

September 10, 2004

LICENSEE: Tennessee Valley Authority
FACILITY: Sequoyah Nuclear Plant, Unit 1
SUBJECT: SUMMARY OF JUNE 17, 2003, TELEPHONE CONFERENCE WITH THE
TENNESSEE VALLEY AUTHORITY REGARDING THE PRESERVICE
STEAM GENERATOR TUBE INSPECTIONS AT SEQUOYAH UNIT 1
(TAC NO. MC3377)

On June 17, 2003, a telephone conference was held between the staff of the U.S. Nuclear Regulatory Commission (NRC) and representatives of Tennessee Valley Authority (TVA). The purpose of the meeting was to discuss the design of the replacement steam generators for Sequoyah Nuclear Plant, Unit 1, and the scope and results of the preservice inspection.

The manufacturer of the Sequoyah replacement steam generators was the same manufacturer of the steam generators at Ulchin 4, a Korean plant. Ulchin 4 experienced a steam generator tube rupture in 2002, which was associated with a bulge in a tube (i.e., a manufacturing related defect). The bulge was located slightly above the top of the hot-leg tubesheet. The rupture occurred after only a few cycles of operation.

With respect to the design of the replacement steam generators, the licensee indicated the following:

- Manufacturer: Doosan
- Designer: ABB (now Westinghouse)
- Tube Manufacturer: Sandvik
- Tube material: thermally treated Alloy 690
- Tube outside diameter: 0.75-inch
- Tube wall thickness: 0.043-inch
- Number of tubes per steam generator: 4983
- Tube support design: Lattice
- Tube support material: 409 stainless steel
- Tube Pitch: Triangular, 1.0625-inch
- Expansion Method: Hydraulic

The licensee also indicated that the Korean manufacturer performed a qualification and verification program to validate the adequacy of the hydraulic expansion. This qualification program was reviewed/observed by Westinghouse personnel. The ratio of the diameter of the tube to the tubesheet hole in the replacement steam generators is greater than that used in the original Sequoyah steam generators (i.e., the clearance between an unexpanded tube and the tubesheet is smaller in the replacement steam generators).

The Ulchin 4 steam generators, in contrast to the Sequoyah replacement steam generators, have several different features. For example, the Ulchin 4 tube material is mill annealed Alloy 600 and the tubes were fabricated by Babcock & Wilcox (B&W) Specialty Products. At the time the Ulchin 4 steam generators were fabricated, Ulchin 4 was the only commercial unit with tubes fabricated by B&W Specialty Products. The tubes in the Sequoyah replacement steam generators were fabricated by Sandvik. The Ulchin 4 steam generator tubes were explosively expanded into the tubesheet (rather than hydraulically expanded as was done for the Sequoyah replacement steam generators). The Ulchin 4 steam generators were based on the CE System 80 steam generator design.

With respect to the preservice inspection, the TVA representatives indicated the following:

Profilometry was performed on 100-percent of the tubes from the tube end through the first tube support. The profilometry was done in the shop (i.e., Korea), in both the hot- and cold-leg of the steam generator using a specialized bobbin probe with Zetec profiling software. During this examination, no bulges were identified; however, several tubes were identified as requiring re-expansion (i.e., the tube was not fully expanded as a result of original application of the hydraulic expansion).

100-percent of the tubes were examined full length with a bobbin coil probe. This examination was done in the U.S. A few geometry indications were identified in the tubesheet region that were attributed to the tubesheet drilling process.

The U-bend region of 100-percent of the tubes in Rows 1 through Row 3 were examined with a +Point coil

The top of tubesheet region (+3-inches to -3-inches) of 100-percent of the hot-leg tubes were examined with a +Point coil.

Approximately 100 special interest locations were examined with a +Point coil.

A rotating ghent probe (a transmit/receive probe) was used to examine a few permeability type indications.

The licensee indicated that the rotating probe used during the examination not only had a +Point coil but also a pancake coil. The pancake coil data was also evaluated.

As a result of the preservice inspection, one tube was identified with manufacturing damage (i.e., a mar on the tube) in the U-bend area and was plugged. The manufacturing damage was attributed to a modification made in the U-bend area during the fabrication process. Another tube was plugged as a result of a geometry/lift-off signal in the U-bend region. Several other tubes were plugged as a result of flow-induced vibration concerns. In total, 20 tubes were plugged in the four steam generators (4 in SG A, 6 in SG B, 5 in SG C and 5 in SG D).

Based on the results of the preservice inspections, the design of the steam generator, and an understanding of the cause of the tube rupture at Ulchin 4, TVA concluded that they do not have the same conditions in their steam generator as was present in Ulchin 4. The staff did not identify any issues with the licensee's conclusions.

Please direct any inquiries to Ken Karwoski at 301-415-2752, or [KJK1@nrc.gov].

/RA/

Robert J. Pascarelli, Project Manager, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-327

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OFFICE	PDII-2/PM	PDII-2/LA	PDII-2/SC (A)		
NAME	RPascarelli	BClayton	MMarshall		
DATE	8/23/04	8/23/04	9/10/04		

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Tennessee Valley Authority

cc:

Mr. Karl W. Singer
Chief Nuclear Officer and
Executive Vice President
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, Tennessee 37402-2801

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

Mr. James E. Maddox, Vice President
Engineering & Technical Services
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

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

General Counsel
Tennessee Valley Authority
ET 11A
400 West Summit Hill Drive
Knoxville, TN 37902

Mr. John C. Fornicola, Manager
Nuclear Assurance and Licensing
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Mr. Mark J. Burzynski, Manager
Nuclear Licensing
Tennessee Valley Authority
4X Blue Ridge
1101 Market Street
Chattanooga, TN 37402-2801

SEQUOYAH NUCLEAR PLANT

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

Mr. David A. Kulisek, 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
Division of Radiological Health
Dept. of Environment & Conservation
Third Floor, L and C Annex
401 Church Street
Nashville, TN 37243-1532

County Mayor
Hamilton County Courthouse
Chattanooga, TN 37402-2801

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