August 18, 2003

Mr. J. A. Scalice
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 1 - RELIEF REQUEST ASSOCIATED WITH ESSENTIAL RAW COOLING WATER FLAW REPAIR (TAC NO. MB9643)

Dear Mr. Scalice:

By a letter dated June 14, 2003, and as supplemented on June 14, 2003, the Tennessee Valley Authority (TVA, the licensee) submitted a request for relief from the inservice inspection requirements specified in American Society of Mechanical Engineers (ASME) Code, Section XI, for the repair of a through-wall flaw. The flaw was located in moderate energy Class 3 piping identified in the essential raw cooling water (ERCW) 1B return piping to the ERCW discharge piping for Sequoyah Unit 1.

In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(a)(3)(ii), your request for relief proposes three compensatory measures. TVA will perform a weekly walkdown and assess the operability of the ERCW system. Any changes which affect system operability or structural integrity will be evaluated. Also, an ultrasonic examination will be performed every 3 months to assess the piping degradation rate. Based upon the weekly walkdowns and ultrasonic examinations, an engineering evaluation will be performed to determine if further remedial measures or corrective actions are needed.

Based on our review of your submittals, we have concluded that performing the ASME Code repair under the conditions identified in the Relief Request would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Therefore, the licensee's request is authorized pursuant to 10 CFR 50.55a(a)(3)(ii) until startup of Sequoyah Unit 2 from the Cycle 12 refueling outage.

As the through-wall flaw failed to significantly affect the capability of the ERCW system to perform its intended function and the structural integrity is being routinely monitored and evaluated, a verbal authorization for this request was granted for Sequoyah Unit 1 in a telephone conversation on June 14, 2003. Participants in the call included Scott Moore, Allen Howe, Terence Chan, Stephen Cahill, and Eva Brown of the US Nuclear Regulatory Commission (NRC) staff and Pedro Salas, James Smith, and Dennis Lundy for TVA.

The bases for the NRC staff's conclusions are contained in the enclosed Safety Evaluation. If you have any questions regarding this issue, please feel free to contact Michael Marshall at (301) 415-2734 or Eva Brown at (301) 415-2315.

Sincerely,

/RA/

Allen G. Howe, Chief, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-327

Enclosure: As stated

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

INSERVICE INSPECTION PROGRAM

RELIEF REQUEST

TENNESSEE VALLEY AUTHORITY

SEQUOYAH NUCLEAR PLANT, UNIT 1

DOCKET NO. 50-327

## 1.0 INTRODUCTION

By a letter dated June 14, 2003, and as supplemented June 14, 2003, the Tennessee Valley Authority (TVA, the licensee) submitted a request for relief from the inservice inspection requirements specified in American Society of Mechanical Engineers (ASME) Code, Section XI, for the repair of a through-wall flaw in moderate energy Class 3 piping identified in the essential raw cooling water (ERCW) 1B return piping to the ERCW discharge piping for the Sequoyah Nuclear Plant, Unit 1 (SQN1). In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(a)(3)(ii), your request for relief proposes to monitor the leak weekly and to perform ultrasonic examinations every 3 months until an ASME Code repair can be completed. The subject relief was requested for the remainder of the Sequoyah Nuclear Plant, Unit 2 (SQN2), operating cycle and Cycle 12 Refueling Outage.

On June 13, 2003, the licensee discovered a through-wall leak in the ERCW system at SQN1. The leak was located in an 8-inch diameter carbon steel pipe in the ERCW header 1B return piping to the 1B ERCW discharge header. At the time of discovery, TVA determined that the leakage from the piping was less than one gallon per minute (gpm). Upon review of the design requirements for the system, TVA concluded that the amount of leakage observed failed to significantly affect the operability of the system, and that the leakage observed was not spraying on any electrical equipment or causing any flooding concerns. TVA prepared Problem Evaluation Report (PER) 03-008909-000 to initiate corrective action for this condition.

TVA indicated that SQN1 was currently in Mode 3, starting up from the Cycle 12 refueling outage and requested that the U.S. Nuclear Regulatory Commission (NRC) approve the relief request by June 14, 2003. TVA indicated the intention to replace the affected section of pipe prior to startup from the SQN2 Cycle 12 Refueling Outage (scheduled to begin in November). Verbal relief was granted by the NRC staff on June 14, 2003. This Safety Evaluation documents the bases for that approval.

Enclosure

## 2.0 REGULATORY EVALUATION

### 2.1 Regulations/Requirements

Section 50.55a of 10 CFR requires nuclear power facility piping and components to meet the applicable requirements of Section XI of the ASME Boiler and Pressure Vessel Code (hereafter referred to as the Code). Section XI of the Code specifies Code-acceptable repair methods for flaws that exceed Code acceptance limits in piping that is in-service. A Code repair is required to restore the structural integrity of flawed Code piping, independent of the operational mode of the plant when the flaw is detected. Those repairs not in compliance with Section XI of the Code are non-Code repairs.

Section 50.55a(a)(3) of 10 CFR states, in part, that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if the licensee demonstrates that:
(i) the proposed alternatives would provide an acceptable level of quality and safety, or
(ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

In accordance with 10 CFR 50.55a(f)(4)(ii), licensees are required to comply with the requirements of the latest edition and addenda of the ASME Code incorporated by reference in the regulations 12 months prior to the start of subsequent 120-month inservice testing (IST) program intervals. Licensees whose IST program reaches its 120-month (10-year) interval after November 22, 2000, are required to implement the 1995 Edition with the 1996 Addenda of the ASME *Code for Operation and Maintenance of Nuclear Power Plants* (ASME OM Code).

ASME Code Cases approved by the NRC provide an acceptable voluntary alternative to the mandatory ASME Code provisions. Section 50.55a of 10 CFR was amended to incorporate Regulatory Guide (RG) 1.147, Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1, by reference and states the requirements governing the use of Code Cases. ASME Code Case N-463-1 has been approved for use as indicated in RG 1.147 and addresses evaluation procedures and acceptance criteria for flaws in Class 1 ferritic piping. Although ASME Code Case N-463-1 addresses Class 1 piping specifically, the acceptance standards in ASME Code Case N-463-1 are extended by the NRC staff, in this instance, to include moderate-energy Class 3 piping. This position is consistent with previous generic guidance provided by the NRC staff and does not apply to flaws in pumps, valves, heat-exchangers, or any other components.

Using linear elastic fracture mechanics and assuming the minimum acceptable wall thickness, the applied stress intensity factor “K” should be less than 35 ksi$\sqrt{\text{in}}$, which is consistent with the lower-bound fracture toughness property in ASME Code Case N-463-1. The calculation of “K” using the evaluation procedures in the Code Case and applicable acceptance criteria are sufficient to demonstrate the continued structural integrity for a defined period of time.

### 2.2 Regulatory Guidance

Generic Letter (GL) 90-05, entitled "Guidance for Performing Temporary Non-Code Repair of ASME Code Class 1, 2 and 3 Piping," dated June 15, 1990, provides guidance for performing temporary non-Code repairs of ASME Class 1, 2, and 3 piping. For Class 3 piping, licensees

can perform temporary non-Code repairs as long as the guidance in GL 90-05 is followed. The licensee is required to document the repair by requesting the NRC to grant relief from the ASME Code for the implementation of temporary non-Code repairs of Class 3 piping.

GL 90-05 provides for temporary non-Code repairs in Class 3 piping only when the flaw is detected during plant operation (Modes 1-2) and cannot be isolated without a plant shutdown. This provision allows for the rather infrequent instances of small leaks in some Class 3 systems, which could lead to an excessive number of plant start-up and shutdown cycles with undue and unnecessary stress on systems and components without a compensating increase in safety. If a flaw is detected during a plant shutdown (Modes 3-6), an ASME Code repair is required before plant restart. At the time of the request, SQN1 was in Mode 3, starting up from the Cycle 12 refueling outage and, therefore, the provisions of GL 90-05 did not apply.

3.0 RELIEF REQUEST

3.1 Component for Which Relief is Requested:

8-inch Nominal Pipe Size (NPS), Schedule 40 carbon steel pipe, ERCW ASME Class 3. This section of piping returns cooling water to the 1B ERCW discharge header.

3.2 Code Requirement (as stated):

When an American Society of Mechanical Engineers (ASME), Section XI code repair or replacement is performed, it is required to be performed in accordance with ASME, Section XI, IWA-4000 or IWA-7000, respectively, in order to restore the system's structural integrity back to its original design requirements.

3.3 Proposed Temporary Non-code Repair (as stated):

Based upon the above, TVA requests relief from ASME code. TVA plans to leave the piping "as is." The leakage is negligible and does not present a maintenance or operational problem. Additionally, the pin-hole opening in the pipe usually closes itself, thereby limiting or stopping the leakage, due to the debris associated with river-water systems. The GL 90-05 evaluation shows that this piping still has sufficient strength. Based on the continued monitoring discussed below, TVA will reevaluate the need for additional housekeeping measures as appropriate.

3.4 Alternative Temporary Requirements (as stated):

Engineering will perform a weekly walkdown and assess the operability of the system. Any changes which affect system operability or structural integrity will be evaluated. An ultrasonic examination will be performed every three months to assess the piping degradation rate. Based upon the weekly walkdowns and ultrasonic examinations, an engineering evaluation will be performed to determine if further remedial measures or corrective actions are needed. An ASME Section XI repair or replacement will be performed before the completion of the Unit 2 Cycle 12 refueling outage which is currently scheduled to start in November 2003.

3.5 TVA Commitments (as stated):

1. TVA will replace the affected piping in accordance with the American Society of Mechanical Engineers code prior to startup from the Unit 2 Cycle 12 refueling outage (currently scheduled to begin November 2003).

2. Engineering will perform a weekly walkdown and assess the operability of the system. Any changes which affect system operability or structural integrity will be evaluated.

3. An ultrasonic examination will be performed every three months to assess the piping degradation rate. Based upon the weekly walkdowns and ultrasonic examinations, an engineering evaluation will be performed to determine if further remedial measures or corrective actions are needed.

3.6 Evaluation

3.6.1 Operability Determination, and Root Cause Analysis

The licensee reviewed the design requirements for the system and concluded that the amount of leakage did not affect the operability of the system. The small amount of leakage from the pipe was not spraying on any electrical equipment or creating any flooding concerns.

The licensee performed a root-cause analysis of the flaws, and determined that the degradation resulted from microbiological induced corrosion (MIC). The PER will require examination of the piping once it is removed to confirm the root cause along with any other corrective actions. Since the preliminary root cause is considered to be MIC, no additional areas were examined because potential MIC locations cannot be predicted. TVA stated that SQN1 has had numerous examples of MIC leakage with no threat to operability or structural integrity. The licensee determined that the leakage had not caused any flooding or spraying onto adjacent electrical equipment. TVA included the flaw evaluation as Enclosure 3 to the submittal.

The adequacy and completeness of the operability assessment, root cause determination, and associated corrective actions will be reviewed by the NRC in accordance with the requirements of the inspection program. This program is described in NRC Manual Chapter 2515, Light-Water Reactor Inspection Program - Operations Phase.

3.6.2 Structural Integrity

The NRC staff reviewed the licensee's flaw evaluation and noted that the formulas used for determining the applied stress intensity factor "K", resulting from the flaw under an applied load were consistent with those provided in NUREG/CR-4572, NRC Leak-Before-Break (LBB.NRC) Analysis Method for Circumferentially Through-Wall Cracked Pipes Under Axial Plus Bending Loads. The licensee indicated the use of the "Through-Wall Flaw" approach. This approach assumes a through-wall flaw and evaluates the flaw stability by a linear elastic fracture mechanics methodology. The approach is applicable to through-wall flaw lengths less than 3 inches or 15 percent of the length of the affected pipe circumference. The NRC staff verified that the flaw length was within the applicable limit.

For flaw stability, linear elastic fracture mechanics specifies that “K” should be less than the critical stress intensity factory. Therefore, for ferritic steel the critical stress intensity factor should be less than 35 ksi$\sqrt{in}$. The NRC staff reviewed the evaluation and observed that the applied “K” for the degraded piping was 26.3 ksi$\sqrt{in}$. As this is below 35 ksi$\sqrt{in}$, the NRC staff finds the structural integrity at the time of the evaluation acceptable.

3.6.3 Augmented Inspection

The flaw is located in an 8-inch diameter carbon steel pipe in the ERCW system header 1B return piping to the 1B ERCW discharge header. TVA stated that a weekly walkdown and an assessment of the continued operability of the system will be performed. Any changes which affect system operability or structural integrity will be evaluated. Also, an ultrasonic examination will be performed every three months to assess the piping degradation rate. Based upon the results of the weekly walkdowns and ultrasonic examinations, changes will be evaluated to determine if further remedial measures or corrective actions are needed.

The NRC staff reviewed the augmented inspection activities proposed as TVA commitments 2 and 3. The activities proposed give reasonable assurance that overall degradation of the system, and the affected pipe in particular, will be identified and appropriate determinations completed to assure safety. Therefore, the NRC concludes that the measures committed to by TVA will ensure structural integrity is maintained within the degraded ERCW piping until a permanent ASME Code repair is accomplished.

3.6.4 Flaw Detection

The licensee determined that the leak is located in an 8-inch diameter carbon steel pipe in the ERCW system header 1B return piping to the 1B ERCW discharge header. The leak is located in the ERCW system which is classified as ASME Code Class 3 system. At the time of discovery, the licensee determined that the leakage from the piping was less than 1 gpm.

TVA stated that removing this portion of the ERCW system from service for repair would place SQN1 in an action statement of 72 hours. The ERCW 1B ESF header also supplies ERCW cooling to the SQN2 Component Cooling System for safety-related cooling loads; therefore, the removal of this portion of the ERCW system would place both units in a 72-hour action statement.

Given the location and the magnitude of the leak (less than 1 gpm), the licensee's alternatives, and the relatively short time until the repair is completed (November 2003), the isolation of ERCW to both units is not in the best interest of plant safety. Therefore, the NRC staff finds that performance of an immediate Code repair would have constituted an undue burden (create undue hardship) upon the licensee without a compensating increase in the level of quality and safety.

4.0 CONCLUSION

Based on the information provided in the licensee’s submittals and the effective implementation of the commitments described in Section 3.5, the NRC staff has determined that performing an ASME Code repair at the time would have resulted in hardship or unusual difficulty without a

compensating increase in the level of quality and safety. As the licensee's proposed actions provide reasonable assurance of structural integrity until an ASME Code repair is completed, the licensee's request is authorized pursuant to 10 CFR 50.55a(a)(3)(ii) for the remainder of the current SQN2 operating cycle and Cycle 12 Refueling Outage. All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: George Georgiev, NRR

Date: August 18, 2003

Mr. J. A. Scalice
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