



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

May 6, 2002

TVA-SQN-TS-02-05

10 CFR 50.90

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

Gentlemen:

In the Matter of ) Docket No. 50-328  
Tennessee Valley Authority )

**SEQUOYAH NUCLEAR PLANT (SQN) - UNIT 2 - EMERGENCY TECHNICAL SPECIFICATION (TS) CHANGE NO. 02-05, STEAM GENERATOR (SG) INSPECTION SCOPE**

In accordance with the provisions of 10 CFR 50.90, TVA is submitting an emergency request for an amendment to SQN's License DPR-79 to change the TSs for Unit 2. The proposed change specifically revises TS Surveillance Requirement (SR) 4.4.5.4.a.8 to clearly delineate the scope of the SG tube inspection required in the tube sheet region. The basis for the proposed change is WCAP-13532, Revision 1, "Sequoyah Units 1 and 2, W\* Tube Plugging Criteria for SG Tubesheet Region of Wextex Expansions." The WCAP was previously submitted to NRC by TVA letter dated November 18, 1992. This WCAP was docketed in support of TS Change 92-10, which was noticed in the Federal Register on February 3, 1993, (58 FR 7006) and subsequently withdrawn on June 28, 1994.

The need for the proposed change is based on a late emerging issue regarding the results of the Unit 2 SG tube inspections and the identification of indications within the tubesheet region. This change is needed to resolve a regulatory issue that was identified late in the current Unit 2 refueling outage. As discussed with NRC staff on May 3, 2002, an emergency TS change is needed to prevent a delay in the resumption of operation.

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TVA has determined that there are no significant hazards considerations associated with the proposed change and that the change is exempt from environmental review pursuant to the provisions of 10 CFR 51.22(c)(9). The SQN Plant Operations Review Committee and the SQN Nuclear Safety Review Board have reviewed this proposed change and determined that operation of SQN Unit 2, in accordance with the proposed change, will not endanger the health and safety of the public. Additionally, in accordance with 10 CFR 50.91(b)(1), TVA is sending a copy of this letter to the Tennessee State Department of Public Health.

Enclosure 1 to this letter provides the description and evaluation of the proposed change. This includes TVA's determination that the proposed change does not involve a significant hazards consideration, and is exempt from environmental review. Enclosure 2 contains copies of the appropriate TS page from Unit 2 marked up to show the proposed change. Enclosure 3 forwards the revised TS page for Unit 2 which incorporate the proposed change.

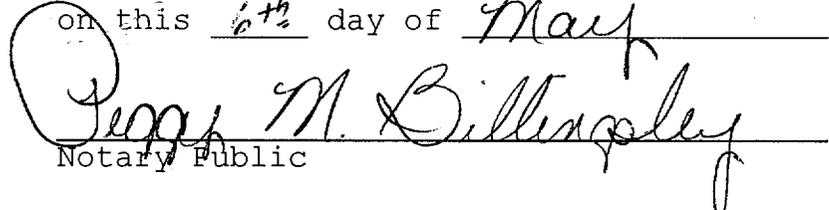
TVA requests NRC review and approval by May 11, 2002, to support entry into Mode 4 from the Unit 2 refueling outage. Mode 4 is currently scheduled for May 13, 2002. There are no commitments in this letter. This letter is being sent in accordance with NRC RIS 2001-05. If you have any questions about this change, please telephone me at (423) 843-7170 or J. D. Smith at (423) 843-6672.

Sincerely,



Pedro Salas  
Licensing and Industry Affairs Manager

Subscribed and sworn to before me  
on this 6<sup>th</sup> day of May



Peggy M. Billingsley  
Notary Public

My Commission Expires October 9, 2002

Enclosures

## ENCLOSURE 1

TENNESSEE VALLEY AUTHORITY  
SEQUOYAH NUCLEAR PLANT (SQN)  
UNIT 2  
DOCKET NO. 328

**PROPOSED TECHNICAL SPECIFICATION (TS) CHANGE NO. 02-05**  
**DESCRIPTION AND EVALUATION OF THE PROPOSED CHANGE**

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### I. DESCRIPTION OF THE PROPOSED CHANGE

TVA proposes a revision of TS Surveillance Requirement (SR) 4.4.5.4.a.8 to clarify the scope of the steam generator (SG) tube inspections required in the SG tube sheet region. The SR 4.4.5.4.a.8 provides a definition for tube inspection as used in SQN SG TS 4.5.4. The SR currently reads as follows:

"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."

TVA's proposed change clarifies the scope of the tube inspection required for the region within the SG tubesheet. The proposed change excludes the portion of the tube within the tubesheet below the W\* distance. The proposed change reads as follows:

"Tube Inspection means an inspection of the steam generator tube from the point of entry (hot leg side) completely around the U-bend to the top support of the cold leg, excluding the portion of the tube within the tubesheet below the W\* distance, as defined by WCAP-13532, Revision 1."

### II. REASON FOR THE PROPOSED CHANGE

The SQN Unit 2 SGs eddy current tube inspections were performed during the Unit 2 Cycle 11 refueling outage. During rotating pancake coil (RPC) probe inspections that TVA voluntarily performs as a good practice, indications of circumferential cracks were found in the tubesheet region. The scope of the inspections had recently been increased from 2 inches to 5.5 inches into the tube sheet as a result of a self-assessment finding that indicated that a technical basis was needed for the depth inspected into the tube sheet. TVA determined that the indications in the tubesheet region met the performance criteria for continued plant operation. Voluntary SG conference calls were held with NRC staff members to update the staff regarding the

results of the Unit 2 SG inspections. During the teleconferences, the staff questioned the extent of the tube inspections that were performed with RPC probe within the tubesheet region. The scope of TVA's RPC probe inspections in the tubesheet region covered 5.5 inches (as a minimum) below the top of the tubesheet. TVA plugged the affected tubes and did not expand the RPC inspection below 5.5 inches. NRC requested that TVA clarify tube inspection criteria within the TS for this region of the tube. Consequently, TVA is proposing the enclosed change as an emergency TS change to clarify the current Unit 2 TS tube inspection criteria.

### **III. SAFETY ANALYSIS**

The SGs at SQN are Westinghouse Model 51 with a U-tube configuration. Each tube is secured in the tubesheet above the lower plenum of the SG by an explosive expansion process (WEXTEX). The WEXTEX process expands each tube over its entire length of the tubesheet and forms an interference fit between the tube and tubesheet. This interference fit forms the interface which provides the structural and part of the leaktight boundary between the primary and secondary systems at each end of a SG tube. Located near the top of the tubesheet is a region where the tube transitions from the tubesheet hole diameter to that of the original tube. This region is referred to as the WEXTEX transition region.

An alternate tube repair criteria (referred to as W\*) was developed by Westinghouse Electric Company to permit tubes with predominantly axially oriented primary water stress corrosion cracking (PWSCC) in the WEXTEX tubesheet expansions to remain in service. The W\* analysis defines a W\* length that would permit flaws to remain in service and assure adequate strength is available to resist the axial pullout loads experienced within the tubesheet. This proposed change is for the purpose of defining the inspection scope only and is not requesting an alternate repair criteria as intended by WCAP-13532, Revision 1.

A SQN specific W\* analysis was developed and is documented in WCAP-13532, Revision 1. By letter dated November 18, 1992, TVA submitted the SQN specific W\* analysis for Units 1 and 2. At that time, the W\* analysis supported a proposed TS change for SQN that was subsequently withdrawn by letter dated June 28, 1994.

The 1992 SQN specific W\* analysis remains applicable to the SQN SGs and defines the maximum W\* length as 5.1 inches and the W\* distance including uncertainties as 5.46 inches. The W\* analysis provides the basis for tubes with any form of degradation below the W\* length to remain in service.

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\* length contributes less than 5 percent of the total leakage assumed for a steamline break (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.

Definitions:

W\* length - The length of tubing below the bottom of the WEXTEx transition (BWT) which must be demonstrated to be non-degraded and is defined in WCAP 13532, Revision 1, Section 4 as 5.1 inches below the top of the tubesheet.

BWT - Bottom of the WEXTEx transition and is defined in WCAP 13532, Revision 1, Section 4 as approximately 0.3 inch from the top of the tubesheet.

W\* distance - The distance from the top of the tubesheet to the bottom of the W\* length including the distance to the BWT and uncertainties. Uncertainties are defined in Section 8 as 0.06 inch."

SQN SG inspection fulfills TS 4.4.5.4.a.8 requirements for inspecting SG tubing by performing 100 percent full-length inspection of each tube using a bobbin coil probe. To reduce the probability and consequences of SG tube rupture or tube failure, SQN performs RPC probe examinations in critical regions for crack-like indications that would not be easily identified with the bobbin coil probe. 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-13532, Revision 1, considering the most stringent loads associated with plant operation, including transients, and accident conditions. Beyond the W\* distance, any degradation or combination thereof is acceptable.

SQN Unit 2 does not use WCAP-13532, Revision 1 to leave degraded tubes in service via an alternate repair criteria. The WCAP is used to define the length of tubing that should be inspected with an RPC probe to remove degraded tubes from service by plugging.

Tube burst is precluded for cracks within the tubesheet by the constraint provided by the tubesheet. Thus, structural criterion is satisfied by the tubesheet constraint. However, a 360-degree circumferential crack or many axially oriented cracks could permit severing of the tube and tube pullout from the tubesheet under the axial forces on the tube from primary to secondary pressure differentials. Section 4 of WCAP-13532 describes the testing that was performed to define the length of non-degraded tubing that is sufficient to compensate for the axial forces on the tube and thus prevent pullout. The operating conditions utilized in WCAP-13532, Revision 1 were specific to SQN and are summarized in Section 3. The differences in current operating conditions do not change the calculation results. Section 4 also defines the  $W^*$  length.

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 steamline break conditions provide the most stringent radiological hazards for postulated accidents involving loss of pressure or fluid in the secondary system. WCAP-13532, Section 6 describes the methodology for calculating leakage for all cracks left in service. However, SQN does not allow cracks to remain in service, therefore, this section is not applicable to this TS change. WCAP-13532, Section 6.5.1 provides the justification to neglect the total SLB leak rate contributed by cracks below the  $W^*$  distance. Therefore, RPC probe inspection in the area below the  $W^*$  distance is not necessary to preclude normal operating or accident induced leakage.

#### **IV. NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION**

TVA has concluded that operation of Sequoyah Nuclear Plant (SQN) Unit 2, in accordance with the proposed change to the technical specifications (TS), does not involve a significant hazards consideration. TVA's conclusion is based on its evaluation, in accordance with 10 CFR 50.91(a)(1), of the three standards set forth in 10 CFR 50.92(c).

TVA is proposing to modify the SQN Unit 2 TSs to revise Surveillance Requirement (SR) 4.4.5.4.a.8. This SR defines steam generator (SG) tube inspection scope. TVA's proposed change clarifies the tube inspection to exclude

the portion of the tube within the tubesheet below the W\* distance. The amendment is based on Westinghouse Electric Company WCAP-13532, Revision 1 entitled, "Sequoyah Units 1 and 2, W\* Tube Plugging Criteria For SG Tubesheet Region of Wextex Expansions." The WCAP was developed for SQN SGs for application of W\* alternate repair criteria. The W\* analysis accounts for the reinforcing effect that the tubesheet has on the external surface of the SG tube within the tubesheet region. The W\* analysis shows that tube integrity and leakage below the W\* distance remain within the existing design limits.

A. **The proposed amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated.**

TVA proposes to modify the SQN Unit 2 TSS to incorporate SG tube inspection scope based on WCAP-13532. The W\* analysis take into account the reinforcing effect the tubesheet has on the external surface of an expanded SG tube.

Tube-bundle integrity will not be adversely affected by the implementation of the W\* tube inspection scope. SG tube burst or collapse cannot occur within the confines of the tubesheet; therefore, the tube burst and collapse criteria of draft Regulatory Guide (RG) 1.121 are inherently met. Any degradation below the W\* distance is shown by analyses and test results to be acceptable, thereby precluding an event with consequences similar to a postulated tube rupture event.

Tube burst is precluded for cracks within the tubesheet by the constraint provided by the tubesheet. Thus, structural criterion is satisfied by the tubesheet constraint. However, a 360-degrees circumferential crack or many axially oriented cracks could permit severing of the tube and tube pullout from the tubesheet under the axial forces on the tube from primary to secondary pressure differentials. Section 4 of WCAP-13532 describes the testing that was performed to define the length of non-degraded tubing that is sufficient to compensate for the axial forces on the tube and thus prevent pullout. The operating conditions utilized in WCAP-13532, Revision 1 were specific to SQN and are summarized in Section 3. The differences in current operating conditions do not change the calculation results. Section 4 also defines the W\* length.

In conclusion, the incorporation of the W\* inspection scope into SQN Unit 2 TS maintains existing design limits and does not involve a significant increase in the probability or consequences of an accident previously evaluated.

- B. The proposed amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated.**

Tube-bundle integrity is expected to be maintained during all plant conditions upon implementation of the proposed tube inspection scope. Use of this scope does not induce a new mechanism that would result in a different kind of accident from those previously analyzed. Even with the limiting circumstances of a complete circumferential separation of a tube occurring below the W\* distance, SG tube pullout is precluded and leakage is predicted to be maintained within the Final Safety Analysis Report limits during all plant conditions.

- C. The proposed amendment does not involve a significant reduction in a margin of safety.**

Upon implementation of the W\* inspection scope, operation with potential cracking below the W\* distance in the WEXTEx expansion region of the SG tubing meets the margin of safety as defined by RG 1.121 and RG 1.83 and the requirements of General Design Criteria 14, 15, 31, and 32. Accordingly, the proposed change does not involve a significant reduction in the margin of safety.

## **V. ENVIRONMENTAL IMPACT CONSIDERATION**

The proposed change does not involve a significant hazards consideration, a significant change in the types of or significant increase in the amounts of any effluents that may be released offsite, or a significant increase in individual or cumulative occupational radiation exposure. Therefore, the proposed change meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), an environmental assessment of the proposed change is not required.

ENCLOSURE 2

TENNESSEE VALLEY AUTHORITY  
SEQUOYAH PLANT (SQN)  
UNIT 2

PROPOSED TECHNICAL SPECIFICATION (TS) CHANGE 02-05  
MARKED PAGES

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I. AFFECTED PAGE LIST

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II. MARKED PAGES

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## REACTOR COOLANT SYSTEM

### SURVEILLANCE REQUIREMENTS (Continued)

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#### 4.4.5.4 Acceptance Criteria

a. As used in this Specification:

1. Imperfection means an exception to the dimensions, finish or contour of a tube from that required by fabrication drawings or specifications. Eddy-current testing indications below 20% of the nominal tube wall thickness, if detectable, may be considered as imperfections.
2. Degradation means a service-induced cracking, wastage, wear or general corrosion occurring on either inside or outside of a tube.
3. Degraded Tube means a tube containing imperfections greater than or equal to 20% of the nominal wall thickness caused by degradation.
4. % Degradation means the percentage of the tube wall thickness affected or removed by degradation.
5. Defect means an imperfection of such severity that it exceeds the plugging limit. A tube containing a defect is defective.
6. Plugging Limit means the imperfection depth at or beyond which the tube shall be removed from service and is equal to 40% of the nominal tube wall thickness. Plugging limit does not apply to that portion of the tube that is not within the pressure boundary of the reactor coolant system (tube end up to the start of the tube-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.
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.
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.

excluding the portion of the tube within the tubesheet below the W\* distance as defined by WCAP-13532, Revision 1.

ENCLOSURE 3

TENNESSEE VALLEY AUTHORITY  
SEQUOYAH PLANT (SQN)  
UNIT 2

PROPOSED TECHNICAL SPECIFICATION (TS) CHANGE  
REVISED PAGES

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I. AFFECTED PAGE LIST

3/4 4-13

II. REVISED PAGES

See attached.

## REACTOR COOLANT SYSTEM

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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.