March 16, 2001

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 UNITS 1 AND 2, AND WATTS BAR, UNIT 1, RE: TRITIUM PRODUCTION PROGRAM — NUREG-1672 INTERFACE ISSUE 17 — ANTICIPATED TRANSIENT WITHOUT SCRAM ANALYSES (TAC NOS. MA9583 AND MB0515)

Dear Mr. Scalice:

The Tennessee Valley Authority (TVA) plans to irradiate tritium-producing burnable absorber rods (TPBARs) in Sequoyah Nuclear Plant, Units 1 and 2, and Watts Bar Nuclear Plant, Unit 1, for the U.S. Department of Energy (DOE). The U.S. Nuclear Regulatory Commission (NRC) reviewed DOE's safety assessments for doing this and issued a safety evaluation as NUREG-1672 in May 1999. NUREG-1672 identified plant-specific interface issues that TVA must address to get NRC approval to irradiate the TPBARs.

Interface Issue 17 “ATWS Analysis” states that TVA must submit plant-specific ATWS analyses to the NRC. TVA’s two letters of September 29, 2000, submitted this information to us. The staff reviewed this information and finds that your plant-specific ATWS analyses for Sequoyah Nuclear Plant, Units 1 and 2, and Watts Bar Nuclear Plant, Unit 1 are acceptable. Enclosed is our safety evaluation.

Sincerely,

/RA/

L. Mark Padovan, Project Manager, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-327, 50-328 and 50-390

Enclosure: Safety Evaluation

cc w/enclosure: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

TRITIUM PRODUCTION PROGRAM — NUREG-1672 INTERFACE ISSUE 17

ANTICIPATED TRANSIENT WITHOUT SCRAM ANALYSES REVIEW

TENNESSEE VALLEY AUTHORITY

SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2

WATTS BAR NUCLEAR PLANT, UNIT 1

DOCKET NOS. 50-327, 50-328 and 50-390

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) previously announced that they selected Tennessee Valley Authority's (TVA's) Sequoyah and Watts Bar nuclear plants to irradiate tritium-producing burnable absorber rods (TPBARs) for the DOE. The U.S. Nuclear Regulatory Commission (NRC) reviewed DOE's safety assessments for doing this and issued its safety evaluation as NUREG-1672 in May 1999. NUREG-1672 identified plant-specific interface issues that TVA must address to get NRC approval to irradiate the TPBARs. Interface Issue 17 "ATWS Analysis" states that TVA must submit plant-specific anticipated transient without scram (ATWS) analyses to the NRC. TVA's two letters of September 29, 2000 (Refs. 1 and 2), submitted this information.

The DOE's letter of July 30, 1998, submitted Westinghouse report NDP-98-153, "Tritium Production Core (TPC) Topical Report," to the NRC for review and approval. The report described how installing many TPBARs in the reactor core of a reference, commercial, light-water reactors affect nuclear plant systems, safety and component analyses, and performance. Westinghouse intended the topical report to be generic and evaluated a reference plant and a reference core design. The NRC's Reactor Systems Branch reviewed the report and issued a Safety Evaluation Report on January 27, 1999. The staff's effort focused on the acceptability of using TPBARs in the reference plant. Plant-specific efforts are necessary to evaluate TPBAR use in other commercial plants. TVA's two submittals of September 29, 2000, are plant-specific ATWS submittals for the Sequoyah and Watts Bar plants. Westinghouse's analysis shows that nuclear cores with TPBARs have similar, if not better, responses to an ATWS event based on the moderator temperature coefficient (MTC) remaining negative throughout the cycle. A review of this evaluation follows below.

ENCLOSURE

2.0 EVALUATION

2.1 Background

An ATWS incident is an expected operational occurrence requiring an automatic reactor scram that fails to occur due to some common mode fault in the reactor protection system. Westinghouse conducted a series of ATWS studies and showed that acceptable consequences will result if plant operators trip the turbine and initiate auxiliary feedwater flow within Technical Specifications (TSs) time limits. The limiting criterion associated with ATWS analyses for Westinghouse plants is for maximum reactor coolant system (RCS) pressure to not exceed 3200 psig. This pressure corresponds to the American Society of Mechanical Engineers Boiler and Pressure Vessel Code Service Level C stress limit in the most stressed limiting RCS component. The NRC's ATWS rule requires that Westinghouse-designed plants have ATWS mitigation system actuation circuitry to initiate a turbine trip and actuate auxiliary feedwater flow independent of the reactor protection system.

A major control component of an ATWS event is the net amount of reactivity feedback available at the time of the event. The core must rely entirely upon inherent feedback mechanisms such as Doppler and moderator coefficients to bring the core under control since control rods fail to function during an ATWS incident.

2.2 TPBAR-Core Moderator Temperature Coefficient Comparison With Non-TPBAR Cores

TVA analyzed MTC effects and ATWS event response of the TPBAR cores and compared the results with that of non-TPBAR cores for Sequoyah and Watts Bar. At Sequoyah, plant TSs limit the MTC. Sequoyah's MTC is, by design, negative at all power levels throughout core life for both TPBAR and non-TPBAR cores. In an ATWS event, negative feedback effects associated with increasing moderator temperature contribute most to reducing reactor power (and thus the reactivity). Negative MTC, along with plant safety systems such as the auxiliary feedwater system, mitigate the event. For Watts Bar, TVA assessed the TPBAR cores for sensitivity to ATWS events. TVA's sensitivity analysis calculated MTCs for several Watts Bar TPBAR core designs and compared them with the current non-TPBAR fuel Cycle 3 MTC values.

TVA generated MTCs as a function of fuel burnup over the span of the fuel cycle for both the TPBAR cores and non-TPBAR cores at hot, full-power conditions. For Sequoyah, TVA generated TPBAR-core MTCs for an equilibrium 96-fresh-fuel-assembly feed batch core design. For Watts Bar, TVA generated TPBAR-core MTCs for several core designs. Analysis results showed that the TPBAR cores have a stronger feedback during the early part of the cycle for both plants. For an ATWS event, the early part of the cycle is the most limiting time of the cycle and the MTC value is typically the least negative then. This is due, in part, to the presence of many TPBARs that reduce the worth of soluble boron in the core. Soluble boron makes the MTC less negative due to the smaller concentration of boron-10 atoms in the moderator with increasing moderator temperature and decreasing moderator density. Lower soluble boron worths, therefore, result in more negative MTCs. Later in the cycle, when the MTCs become very negative, the cores continue to exhibit comparable MTCs, with the TPBAR core being slightly less negative than the non-TPBAR core in the case of fuel Cycle 3 for Watts Bar.

The differences encountered in the MTC values for these cores are well within the cycle-to-cycle variability typically encountered. In addition, the MTC TS for both Sequoyah and Watts Bar must be less than zero pcm/ ^{0}F at all power levels despite the core designs. TVA stated in their submittals that they currently do not plan to change this TS for the TPBAR cores.

TVA contends that TPBAR-core response to ATWS events compares with non-TPBAR core response and complies with 10 CFR Part 50.62 (the ATWS Rule) since moderator feedback for TPBAR cores resembles that of the non-TPBAR Sequoyah and Watts Bar cores. The staff concurs with TVA's results presented in References 1 and 2.

3.0 CONCLUSION

Based on the above, the staff concludes that using TPBAR cores in Sequoyah, Units 1 and 2, and Watts Bar Unit 1, conforms to the ATWS rule as specified in 10CFR 50.62(c)(1) for Westinghouse plants and is therefore acceptable.

4.0 REFERENCES

1. Letter from P.L. Pace, TVA, to NRC, "Watts Bar Nuclear Plant – Tritium Production Program – Anticipated Transients without Scram (ATWS)" dated September 29, 2000.

2. Letter from Pedro Salas, TVA, to NRC, "Sequoyah Nuclear Plant (SQN) – Tritium Production Program – Anticipated Transients without Scram (ATWS)" dated September 29, 2000.

Principal Contributor: Anthony C. Attard

Date: March 16, 2001

Mr. J. A. Scalice
Tennessee Valley Authority

SEQUOYAH NUCLEAR PLANT
WATTS BAR 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. Jack A. Bailey, Vice President
Engineering & Technical Services
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Mr. William R. Lagergren, Site Vice President
Watts Bar Nuclear Plant
Tennessee Valley Authority
P.O. Box 2000
Spring City, TN 37381

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 10H
400 West Summit Hill Drive
Knoxville, TN 37902

Mr. Robert J. Adney, General Manager
Nuclear Assurance
Tennessee Valley Authority
5M 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

County Executive
Hamilton County Courthouse
Chattanooga, TN 37402-2801

Mr. Paul L. Pace, Manager
Licensing and Industry Affairs
Watts Bar Nuclear Plant
Tennessee Valley Authority
P.O. Box 2000
Spring City, TN 37381

Mr. Larry S. Bryant Manager
Watts Bar Nuclear Plant
Tennessee Valley Authority
P.O. Box 2000
Spring City, TN 37381

Mr. J. A. Scalice
Tennessee Valley Authority

SEQUOYAH NUCLEAR PLANT
WATTS BAR NUCLEAR PLANT

cc:
Senior Resident Inspector
Watts Bar Nuclear Plant
U.S. Nuclear Regulatory Commission
1260 Nuclear Plant Road
Spring City, TN 37381

Rhea County Executive
375 Church Street
Suite 215
Dayton, TN 37321

County Executive
Meigs County Courthouse
Decatur, TN 37322

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

Ms. Ann Harris
305 Pickel Road
Ten Mile, TN 37880