as it expired at the end of Cycle 12 operation and further justification for its extension will not be pursued. The PWSCC ARC was not utilized on Unit 2.

TVA is submitting this TS change request in response to Generic Letter 2004-001 "Requirements for Steam Generator Tube Inspections."

2.0 PROPOSED CHANGE

The following changes are proposed to SQN Unit 2 TSs:

1. Add TS 4.4.5.2.e to provide a new requirement for a 100 percent inspection of the hot-leg tubesheet W* distance and to remove the axial PWSCC at dented tube support plate ARC.
2. Revise TS 4.4.5.4.a.6 to change the current definition of "Plugging Limit" to account for plugging all service induced degradation in the W* distance, and delete the axial PWSCC at dented tube support plate (TSP) ARC.
3. Revise TS 4.4.5.4.a.8, "Tube Inspection" definition to remove the revision made for Cycle 12 operation only, and to change the wording to exclude the portion the tube below the W* distance.
4. Replace TS 4.4.5.4.a.11 "PWSCC Tube Support Plate Plugging Limit" definition with definitions associated with W*.
5. Revise TS 4.4.5.5.d.1 to include reporting requirements for W* postulated leakage.
6. Replace TS 4.4.5.5.e by removing the reporting requirements for axial PWSCC at dented TSP and replacing with new reporting requirements for W*.
7. Revise Note 2 on page 3/4 4-14a to correct a typographical error. The note should have referenced Generic Letter 95-05 not 90-05.
8. Revise Bases 3/4.4.5 to add information that explains the basis for the W* criteria and removes information related to ARC for axial PWSCC at dented TSP.

In summary, this change removes the ARC for axial PWSCC at dented TSP and replaces it with requirements associated with the W* methodology for tubesheet inspections.

3.0 BACKGROUND

Existing plant TS tube repair/plugging criteria apply throughout the tube length and do not take into account the reinforcing effect of the tubesheet on the external surface of an expanded tube. The presence of the tubesheet constrains the tube and complements tube integrity in that region by essentially precluding tube deformation beyond the expanded outside diameter. The resistance to both tube rupture and tube collapse is significantly enhanced by the tubesheet. In addition, the proximity of the tubesheet in the expanded region significantly reduces the leakage of through wall tube cracks. Based on these considerations, the

establishment of W* methodology criteria to the portion of tubing expanded by Westinghouse explosive tube expansion is supported by testing and analysis results included in WCAP-14797, Revision 2.

The W* methodology provides the basis for tubes with any form of degradation below the W* length to remain in service. In addition, any primary to secondary leakage from tube degradation below the W* length is determined to be acceptably low as discussed in Enclosure 5.

As discussed in more detail in Enclosure 5, the generic W* methodology contained in WCAP-14797, Revision 2 is applicable to the SQN Unit 2 SGs and it defines the hot-leg W* length for pullout resistance as 7.0 inches below the bottom of the WEXTEX transition. SQN has chosen to use the 7.0 inches length in this request since it is the more conservative of the two listed lengths (5.2 inches for Zone A and 7.0 inches for Zone B) specified in WCAP-14797.

Since SQN proposes to inspect and repair any service induced degradation within the W* distance, this proposal is a conservative limited scope application of the complete W* methodology as described in WCAP-14797, Revision 2. TVA conservatively defines the W* distance as 8.0-inches below the top of the tubesheet. Therefore, TVA will inspect to 8-inches below the top of the tubesheet or the distance defined in WCAP-14797, Revision 2 whichever is greater.

SQN Unit 2 does not use WCAP-14797, Revision 2 to leave tubes degraded within the W* distance in service via the W* methodology. SQN's proposed change requires that any service induced degradation identified in the W* distance be plugged. The WCAP is only used to define the length of tubing that will be inspected to remove degraded tubes from service by plugging. This proposal implements the following W* repair criteria and acceptance criteria:

1. All service-induced indications within the W* distance below the TTS, will be plugged.
2. Any type or combination of tube degradation below the W* distance is acceptable.

SQN proposes to postulate additional leakage below the W* distance to be included in the total SQN Unit 2 steam line break (SLB) leak rate during postulated SLB conditions as described in Enclosure 5.

For the first inspection utilizing the criteria, SQN will base the projections on site-specific data detailed in Enclosure 5. Twenty-five percent of the total historical

indication count and End of Cycle (EOC)-13 projected indication count will be assumed to reside between 8 and 12 inches below TTS. To date, 138 total indications have been reported, only 25 of which were circumferentially oriented. A regression analysis using the data suggests that approximately 23 indications are expected for the EOC-13 outage. Using only the last four outages' data, 25 indications are anticipated.

Therefore, the cumulative SQN Unit 2 total number of indications including the EOC-13 projection is a maximum of 163 (138 + 25). An additional 41 indications (25 percent of combined historical indications plus EOC-13 new indications) might be observed if the inspection distance were increased from 8 to 12 inches below TTS.

Note that this analysis is provided to estimate the number of indications between 8 and 12 inches below TTS using existing data. TVA will continue to evaluate this methodology of predicting indications to ensure that it is conservative. PWSCC data from each subsequent outage inspection will be used. If this methodology continues to be conservative, future predictions will be made using the same methodology as described in this submittal. If this methodology is determined to be non-conservative, TVA will make necessary changes and discuss these corrective actions in the 90-day report.

Because of recent NRC questions, the following topics are included in Enclosure 5:

- Basis supporting the validity of the original conclusion presented by WCAP-14797, Revision 2 that postulated circumferential degradation below the W* distance would not produce leakage at SLB conditions
- SLB conditions leakage potential from axial PWSCC within W* distance
- SQN Unit 2 inspection history and industry experience
- The impact of locked tubes on W*
- The impact of tubesheet bow on pullout and leak-rate testing
- Tubesheet finite element modeling
- Ligament tearing
- No contact length for normal/postulated accident conditions
- Tube radial contraction effects
- The leakage model included in WCAP-14797, Revision 2
- Secondary to primary leakage following a postulated loss-of-coolant accident (LOCA)

- Consistency of different industry leak-rate results
- How leak model addresses 360 degree circumferential cracks
- Leak-rate loss coefficient

4.0 TECHNICAL ANALYSIS

SQN is proposing to modify the Unit 2 TSs to revise SRs 4.4.5.4.a.6, 4.4.5.4.a.8, and 4.4.5.5.d.1, add SR 4.4.5.2.e, and replace SRs 4.4.5.4.a.11 and 4.4.5.5.e.

SR 4.4.5.4.a.8 defines SG tube inspection scope. SQN's proposed change alters the tube inspection scope to exclude the portion of the tube within the tubesheet below the W* distance. SR 4.4.5.4.a.6 provides SG tube repair criteria.

SQN's proposed change requires repair of any service induced degradation identified in the W* distance below the TTS. The amendment is based on the Westinghouse WCAP-14797, Revision 2. Since SQN proposes to repair any service induced degradation within the W* distance, this proposal is a conservative limited scope application of the complete W* methodology as described in WCAP-14797, Revision 2. The WCAP was developed for Westinghouse fabricated SGs that utilized the WEXTEX tube expansion process for application of W* methodology. The W* methodology accounts for the reinforcing effect that the tubesheet has on the external surface of the SG tube within the tubesheet region. The W* methodology shows that tube integrity and leakage below the W* distance remain within the existing design limits. The W* criteria were developed for the tubesheet region of 51 Series SGs considering the most stringent loads associated with plant operation, including transients and postulated accident conditions. The W* criteria were selected to prevent tube burst and axial separation due to axial pullout forces acting on the tube, and to ensure that the SLB leakage limits are not exceeded.

Constraint provided by the tubesheet precludes tube burst for cracks within the tubesheet. Thus, the NRC Draft Regulatory Guide (RG) 1.121 criteria are satisfied by the tubesheet constraint. Therefore, within the tubesheet, crack lengths do not need to be limited by burst considerations, and the current 150 gallons per day leakage limit does not need to be changed.

Conceivably, a 360 degree through-wall circumferential crack or a significant number of axially oriented cracks could permit severing of the tube and tube pullout from the tubesheet when the tube is subjected to axial forces from

primary-to-secondary pressure differentials. The W* criteria were developed to allow certain tubes with indications in the tubesheet region of the tubesheet to remain in service, while precluding tube pullout from the tubesheet under axial loading conditions. A non-degraded W* length is required such that the tube-to-tubesheet contact pressures integrated over the W* length are sufficient to compensate for the axial forces on the tube, thus preventing tube pullout.

Loading analyses were conducted per the requirements of RG 1.121 for both the 3 times the difference between main steam pressure and reactor coolant pressure (3ΔP) at normal operating load and the limiting faulted condition load (with the applicable safety factor applied). To prevent pullout, these loads must be reacted by the axial restraint afforded by the contact pressure between the tube and tubesheet times the friction coefficient of the tube-to-tubesheet interface acting over some interface length. Contact pressure between the tube and tubesheet is a function of the WEXTEX expansion pressure, and primary-to-secondary pressure and temperature differentials. The W* length is defined to be the length of tube that provides assurance that tube pullout criteria are met with an appropriate safety factor for the most limiting loading scenario. The WCAP-14797, Revision 2 bounding generic methodology parameters used in the calculation of the W* length are conservative for Sequoyah Unit 2.

The generic W* methodology detailed in WCAP-14797, Revision 2 is applicable to the SQN SGs and defines the maximum hot-leg W* lengths for pullout resistance as 7.0 inches below the bottom of the WEXTEX transition. These distances are increased by an allowance for Non-Destructive Examination (NDE) uncertainties in measuring the W* length. The NDE uncertainty on the W* length in WCAP-14797, Revision 2 is 0.12 inch. The W* methodology provides the basis for tubes with any form of degradation below the W* distance to remain in service. This includes a tube with a 360 degree circumferential through-wall crack located just below the W* distance, which would still not be pulled out by the worst-case main SLB axial loads on the tube. The presence of the surrounding tubesheet prevents tube rupture and provides resistance against axial pullout loads during normal and accident conditions. In addition, any primary-to-secondary leakage from tube degradation below the W* distance contributes less than 5 percent of the total leakage assumed for a postulated SLB accident and may be considered negligible. Consequently, any tube degradation that may go undetected in this area would not affect structural or leakage margins. TVA conservatively defines the W* distance as 8.0-inches below the top-of-tubesheet.

To reduce the probability and consequences of SG tube rupture or tube failure, SQN performs examinations in critical regions for crack like indications. These critical regions are based on a degradation assessment where potential and active degradation is expected in SG tubes that could challenge structural and/or leakage integrity if the tubes are not taken out of service by repair.

The critical region of the tubes in the tube-to-tubesheet expansion in Westinghouse Model 51 SGs with WEXTEX explosive expansions is defined as the W* length. The W* length is defined for SQN Unit 2 in WCAP-14797, Revision 2, considering the most stringent loads associated with plant operation, including transients, and accident conditions. The W* distance is the required inspected length as measured downward from the TTS including the distance to the Bottom of WEXTEX Transition (BWT) and includes the NDE uncertainty.

SQN Unit 2 does not use WCAP-14797, Revision 2 to leave tubes degraded within the W* distance in service via the W* methodology. SQN's proposed change requires that any service induced degradation identified in the W* distance be plugged. The WCAP is only used to define the length of tubing that will be inspected to remove degraded tubes from service by plugging.

Operating experience has demonstrated negligible normal operating leakage from PWSCC even under free span conditions in roll transitions. PWSCC in WEXTEX expansion in the tubesheet region would be even further leakage limited by the tight tube-to-tubesheet crevice and the limited crack opening permitted by the tubesheet constraint. The SLB conditions provide the most stringent radiological hazards for postulated accidents involving loss of pressure or fluid in the secondary system. WCAP-14797, Revision 2 describes the methodology for calculating leakage for all cracks left in service and the justification to neglect the total SLB leak rate contributed by cracks below the W* distance. Therefore, inspection in the area below the W* distance is not necessary to preclude normal operating or accident induced leakage.

The above discussion states that there will be negligible leakage from any type of degradation below the W* distance, even under SLB conditions. SQN proposes to postulate additional leakage below the W* distance to be included in the total SQN Unit 2 SLB leak rate during postulated SLB conditions.

ENCLOSURE 2

TENNESSEE VALLEY AUTHORITY
SEQUOYAH NUCLEAR PLANT (SQN)
UNIT 2

Proposed Technical Specification Changes (mark-up)

I. AFFECTED PAGE LIST

Unit 2

3/4.4-11
3/4.4-13
3/4.4-14a
3/4.4-14b
3/4.4-14c

II. MARKED PAGES

See attached.

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. ~~Inspection of dented tube support plate intersections will be performed in accordance with WCAP-15128, Revision 2, dated February 2000 as supplemented by TVA's letter to NRC dated March 2, 2000. This alternate repair criteria is applicable to Cycle 11 and 12 operation.~~

The results of each sample inspection shall be classified into one of the following three categories:

Category	Inspection Results
C-1	Less than 5% of the total tubes inspected are degraded tubes and none of the inspected tubes are defective.

Implementation of the steam generator WEXTEX expanded region inspection methodology (W*) requires a 100 percent inspection of the hot leg tubesheet W* distance.

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. ~~For Cycle 11 and 12 operation, this definition does not apply for axial PWSCC indications, or portions thereof, which are located within the thickness of dented tube support plates which exhibit a maximum depth greater than or equal to 40 percent of the initial tube wall thickness. Refer to 4.4.5.4.a.11 for the repair limits applicable to these intersections.~~ [Delete] Insert 1

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 ~~5.5 inches (as measured from the top of the tubesheet).*~~ [Delete] Insert 2

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.

~~* This exclusion is for Unit 2 Cycle 12 operation only.~~ [Delete]

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
Δt	=	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 ~~90~~ -05 as supplemented. V_{URL} may differ at the TSPs and flow distribution baffle.

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11. ~~Primary Water Stress Corrosion Cracking (PWSCC) Tube Support Plate Plugging Limit is used for the disposition of an Alloy 600 steam generator tube for continued service that is experiencing predominantly axially oriented PWSCC at dented tube support plate intersections as described in WCAP 15128, Revision 2, dated February 2000 as supplemented by TVA's letter to NRC dated March 2, 2000. This alternate repair criteria is applicable to Cycle 11 and 12 operation.~~

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.

Delete and replace with Insert 3

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. 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. ← Insert 4

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 X 10^{-2}, notify the NRC and provide an assessment of the safety significance of the occurrence.

SURVEILLANCE REQUIREMENTS (Continued)

e. ~~For implementation of the depth-based repair criteria for axial PWSCC at dented TSPs, the results of the condition monitoring and operational assessments will be reported to the NRC within 120 days following completion of the inspection. The report will include tabulations of indications found in the inspection, tabulations of tubes repaired and left in service under the ARC, and growth rate distributions for indications found in the inspection as well as the growth distributions used to establish the tube repair limits. Any corrective actions found necessary in the event that condition monitoring requirements are not met will be identified in the report.~~

Insert 5

Insert 1

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.

Insert 2

the W* distance, the tube to tubesheet weld and the tube end extension.

Insert 3

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) W* Distance is defined in WCAP-14797, Revision 2, as the non-degraded distance from the top of the tubesheet to the bottom of the W* length including the distance from the top of the tubesheet to the bottom of the WEXTEX transition (BWT) and Non-Destructive Examination (NDE) measurement uncertainties (i.e., W* distance = W* length + distance to BWT + NDE uncertainties). TVA conservatively defines the W* distance as 8.0-inches below the top of the tubesheet. Therefore, TVA will inspect to 8-inches below the top of the tubesheet or the distance defined in WCAP-14797, Revision 2 whichever is greater.
    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.

Insert 4

The postulated leakage resulting from the implementation of the voltage-based repair criteria to tube support plate intersections shall be combined with the postulated leakage resulting from the implementation of the W* criteria to tubesheet inspection depth.

Insert 5

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, 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).

ENCLOSURE 3

TENNESSEE VALLEY AUTHORITY
SEQUOYAH NUCLEAR PLANT (SQN)
UNIT 2

Changes to Technical Specifications Bases Pages

I. AFFECTED PAGE LIST

Unit 2

B 3/4.4-3a

B 3/4.4-3b

II. MARKED PAGES

See attached.

where V_{GR} represents 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 of SR 4.4.5.4.a.10.e should only be used during unplanned inspection in which eddy current data is acquired for indications at the tube support plates.

SR 4.4.5.5 implements several reporting requirements recommended by GL 95-05 for situations which NRC wants to be notified prior to returning the S/Gs to service. For SR 4.4.5.5.d., Items 3 and 4, indications are applicable only where alternate plugging criteria is being applied. For the purposes 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 S/Gs to service. Note that if leakage and conditional burst probability were calculated using the measured EOC voltage distribution for the purposes of addressing GL Sections 6.a.1 and 6.a.3 reporting criteria, then the results of the projected EOC voltage distribution should be provided per GL Section 6.b(c) criteria.

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. Plugging will be required for all tubes with imperfections exceeding the repair limit defined in Surveillance Requirement 4.4.5.4.a. The portion of the tube that the plugging limit does not apply to is the portion of the tube that is not within the RCS pressure boundary (tube end up to the start of the tube-to-tubesheet weld). The tube end to tube-to-tubesheet weld portion of the tube does not affect structural integrity of the steam generator tubes and therefore indications found in this portion of the tube will be excluded from the Result and Action Required for tube inspections. It is expected that any indications that extend from this region will be detected during the scheduled tube inspections. Steam generator tube inspections of operating plants have demonstrated the capability to reliably detect degradation that has penetrated 20% of the original tube wall thickness.

Tubes experiencing outside diameter stress corrosion cracking within the thickness of the tube support plate are plugged or repaired by the criteria of 4.4.5.4.a.10.

~~The steam generator tube repair limits for primary water stress corrosion cracking (PWSCC) of SR 4.4.5 represents a steam generator tube alternate repair criteria for greater than or equal to 40 percent deep PWSCC indications which are located within the thickness of tube support plates. The repair bases for PWSCC are not applicable to other types of localized tube wall degradation located at the tube-to-tube support plate intersections.~~

~~The ARC includes completion of a condition monitoring assessment to determine the end-of-cycle (EOC) condition of the tube bundle. An operational assessment is completed to determine the need for tube repair on a forward-fit basis. The ARC is based on the use of crack depth profiles obtained from Plus Point analyses. Burst pressures and leak rates are calculated from depth profiles by searching the total crack length for the partial length that~~

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Insert A

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~~results in the lowest burst pressure and the longest length that would tear through-wall at steam line break conditions. The repair bases for PWSCC at dented TSP intersections is obtained by projecting the crack profile to the end of the next operating cycle and determining if the projected profile meets the requirements of WCAP 15128, Revision 2, dated February 2000 as supplemented by TVA's letter to NRC dated March 2, 2000. The following provides the limits and bases for repair established in the WCAP analyses:~~

~~Freespan Indication Repair Limits~~

~~The tube will be repaired if the crack length outside the dented TSP is ≥40% maximum depth.~~

~~Crack Length Limit for ≥40% Maximum Depth~~

~~The crack length limit for ≥40% maximum depth indications is defined as 0.375 inch from the centerline of the TSP. This limit defines the edges of the TSP thickness of 0.75 inch for Model 51 S/Gs. It is acceptable for the crack to extend to both edges of the TSP as long as the maximum depth of the crack outside the TSP is <40% maximum depth and the requirements for EOC conditions are acceptable.~~

~~Operational Assessment Repair Bases~~

~~If the indication satisfies the above maximum depth and length requirements, the repair bases is then obtained by projecting the crack profile to the end of the next operating cycle and determining the burst pressure and leakage for the projected profile. The burst pressure and leakage is compared to the requirements in WCAP 15128, Revision 2, dated February 2000 as supplemented by TVA's letter to NRC dated March 2, 2000. Separate analyses are required for the total crack length and the length outside the TSP due to differences in requirements. If the projected EOC requirements are satisfied, the tube will be left in service.~~

~~The results of the condition monitoring and operational assessments will be reported to the NRC within 120 days following completion of the inspection.~~

Insert A

The W* criteria incorporate the guidance provided in WCAP-14797, Revision 2, "Generic W* Tube Plugging Criteria for 51 Series Steam Generator Tubesheet Region WEXTEX Expansions." W* length is the length of tubing into the tubesheet below the bottom of the WEXTEX transition (BWT) that precludes tube pullout in the event of a complete circumferential separation of the tube below the W* length. W* distance is the distance from the top of the tubesheet to the bottom of the W* length including the distance from the top of the tubesheet to the BWT and measurement uncertainties. TVA conservatively defines the W* distance as 8.0-inches below the top of the tubesheet. Therefore, TVA will inspect to 8-inches below the top of the tubesheet or the distance defined in WCAP-14797, Revision 2 whichever is greater.

Indications detected within the W* distance below the top-of-tube sheet (TTS), will be plugged upon detection. Tubes to which WCAP-14797 is applied can experience through-wall degradation up to the limits defined in Revision 2 without increasing the probability of a tube rupture or large leakage event. Tube degradation of any type or extent below W* distance, including a complete circumferential separation of the tube, is acceptable. As applied at Sequoyah Nuclear Plant Unit 2, the W* methodology is used to define the required tube inspection depth into the hot-leg tubesheet, and is not used to permit degradation in the W* distance to remain in service. Thus while primary to secondary leakage in the W* distance need not be postulated, primary to secondary leakage from potential degradation below the W* distance will be assumed for every inservice tube in the bounding steam generator.

The postulated leakage during a steam line break shall be equal to the following equation:

Postulated SLB Leakage = $ARC_{GL\ 95\text{-}05}$ + Assumed $Leakage_{0''\text{-}8''<TTS}$ + Assumed $Leakage_{8''\text{-}12''<TTS}$ + Assumed $Leakage_{>12''<TTS}$

Where: $ARC_{GL\ 95\text{-}05}$ is the normal SLB leakage derived from alternate repair criteria methods and the steam generator tube inspections.

Assumed $Leakage_{0''\text{-}8''<TTS}$ is the postulated leakage for undetected indications in steam generator tubes left in service between 0 inches and 8 inches below the top of the tubesheet.

Assumed $Leakage_{''8\text{-}12''<TTS}$ is the conservatively assumed leakage from the total of identified and postulated unidentified indications in steam generator tubes left in service between 8 and 12 inches below the top of the tubesheet. This is 0.0045 gpm multiplied by the number of indications. Postulated unidentified indications will be conservatively assumed to be in one steam generator. The highest number of identified indications left in service between 8 and 12 inches below TTS in any one steam generator will be included in this term.

Assumed $Leakage_{>12''<TTS}$ is the conservatively assumed leakage for the bounding steam generator tubes left in service below 12 inches below the top of the tubesheet. This is 0.00009 gpm multiplied by the number of tubes left in service in the least plugged steam generator.

The aggregate calculated SLB leakage from the application of all alternate repair criteria and the above assumed leakage shall be reported to the NRC in accordance with applicable Technical Specifications. The combined calculated leak rate from all alternate repair criteria must be less than the maximum allowable steam line break leak rate limit in any one steam generator in order to maintain doses within 10 CFR 100 guideline values and within GDC-19 values during a postulated steam line break event.