ENCLOSURE 1

PROPOSED TECHNICAL SPECIFICATION (TS) CHANGE

SEQUOYAH NUCLEAR PLANT (SQN) UNIT 1

DOCKET NO. 50-327

(TVA-SQN-TS-95-15, REVISION 1)

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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.

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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. R19?

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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.
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.

SURVEILLANCE REQUIREMENTS (Continued)

4.4.5.4 Acceptance Criteria

a. As used in this Specification:

1. Imperfection means an exception to the dimensions, finish or contour of a tube from that required by fabrication drawings or specifications. Eddy-current testing indications below 20% of the nominal tube wall thickness, if detectable, may be considered as imperfections.

2. Degradation means a service-induced cracking, wastage, wear or general corrosion occuring or 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).

Insert C Here

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 a tube inspection of the full length of each tube in each steam generator performed by eddy current techniques prior to service 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.

Insert D Here

SURVEILLANCE REQUIREMENTS (Continued)

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.

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 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 pursuant to Specification 6.6.1 prior to resumption of plant operation. The written followup of this report shall provide a description of investigations conducted to determine cause of the tube degradation and corrective measures taken to prevent recurrence. R

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REACTOR COOLANT SYSTEM

OPERATIONAL LEAKAGE

LIMITING CONDITION FOR OPERATION

3.4.6.2 Reactor Coolant System leakage shall be limited to:

a. No PRESSURE BOUNDARY LEAKAGE,

b. 1 GPM UNIDENTIFIED LEAKAGE,

Insert F Here

c. ~~1 GPM total primary-to-secondary leakage through all steam generators and 500 gallons per day through any one steam generator~~,

d. 10 GPM IDENTIFIED LEAKAGE from the Reactor Coolant System, and

e. 40 GPM CONTROLLED LEAKAGE at a Reactor Coolant System pressure of 2235 $\pm$ 20 psig.

f. 1 GPM leakage at a Reactor Coolant System pressure of 2235 $\pm$ 20 psig from any Reactor Coolant System Pressure Isolation Valve specified in Table 3.4-1. R1

APPLICABILITY: MODES 1, 2, 3 and 4

ACTION:

a. With any PRESSURE BOUNDARY LEAKAGE, be in at least HOT STANDBY within 6 hours and in COLD SHUTDOWN within the following 30 hours.

b. With any Reactor Coolant System leakage greater than any one of the above limits, excluding PRESSURE BOUNDARY LEAKAGE, and leakage from Reactor Coolant System Pressure Isolation Valves, reduce the leakage rate to within limits within 4 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

c. With any Reactor Coolant System Pressure Isolation Valve leakage greater than the above limit, isolate the high pressure portion of the affected system from the low pressure portion within 4 hours by use of at least two closed manual or deactivated automatic valves, or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.4.6.2.1 Reactor Coolant System leakages shall be demonstrated to be within each of the above limits by: R

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BASES

The plant is expected to be operated in a manner such that the secondary coolant will be maintained within those chemistry limits found to result in negligible 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 limitation of steam generator tube leakage between the primary coolant system and the secondary coolant system (primary-to-secondary leakage = ~~500~~ 150 gallons per day per steam generator). 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~~ Sequoyah has demonstrated that primary-to-secondary leakage of ~~500~~ gallons per day per steam generator can readily be detected by radiation monitors of steam generator blowdown or condenser off-gas. Leakage in excess of this limit will require plant shutdown and an unscheduled inspection, during which the leaking tubes will be located and plugged.

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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 ~~plugging limit of 40% of the tube nominal wall thickness~~ 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. R19

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Whenever the results of any steam generator tubing inservice inspection fall into Category C-3, these results will be promptly reported to the Commission pursuant to Specification 6.6.1 prior to resumption of plant operation. Such cases will be considered by the Commission on a case-by-case basis and may result in a requirement for analysis, laboratory examinations, tests, additional eddy-current inspection, and revision of the Technical Specifications, if necessary. R4

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

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.

FP

The surveillance requirements for RCS Pressure Isolation Valves provide added assurances of valve integrity thereby reducing the probability of gross valve failure and consequent intersystem LOCA. Leakage from the RCS isolation valves is IDENTIFIED LEAKAGE and will be considered as a portion of the allowed limit.

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 CONTROLLED LEAKAGE limitation restricts operation when the total flow supplied to the reactor coolant pump seals exceeds 40 GPM with the modulating valve in the supply line fully open at a nominal RCS pressure of 2235 psig. This limitation ensures that in the event of a LOCA, the safety injection flow will not be less than assumed in the accident analyses.

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The total steam generator tube leakage limit of 1 GPM for all steam generators ensures that the dosage contribution from the tube leakage will be limited to a small fraction of Part 100 limits in the event of either a steam generator tube rupture or steam line break. The ~~1 GPM~~ limit is consistent with the assumptions used in the analysis of these accidents. The ~~500~~ 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.

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.

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 the chemistry within the Steady State Limits provides adequate corrosion protection to ensure the structural integrity of the Reactor Coolant System over the life of the plant. The associated effects of exceeding the oxygen, chloride and fluoride limits are time and temperature dependent. Corrosion studies show that operation may be continued with contaminant concentration levels in excess of the Steady State Limits, up to the Transient Limits, for the specified limited time intervals without having a significant effect on the structural integrity of the Reactor Coolant System. The time interval permitting continued operation within the restrictions of the Transient Limits provides time for taking corrective actions to restore the contaminant concentrations to within the Steady State Limits.

Insert A

4.4.5.2.b.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.

Insert B

4.4.5.2.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.

Insert C

4.4.5.4.a.6. 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.

Insert D

4.4.5.4.a.10 Tube Support Plate Plugging Limit is used for the disposition of an 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. At tube support plate intersections, the plugging (repair) limit is based on maintaining steam generator tube serviceability as described 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 voltages 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.10.c below.

Insert D (continued)

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 upper voltage repair 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 a bobbin coil voltage greater than the upper voltage repair limit (Note 2) will be plugged or repaired.

d. Not applicable to SQN.

e. If an unscheduled mid-cycle inspection is performed, the following mid-cycle repair limits apply instead of the limits identified in 4.4.5.4.a.10.a, 4.4.5.4.a.10.b, and 4.4.5.4.a.10.c.

The mid-cycle repair limits are determined from the following equations:

$$V_{MURL} = \frac{V_{SL}}{1.0 + NDE + Gr\ \frac{(CL-\Delta t)}{CL}}$$

$$V_{MLRL} = V_{MURL} - (V_{URL} - V_{LRL})\ \frac{(CL-\Delta t)}{CL}$$

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 95-05 as supplemented. V_{URL} may differ at the TSPs and flow distribution baffle.

Insert E

4.4.5.5.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.

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.

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3.4.6.2.c 150 gallons per day of primary-to-secondary leakage through any one steam generator.

Insert G

The voltage-based repair limits of SR 4.4.5 implement the guidance in GL 95-05 and are applicable only to Westinghouse-designed steam generators (S/Gs) with outside diameter stress corrosion cracking (ODSCC) located at the tube-to-tube support plate intersections. The voltage-based repair limits are not applicable to other forms of S/G tube degradation nor are they applicable to ODSCC that occurs at other locations within the S/G. 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 GL 95-05 for additional description of the degradation morphology.

Implementation of SR 4.4.5 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).

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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 must be adjusted downward 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:

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

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.

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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.

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The total steam generator tube leakage limit of 600 gallons per day for all steam generators and 150 gallons per day for any one steam generator will minimize the potential for a significant leakage event during steam line break. Based on the NDE uncertainties, bobbin coil voltage distribution and crack growth rate from the previous inspection, the expected leak rate following a steam line rupture is limited to below 4.3 gpm in the faulted loop, which will limit the calculated offsite doses to within 10 percent of the 10 CFR 100 guidelines. If the projected end of cycle distribution of crack indications results in primary-to-secondary leakage greater than 4.3 gpm in the faulted loop during a postulated steam line break event, additional tubes must be removed from service in order to reduce the postulated primary-to-secondary steam line break leakage to below 4.3 gpm.

ENCLOSURE 2

PROPOSED TECHNICAL SPECIFICATION (TS) CHANGE

SEQUOYAH NUCLEAR PLANT (SQN) UNIT 1

DOCKET NO. 50-327

(TVA-SQN-TS-95-15, REVISION 1)

DESCRIPTION AND JUSTIFICATION FOR

TS AMENDMENT

Description of Change

TVA proposes to modify the SQN Unit 1 technical specifications (TSs) to incorporate new requirements associated with steam generator (S/G) tube inspection and repair. The new requirements establish alternate S/G tube plugging criteria at tube support plate (TSP) intersections. The proposed changes are as follows:

1. Add Surveillance Requirement (SR) 4.4.5.2.b.4

   "Indications left in service as a result of application of the tube support plate voltage-based plugging repair criteria shall be inspected by bobbin coil probe during all future refueling outages."

2. Add SR 4.4.5.2.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."

3. Add requirements to SR 4.4.5.4.a.6.

   "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."

4. Add SR 4.4.5.4.a.10

   "Tube Support Plate Plugging Limit is used for the disposition of an 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. At tube support plate intersections, the plugging (repair) limit is based on maintaining steam generator tube serviceability as described 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 voltages 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.10.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 upper voltage repair 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 a bobbin coil voltage greater than the upper voltage repair limit (Note 2) will be plugged or repaired.

d. Not applicable to SQN.

e. If an unscheduled mid-cycle inspection is performed, the following mid-cycle repair limits apply instead of the limits identified in 4.4.5.4.a.10.a, b, & c.

The mid-cycle repair limits are determined from the following equations:

$$V_{MURL} = \frac{V_{SL}}{1.0 + NDE + Gr\,\frac{(CL-\Delta t)}{CL}}$$

$$V_{MLRL} = V_{MURL} - (V_{URL} - V_{LRL})\,\frac{(CL-\Delta t)}{CL}$$

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 TSs 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 95-05 as supplemented. V_{URL} may differ at the TSPs and flow distribution baffle.

5. Add SR 4.4.5.5.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.

   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."

6. Replace SR 3.4.6.2.c with

   "Primary-to-secondary leakage shall be limited to 150 gallons per day through any one steam generator."

7. Change Bases 3/4.4.5, "Steam Generator," to reflect the new primary-to-secondary leakage limit (150 gallons per day per S/G) and include a reference to the tube repair limit as defined in Specification 4.4.5.4.a. In addition, Bases Section 3/4.4.6.2, "Operational Leakage," is revised to reflect the S/G operational leakage limits.

Reason for Change

TVA is proposing to change SQN Unit 1 TSs to reduce the need for repairing or plugging S/G tubes having indications that exceed the current TS depth-based plugging limit. TVA proposes to add alternate tube plugging criteria at TSP intersections that are based on maintaining structural and leakage integrity of tubes with indications of ODSCC within the confines of the TSP regions. Westinghouse Electric Corporation has performed analyses to: (1) show that indications within the TSP region meet Regulatory Guide (RG) 1.121 criteria for tube structural integrity, and (2) leakage in a faulted condition remains below that assumed in calculating the allowable offsite radiation dose limits. The guidance of Generic Letter (GL) 95-05 was utilized.

The proposed change would preserve the reactor coolant flow margin and reduce the radiation exposure incurred in the process of plugging or repairing the S/G tubes (approximately 0.060 man-rem per tube of exposure would be saved for a plugging operation). Other benefits of not plugging TSP indications that meet the alternate plugging criteria (APC) would be a reduction in man-hours and potential impact to critical path time during refueling outages.

TVA's goal is to prolong S/G life over the expected remaining plant life. This goal is best achieved by proactive measures that defer or eliminate the need to replace S/Gs. S/G replacement results from the loss-of-tube plugging margin.

Accordingly, the proposed TS change would prolong S/G life and reduce personnel exposure while maintaining the SQN S/G plugging margin.

Justification for Changes

The proposed APC for SQN can be summarized as follows:

Tube Support Plate APC

Tubes with bobbin indications exceeding the 2.0-volt APC voltage repair limit and less than or equal to 5.4 volts are plugged or repaired if confirmed as flaw indications by a rotating pancake coil (RPC) inspection. Bobbin indications greater than 5.4 volts attributable to ODSCC are repaired or plugged independent of RPC confirmation.

Operating Leakage Limits

Plant shutdown will be implemented if normal operating leakage exceeds 150 gallons per day per S/G.

Steam Line Break (SLB) Leakage Criterion

Projected end-of-cycle SLB leak rate from tubes left in service, including a probability of detection adjustment and allowances for nondestructive examination (NDE) uncertainties and ODSCC growth rates, must be less than 4.3 gallons per minute for the S/G in the faulted loop. If necessary to satisfy the allowable leakage limit, additional indications less than the repair limit shall be plugged or repaired.

Tube Burst Conditional Probability

The projected end-of-cycle SLB tube burst conditional probability shall be calculated and compared with the value 1 X 10^{-2} as defined in GL 95-05.

Exclusion from Tube Plugging Criteria

The APC does not apply to TSP intersections having:

1. Dent signals greater than 5 volts as measured with the bobbin probe.
2. Mixed residuals of sufficient magnitude to cause a 1-volt ODSCC indication (as measured with a bobbin probe) to be missed or evaluated incorrectly.
3. Circumferential indications.

These indications shall be evaluated to the TS limit of 40 percent depth.

SQN's current TS plugging limit of 40 percent throughwall applies throughout the tube length and is based on the tube structural integrity for general area wall loss such as pitting or wear. Tube plugging criteria are based upon the conservative assumptions that the tube to TSP crevices are open (negligible crevice deposits or TSP corrosion) and that the TSPs are displaced under accident conditions. The ODSCC existing within the TSPs is thus assumed to be free-span degradation under accident conditions and the principal requirement for tube plugging considerations is to provide margins against tube burst in accordance with RG 1.121. The open crevice assumption leads to maximum leak rates compared with packed crevices and also maximizes the potential for TSP displacements under accident conditions.

One pulled tube with two TSP intersections from SQN Unit 1 support ODSCC as the dominant corrosion mechanism consistent with the Electric Power Research Institute (EPRI) database of pulled tubes. The EPRI database, which includes the SQN pulled tube data, is more conservative for SLB leak rate analyses and will be used for all SLB analyses.

RG 1.121 guidelines establish the structural limit as the more limiting of three times normal operating pressure differential ($3\Delta P_{NO}$) or 1.43 times the SLB pressure differential ($1.43\Delta P_{SLB}$) at accident conditions. At normal operating conditions, the tube constraint provided by the TSP assures that $3\Delta P_{NO}$ burst capability is satisfied. At SLB conditions, the EPRI alternate repair criteria (ARC) are based on free-span indications under the conservative assumption that SLB TSP displacements uncover the ODSCC indications formed within the TSPs at normal operation. From Figure 6-1 of WCAP-13990, the bobbin voltage corresponding to $1.43\Delta P_{SLB}$ (3,657 pounds per square inch) is 8.82 volts.

The structural limit is reduced by allowance for NDE uncertainties and crack growth. The EPRI ARC supplies the NDE uncertainty (WCAP-13990, Section 7.3) at 95 percent uncertainty to obtain an allowance of 20.5 percent of the repair limit. For SQN, there is insufficient ODSCC data to define the voltage growth rates. In EPRI Report TR-100407, Draft Revision 1, "PWR Steam Generator Tube Repair Limit - Technical Support Document for Outside Diameter Stress Corrosion Crack at Tube Support Plates,"

the EPRI criteria provides a growth allowance of 35 percent per effective full power years (EFPY) when plant specific growth data is not available. For SQN, the near-term cycle lengths are bounded by 1.23 EFPY. The growth allowance for SQN is then 43.1 percent. The full APC repair limit is obtained by dividing the structural limit of 8.82 volts by 1.64 (1.0 + 20.5 percent for NDE uncertainties and 43 percent for crack voltage growth). Thus, the full EPRI ARC defined repair limit is obtained as 5.4 volts. This repair limit conservatively bounds the limit obtained by applying either the EPRI database, as described above, or the NRC database additions described in WCAP-13990, Section 5.1.

In addressing the combined effects of loss-of-coolant accident (LOCA), plus safe shutdown earthquake (SSE) on the S/G component (as required by General Design Criteria 2), it has been determined that tube collapse may occur in the S/Gs at some plants. This is the case as the TSP may become deformed as a result of lateral loads at the wedge supports at the periphery of the plate because of the combined effects of the LOCA rarefaction wave and SSE loadings. Then, the resulting pressure differential on the deformed tubes may cause some of the tubes to collapse.

There are two issues associated with S/G tube collapse. First, the collapse of S/G tubing reduces the reactor coolant system flow area through the tubes. The reduction in flow area increases the resistance to flow of steam from the core during a LOCA, which in turn, may potentially increase peak clad temperature. Second, there is a potential that partial through-wall cracks in tubes could progress to through-wall cracks during tube deformation or collapse.

Consequently, since the leak-before-break methodology is applicable to the SQN reactor coolant loop piping, the probability of breaks in the primary loop piping is sufficiently low that they need not be considered in the structural design of the plant. The limiting LOCA event becomes either the accumulator line break or the pressurizer surge line break. LOCA loads for the primary pipe breaks were used to bound the conditions at SQN for smaller breaks. The results of the analysis using the larger break inputs show that the LOCA loads were found to be of insufficient magnitude to result in S/G tube collapse or significant deformation. The LOCA, plus SSE tube collapse evaluation performed for another plant with Series 51 S/Gs using bounding input conditions (large-break loadings), is applicable to SQN.

Environmental Impact Evaluation

The proposed change does not involve an unreviewed environmental question because operation of SQN Unit 1 in accordance with this change would not:

1. Result in a significant increase in any adverse environmental impact previously evaluated in the Final Environmental Statement (FES) as modified by NRC's testimony to the Atomic Safety and Licensing Board, supplements to the FES, environmental impact appraisals, or decisions of the Atomic Safety and Licensing Board.

2. Result in a significant change in effluents or power levels.

3. Result in matters not previously reviewed in the licensing basis for SQN that may have a significant environmental impact.

ENCLOSURE 3

PROPOSED TECHNICAL SPECIFICATION CHANGE

SEQUOYAH NUCLEAR PLANT (SQN) UNIT 1

DOCKET NO. 50-327

(TVA-SQN-TS-95-15, REVISION 1)

TVA COMMITMENT

TVA COMMITMENT

TVA will revise the SQN steam generator program by October 25, 1995, to include the following requirements:

A. "If alternate plugging criteria (APC) is implemented, the following results, distributions, and evaluations will be submitted to the NRC staff within 90 days of unit restart:

1. The results of metallurgical examinations of tube intersections removed from the unit.
2. End-of-cycle (EOC) voltage distribution - all indications found during the inspection regardless of a rotating pancake coil (RPC) confirmation.
3. Cycle voltage growth rate distribution (i.e., from beginning of cycles to EOC).
4. Voltage distribution for EOC repaired indications - distribution of indications presented in item 1 that were repaired (i.e., plugged or sleeved).
5. Voltage distribution for indications left in service at the beginning of the next operating cycle regardless of RPC confirmation - obtained from Items 1 and 3 above.
6. Voltage distribution for indications left in service at the beginning of the next operating cycle that were confirmed by RPC to be crack-like or not RPC inspected.
7. Nondestructive examination uncertainty distribution used in predicting of the EOC (for the next cycle of operation) voltage distribution.
8. Conditional probability of burst during main steam line break (MSLB) evaluation.
9. Total leak rate during MSLB evaluation.

B. If the APC is implemented, the actions and administrative controls provided in Enclosure 4 become effective.

C. TVA will implement the probe wear inspection/reinspection requirements of Enclosure 4 for one cycle of operation (Cycle 8)."

ENCLOSURE 4

SEQUOYAH NUCLEAR PLANTS (SQN'S)

STEAM GENERATOR (S/G) PROGRAM PLAN FOR THE

IMPLEMENTATION OF GENERIC LETTER (GL) 95-05

1. The inspection guidance discussed in Section 3 of Attachment 1 of the GL 95-05 will be implemented.

3.b Rotating pancake coil (RPC) for the purposes of the technical specification (TS) change, also includes the use of comparable or improved nondestructive examination techniques.

3.b.1 TVA will inspect all bobbin flaw indications with voltages greater than lower voltage repair limit volts utilizing a RPC probe.

3.b.2 TVA will inspect all intersections where copper signals interfere with the detection of flaws utilizing a RPC probe. Any indications found at such intersections with RPC should cause the tube to be repaired.

3.b.3 TVA will implement the following dent sample program:

Dent Sample Program

Initial Implementation of Dent Sampling Plan:
The initial sample in S/Gs 1 and 2 shall be 100 percent of the total hot-leg (HL) dented tube support plate (TSP) population in S/Gs 1 and 2.

The initial sample for S/Gs 3 and 4 will be 100 percent of the dented TSP intersections at the first and second HL TSPs and 20 percent of the dented intersections at the third HL TSP.

The dent examinations will be performed with a technique qualified to Appendix H of the Electric Power Research Institute (EPRI) Steam Generator Examination Guidelines. A RPC inspection will be performed. Alternate probes, such as the Cecco probe, which has demonstrated detection capability for axial and circumferential indications comparable to or better than the RPC probes, can be used for these inspections. RPC is used as a general term to reflect an acceptable technique.

If the RPC inspection of dented intersections identifies circumferential indication or an axial indication not detected by bobbin, the RPC inspection shall be expanded consistent with Table 1. The result classification as defined in TS Section 4.4.5.2 shall be utilized.

Future Outage Dent Sample Selection and Inspections:

The S/G tube inspection result classification and the corresponding action required shall be as specified in Table 1. The dent inspection frequency shall be performed coinciding with the S/G surveillance requirements. If an unscheduled mid-cycle S/G surveillance is required, the dented TSP inspection shall be performed.

The initial sample in S/Gs 1 and 2 shall be 100 percent of the total HL dented TSP population in S/Gs 1 and 2.

The initial sample in S/Gs 3 and 4 will be 20 percent of the total HL dented TSP population in S/Gs 3 and 4.

The dented TSP intersections selection for S/Gs 3 and 4 will begin at the lowest HL TSP elevations, which has the highest probability that stress corrosion cracking will occur. The initial sample will be 20 percent of the total HL dents in the respective S/G and randomly distributed at the first HL TSP. Every two S/G inspections, 100 percent of the first HL dented TSP intersections will be inspected.

If the RPC inspection of dented intersections identifies circumferential indication or an axial indication not detected by bobbin, the RPC inspection shall be expanded consistent with the Table 1. The result classification as defined in TS Section 4.4.5.2 shall be utilized.

Expansion samples would be selected from the lowest HL dented TSP intersections and continue to higher TSP elevations.

Table 1 : SQN Unit 1 SGs 3 and 4 Expansion of the HL dented TSP Sample

Initial Sample		First Expansion		Second Expansion	
Result	**Action Required**	**Result**	**Action Required**	**Result**	**Action Required**
C-1	None	N/A	N/A	N/A	N/A
C-2	Inspect an additional 20% sample of TSP intersections in this SG	C-1	None	N/A	N/A
		C-2	Inspect an additional 20% sample of TSP intersections in this SG	C-1	None
				C-2	Inspect all remaining TSP intersections in this SG
				C-3	Inspect all remaining TSP intersections in this SG and a 20% sample in other SGs
		C-3	Inspect all remaining TSP intersections in this SG and a 20% sample in other SGs	N/A	N/A
C-3	Inspect all remaining TSP intersections in this SG and a 20% sample in other SGs	C-1 in other SG	None	N/A	N/A
		C-2 but not C-3 in other SG	Inspect an additional 20% sample of TSP intersections in other SG	N/A	N/A
		C-3 in other SG	Inspect all remaining TSP intersections in other SGs	N/A	N/A

TSP = dented hot-leg tube support plate

3.b.4 TVA will inspect all intersections with large mixed residuals utilizing a RPC probe. Any indications found at such intersections with RPC should cause the tube to be repaired.

3.c.1 TVA will use a bobbin coil calibrated against a reference standard used in the laboratory as part of the development of the voltage-based approach, through the use of a transfer standard.

3.c.2 TVA will comply with a ± 10 percent probe variability. TVA will increase the number of probe samples to 20. Testing will be performed at the mix frequency. TVA plans to follow the industry approach to probe variability that was presented to NRC in November 1994.

Probe wear inspection/reinspections will be governed by the following:

If the last probe-wear-standard signal amplitudes prior to probe replacement exceed the $\pm$15 percent limit by a value of X percent, then any indications measured since the last acceptable probe wear measurement that are within X percent of the plugging limit must be reinspected with the new probe. For example, if any of the last probe wear signal amplitudes prior to probe replacement were 17 percent above or below the initial amplitude, then indications that are within 2 percent (17 - 15 percent) of the plugging limit must be reinspected with the new probe. Alternatively, the voltage criterion may be lowered to compensate for the excess variation, for the case above, amplitudes $\geq$ 0.98 times the voltage criterion would be subject to repair.

3.c.4 TVA data analysts will be trained and qualified in the use of analysis guidelines and procedures.

3.c.5 Data analysts will use quantitative noise criteria guidelines in the evaluation of the data. However, it is expected that these criteria will be evolving over the inspection and as a result, are subject to change. Data failing to meet these criteria should be rejected, and the tube will be reinspected.

2. If the alternate plugging criteria is implemented, SQN will pull a minimum of two tubes and four intersections during the Unit 1 Cycle 7 outage and implement a tube pull program consistent with the GL.

3. In support of Section 4.4.5.4.a.10 of the proposed TS change, the methodology used for calculating the (1) conditional probability of burst, (2) methods for projecting EOC voltage distributions, (3) upper voltage repair limit, and (4) total leak rate during main steam line break, will be in accordance with Westinghouse Electric Corporation, WCAP-14277, "Steam Line Break Leak Rate and Tube Burst Probability Analysis Method for ODSCC at TSP Intersections, January 1995."

   The data sets for burst pressure verses bobbin voltage will contain all applicable data consistent with the latest revision of the industry data base as approved by NRC with the latest tube pull data.

4. SQN Abnormal Operating Instruction 24 provides instructions on the trending and response to rapidly increasing leaks. This instruction is a defense-in-depth measure that provides a means for identifying leaks during operation to enable repair before such leaks result in tube failure.

ENCLOSURE 5

ADDITIONAL INFORMATION REQUESTED

DURING THE AUGUST 28, 1995, PHONE CALL

REGARDING UNIT 1 STEAM GENERATOR (S/G) TUBES

1. Dent distribution voltage data from tube support locations with primary water stress corrosion cracking identified in Unit 1 Cycle 6.

SG	ROW	COL	LOCATIONS	CYCLE	CHAN	VOLTS
3	1	56	H01	C6	M1	5.4
	15	67	H02	C6	M1	13.4
	21	64	H01	C6	M1	14.0
4	3	30	H02	C6	M1	6.8
	10	36	H01	C6	M1	24.4
	14	25	H01	C6	M1	42.0
	21	44	H01	C6	M1	46.3
	36	59	H01	C5	M1	5.5
	38	35	H01	C6	M1	10.7

2. Representative dent distribution data as of Unit 1 Cycle 6 inspection by voltage and TSP elevation.

UNIT 1 S/G 3

VOLTS	H01	H02	H03	H04	H05	H06	H07	TOTAL
>= 5 <10	393	367	205	392	50	237	35	1679
>=10 <20	237	184	47	286	8	151	10	923
>=20 <30	39	26	1	67	1	27	1	162
>=30 <40	11	7	0	14	1	4	0	37
>=40 <50	2	2	0	11	0	2	0	17
>=50	2	1	0	7	0	1	0	11

UNIT 1 S/G 4

VOLTS	H01	H02	H03	H04	H05	H06	H07	TOTAL
>= 5 <10	390	338	395	256	67	7	27	1480
>=10 <20	461	246	428	214	22	0	6	1377
>=20 <30	247	92	189	59	2	0	0	589
>=30 <40	185	28	84	22	0	0	4	323
>=40 <50	166	12	41	12	0	0	0	231
>=50	233	5	33	2	1	0	2	276

3. General Considerations for Accident Condition Analyses (Section 4.1 of SQN WCAP-13990)

The following information addresses the applicability of analyses performed for the Farley Nuclear Plant steam generators (S/Gs) for tube deformation under combined loss-of-coolant accident (LOCA) plus safe shutdown earthquake (SSE) and for tube stresses under combined SSE plus steam line break/feed line break (SLB/FLB)

(WCAP-12871) to SQN Units 1 and 2. There are several inputs that were reviewed in order to establish the applicability of the analysis results for Farley to SQN Units 1 and 2. These inputs include the tube support plate (TSP) loads resulting from a SSE, LOCA induced TSP loads, the deformation characteristics of the TSP under localized in-plate loads, and combined SSE plus SLB/FLB loads. The applicability of the Farley analysis to SQN Units 1 and 2 in each of these areas is summarized below.

Applicability of Seismic Loads:

The seismic loads for the Farley analysis are taken from a generic seismic analysis for Series 51 S/Gs. The generic analysis is performed using an umbrella spectra that was generated from the plant specific spectra for a number of plants with Series 51 S/Gs. The plant specific spectra for SQN Units 1 and 2 were included in the generation of the umbrella spectra. Thus, the TSP loads from the umbrella analysis, which were used for the Farley evaluation, are also applicable to the SQN units.

Applicability of LOCA Induced TSP Loads:

Both Farley and SQN have been qualified for leak-before-break for their primary piping. Thus, the limiting LOCA event for both of these plants is a branch line break (see Attachment A). However, the tube deformation calculations for Farley were performed using TSP loads for the most limiting large break LOCA event. A transient dynamic analysis for Farley for both primary piping and branch line breaks shows the primary breaks to result in TSP loads that are three to four times higher than the branch line breaks. It has subsequently been determined that the induced pressure loadings from a large piping break at Farley will umbrella loadings from a branch line break for SQN Units 1 and 2. Thus, using the large pipe break loads for Farley to calculate flow area reduction provides a conservative basis for the SQN branch line breaks.

Applicability of TSP Deformation Characteristics:

The plate deformation characteristics used in the Farley analysis are based on crush tests performed for Series 51 S/Gs. The plate geometry and wedge configuration (load transfer locations) are the same for both Farley and SQN Units 1 and 2. Thus, the plate deformation characteristics are the same for both plants. Since the loads used to calculate flow area reduction for Farley are a conservative basis for SQN Units 1 and 2, the flow area reduction calculations will be conservative.

Applicability of Combined SSE Plus SLB/FLB Loads:

Combined SSE plus SLB/FLB loads were evacuated for Farley relative to the potential for SSE induced bending stress to reduce the burst pressure for the tubes. The effect on burst strength is a function of the SSE bending stresses at TSP locations. Since the seismically induced tube stresses are the result of a generic analysis that umbrellas the SQN Units 1 and 2 spectra, the SSE stresses used in the Farley analysis also apply to SQN. Therefore, the discussion relative to the effect on burst strength of the combined SSE plus SLB/FLB stresses for Farley also applies to SQN.

Based on the above, it is concluded that the analyses performed for Farley in WCAP-12871 also apply to the SQN Units 1 and 2 S/Gs.

4. Comparison of 0.740-Inch Versus 0.720-Inch Diameter Bobbin Probes

During the Unit 2 Cycle 6 outage at Sequoyah, Westinghouse demonstrated their 0.720-inch diameter, long life bobbin probe. This probe displayed a signal-to-noise ratio that was better than the 0.740-inch and 0.720-inch MULC probes used for the inspection. Additionally, the long life probe did not exceed the probe wear tolerance as quickly as the MULC probe did, when using the alternate plugging criteria (APC) four-hole standard.

A study was performed that compared the tube data collected with the 0.720-inch long life and the 0.740-inch MULC probes during the last inspection. A total of 116 tubes in S/G 2 were examined with a 0.720-inch long life probe. Thirty-seven tubes were reported as no detectable degradation by both probes. Twenty tubes had 0.720-inch MULC data (no 0.740-inch MULC data) and one had only MRPC data. This left 58 tubes for comparison. Eighty seven calls were reported in the 58 tubes.

The sample set provides a good cross section of the indications and anomalies seen in Unit 2. The indications include cold-leg thinning, anti-vibration bar wear, and primary water stress corrosion cracking below the hot-leg tubesheet. Anomalies include dents and copper deposits. Detectability and sizing were the two areas of concern addressed in the comparison.

Concerning detectability, three permeability variation (PVN) calls were not reported during analysis of the long-life probe data. Reviewing the data shows that all were present.

Concerning sizing, the amplitude of PVN calls varied the most between the two probe types. This may be due to differences in size, strength, and orientation of the magnets in the two probes. Also, most PVN signals occur over a short range. Analysts may select different locations within this range to report the call. These reasons may explain why differences for these signals ranged from -41 percent to +34 percent. The large variability, coupled with the fact that reduced PVN is a positive quality, led to not consider PVN signals for sizing.

Eliminating the calls made with only one probe and PVN signals leaves 59 tubes to use for a sizing comparison. Listings for the majority of these 59 signals, along with a summary of the results, can be found in Attachment 1.

Further information was gathered from the October 1990 EPRI report, "Eddy-Current Probe Characterization." Although many types and sizes of probes were included in the report, the 0.740-inch and 0.720-inch diameter bobbin coils were concentrated on. During the testing the sensitivity of different probes to volumetric and planar tube wall degradation was evaluated. Signal amplitude was the factor used for measuring the sensitivity. In all tests, the voltages were normalized to a 360-degree dent on the sample.

No attempt was made to optimize signal levels of each scan by positioning the probe closer to the side of the tube containing the flaws. Test pieces were scanned as in the field using a motorized pusher-puller and a MIZ-18 tester. Some variations existed from multiple scanning of the same flaw using the same probe. The largest change in signal amplitude is caused by adding extension cables. Adding these cables reduced coil impedance, reducing signal amplitude response.

To accomplish the task of flaw detection, especially small volume flaws such as axial cracks, it is important to have an optimum frequency providing the highest flaw detection sensitivity included as one of the four operating frequencies. EPRI found that for tube wall thickness in the range 0.043 to 0.050 inch, the best detection frequency providing optimal flaw signal responses were centered around 200 - 300 kilohertz (kHz). TVA elected to use 200 kHz as one of their test frequencies prior to the Unit 2 Cycle 6 outage (optimum flaw detection frequency is different for narrow-groove probes).

Conclusions from EPRI's testing show a difference in signal amplitude between 0.740-inch and 0.720-inch bobbin coils, especially when test frequencies exceed 500 kHz. For the range of frequencies used at Sequoyah (10 kHz - 400 kHz), differences in signal amplitude for the two probe sizes is minimal. In all cases, the 0.720-inch probe had a larger signal amplitude. These results help to support the comparison. Attachment 2 contains figures from the EPRI report showing voltage responses for various types of indications at different frequencies.

In conclusion, it appears that using a 0.720-inch diameter bobbin probe, in lieu of the 0.740-inch probe, will not detract from the eddy current inspections performed at SQN. This study shows that flaws will be detected and changes in amplitude, from those called in history with a 0.740-inch probe, should be minimal. Also, using a 0.720-inch probe will eliminate the required probe change when testing begins below Row 20. A 0.720-inch probe can be used all the way down to Row 3. If TVA elects to perform an APC exam during the Unit 1 Cycle 7 outage, the Westinghouse long life probe has been shown to stay within tolerance better than the MULC probes used during Unit 2 Cycle 6. Should the long life probe perform as well this outage, savings in time and dose would occur. Lastly, the fill factor with a 0.720-inch probe is 0.86 (a 0.740-inch probe fill factor is 0.91), which is above the recommended minimal fill factor of 0.80.

5. Comparison of Unit 1 Cycle 6 RPC Inspection to WCAP-13990 Appendix A Requirements

<u>RPC Appendix A Issues</u>

1. Electron discharge machined (EDM) notch standard calls for a simulated support plate ring 270 degree 3/4 inch thick.

2. EDM notch standard voltage setup calls for setting 400 kHz and 300 kHz to 20 volts on the 100 percent EDM notch.

Unit 1 Cycle 6

1. EDM notch standard did not have a support ring.
2. EDM notch standard voltage was set at 5.0 volts on the 60 percent indication for 400 kHz.

This would result in the voltage reading for the 100 percent EDM notch to be 79.37 volts at 400 kHz and 70.82 volts at 300 kHz. Utilizing this setup in Unit 1 Cycle 6 outage would have resulted in voltage reading being four times higher than those if using the setup in Appendix A of WCAP-13990. Since indications were plugged on detection without regard to voltage, there is no significant differences in the data collected and analyzed in Unit 1 Cycle 6 than that which will be collected and analyzed in the Unit 1 Cycle 7 refueling outage.

ATTACHMENT 1

COMPARISON OF

A740MULC & EB720LL PROBES

DURING U2C6

Attachment 1

The following listing is a comparison of 740 and 720 diameter bobbin coil probes. The 740 probe is an A740MULC manufactured by Zetec, while the 720 is Westinghouse's long life probe, EC720LL. All data is from the U2C6 Sequoyah outage.

The comparison will be broken into three sections; quantifiable indications, dents, and other indications and anomalies.

Section 1 - Quantifiable Indications

Row	Col	Probe	Volts	Call	Location
3	44	740	1.14	64%	HTS-1.03
		720	1.24	64%	
7	59	740	3.64	93%	HTS-1.43
		720	4.08	92%	
8	53	740	5.36	95%	HTS-0.72
		720	4.91	94%	
8	57	740	4.46	86%	HTS-1.57
		720	5.35	83%	
8	63	740	1.63	73%	HTS-1.88
		720	1.65	76%	
8	66	740	2.68	70%	HTS-0.80
		720	2.80	67%	
12	92	740	1.38	32%	C01
		720	1.21	35%	
15	19	740	4.78	15%	H02+24.4
		720	4.14	12%	
17	28	740	1.10	30%	AV3
		720	1.24	33%	
19	28	740	0.89	27%	AV1
		720	0.89	28%	
18	89	740	0.39	20%	C01
		720	0.35	22%	
21	37	740	0.45	61%	H01+42.53
		720	0.45	56%	
22	41	740	0.51	24%	AV2
		720	0.49	21%	
23	69	740	0.96	31%	AV2
		720	0.87	28%	

Row	Col	Probe	Volts	Call	Location
23	69	740	0.71	27%	AV3
		720	0.89	28%	
24	61	740	0.78	29%	AV2
		720	0.89	28%	
24	63	740	0.82	29%	AV2
		720	0.85	27%	
24	67	740	1.81	41%	AV2
		720	2.05	40%	
24	67	740	2.02	42%	AV3
		720	2.17	41%	
25	54	740	12.21	90%	HTE+20.41
		720	13.77	90%	
26	70	740	0.66	27%	AV3
		720	1.15	32%	
27	65	740	0.64	26%	AV2
		720	0.73	26%	
27	65	740	0.40	20%	AV3
		720	0.38	18%	
29	32	740	0.55	28%	AV2
		720	0.87	28%	
29	32	740	0.67	31%	AV3
		720	0.75	26%	
29	32	740	0.66	31%	AV4
		720	0.62	24%	
29	37	740	0.32	18%	AV2
		720	0.45	20%	
29	37	740	0.25	16%	AV3
		720	0.19	12%	
29	42	740	0.66	27%	AV1
		720	0.75	26%	
29	42	740	0.77	29%	AV2
		720	0.91	29%	
29	42	740	1.41	37%	AV3
		720	1.57	36%	

Row	Col	Probe	Volts	Call	Location
29	42	740	0.31	18%	AV4
		720	0.30	15%	
29	56	740	0.34	21%	C04
		720	0.33	17%	
30	44	740	0.48	9%	H04+2.66
		720	0.59	11%	
32	55	740	1.69	40%	AV3
		720	1.75	38%	
32	79	740	1.35	32%	C01
		720	1.42	41%	
33	62	740	0.38	20%	AV3
		720	0.56	22%	
34	17	740	0.79	15%	C01
		720	0.68	19%	
34	63	740	0.39	20%	AV1
		720	0.53	22%	
34	63	740	1.66	39%	AV2
		720	1.59	36%	
34	63	740	0.49	23%	AV3
		720	0.57	23%	
34	64	740	1.92	41%	AV2
		720	1.88	39%	
36	18	740	1.72	22%	C01
		720	1.79	23%	
37	21	740	0.51	16%	C01
		720	0.51	14%	
38	24	740	1.30	29%	C01
		720	1.24	20%	
42	31	740	2.01	25%	C01
		720	1.58	30%	
42	64	740	1.35	20%	C01
		720	1.13	17%	
42	66	740	0.63	14%	C01
		720	0.61	23%	

Row	Col	Probe	Volts	Call	Location
43	63	740	0.67	27%	C01
		720	0.58	26%	

Indications within the hot leg tubesheet generally had a larger voltage response with the 720 probe, but the measured percent throughwall was close for all calls. The majority of cold leg thinning calls show a larger voltage with the 740 probe. Throughwall percentages are similar for both probes, with the exception of two tubes which had a difference of 9%. In each circumstance one of the signals was slightly distorted, thus producing the large difference in throughwall measurements. Voltages for AVB calls vary between the two probes (probably due to probe motion caused by the geometry of the u-bend), but the measurements for the wear signals is similar.

Section 2 - Dents

Row	Col	Probe	Volts	Call	Location
3	94	740	2.22	DNT	H06-0.85
		720	2.43		
5	4	740	6.65	DNT	HTS+30.23
		720	5.63		
6	1	740	6.19	DNT	H01
		720	7.62		
7	2	740	5.14	DNT	H01
		720	6.33		
8	2	740	5.37	DNT	H01
		720	5.88		
8	3	740	2.53	DNT	C07
		720	2.49		
9	3	740	4.82	DNT	H01
		720	5.78		
9	4	740	13.32	DNT	H01
		720	15.92		
11	72	740	5.33	DNT	H02+8.01
		720	5.13		
12	19	740	2.12	DNT	C07
		720	2.15		
13	9	740	5.21	DNT	H04
		720	5.73		
23	21	740	8.84	DNT	HTS+1.99
		720	9.20		

Row	Col	Probe	Volts	Call	Location
23	21	740	8.62	DNT	HTS+5.52
		720	8.92		
23	24	740	8.53	DNT	C05
		720	7.07		
24	10	740	8.93	DNT	HTS+3.10
		720	9.62		
24	10	740	11.19	DNT	HTS+6.78
		720	10.99		
24	10	740	4.84	DNT	HTS+4.24
		720	5.26		

There were more dent calls which are not listed here (only about half are listed), but a pattern can be seen from those above. The 720 probe provides a larger voltage response on the majority of the dent calls. If a 720 diameter probe is used during the U1C7 outage some dents which measured just under 2.0 volts with the 740 probe may become reportable.

Section 3 - Other Indications & Anomalies

Row	Col	Probe	Volts	Call	Location
3	44	740	2.02	CUD	H01
		720	2.13		
7	3	740	8.29	CUD	H01
		720	9.02		
10	43	740	2.39	CUD	H01
		720	2.93		
16	73	740	14.74	RIC	HTS-1.09
		720	15.14		
23	16	740	3.54	CUD	C05
		720	4.15		
23	57	740	6.41	IRI	AV3+13.38
		720	6.19		
27	84	740	0.23	IRI	H01
		720	0.28		
31	70	740	0.34	IRI	H01
		720	0.44		
35	55	740	0.34	RIC	HO2
		720	0.45		

Row	Col	Probe	Volts	Call	Location
37	76	740	0.63	IRI	HTS+41.43
		720	0.61		
43	59	740	4.36	CUD	C03
		720	4.84		

All the above anomalies, with the exception of two freespan IRI calls, had a larger voltage recorded using the 720 long life probe. Most important is the fact that all the calls from all three sections were detected with both probes.

ATTACHMENT 2

RESULTS FROM EPRI'S

EDDY-CURRENT PROBE CHARACTERIZATION

Attachment 2

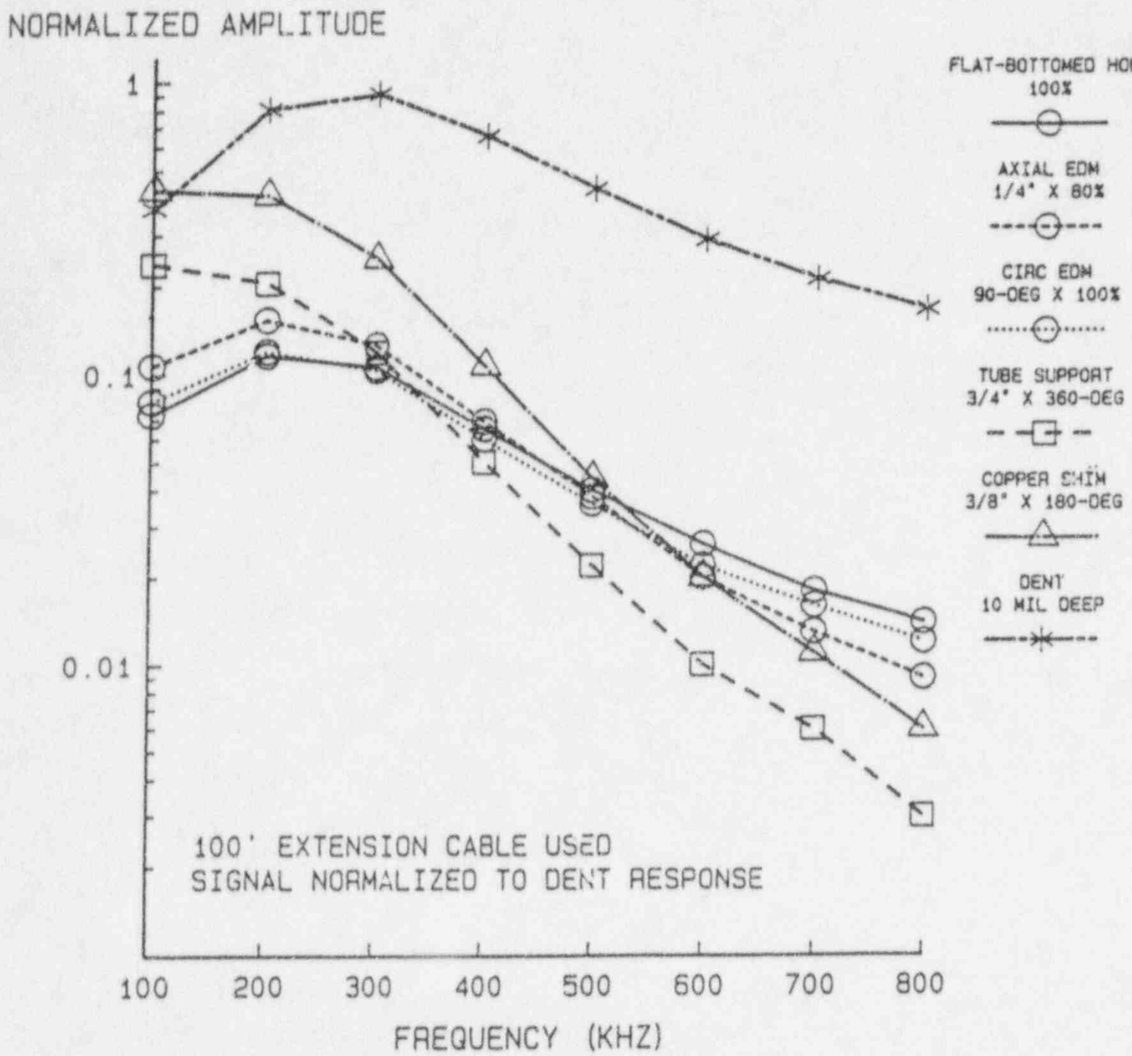

Figure 1A. S/N ratios from 720 bobbin coil with a 100-foot extension cable in a nominal tube with various flaws.

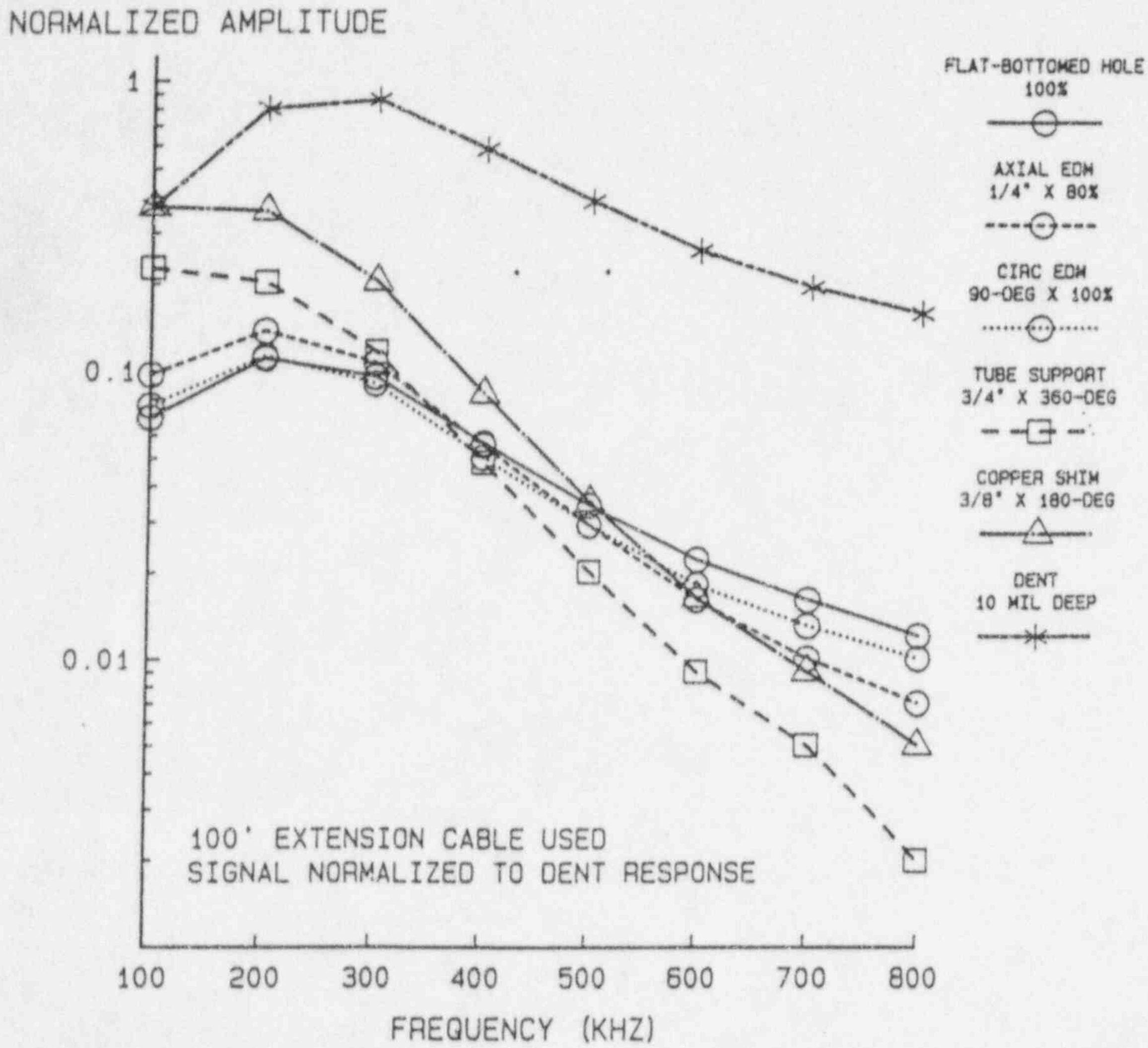

Figure 1B. S/N ratios from 740 bobbin coil with a 100-foot extension cable in a nominal tube with various flaws.

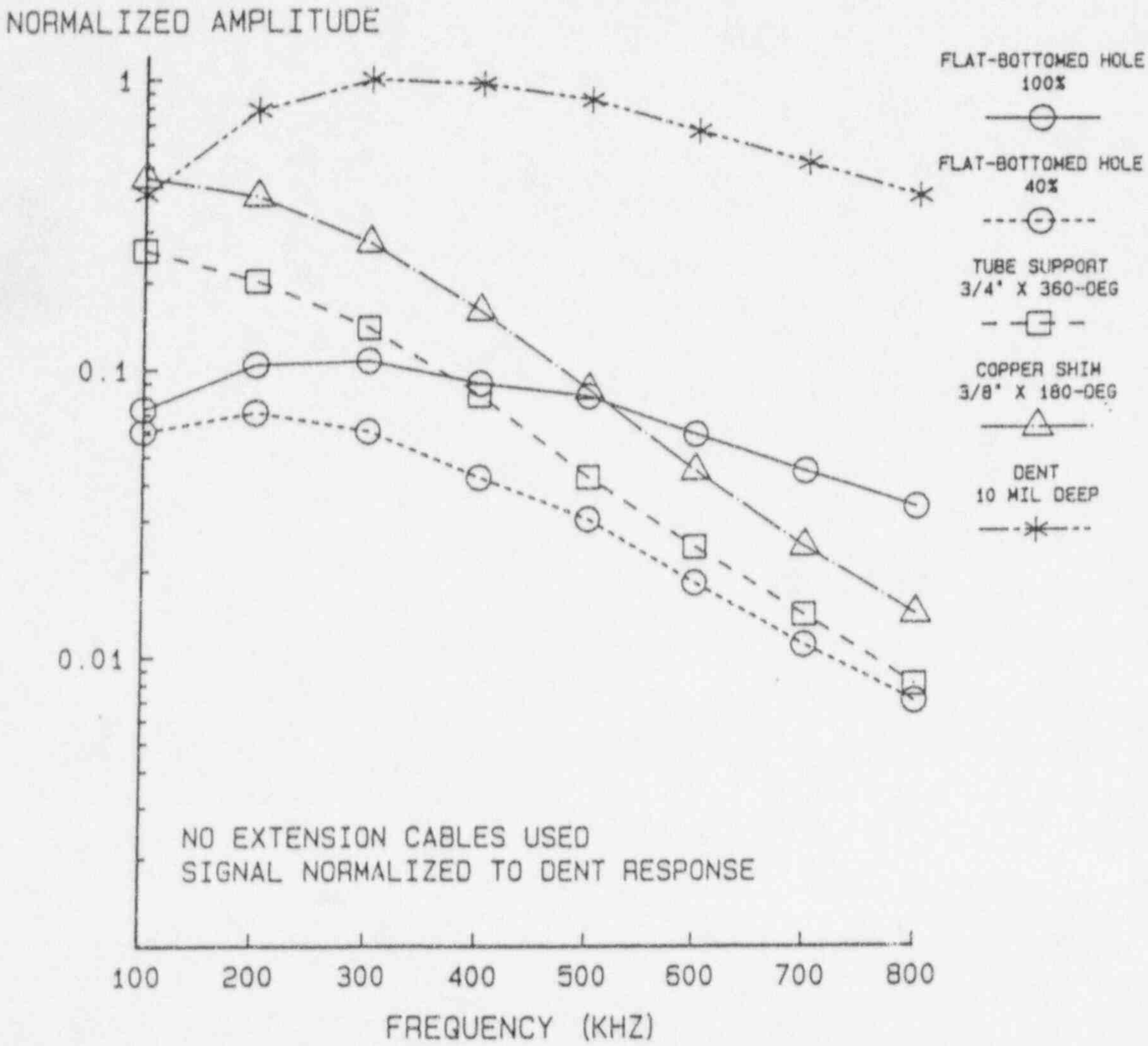

Figure 2A. S/N ratios from 720 bobbin coil in a nominal tube with various flaws.

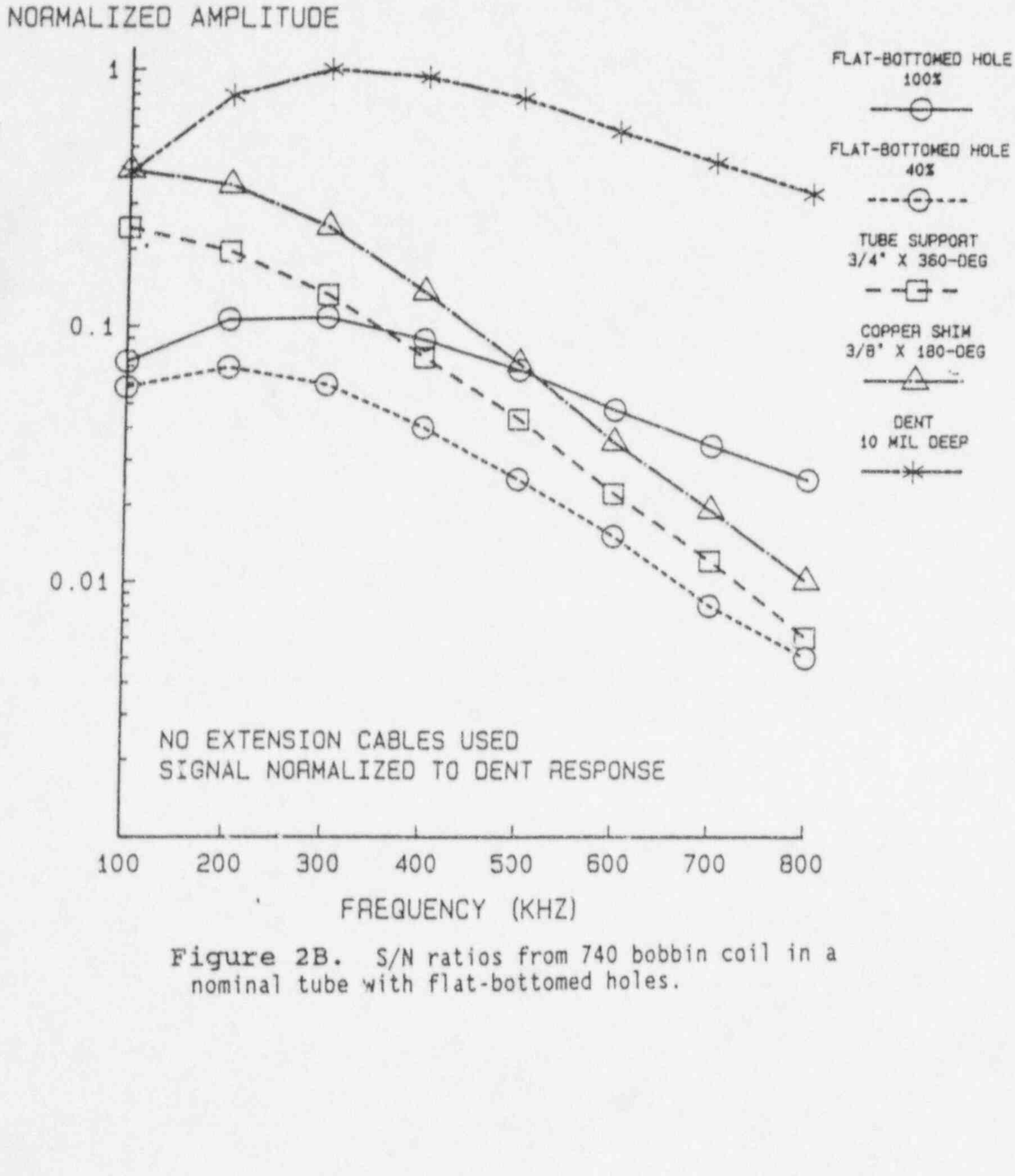

Figure 2B. S/N ratios from 740 bobbin coil in a nominal tube with flat-bottomed holes.

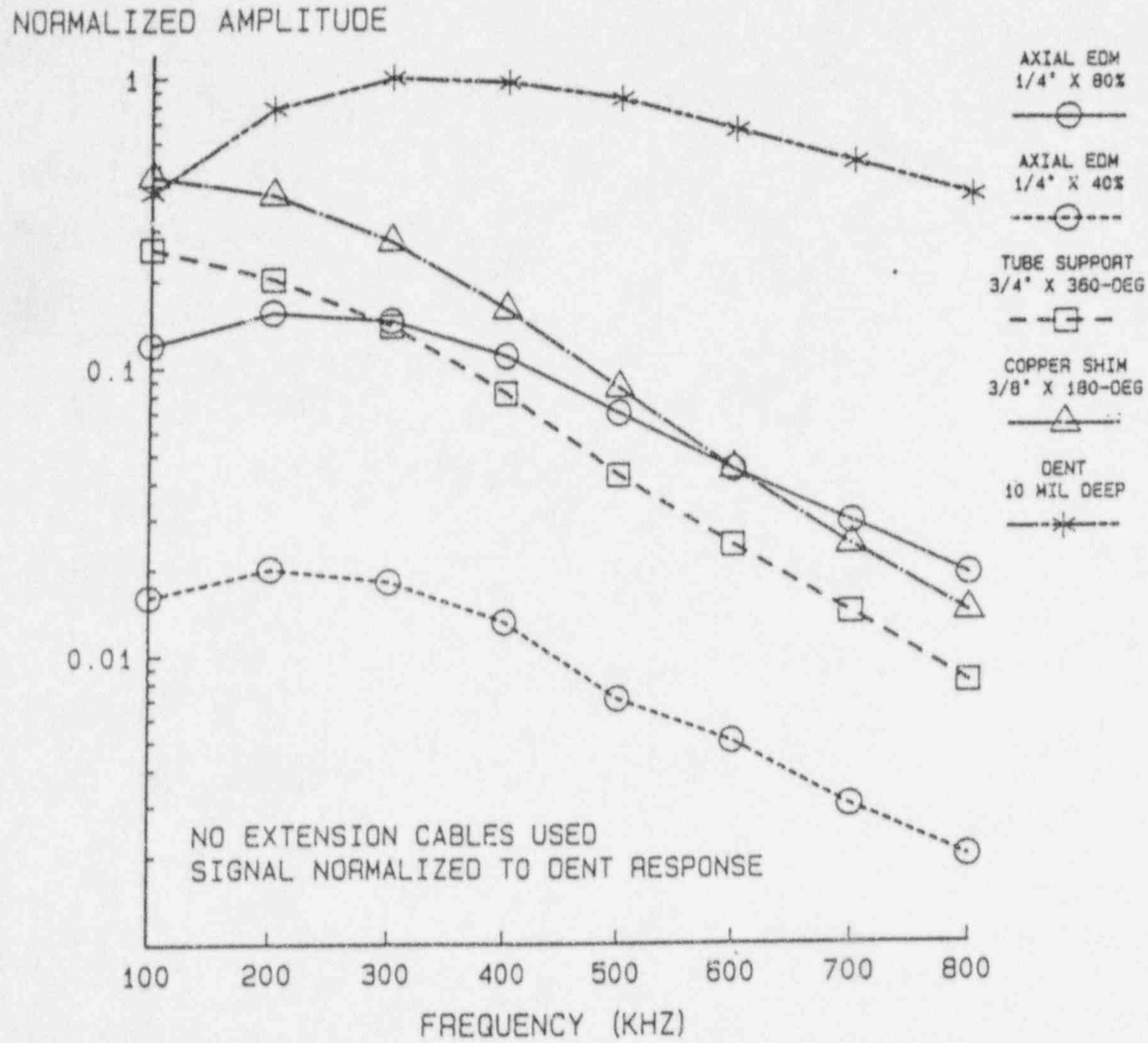

Figure 3A. S/N ratios from 720 bobbin coil in a nominal tube with axial notches.

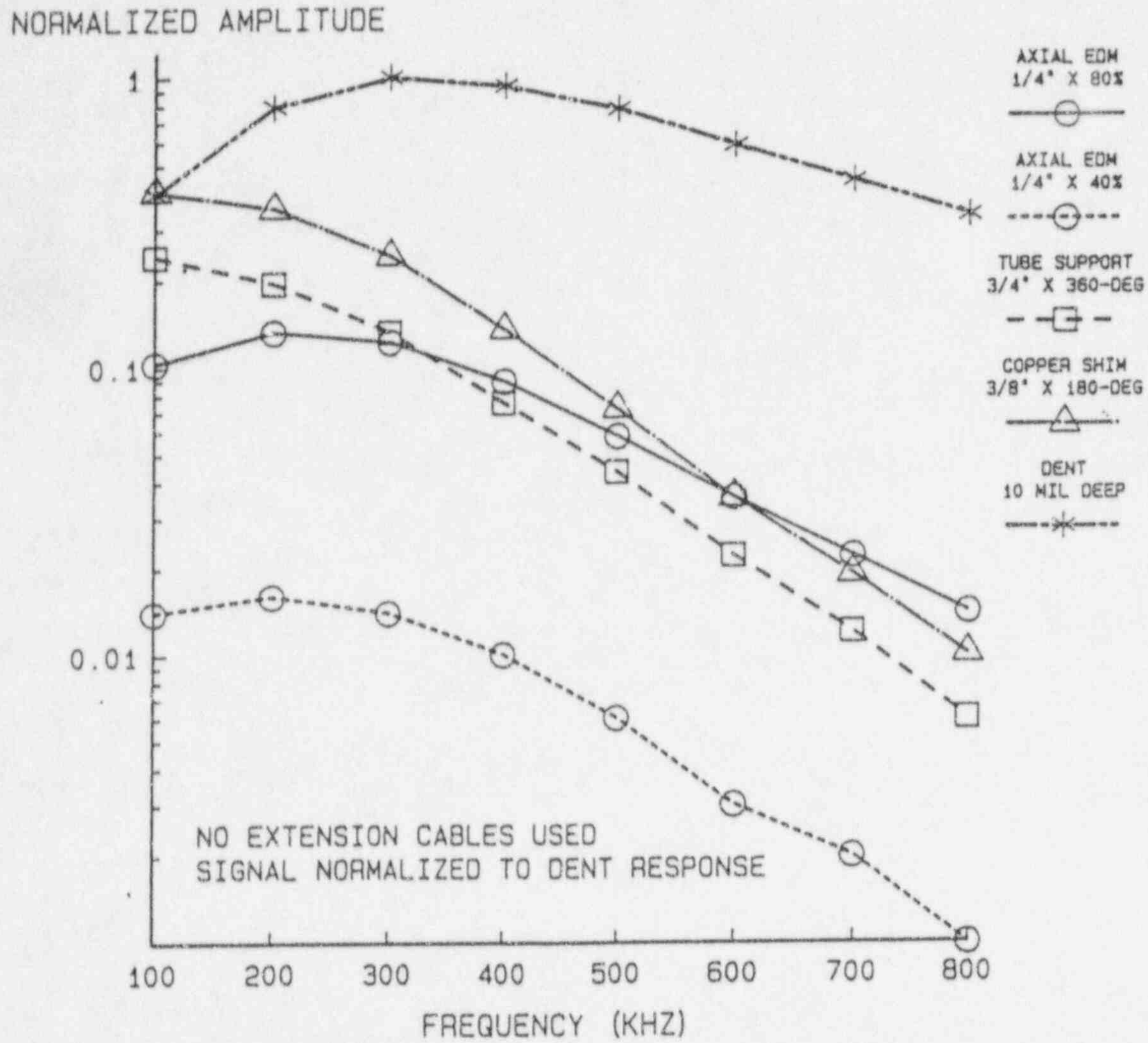

Figure 3B. S/N ratios from 74C bobbin coil in a nominal tube with axial notches.