April 18, 2003

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

SUBJECT: SAFETY EVALUATION OF TVA TOPICAL REPORT NO. 24370-TR–C-003, "STEAM GENERATOR COMPARTMENT ROOF MODIFICATION, REVISION 1" (TAC NO. MB5387)

Dear Mr. Scalice:

On March 28, 2002, the Tennessee Valley Authority (TVA, the licensee) requested the U. S. Nuclear Regulatory Commission (NRC) staff's approval of Topical Report No. 24370-TR-C-003, "Steam Generator Compartment Roof Modification," proposing an alternative methodology for the reconstruction of the steam generator compartment concrete roof. The staff rejected the original proposed methodology in a letter dated January 10, 2003. Subsequently, on February 14, 2003, TVA resubmitted Topical Report No. 24370-TR-C-003, "Steam Generator Compartment Roof Modification, Revision 1" (Topical Rev. 1) for Sequoyah Nuclear Plant Unit 1. Topical Rev. 1 contains a new design and analysis of the reconstruction method for the Unit 1 steam generator compartment roof modification.

The enclosed NRC safety evaluation contains the NRC staff's review. The NRC staff has reviewed the submittal and determined that the alternative method contained in Topical Rev. 1 is acceptable.

In accordance with the guidance provided on the NRC web site, we request that TVA publish an accepted version of this topical report within 3 months of receipt of this letter. The accepted version shall incorporate this letter and the enclosed safety evaluation between the title page and the abstract. It must be well indexed such that information is readily located. Also, it must contain in appendices historical review information, the questions and accepted responses, and original report pages that were replaced. The accepted version shall include an "-A" (designated accepted) following the report identification symbol.

If the NRC's criteria or regulations change so that the conclusions in this letter are invalidated, thus making the topical report unacceptable, TVA will be expected to revise and resubmit its

respective documentation, or submit justification for the continued applicability of the topical report without revision of the respective documentation.

If you have any questions concerning this matter, please contact Eva Brown at (301) 415-2315.

Sincerely,

/RA/

Michael L. Marshall, Jr., Senior Project Manager, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-327

Enclosure: Safety Evaluation

cc w/encl: See next page

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SEQUOYAH NUCLEAR PLANT

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR SAFETY EVALUATION OF TOPICAL REPORT NO. 24370-TR–C-003,

"STEAM GENERATOR COMPARTMENT ROOF MODIFICATION, REVISION 1"

TENNESSEE VALLEY AUTHORITY

SEQUOYAH NUCLEAR PLANT, UNIT 1

DOCKET NO. 50-327

1.0 INTRODUCTION

In a letter dated March 28, 2002, Tennessee Valley Authority (TVA, the licensee) requested approval of Topical Report No. 24370-TR-C-003, "Steam Generator Compartment Roof Modification," for use at Sequoyah Nuclear Plant, Unit 1 (SQN1). This submittal described an alternate methodology for the reconstruction of the steam generator (SG) compartment concrete roof. The staff rejected the original proposed methodology by the licensee in a letter dated January 10, 2003. Subsequently, in a letter dated February 14, 2003, the licensee submitted Revision 1 of the subject topical report for U. S. Nuclear Regulatory Commission (NRC) review and approval. Topical Report No. 24370-TR-C-003, "Steam Generator Compartment Roof Modification, Revision 1" (the Topical Rev. 1) contained a new design and analysis of the reconstruction method for the Unit 1 SG compartment roof modification.

2.0 DESIGN STANDARDS

NUREG-0800, Revision 1, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants" (SRP), Section 3.8.3, outlines the standards for use by the NRC staff during the review of concrete containment internal structures. The SG compartment roof or divider barrier is designed in the event of a loss-of-coolant-accident to contain the steam released from the reactor coolant system, and to channel the steam through venting doors to the ice-condenser, temporarily serving as a pressure-retaining envelope.

SRP 3.8.3, Section II.3.d, indicates that the loads and load combinations for the divider barrier are required to be evaluated against Article CC-3000 of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Code, 1975 Edition (the Code) Section III, Division 2 with some exceptions. The design and analysis of the modification are contained in Section III, Division 2 of the Code with the specified limits for stresses and strains requirements being contained in Subsection CC-3430.

Enclosure

3.0 EVALUATION

3.1 Description of Compartment Roof Modification

The four SGs of the SQN1 will be replaced during the spring of 2003. To support the replacement of the old SGs with the replacement SGs, access openings will be created in the roof of the SG compartments. Each access opening will be sized and cut to allow the removal and replacement of the SG in the compartment.

To provide an access opening for SG replacement, a section of the compartment concrete roof over each SG will have to be cut out. Cutting of the concrete will be accomplished by first core-boring holes around the perimeter of the cut, then using wire saws to cut straight lines between the cores. The cores also serve as the bolt holes for the through-bolts used to connect the concrete section back to the existing compartment roof concrete. After removal, the edges of the concrete section will be bush-hammered to provide a gap that ranges from 3/4 inch to 1-1/4 inches between the cut-out portion of the concrete and the existing compartment roof concrete.

The cut-out portion of the concrete will be re-attached to the existing compartment roof concrete once the replacement SG and associated piping are placed inside the compartment. A top and bottom steel connecting frame will sandwich the cut-out portion of the concrete. The steel frames will be through-bolted by four 2-inch diameter threaded rods and span over the existing compartment roof concrete. The steel frames will also be through-bolted by six 2-1/2 inch and eighteen 2-inch diameter threaded rods along the perimeter of the cut line. The threaded rods will be pretensioned to a stress level of 70 percent of its yield stress.

Approximately 30 tapered steel shim sets will be installed along the perimeter of the cut line. Each tapered shim set will comprise a tapered shim attached to the sectional surface of the cut-out portion of the concrete with anchor bolts and a loose tapered shim that will be driven into the gap between the fixed tapered shim and the existing compartment roof concrete. The loose tapered shim will be welded to the fixed shim to prevent movement. The bolt holes and the remaining annular space will be grouted using nonshrink grout.

3.2 Evaluation of Proposed Modification

The licensee analyzed the roof of the SG compartments using a finite element computer code (STRUDL). Manual calculations were performed at various locations to confirm results obtained from the computer analysis. The analysis results indicated that the maximum concrete and rebar stresses in the modified roof are within the allowable stress limits for normal and abnormal/extreme environmental conditions as specified in Section CC-3000 of Section III, Division 2 of the Code. The maximum calculated bending stress in the connecting frame beams and the maximum calculated bearing stress on concrete and the tapered steel shims were determined to be below the allowable limits.

Vertical loads generated by the vertical seismic inertia of the cut-out portion of the concrete roof and the maximum design basis accident to the existing compartment roof concrete. This force transfer would occur because the cut-out portion of the concrete roof is not only sandwiched between two steel frames, but, also through-bolted to the frames that span over the existing compartment roof concrete and are connected to it by through-bolts along the perimeter of the

cut line. Horizontal loads generated by the horizontal seismic inertia of the cut-out portion of the concrete roof would be transferred through steel shims to the existing compartment roof concrete. The steel frames, in conjunction with the through-bolts and the steel shims, eliminate any significant movement between the cut-out portion of the concrete roof and the existing compartment roof concrete and provide a positive connection between the two. The NRC staff finds that the proposed modification method provides a positive connection between the cut-out portion of the concrete roof and the existing compartment roof concrete and is, therefore, reasonable and acceptable.

The licensee used STRUDL computer code to analyze the structure of the proposed roof modification and verified the adequacy of the computer results by manual calculations at several locations. The staff finds that the manual verification adds confidence to the analysis results. The acceptance criteria were based on Section III, Division 2 of the Code requirements, which are acceptable to the staff. The analysis results indicate that the stresses in concrete and steel of the roof modification structure, under all loading combinations prescribed by the Section III, Division 2 of the Code, are within the allowable specified stress limits. The NRC finds that the licensee has used appropriate analysis methods and criteria to analyze the modified roof compartment, and that the analysis results indicate conformance with the design code requirements.

4.0 CONCLUSION

The NRC staff has reviewed the proposed SG compartment roof modification method for SQN1. Based on the information provided by the licensee, the NRC staff has concluded that the load and load combinations proposed are conservative, the design and analysis were completed consistent with appropriate industry standards, and the allowable stresses and strains are reasonable and acceptable. Therefore, the proposed modification satisfies the design requirements at the SQN1.

Principal Contributor: John S. Ma, NRR

Date: April 18, 2003