

March 5, 2008

Mr. William R. Campbell, Jr.
Chief Nuclear Officer and
Executive Vice President
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

SUBJECT: SEQUOYAH NUCLEAR PLANT, UNIT 2 – REVIEW OF STEAM GENERATOR
TUBE INSPECTION REPORTS FOR THE 2006 REFUELING OUTAGE
(TAC No. MD5142)

Dear Mr. Campbell:

By letters dated December 20, 2006, March 20, March 21, November 15, and December 4, 2007, Tennessee Valley Authority, the licensee, submitted information summarizing the results of the 2006 steam (SG) generator tube inspections at Sequoyah Nuclear Plant, Unit 2 (SQN2). These inspections were performed during the 14th refueling outage (U2C14). In addition to these reports, the U.S. Nuclear Regulatory Commission (NRC) staff summarized additional information concerning the 2006 SG tube inspections at SQN2 in a letter dated February 6, 2007.

The NRC staff has completed its review of these reports and concludes that the licensee provided the information required by its technical specifications and that no additional followup is required at this time. The NRC staff's review of the reports is enclosed.

Sincerely,

/RA/

Brenda Mozafari, Senior Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-328

Enclosure: As stated

cc w/encl: See next page

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William R. Campbell, Jr.
Tennessee Valley Authority
cc:

Mr. Ashok S. Bhatnagar
Senior Vice President
Nuclear Generation Development
and Construction
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Mr. James R. Douet
Senior Vice President
Nuclear Support
Tennessee Valley Authority
3R Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Mr. H. Rick Rogers
Vice President
Nuclear Engineering & Technical Services
Tennessee Valley Authority
3R Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Mr. Timothy P. Cleary, Site Vice President
Sequoyah Nuclear Plant
Tennessee Valley Authority
P.O. Box 2000
Soddy Daisy, TN 37384-2000

General Counsel
Tennessee Valley Authority
6A West Tower
400 West Summit Hill Drive
Knoxville, TN 37902

Mr. John C. Fornicola, Manager
Nuclear Assurance
Tennessee Valley Authority
3R Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Ms. Beth A. Wetzel, Manager
Corporate Nuclear Licensing and
Industry Affairs
Tennessee Valley Authority
4X Blue Ridge
1101 Market Street
Chattanooga, TN 37402-2801

SEQUOYAH NUCLEAR PLANT

Mr. James D. Smith, Manager
Licensing and Industry Affairs
Sequoyah Nuclear Plant
Tennessee Valley Authority
P.O. Box 2000
Soddy Daisy, TN 37384-2000

Mr. Christopher R. Church, Plant Manager
Sequoyah Nuclear Plant
Tennessee Valley Authority
P.O. Box 2000
Soddy Daisy, TN 37384-2000

Senior Resident Inspector
Sequoyah Nuclear Plant
U.S. Nuclear Regulatory Commission
2600 Igou Ferry Road
Soddy Daisy, TN 37379

Mr. Lawrence E. Nanney, Director
TN Dept. of Environment & Conservation
Division of Radiological Health
Third Floor, L and C Annex
401 Church Street
Nashville, TN 37243-1532

County Mayor
Hamilton County Courthouse
Chattanooga, TN 37402-2801

Mr. Larry E. Nicholson, General Manager
Performance Improvement
Tennessee Valley Authority
3R Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Mr. Michael A. Purcell
Senior Licensing Manager
Nuclear Power Group
Tennessee Valley Authority
4X Blue Ridge
1101 Market Street
Chattanooga, TN 37402-2801

Ms. Ann P. Harris
341 Swing Loop Road
Rockwood, TN 37854

SUMMARY OF THE NRC STAFF'S REVIEW
SEQUOYAH NUCLEAR PLANT, UNIT 2
2006 STEAM GENERATOR TUBE INSPECTIONS

TAC NO. MD5142

DOCKET NO. 50-328

By letters dated December 20, 2006 (ML063620407 [Agencywide Documents Access and Management System Accession Number]), March 20, 2007 (ML070870118), March 21, 2007 (ML070860384), November 15, 2007 (ML073240045), and December 4, 2007 (ML073450555), Tennessee Valley Authority (TVA, the licensee), submitted information summarizing the results of the 2006 steam generator (SG) tube inspections at Sequoyah Nuclear Plant, Unit 2 (SQN2). These inspections were performed during the 14th refueling outage (U2C14). In addition to these reports, the U.S. Nuclear Regulatory Commission (NRC) staff summarized additional information concerning the 2006 SG tube inspections at SQN2 in a letter dated February 6, 2007 (ML070320194).

The SQN2 has four Westinghouse model 51 SGs. Each SG contains 3,388 mill-annealed Alloy 600 tubes. Each tube has a nominal outside diameter of 0.875 inches and a nominal wall thickness of 0.050 inches. The tubes are supported by seven carbon steel tube support plates and several Alloy 600 anti-vibration bars. The tubes were explosively expanded into the tubesheet at both ends for the full length of the tubesheet.

In addition to a depth-based tube repair criteria, the licensee is authorized to apply a voltage-based tube repair criteria for predominantly axially oriented outside diameter stress corrosion cracking (ODSCC) within the tube support plates. 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 inspections in the documents referenced above. In addition, the licensee described corrective actions (i.e., tube plugging) taken in response to the inspection findings.

As a result of the review of the reports, the NRC staff has the following comments/observations:

- TVA pulled one SG tube during the outage in support of their voltage-based tube repair criteria. This tube was damaged during the tube pull operation (e.g., bowing, gouged, ovalized). As a result, the data could not be directly used in the burst pressure and accident leak rate databases. However, to ensure that the burst pressure and leak rate from the flaws in this tube were consistent with the other data in the database, the licensee performed an analytical assessment of the severity of these flaws. The licensee concluded, based on these analytical assessments, that the burst pressure and leak rate of the flaws in the pulled tube (based on the destructive examination profile of

the flaw) were consistent with the burst pressure and leak rates in the database (given the voltage of the flaws). Although the NRC staff did not review in detail the analytical adjustments performed by the licensee, the NRC staff did review the destructive examination results. The NRC staff concluded that it was reasonable to expect the burst pressure of the flaws in the pulled tube to be consistent with the burst pressures of flaws with similar voltages in the database.

- Of the 11 tubes with indications of ODSCC at a tube support plate elevation, there was one which was not confirmed to contain a flaw with a rotating probe
- A plot of voltage growth as a function of beginning-of-cycle voltage in steam generator 4 was approximately 0.1. Such a slope is normally considered to indicate the onset of voltage-dependent growth. The licensee will continue to check for the presence of voltage-dependent growth.
- There was one tube with a 1.03 volt indication that was only detected with a “non-worn” probe (i.e., a previous inspection with a probe subsequently determined to be worn did not detect this indication). The licensee indicated that the indication was most likely missed as a result of the probability of detection.
- 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).
- The licensee detected a few tubes with the following degradation mechanisms: axially oriented ODSCC in the freespan, axially and circumferentially oriented ODSCC at the top of the tubesheet, axially and circumferentially oriented primary water stress corrosion cracking (PWSCC) at the top of the tubesheet, circumferentially oriented ODSCC at a dented tube support plate, axially and circumferentially oriented PWSCC at dented tube support plates, and axially and circumferentially oriented PWSCC in the U-bend (the circumferential indications were detected in Rows 3 and 4 only).

Based on a review of the information provided, the staff concludes that the licensee provided the information required by their technical specifications. In addition, the 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.

Principal Contributor: Kenneth Karwoski

Date: March 5, 2008