



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 29, 2010

Mr. Rodney M. Krich
Vice President, Nuclear Licensing
Tennessee Valley Authority
3R Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

SUBJECT: SEQUOYAH NUCLEAR PLANT, UNIT 2 – REVIEW OF THE 2009 REFUELING
OUTAGE STEAM GENERATOR TUBE INSERVICE INSPECTION REPORTS
(TAC NOS. ME3400 AND ME3971)

Dear Mr. Krich:

By letters dated February 19 and May 19, 2010, Tennessee Valley Authority (the licensee) submitted 90-day and 180-day steam generator tube inspection reports, respectively, for the Cycle 16 refueling outage (fall 2009) in accordance with Technical Specification (TS) Section 6.9.1.16.2 for Sequoyah Nuclear Plant (SQN), Unit 2. The licensee provided additional information by letters dated July 16 and August 13, 2010, and by e-mail on August 31, 2010. In addition to these reports, the U.S. Nuclear Regulatory Commission (NRC) staff summarized additional information concerning the 2009 SG tube inspections at SQN, Unit 2 in a letter dated December 10, 2009.

The NRC staff has completed its review of these reports and concludes that the licensee provided the information required by their TSs and that no additional follow-up is required at this time. The NRC staff's review of the reports is enclosed.

Sincerely,

A handwritten signature in black ink that reads "Siva P. Lingam".

Siva P. Lingam, Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-328

Enclosure:
Inspection Summary Report

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REVIEW OF THE 2009 REFUELING OUTAGE
STEAM GENERATOR TUBE INSPECTION REPORTS
TENNESSEE VALLEY AUTHORITY
SEQUOYAH NUCLEAR PLANT, UNIT 2
DOCKET NO. 50-328

By letters dated February 19 and May 19, 2010 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML100550767 and ML101450411, respectively), Tennessee Valley Authority (the licensee) submitted the Cycle 16 refueling outage (fall 2009) 90-day and 180-day steam generator (SG) tube inspection reports, respectively, per Technical Specification (TS) Section 6.9.1.16.2 for Sequoyah Nuclear Plant (SQN), Unit 2. The licensee provided additional information by letters dated July 16, 2010 (ADAMS Accession No. ML102020200) and August 13, 2010 (ADAMS Accession No. ML102300174), and by e-mail on August 31, 2010 (ADAMS Accession No. ML102430446). In addition to these reports, the U.S. Nuclear Regulatory Commission (NRC) staff summarized additional information concerning the 2009 SG tube inspections at SQN, Unit 2 in a letter dated December 10, 2009 (ADAMS Accession No. ML093360644).

The SGs at SQN, Unit 2 are Westinghouse model 51 SGs. Each SG contains 3,388 mill annealed Alloy 600 tubes. Each tube has a nominal outside diameter (OD) of 0.875 inches and a nominal wall thickness of 0.050 inches. The tubes are supported by a number of carbon steel tube support plates and Alloy 600 anti-vibration bars. The tubes were explosively expanded into the tubesheet at both ends for the full length of the tubesheet. The U-bend region of the small radius tubes (i.e., rows 1 and 2) were in-situ stress relieved following Cycle 6 (the row 1 tubes were plugged following Cycle 3 and were unplugged, inspected, and stress relieved following Cycle 6).

In addition to the depth-based tube repair criteria, the licensee is also authorized to apply a voltage-based tube repair criteria for predominantly axially oriented OD stress-corrosion cracking (ODSCC) at the tube support plate elevations. The licensee is also authorized to leave flaws within the tubesheet region in service, provided they satisfy the W* repair criterion.

The licensee provided the scope, extent, methods, and results of their SG tube inspection reports in the documents referenced above. In addition, the licensee described corrective actions (e.g., tube plugging) taken in response to the inspection findings.

Based on its review of the reports submitted, the NRC staff has the following observations and comments:

- In SGs 2 and 3 (Tables 4-7 and 4-8 of the February 19, 2010, letter, respectively) the ratio of new indications in tubes tested with worn probes is higher than the ratio of new indications in tubes tested with good probes. This possibly indicates that the worn probes are missing indications (although the overall average from all four SGs indicates that the ratios of these two quantities are comparable). The licensee attributed these results to random variations in the detectability of these indications.
- The largest indication of ODSCC at the tube support elevations grew from approximately 0.4 volts in 2008 to 6.6 volts in 2009. The 0.4 volt indication in 2008 had been inspected with a worn probe. In general, the growth rates for indications previously inspected with a worn probe were comparable to the growth rates for indications previously inspected with a non-worn (good) probe.

As a result of the comparison of worn probe voltages to non-worn probe voltages for the same indication, which indicated the maximum difference in voltage reading to be approximately 1 volt, the licensee concluded that there was no reason that indications previously tested with a worn probe would experience more apparent growth than indications previously tested with a good probe.

- During the 2009 outage, the voltages of two of the indications of ODSCC at the tube support plates exceeded previous cycle projections. The methodology for projecting the end-of-cycle voltage distribution for such indications was intended to be conservative in terms of projecting the number and severity of the flaws (and therefore conservative in estimating the accident induced leakage and burst probability). This under prediction in the severity of the indications led to under predicting the burst probability in SG 4. Although no performance criteria were exceeded, these results may indicate the need for additional attention if the projections of burst probability and leakage become closer to the performance criteria.
- Twelve indications of axial ODSCC were detected in the freespan region in three tubes. In addition, one axial ODSCC indication was detected in the sludge pile (freespan) region of a fourth tube.
- In implementing the W* repair criterion, the licensee assigned a leak rate to the indications detected within the top 8 inches of the tubesheet even though the indications were not expected to leak. The NRC staff did not review the appropriateness of assigning the specific leak rate to these indications (i.e., those in the top 8 inches of the tubesheet) since such indications are not expected to leak (given a plug-on-detection approach and past operating experience with inspections in the tubesheet region).

Based on a review of the information provided, the NRC staff concludes that the licensee provided the information required by their TSs. In addition, the NRC staff concludes that there are no technical issues that warrant follow-up action at this time since the inspections appear to be consistent with the objective of detecting potential tube degradation and the inspection results appear to be consistent with industry operating experience at similarly designed and operated units.

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/RA/

Siva P. Lingam, Project Manager
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