Tennessee Valley Authority, Post Office Box 2000, Soddy-Daisy, Tennessee 37384-2000

February 28, 2003

TVA-SQN-TS-03-04

10 CFR 50.59(c)(2)(viii)
10 CFR 50.90

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555

Gentlemen:

In the Matter of)
Tennessee Valley Authority)

Docket No. 50-327

SEQUOYAH NUCLEAR PLANT (SQN) - UNIT 1 - LICENSE AMENDMENT (SQN-TS-03-04) TO UTILIZE METHODOLOGY DESCRIBED IN TOPICAL REPORT NO. 24370-TR-C-001, ALTERNATE REBAR SPLICE - BAR-LOCK MECHANICAL SPLICES (TAC NO. MB5371)

Reference: TVA letter to NRC dated March 18, 2002, Sequoyah Nuclear Plant - Steam Generator Replacement Project - Topical Report No. 24370-TR-C-001, "Alternate Rebar Splice - Bar Lock Mechanical Splices"

In accordance with the provisions of 10 CFR 50.90 and 10 CFR 50.59(c)(2)(viii), TVA is requesting an amendment to the SQN Unit 1 Operating License (OL) DPR-77. The proposed request provides a revision to the SQN Updated Final Safety Analysis (UFSAR) that includes alternate methodology for concrete reinforcement bar splicing. The change in methodology applies to restoration of concrete shield building dome as part of the upcoming steam generator replacement project for Unit 1. The alternate methodology uses a Bar-Lock mechanical

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splice in lieu of the Cadweld splice used for the original design and construction. The Bar-Lock mechanical splice is described in Topical Report No. 24370-TR-C-001 (see TVA reference letter).

The revision to the UFSAR was reviewed under the requirements of 10 CFR 50.59, "Changes, Tests and Experiments" and based on this review, it was concluded that a license amendment is required in accordance with 10 CFR 50.59(c)(2)(viii).

TVA has determined that there are no significant hazards considerations associated with the proposed change and that the license amendment qualifies for categorical exclusion from environmental review pursuant to the provisions of 10 CFR 51.22(c)(9).

The SQN Plant Operations Review Committee and the SQN Nuclear Safety Review Board have reviewed this proposed change and determined that operation of SQN Unit 1, in accordance with the proposed change, will not endanger the health and safety of the public. Additionally, in accordance with 10 CFR 50.91 (b)(1), TVA is sending a copy of this letter and enclosures to the Tennessee State Department of Public Health.

Enclosure 1 provides a complete description and justification of the proposed amendment. Enclosure 2 contains revised markup pages from the SQN UFSAR.

TVA requests that the implementation of the proposed UFSAR change be consistent with startup activities (prior to Mode 4) from the Unit 1 steam generator replacement outage scheduled to begin March 16, 2003.

There are no commitments contained in this submittal. This letter is being sent in accordance with NRC RIS 2001-05, "Guidance on Submitting Documents to the NRC by Electronic Information Exchange, CD-ROM, or Hard Copy."

If you have any questions about this change, please telephone me at (423) 843-7170 or J. D. Smith at (423) 843-6672.

Sincerely,

Pedro Salas
Licensing and Industry Affairs Manager

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 28 day of February, 2003.

Enclosures:
1. TVA Evaluation of the Proposed Changes
2. Annotated pages from the SQN UFSAR

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TENNESSEE VALLEY AUTHORITY
SEQUOYAH PLANT (SQN)
UNIT 1

TVA EVALUATION OF THE PROPOSED CHANGE

1. DESCRIPTION

This letter is a request to amend the Operating License DPR-77 for SQN Unit 1. The proposed license amendment revises the SQN Updated Final Safety Analysis (UFSAR) to include a change to the methodology for restoration of the Unit 1 concrete shield building dome as part of the steam generator replacement (SGR) project. A modification to the shield building concrete dome is necessary to support removal of the original steam generators (OSGs) and installation of the replacement steam generators (RSGs). To facilitate removal of the OSGs and installation of the RSGs, two openings will be cut in the concrete shield building dome. The two openings in the shield building concrete will be restored by splicing new reinforcing bar to the existing reinforcing bar (rebar) using Bar-Lock mechanical couplers. The Bar-Lock mechanical splice provides an alternate methodology to the Cadweld splice used for the original design and construction. The Bar-Lock methodology is described in Topical Report No. 24370-TR-C-001 and was previously submitted to NRC for review and approval. The SQN UFSAR was reviewed under the requirements of 10 CFR 50.59, "Changes, Tests and Experiments" and based on this review, it was concluded that a license amendment is required in accordance with 10 CFR 50.59(c)(2)(viii).

2. PROPOSED CHANGE

During the Unit 1 SGR outage, (scheduled to begin March 16, 2003), two construction openings in the concrete shield building dome will be created to facilitate removal of the OSGs and installation of the RSGs. The two openings will be restored by splicing new reinforcing bar to the existing reinforcing bar using Bar-Lock mechanical splice couplers and pouring new concrete to close the openings. The Bar-Lock mechanical splice couplers are described in Topical Report 24370-TR-C-001.

During preparation for the SQN Unit 1 SGR project, evaluations were performed in accordance with 10 CFR 50.59 that identified the Bar-Lock splice design as a new methodology for restoration of the concrete shield building dome. Based on the 10 CFR 50.59 evaluation, it was determined that this modification activity would result in a departure from the method of evaluation described in the SQN UFSAR. Accordingly, TVA is proposing a revision to the SQN Unit 1 Operating License (i.e., UFSAR) to request NRC review and approval for the new methodology.

3. BACKGROUND

Four SGs from SQN Unit 1 will be replaced during the SGR outage scheduled to begin March 16, 2003. To support the replacement of the OSGs with the RSGs, access openings will be created in the concrete shield building dome, the containment steel vessel and the SG compartments inside containment. The concrete shield building dome will be restored by removing concrete to expose sufficient rebar, splicing new rebar to the existing rebar, and pouring new concrete. The new concrete will be formed and poured back using formwork supported from overhead.

The original design of the shield building dome is described in SQN UFSAR Section 3.8.1.1. The shield building is designed to provide radiation shielding from accident conditions, radiation shielding from parts of the reactor coolant system during operation, and protection of the steel containment vessel from low temperatures, adverse atmospheric conditions, external missiles, and floods. The shield building also provides a barrier for the annulus ventilation system that serves as a redundant second containment barrier for control of leakage. Per UFSAR Section 3.8.1.2, the structural design of the reinforced concrete shield building complies with ACI 318-63 building code working stresses. The existing shield building design compressive strength for concrete is 4000 pounds per square inch (psi), as noted in UFSAR Section 3.8.1.6. The reinforcement for the shield building concrete dome conforms to ASTM A615, Grade 60.

TVA plans to use a Bar-Lock coupler to connect the new and existing shield building concrete reinforcement as described in Topical Report No. 24370-TR-C-001. The Bar-Lock couplers are manufactured of seamless hot-rolled steel tube conforming to ASTM A-519 specification, with minimum tensile strength exceeding 100,000 psi.

4. TECHNICAL ANALYSIS

Mechanical splices for reinforcing steel used in nuclear safety-related concrete structures are subject to the stringent requirements of American Society of Mechanical Engineers (ASME) Section III, Division 2/ACI-359 and ACI-318, which includes the requirement that the splice develop 125 percent of the minimum yield strength of the rebar. In order to demonstrate that the Bar-Lock coupler can meet these requirements, a qualification program was performed. The qualification program included development of a testing program, performance of physical tests, and analysis and interpretation of the test results.

The Bar-Lock coupler qualification testing program was carried out on two representative sizes (#6 and #8) of their L-Series

couplers. A total of 160 coupler assemblies were tested. Fourteen pieces of rebar were tested to determine the actual, or measured, mechanical properties of the two heats of bar material used to fabricate the test specimens.

The tensile strength tests on each of the 80 samples exceeded the ASME requirements by a large margin. Statistical analyses of the test results determined several important performance indicators. Based on the observed data distribution, the probability of a coupler assembly (in size #6 or #8) failing to meet the minimum qualification strength criterion is less than 3 in 100,000.

Comparing and correlating the tensile strength test results show that Bar-Lock L-Series coupler splices will achieve a tensile strength greater than 96 percent of the ultimate tensile strength of the rebar. These test results show that the coupler strength is well in excess of the ASME tensile strength requirements.

Slip tests performed on selected specimens of both sizes showed a solid mechanical connection between the coupler and the rebar. There was no tendency for the rebar to move within the coupler prior to developing full splice strength. This was expected since the conical-tipped lock bolts physically embed into the bar material providing a physical shear force transfer from bar to coupler.

Each of the 80 splice specimens that underwent the cyclic loading durability test passed the 100-cycle test, with no obvious physical degradation of the spliced joint. To provide an additional degree of assurance of adequate cyclic durability, selected specimens received 1000 cycles of loading, again with no noticeable physical degradation. Some of the specimens that passed the 100 cycle test were subsequently tested by monotonic loading to failure. The resultant measured strengths were essentially the same as the virgin strength test specimens (no cyclic loading applied). These results suggest that the design of the Bar-Lock coupler is essentially insensitive to cyclic loading to levels below 90 percent of the minimum bar yield strength.

The results of these tests, compared to the ASME splice system qualification requirements, indicate that the Bar-Lock coupler design for rebar splicing is entirely adequate from a strength point of view for use in nuclear safety-related construction. The additional quantity of couplers tested provides higher confidence that the couplers do meet, and indeed far exceed, those ASME-specified requirements.

The information described above is detailed in Topical Report No. 24370-TR-C-001.

5. REGULATORY SAFETY ANALYSIS

The proposed license amendment provides a revision to the Sequoyah Nuclear Plant (SQN) Updated Final Safety Analysis Report (UFSAR) for NRC review and approval. The revised UFSAR pages are provided in Enclosure 2 of this submittal and a full description of the regulatory requirements/criteria for mechanical splices is provided in Section 4.0 of Topical Report 24370-TR-C-001.

As described in the topical report, the governing regulatory requirement is primarily the ASME Code, Section III, Division 2, Paragraph CC-4333, "Mechanical Splices." In addition, the structural design of the shield building is in compliance with the American Concrete Institute (ACI) 318-63 building code working stress design requirements. The Bar-Lock qualification test program results contained in the topical report demonstrate that the Bar-Lock coupler will meet or exceed the ASME code requirements. The restoration of the temporary concrete construction openings in the shield building, including use of the Bar-Lock couplers, will conform to the requirements of ACI 318. Accordingly, the proposed license amendment continues to meet the applicable regulatory requirements.

5.1 No Significant Hazards Consideration

TVA has evaluated whether or not a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No.

   No changes in event classification, as discussed in UFSAR Chapter 15, will occur due to use of the Bar-Lock couplers.

   The restoration of the temporary concrete construction openings in the shield building will utilize Bar-Lock couplers to splice new rebar to the existing rebar. The shield building structure limits the release of radioactivity following an accident and protects the systems, structures, and components inside containment from external events. The accidents of interest are those that rely on the shield building to limit the release of radioactivity to the environment, and those that result from some external events. The design of the shield

building is such that it is not postulated to fail and initiate an accident described in the UFSAR.

The Bar-Lock coupler qualification tests detailed in Topical Report 24370-TR-C-001 demonstrate that the Bar-Lock coupler meets the American Society of Mechanical Engineers (ASME) strength requirements and is, therefore, acceptable for use in nuclear safety-related applications. Based on these test results, it is concluded that use of the Bar-Lock couplers in restoring the temporary concrete construction openings will not reduce the structural capability of the repaired structure. The shield building will continue to perform its design function as described in the SQN UFSAR.

Therefore, the proposed use of the Bar-Lock couplers will not significantly increase the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No.

   The design of the shield building is such that it is not postulated to fail and initiate an accident described in the UFSAR. The Bar-Lock couplers are passive devices and as such will not initiate or cause an accident.

   The restoration of the temporary concrete construction openings in the shield building will utilize Bar-Lock couplers to splice new rebar to the existing rebar. The Bar-Lock coupler qualification tests detailed in Topical Report 24370-TR-C-001 demonstrate that the Bar-Lock coupler meets the ASME strength requirements and is, therefore, acceptable for use in nuclear safety-related applications. Based on these test results, it is concluded that use of the Bar-Lock couplers in restoring the temporary concrete construction openings will not reduce the structural capability of the shield building. The shield building will, therefore, continue to perform its design functions as described in the SQN UFSAR.

   Therefore, the possibility of a new or different accident situation occurring as a result of this condition is not created.

3. Does the proposed change involve a significant reduction in a margin of safety?

   Response: No.

As indicated in the SQN UFSAR, the structural design of the shield building is in compliance with the American Concrete Institute (ACI) 318-63 building code working stress design requirements. The reinforcing steel conforms to the requirements of ASTM A 615, Grade 60. The SQN UFSAR states that reinforcing bars were lap spliced in accordance with ACI 318-63 requirements for Strength Design.

The restoration of the temporary concrete construction openings in the shield building will utilize Bar-Lock couplers to splice new rebar to the existing rebar. The restoration of the construction openings, including use of the Bar-Lock couplers, will conform to the requirements of ACI 318. Therefore, following completion of the modification, the shield building will continue to comply with ACI 318 requirements.

In addition to conforming to ACI 318 requirements, the Bar-Lock coupler qualification tests detailed in Topical Report 24370-TR-C-001 demonstrate that the Bar-Lock coupler meets the ASME strength requirements.

Therefore, a significant reduction in the margin to safety is not created by this modification.

Based on the above, TVA concludes that the proposed amendment presents no significant hazards consideration under the standards set forth in 10 CFR 50.92 (c), and accordingly, a finding of "no significant hazards consideration" is justified.

5.2 Applicable Regulatory Requirements/Criteria

As stated in 10 CFR 50.59(c)(2), a licensee shall obtain a license amendment pursuant to 10 CFR 50.90 prior to implementing a proposed change, test, or experiment if the change, test, or experiment would:

> *(viii) Result in a departure from a method of evaluation described in the FSAR (as updated) used in establishing the design bases or in the safety analyses.*

As stated in 10 CFR 50.59(a)(2), departure from a method of evaluation described in the Final Safety Analysis Report (FSAR) (as updated) used in establishing the design bases or in the safety analyses means:

> *(i) Changing any of the elements of the method described in the FSAR (as updated) unless the results of the analysis are conservative or essentially the same; or*

(ii) Changing from a method described in the FSAR to another method unless that method has been approved by NRC for the intended application.

TVA's submittal meets the requirements of 10 CFR 50.59(c)(2) and 10 CFR 50.90.

6. ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 50.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

7. REFERENCES

1. Sequoyah Nuclear Plant, Final Safety Analysis Report (As Updated) Revision 17, Section 3.8, dated November 8, 2002
2. TVA letter to NRC dated March 18, 2002, Sequoyah Nuclear Plant - Steam Generator Replacement Project - Topical Report No. 24370-TR-C-001, Alternate Rebar Splice - Bar-Lock Mechanical Splice"

ENCLOSURE 2

TENNESSEE VALLEY AUTHORITY
SEQUOYAH PLANT (SQN)
UNIT 1

PROPOSED UPDATED FINAL SAFETY ANALYSIS REPORT (UFSAR) MARK-UP

FSAR Pages

3.8-2
3.8-13

circumference of the ring beam so that at any cross section only four bars are spliced out of the total 24 bars. That is, at any section, 20 bars are continuous and unspliced. These continuous, unspliced bars alone will carry the imposed load with only a 20 percent increase in stress. Stirrups enclosing the main reinforcement are spaced on 15-inch centers.

To facilitate removal of the old steam generators (OSGs) and installation of the replacement steam generators (RSGs) during the Unit 1 steam generator replacement (SGR), two construction openings were cut in the concrete shield building dome. These openings were restored by splicing new reinforcing bar to the existing reinforcing bar using Bar-Lock couplers and pouring new concrete to close the openings.

3.8.1.1.1 Equipment Hatch Doors and Sleeves

An equipment hatch door and one sleeve are provided for each Reactor Unit. The steel sleeve forms an access through the Shield Building wall to the equipment hatch in the containment vessel for access to upper containment. Each sleeve extends from inside the Shield Building to the shielded passageway leading to the Auxiliary Building floor Elevation 734. Each door is of the hinged, double-leaf, marine type with seals for providing an airtight closure between the annulus surrounding the steel containment vessel and the inside of the Auxiliary Building A door will normally be opened only when the reactor is in the shutdown, depressurized condition such that secondary containment is not required.

The sleeves, embedded in the Shield Building walls, are of welded steel construction, rectangular in cross section. The doors are hinged to the sleeves on the end toward the outside of the Shield Building wall and are of welded construction consisting of structural shapes with a steel skin plate.

Sealing of a door when closed is by means of solid, molded rubber seals mounted on the door. The seals contact the edge of the sleeve at the top and sides, a removable seal bar at the floor level, and a sealing bar at the meeting line of the two leaves.

The sealing bar at the meeting line is mounted on one of the leaves. Penetrations through the doors are sealed with solid rubber 0-ring type seals

The doors are opened and closed manually. Latching of the doors in the closed position is accomplished by multiple hand-lever operated dogs acting on wedge surfaces around the perimeter and meeting edges of the door leaves. The doors are provided with concrete missile shield blocks on their Auxiliary Building side.

The doors and sleeves will maintain their structural and leak tight integrity and remain operational after being subjected to the environmental or accident conditions listed in Section 3.8.1.4.

3.8 1.2 Applicable Codes, Standards, and Specifications

The structural design of the Reinforced Concrete Shield Building is in compliance with the American Concrete Institute 318-63 building code working stress design requirements. All reinforcing steel conforms to the requirements of ASTM Designation A 615, Grade 60. Construction was carried out under the requirements of TVA Construction Specification G-2.

Unless otherwise indicated, the design and construction of the Shield Building was based upon the appropriate sections of the following codes, standards, and specifications.

Reinforcing Steel

Reinforcing steel was deformed billet steel bars conforming to ASTM Designation A 615, Grade 60.

For the Unit 1 steam generator replacement, reinforcing steel used in the restoration of the shield building construction openings conforms to ASTM A615, Grade 60.

Bar-Lock Couplers

During the Unit 1 steam generator replacement, Bar-Lock couplers were used to splice the new reinforcing bar to the existing reinforcing bar during the restoration of the shield building construction openings Bar-Lock couplers are manufactured of seamless hot-rolled steel tube conforming to ASTM A-519 specification, with minimum tensile strength exceeding 100,000 psi.

Equipment Hatch Sleeves and Doors

The structural parts of the sleeves and doors are fabricated from ASTM A 36 steel.

3.8.1.6.2 Quality Control

General

The Sequoyah Quality Assurance Manual contains those procedures to be followed which provide assurance that the Shield Building is built to the desired quality level. The following is a general description of Quality Assurance Requirements required by the Quality Assurance Manual.

Concrete

The quality control and inspection procedures for concrete are detailed in TVA's General Construction Specification G-2 for Plain and Reinforced Concrete.

In general all concrete materials are purchased to standard ASTM specifications and tested by TVA laboratories for compliance.

The quality of all concrete materials are periodically checked by TVA laboratories during the progress of construction to assure continued compliance with the specifications

TVA employed a materials engineer on each project, who was specifically responsible for maintaining quality control of all concrete.

The slip-form construction of the walls of the Shield Building was a continuous placing operation 24 hours a day. Samples for compression testing were taken at approximately 6-hour intervals such that each sample represented approximately 170 yd^3 of concrete.

Each sample was tested for slump, air content, unit weight, and compressive strength.

Quality control charts were required for each class of concrete poured, with limitations on air content, slump, and percent of strengths allowed to fall below the required strength for each concrete class.

Deviations from the requirements of TVA General Construction Specification, G-2, occurred in two areas with respect to the concrete for the Shield Buildings; (1)Modified slump requirements were provided to facilitate concrete placement, and (2)the concrete for the Unit 2 Shield Building deviated from the strength requirements of G-2.