

July 30, 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: SEQUOYAH NUCLEAR PLANT, UNIT 2 - EXEMPTION FROM  
REQUIREMENTS OF TITLE 10 OF THE *CODE OF FEDERAL REGULATIONS*,  
PART 50, APPENDIX G (TAC NO. MB6437)

Dear Mr. Scalice:

The Commission has approved the enclosed exemption from the specific requirements of Title 10 of the *Code of Federal Regulations*, Part 50, Section 50.60(a) and Appendix G for Sequoyah Nuclear Plant, Unit 2. The exemption will allow the use of American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, Code Case N-640, "Alternative Requirement Fracture Toughness for Development of P-T Limit Curves for ASME B&PV Code, Section XI, Code Case N-640," as the basis for the revised reactor pressure vessel pressure-temperature limit curves. This action is in response to your letter of September 6, 2002, as supplemented by letters dated December 19, 2002, and June 24, 2003.

A copy of the exemption has been forwarded to the Office of the Federal Register for publication.

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 Nos. 50-328

Enclosure: Exemption

cc w/encl: See next page

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UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION  
TENNESSEE VALLEY AUTHORITY  
SEQUOYAH NUCLEAR PLANT, UNIT 2  
DOCKET NO. 50-328  
EXEMPTION

1.0 BACKGROUND

Tennessee Valley Authority (TVA, the licensee) is the holder of Facility Operating License No. DRP-79 which authorizes operation of Sequoyah Nuclear Power Station, Unit 2 (SQN2). The license provides, among other things, that the facility is subject to all rules, regulations, and orders of the U.S. Nuclear Regulatory Commission (NRC, the Commission) now or hereafter in effect.

The facility consists of a pressurized water-reactor located on TVA's Sequoyah site, which is located in Hamilton County, Tennessee.

2.0 REQUEST/ACTION

Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Appendix G, which is invoked by 10 CFR 50.60, requires that pressure-temperature (P-T) limits be established for reactor pressure vessels (RPVs) during normal operating and hydrostatic or leak rate testing conditions. Specifically, Appendix G to 10 CFR Part 50 states that “[t]he appropriate requirements on...the pressure-temperature limits and minimum permissible temperature must be met for all conditions,” and “[t]he pressure-temperature limits identified as ‘ASME Appendix G limits’...require that the limits must be at least as conservative as limits obtained by following the methods of analysis and the margins of safety of Appendix G of Section XI of the ASME Code.” Appendix G of 10 CFR Part 50 also specifies that the Editions and Addenda of

the ASME Boiler and Pressure Vessel (B&PV) Code which are incorporated by reference in 10 CFR 50.55a apply to the requirements in Appendix G to 10 CFR Part 50. The NRC endorsed Editions and Addenda of the ASME B&PV Code through the 1998 Edition and 2000 Addenda. However, TVA has currently incorporated the 1995 Edition through the 1996 Addenda of the ASME B&PV Code into the SQN2 licensing basis for defining the ASME B&PV Code requirements which apply to the unit's ASME B&PV Code, Section XI program. Hence, with respect to the statements from Appendix G to 10 CFR Part 50 referenced above, it is the 1995 Edition through 1996 Addenda of ASME B&PV Code, Section XI, Appendix G which apply for SQN2. Finally, 10 CFR 50.60(b) states that, "[p]roposed alternatives to the described requirements in [Appendix G] of this part or portions thereof may be used when an exemption is granted by the Commission under [10 CFR 50.12]."

TVA requested in its submittal dated September 6, 2002, as supplemented by letters dated December 19, 2002, and June 24, 2003, that the staff exempt SQN2 from application of specific requirements of Appendix G to 10 CFR Part 50, and substitute use of ASME B&PV Code Case N-640. ASME B&PV Code Case N-640 permits the use of an alternate reference fracture toughness curve for RPV materials for use in determining the P-T limits. The exemption request is consistent with, and needed to support, a SQN2 license amendment request that was submitted on June 5, 2003, to modify the P-T limit curves in the facility's Technical Specifications (TS). The SQN2 license amendment request will revise the P-T limits for heatup, cooldown, and inservice test limitations for the reactor coolant system (RCS) to 32 effective full power years of operation.

#### Code Case N-640

The licensee has proposed an exemption to allow use of ASME Code Case N-640 in conjunction with ASME Section XI, Appendix G, 10 CFR 50.60(a) and 10 CFR Part 50, Appendix G, to establish P-T limits for the SQN2 RPV. The revised P-T limits have been developed using the lower bound  $K_{IC}$  fracture toughness curve shown in ASME Section XI,

Appendix A, Figure A-2200-1, in lieu of the lower bound  $K_{IA}$  fracture toughness curve of ASME Section XI, Appendix G, Figure G-2210-1, as the basis fracture toughness curve for defining the SQN2 P-T limits. The other margins involved with the ASME Section XI, Appendix G process of determining P-T limit curves remain unchanged.

Use of the  $K_{IC}$  curve as the basis fracture toughness curve for the development of P-T operating limits is more technically correct than use of the  $K_{IA}$  curve. The  $K_{IC}$  curve appropriately implements the use of a relationship based on static initiation fracture toughness behavior to evaluate the controlled heatup and cooldown process of an RPV, whereas the  $K_{IA}$  fracture toughness curve codified into Appendix G to Section XI of the ASME Code was developed from more conservative crack arrest and dynamic fracture toughness test data. The application of the  $K_{IA}$  fracture toughness curve was initially codified in Appendix G to Section XI of the ASME Code in 1974 to provide a conservative representation of RPV material fracture toughness. This initial conservatism was necessary due to the limited knowledge of RPV material behavior in 1974. However, additional knowledge has been gained about RPV materials which demonstrates that the lower bound on fracture toughness provided by the  $K_{IA}$  fracture toughness curve is well beyond the margin of safety required to protect the public health and safety from potential RPV brittle failure. Application of the provisions of ASME Code Case N-640 will result in the implementation of P-T limit curves having sufficient margin to ensure that, when stressed, the reactor pressure vessel will behave in a nonbrittle manner and that the probability of rapidly propagating brittle fracture is extremely low.

In addition, P-T limit curves based on the  $K_{IC}$  fracture toughness curve will enhance overall plant safety by opening the P-T operating window with the greatest safety benefit in the region of low temperature operations. The operating window through which the operator heats up and cools down the RCS is determined by the difference between the maximum allowable pressure determined by Appendix G of ASME Section XI, and the minimum required pressure for the reactor coolant pump seals adjusted for instrument uncertainties. A narrow operating

window could potentially have an adverse safety impact by increasing the possibility of inadvertent overpressure protection system actuation due to pressure surges associated with normal plant evolutions such as RCS pump starts or swapping operating charging pumps with the RCS in a water-solid condition.

Therefore, the licensee concluded that these considerations were special circumstances pursuant to 10 CFR 50.12(a)(2)(ii), and supported the requested exemption to utilize the provisions of ASME B&PV Code Case N-640 in the development of SQN2 RPV P-T limit curves.

The NRC staff has reviewed the exemption request submitted by TVA and has concluded that an exemption should be granted to permit the licensee to utilize the provisions of ASME B&PV Code Case N-640 for the purpose of developing SQN2 RPV P-T limit curves. The NRC staff agrees that special circumstances pursuant to 10 CFR 50.12(a)(2)(ii), "[a]pplication of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule," exist. The NRC staff concurs that the licensee may acceptably apply the provisions of ASME Code Case N-640 to relax the requirements found in the 1995 Edition through 1996 Addenda of the ASME B&PV Code, Section XI, Appendix G, while maintaining, pursuant to 10 CFR 50.12(a)(2)(ii), the underlying purpose of the ASME B&PV Code and the NRC regulations to ensure that adequate margins of safety exist to protect the RCS from the potential for brittle failure.

### 3.0 DISCUSSION

Pursuant to 10 CFR 50.12, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 50, when (1) the exemptions are authorized by law, will not present an undue risk to public health or safety, and are consistent with the common defense and security, and (2) when special circumstances are present. The NRC staff accepts the licensee's determination that an exemption would be required to approve the use of ASME B&PV Code Case N-640. The NRC

staff concluded that the use of ASME B&PV Code Case N-640 would meet the underlying intent of Appendix G to 10 CFR Part 50. Based upon a consideration of the conservatism that is explicitly incorporated into the methodologies of Appendix G to 10 CFR Part 50, the staff concluded that application of ASME Code Case N-640 as described would provide an adequate margin of safety against brittle failure of the RPV. This is also consistent with the determination that the staff has reached for other licensees under similar conditions based on the same considerations. Therefore, the staff concludes that requesting the exemption under the special circumstances of 10 CFR 50.12(a)(2)(ii) is appropriate and that the methodology of Code Case N-640 may be used to revise the P-T limits for the SQN2 RPV.

#### 4.0 CONCLUSION

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12(a), the exemption is authorized by law, will not endanger life or property or common defense and security. Also, special circumstances are present. Therefore, the Commission hereby grants Tennessee Valley Authority an exemption from the requirements of Appendix G to 10 CFR Part 50 for the development of P-T limit curves for the SQN2 RPV.

Pursuant to 10 CFR 51.32, the Commission has determined that the granting of this exemption will not result in any significant effect on the quality of the human environment (68 FR 44550).

This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 30th Day of July 2003.

FOR THE NUCLEAR REGULATORY COMMISSION

*/RA/*

Ledyard B. Marsh, Director  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Tennessee Valley Authority

SEQUOYAH NUCLEAR PLANT

cc:

Mr. Karl W. Singer, 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. Richard T. Purcell  
Site Vice President  
Sequoyah Nuclear Plant  
Tennessee Valley Authority  
P.O. Box 2000  
Soddy Daisy, TN 37379

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

Mr. Robert J. Adney, General Manager  
Nuclear Assurance  
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

Mr. Pedro Salas, Manager  
Licensing and Industry Affairs  
Sequoyah Nuclear Plant  
Tennessee Valley Authority  
P.O. Box 2000  
Soddy Daisy, TN 37379

Mr. D. L. Koehl, Plant Manager  
Sequoyah Nuclear Plant  
Tennessee Valley Authority  
P.O. Box 2000  
Soddy Daisy, TN 37379

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 Executive  
Hamilton County Courthouse  
Chattanooga, TN 37402-2801

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