

April 24, 2003

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

SUBJECT: SEQUOYAH NUCLEAR PLANT, UNIT 1 — ISSUANCE OF AMENDMENT
REGARDING ALTERNATE REBAR SPLICE - BAR-LOCK MECHANICAL
SPLICES (TAC NO. MB8056) (TS-03-04)

Dear Mr. Scalice:

The Commission has issued the enclosed Amendment No. 283 to Facility Operating License No. DPR-77 for the Sequoyah Nuclear Plant (SQN), Unit 1. This amendment is in response to your application dated February 28, 2003, which requested a revision to the methodology contained in the SQN Updated Final Safety Analysis (UFSAR) for splicing reinforcing steel bars during restoration of the Unit 1 concrete shield building dome as part of the steam generator replacement project.

On March 18, 2002, you submitted the methodology for restoration of the shield building dome in Bechtel Topical Report No. 24370-TR-C-001, "Alternate Rebar Splice - Bar-Lock Mechanical Splices" for SQN1. The Nuclear Regulatory Commission (NRC) staff reviewed Topical Report No. 24370-TR-C-001 and found the methodology presented acceptable in a letter dated March 13, 2003. The enclosed NRC safety evaluation approves your request to modify the UFSAR and also authorizes the use of the Topical for SQN1.

A copy of the Safety Evaluation is also enclosed. Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

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

Enclosures: 1. Amendment No. 283 to
License No. DPR-77
2. Safety Evaluation

cc w/enclosures: See next page

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Mr. J. A. Scalice
Tennessee Valley Authority

SEQUOYAH NUCLEAR PLANT

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TENNESSEE VALLEY AUTHORITY

DOCKET NO. 50-327

SEQUOYAH NUCLEAR PLANT, UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 283
License No. DPR-77

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by Tennessee Valley Authority (the licensee) dated February 28, 2003, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;
 - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
 - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
 - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
 - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, changes to the Sequoyah Unit 1 Updated Final Safety Analysis Report (UFSAR) that reflect a change to the methodology for restoration of the Unit 1 concrete shield building dome as part of the steam generator replacement project, as described in the NRC safety evaluation dated March 13, 2003, is authorized. The licensee shall submit the update of the UFSAR authorized by this amendment in accordance with 10 CFR 50.71(e).
3. This license amendment is effective as of its date of issuance and shall be implemented as specified in 2 above.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

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

Date of Issuance: April 24, 2003

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO AMENDMENT NO. 283 TO FACILITY OPERATING LICENSE NO. DPR-77
TENNESSEE VALLEY AUTHORITY
SEQUOYAH NUCLEAR PLANT, UNIT 1
DOCKET NO. 50-327

1.0 INTRODUCTION

By application dated February 28, 2003, the Tennessee Valley Authority (TVA, the licensee) proposed an amendment to the Sequoyah Nuclear Plant, Unit 1 (SQN1), Operating License DPR-77. Presently, the SQN licensing basis does not address the use of this type of reinforcing bar splice. This proposed request provides a revision of the SQN1 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).

In a letter dated March 18, 2002, TVA submitted Bechtel Topical Report No. 24370-TR-C-001, "Alternate Rebar Splice - Bar-Lock Mechanical Splices" (the Topical) for SQN1. The Topical proposed an alternate methodology than that prescribed in the UFSAR for splicing reinforcing bars in concrete for nuclear safety-related applications at the SQN, and described a qualification testing program and test results for the Bar-Lock coupler system. The Nuclear Regulatory Commission (NRC) staff reviewed the Topical and approved it in a letter dated March 13, 2003.

2.0 REGULATORY EVALUATION

American Society of Mechanical Engineers Code Section III, Division 2 (the Code), "Code for Concrete Reactor Vessels and Containment," Paragraph CC-4333.2.1 requires that each splice system manufacturer conduct a series of performance tests in order to qualify a splice system for use.

Section CC-4333.2.3(a), Static Tensile Tests for Mechanical Splices, requires that six splice specimens for each bar size shall be tensile tested to failure, the average tensile strength of the reinforcing bar being tested shall not be less than 90 percent of the actual tensile strength of

ENCLOSURE

the reinforcing bar being tested, nor less than 100 percent of the specified minimum tensile strength. Additionally, the tensile strength of any individual splice system shall not be less than 125 percent of the specified minimum yield strength of the spliced bar.

Section CC-4333.2.3(b), Cyclic Tensile Tests for Mechanical Splices, requires that three specimens of the bar-to-bar splice for each reinforcing bar size shall withstand 100 cycles of stress variation from 5 percent to 90 percent of the specified minimum yield strength of the reinforcing bar.

3.0 TECHNICAL EVALUATION

As the technical issues relevant to the review and approval of the Topical are similar to the arguments used to support approval of this amendment request, some of the information from the Topical's Safety Evaluation is reproduced in this evaluation.

3.1 Test Program

The reinforcing bar used in the Bar-Lock coupler assembly testing program was American Society for Testing and Maintenance (ASTM) A615 Grade 60 material in #6 and #8 sizes. The mechanical properties for the reinforcing bars were tested in according to ASTM Designation A 370-96, Standard Test Methods and Definitions for Mechanical Testing of Steel Products; and ASTM Designation E 8-99, Standard Test Methods for Tension Testing of Metallic Materials.

The test specimen assemblies were made by steel construction workers using Bar-Lock's assembly instructions in a normal field environment. Assembly of the test specimens was monitored by Bechtel quality control personnel. The Bar-Lock's assemblies were tested in the same machine that had tested the mechanical properties of the reinforcing bars and in conforming with the same ASTM A 370-96 and E 8-99 standards.

Two reinforcing bar sizes (#6 and #8) of Bar-Lock coupler assemblies were tested. Forty specimens of each of the two sizes of the Bar-Lock coupler assemblies were statically tested to failure. Forty specimens of each of the two sizes of the Bar-Lock coupler assemblies were tested for cyclic loadings. The cyclic test was performed according to the requirements of ASME Section III, Division 2, "Code for Concrete Reactor Vessels and Containment," Section CC-4433.2.3(b), Cyclic Tensile Tests for Mechanical Splices. In an effort to improve the cyclic durability assessment, after 100 cycles of loading required by the Code, several specimens were randomly selected to receive an additional 1000 cycles, and several other specimens were statically loaded to failure.

The ASME Code requires six splice specimens for each bar size to be tensile tested statically to failure and three to be tested cyclically. The Code requires that the average tensile strength of the splices shall not be less than 90 percent of the actual tensile strength of the reinforcing bar being tested, nor less than 100 percent of the specified minimum tensile strength. Table CC-4334-1, "Tensile Requirements for Mechanical Reinforcing Bar Splices and Welded Joints," of the Code lists a minimum yield strength of 60 kips per square inch (ksi) and minimum tensile strength of 90 ksi for ASTM 615 Grade 60 reinforcing bars.

The licensee's submittal stated that the average tensile strength of the 40 #6 Bar-Lock's assemblies was 106.2 ksi, which was 98.8 percent of the average #6 bar actual tensile

strength. The average tensile strength of the 40 #8 Bar-Lock's assemblies was 109.0 ksi, which is 99 percent of the average #8 bar actual tensile strength. None of the 80 specimens tested cyclically failed in any manner (e.g., bar break, or bar slip within the coupler). For those specimens that received additional 1000 cycles of loading, no obvious physical degradation was observed. For those specimens that passed 100 cycles of loading and then statically loaded to tensile failure, the measured tensile strengths were essentially the same as those tested statically to failure without the 100 cycles of loading. The report also states that no practical differences were observed in the general character of the stress-strain curve of any of the 80 specimens tested statically, and no measurable slip was detected during the cyclic tests.

The phenomena of no measurable slip and the similarity in the stress-strain curves of the specimens tested demonstrate that the Bar-Lock's assembly has delivered predictable results and qualifies as a viable reinforcing bar splicing system. The licensee has tested more specimens than required by the ASME Code, which increases the confidence level for the acceptance of the Bar-Lock's assembly. The static and cyclic test methods and results have met the requirements of the Code. The results of the additional tests of the 1000 cycles of loading and of the tensile test to failure after the 100 cycles of loading demonstrate that the assemblies exceed the ASME, Section III, Division 2, requirements for static and cyclic tests for mechanical splices.

Based on the information provided by the licensee, the NRC staff has determined that the licensee has developed and performed a reasonable test program for the Bar-Lock coupler assemblies, and that the test data demonstrates the adequacy of the proposed alternate methodology for connecting (splicing) reinforcing steel bars for nuclear-safety-related applications. Therefore, the NRC staff finds the revision of the SQN1 UFSAR, to include a change using the Bar-Lock mechanical splices described in the Topical for restoration of the Unit 1 concrete shield building dome, acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Tennessee State official was notified of the proposed issuance of the amendment. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (68 FR 12718). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributors: John S. Ma, NRR
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Dated: April 24, 2003