

September 17, 2002

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, UNITS 1 AND 2 — ENVIRONMENTAL  
ASSESSMENT AND FINDING OF NO SIGNIFICANT ENVIRONMENTAL  
IMPACT FOR INCORE IRRADIATION OF TRITIUM-PRODUCING BURNABLE  
ABSORBER RODS (TAC NOS. MB2972 AND MB2973)

Dear Mr. Scalice:

Enclosed is a copy of the Environmental Assessment and Finding of No Significant Impact related to your application for amendment dated September 21, 2001, as supplemented on June 11, July 19, August 9, August 30, September 5, and September 12, 2002. The proposed amendment would allow the Sequoyah Nuclear Plant, Units 1 and 2 to insert up to 2256 tritium-producing burnable absorber rods into the reactor cores. This change would relate to supporting the U.S. Department of Energy in maintaining the nation's tritium inventory for national defense purposes. The assessment is being forwarded to the Office of the Federal Register for publication.

Sincerely,

**/RA/**

Ronald W. Hernan, Project Manager, Section 2  
Project Directorate II  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Docket Nos. 50-327 and 50-328

Enclosure: Environmental Assessment

cc w/encl: See next page

September 17, 2002

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, UNITS 1 AND 2 — ENVIRONMENTAL  
ASSESSMENT AND FINDING OF NO SIGNIFICANT ENVIRONMENTAL  
IMPACT FOR INCORE IRRADIATION OF TRITIUM-PRODUCING BURNABLE  
ABSORBER RODS (TAC NOS. MB2972 AND MB2973)

Dear Mr. Scalice:

Enclosed is a copy of the Environmental Assessment and Finding of No Significant Impact related to your application for amendment dated September 21, 2001, as supplemented on June 11, July 19, August 9, August 30, September 5, and September 12, 2002. The proposed amendment would allow the Sequoyah Nuclear Plant, Units 1 and 2 to insert up to 2256 tritium-producing burnable absorber rods into the reactor cores. This change would relate to supporting the U.S. Department of Energy in maintaining the nation's tritium inventory for national defense purposes. The assessment is being forwarded to the Office of the Federal Register for publication.

Sincerely,

*/RA/*

Ronald W. Hernan, Project Manager, Section 2  
Project Directorate II  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Docket Nos. 50-327 and 50-328

Enclosure: Environmental Assessment

cc w/encl: See next page

DISTRIBUTION:

|                   |                      |                              |
|-------------------|----------------------|------------------------------|
| PUBLIC            | PDII-2 Reading       | HBerkow                      |
| KJabbour (A)      | BClayton (Hard Copy) | MPadovan                     |
| JTappert (e-mail) | RHernan (Hard Copy)  | OGCACRS    PFredrickson, RII |

**ADAMS Accession No. ML022600693**

\* See previous concurrence

| OFFICE | PDII-2/PM | PDII-2/PM | PDII-2/LA | RLEP/ES/SC | OGC      | PDII-2/SC(A) |
|--------|-----------|-----------|-----------|------------|----------|--------------|
| NAME   | RHernan   | MPadovan  | BClayton  | JTappert*  | SHom     | KJabbour     |
| DATE   | 09/16/02  | 09/16/02  | 09/16/02  | 09/13/02   | 09/17/02 | 09/17/02     |

OFFICIAL RECORD COPY

UNITED STATES NUCLEAR REGULATORY COMMISSION

TENNESSEE VALLEY AUTHORITY

DOCKET NOS. 50-327 AND 50-328

SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2

ENVIRONMENTAL ASSESSMENT AND FINDING OF

NO SIGNIFICANT IMPACT

The U.S. Nuclear Regulatory Commission (NRC) is considering issuance of amendments to Facility Operating Licenses DPR-77 and DPR-79 issued to the Tennessee Valley Authority (TVA or the licensee) for operation of the Sequoyah Nuclear Plant (SQN), Units 1 and 2, located in Hamilton County, Tennessee. Therefore, as required by Title 10, *Code of Federal Regulations* (10 CFR), Section 51.21, the NRC is issuing this environmental assessment and finding of no significant impact.

ENVIRONMENTAL ASSESSMENT

Identification of the Proposed Action:

The proposed action would change SQN's Technical Specifications to allow TVA to irradiate up to 2256 tritium-producing burnable absorber rods (TPBARs) in each of SQN's two reactor cores. Irradiating the TPBARs in the reactor cores supports the U.S. Department of Energy (DOE) in maintaining the nation's tritium inventory. TVA will insert the TPBARs into positions in the reactor cores where conventional burnable poison rods would normally be located (conventional poison rods contain boron which reacts with neutrons making them unavailable for interacting with uranium atoms, thereby slowing fission and heat generation). TPBARs are not reactor fuel and do not generate thermal energy for generating electrical energy.

TPBARs use lithium rather than boron. Neutron irradiation in the reactor core converts the lithium in the TPBARs into tritium. After one operating cycle, TVA would remove the fuel assemblies containing TPBARs from the SQN cores and put them into the spent fuel pool. TVA would then, after several weeks (based on plant schedules rather than decay considerations), remove the irradiated TPBARs from the fuel assemblies and consolidate them into shipping casks for DOE to transport them to its tritium extraction facility at its Savannah River Site.

The proposed action is in accordance with the licensee's application dated September 21, 2001, as supplemented by letters of June 11, July 19, August 9, August 30, September 5, and September 12, 2002.

The Need for the Proposed Action:

The proposed action would allow SQN to provide irradiation services for DOE to maintain the nation's tritium supply as prescribed by Public Law (PL) 106-65. Section 3134 of PL 106-65 directs the Secretary of Energy to produce new tritium at TVA's Watts Bar Nuclear Plant (WBN) or the SQN plant.

Environmental Impacts of the Proposed Action:

DOE's Environmental Impact Statement, DOE/EIS-0288, *Final Environmental Impact Statement (EIS) for the Production of Tritium in a Commercial Light Water Reactor*, dated March 1999, assessed the environmental impacts of producing tritium at WBN and SQN. TVA was a cooperating Federal agency in preparing this EIS and adopted the EIS in accordance with 40 CFR 1506.3(c) of the Council on Environmental Quality regulations. DOE also prepared a Tritium Production Core (TPC) Topical Report, NDP-98-181, Rev. 1, to address the safety and licensing issues associated with incorporating TPBARs in a reference pressurized-water reactor. The NRC used its Standard Review Plan (NUREG-0800) as the basis for evaluating the impact of the TPBARs on a reference plant. The NRC reviewed the TPC Topical Report

and issued a Safety Evaluation Report, NUREG-1672, in May 1999. NUREG-1672 identified 17 plant-specific interface issues that a licensee would be required to address in support of a plant specific amendment to operate a tritium production core. TVA's application of September 21, 2001, and supplements, addressed these interface issues. The NRC staff is reviewing TVA's amendment request and will issue a safety evaluation documenting its review.

1. Radiological Impact from Tritium Release to the Reactor Coolant System (RCS) Under Normal Plant Operations with 2256 TPBARs in each Core

Tritium levels in the RCSs of large pressurized-water reactors have ranged as high as 4000 curies per year (Ci/yr) without exceeding regulatory limits. TVA estimated, as discussed in its June 11, 2002, letter, that the tritium level in the RCS of each SQN unit would be about 3126 Ci/yr with 2256 TPBARs in each unit's reactor. This increased tritium level could increase overall occupational exposure, but NRC data summarized in NUREG-0713, "Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities," dated 1995, indicate tritium exposure is not an important contributor to overall occupational exposure.

TVA, in its letter dated June 11, 2002, stated that it does not expect the increased RCS activity at SQN to greatly affect normal RCS feed-and-bleed operation throughout the cycle. The NRC staff finds no reason to disagree with TVA's conclusion. Thus, primary coolant discharge volumes should be similar to current volumes.

The staff concludes that the additional dose rate from operating SQN with 2256 TPBARs in each reactor will not have a significant impact on TVA's ability to control worker radiation doses and keep them well within regulatory limits using the controls and practices in SQN's existing Radiation Protection Program.

If increased RCS feed and bleed is required, it may be necessary to temporarily store the increased volume of tritiated liquid onsite, or to dilute the tritiated liquid to ensure that 10 CFR Part 20 discharge limits are met. SQN has sufficient storage tanks to accommodate

this additional liquid waste.

2. Radiological Impact from Liquid Effluents Under Normal Plant Operations with 2256 TPBARs in each Core

The SQN facility has waste-treatment systems designed to collect and process liquid waste that may contain radioactive material. The tritium in liquid effluents from SQN is diluted to a relatively low concentration before it reaches even the most highly exposed members of the public. TVA's submittal of June 11, 2002, shows that the total additional dose to the maximally-exposed member of the public is estimated to be less than 0.01 millirem per year (mrem/yr). This total dose, considering the minimal increase from tritium production, is less than 1.0 percent of the NRC 3-mrem/yr guideline for effluent exposure to the public. The staff concludes that the potential radiological impact from liquid effluents on plant workers, members of the public, and the environment from operation with the TPC complies with all regulatory dose limits.

3. Radiological Impact from Radioactive Gaseous Emissions Under Normal Plant Operations with 2256 TPBARs in each Core

A portion of the tritium might be released to the atmosphere. The amount would depend on plant conditions and the manner in which TVA operates SQN. Individuals could be exposed to tritium in a variety of pathways if it was released to the atmosphere. These pathways include inhalation and skin absorption, as well as consumption of meat, vegetables and milk.

According to TVA, in its submittal of June 11, 2002, the calculated incremental increase in the gaseous emission dose to the most highly-exposed member of the public through all pathways because of the TPBARs would be about 1.7 percent of the NRC annual 15 mrem exposure guideline for airborne effluents.

4. Radiological Impact from Solid Radioactive Waste Under Normal Plant Operations with 2256 TPBARs in each Core

Irradiation of TPBARs is expected to increase the number of curies and volume of solid radioactive waste, primarily because of disposal (offsite) of the associated base plates and thimble plugs, which become irradiated. The estimated increase in activity inventory from solid waste (assuming 2256 TPBARs) is approximately 2700 Ci/year and the estimated increase in volume is from 32,820 cubic feet/year to 32,853 cubic feet/year. As the result of this increase in solid waste, the estimated increase in total worker dose from handling the additional solid waste is approximately 1.7 person-rem (about 1.1 percent of the dose assessment estimate of record). Offsite shipment and disposal would be in accordance with established agreements between TVA and DOE.

5. Radiological Impact to Workers in the Fuel Storage Area Under Normal Plant Operations with 2256 TPBARs in each Core

The proposed amendments are not expected to significantly affect the doses to the workers in the fuel storage area. The TPBARs are designed to have minimal effect on plant operations, including refueling operations. Unirradiated TPBARs will produce no increase in exposure, occupational or public, because they are essentially non-radioactive. Possible increases in tritium airborne activity may increase dose to workers handling and consolidating radioactive TPBARs. However, TVA stated, in its submittal of June 11, 2002, that SQN's station dose assessment of record bounds the expected increase.

6. Non-Radiological Impact with 2256 TPBARs in each Core

The proposal does not affect non-radiological plant effluents. The proposal does not result in any significant changes to land use or water use. It also does not result in any significant changes to the quantity or quality of effluents, and no effects on endangered or threatened species or on their habitats are expected. Therefore, no changes in, or different

types of, non-radiological environmental impacts are expected as a result of the amendments.

#### 7. Radiological Impact from Postulated Accidents with 2256 TPBARs in the Core

TVA's submittal of June 11, 2002, discussed the effects of TPBARs on the possible consequences of the following postulated accidents discussed in SQN's Updated Final Safety Analysis Report (UFSAR):

- fuel-handling accident
- design basis loss-of-coolant accident (LOCA)
- main steamline failure outside of containment
- steam generator tube rupture
- loss of normal alternating current power to plant auxiliaries
- waste gas decay tank failure
- rod ejection accident
- failure of small lines carrying primary coolant outside containment

Discussions of the postulated accidents with the greatest radiological consequences appear below.

##### a. Fuel-Handling Accident

This accident is defined as dropping a spent fuel assembly containing irradiated TPBARs resulting in rupture of the cladding on all the fuel rods. TVA's calculations conservatively assumed that 24 TPBARs (the maximum possible number) are in the dropped spent fuel assembly and that they all rupture and transfer their tritium to the spent fuel pool. Releasing this activity to the (1) control room boundary, (2) Exclusion Area Boundary over 2 hours, and (3) Low Population Zone over 30 days results in the doses to the thyroid, skin (beta), whole body (gamma), and Total Effective Dose Equivalent (TEDE), as defined in 10 CFR Part 20, that are small percentages of regulatory limits.



b. LOCA

This accident is defined as losing reactor coolant at a rate in excess of the capability of the reactor coolant makeup system. LOCAs could occur from breaks in pipes in the reactor coolant pressure boundary up to and including a break equivalent in size to the double-ended rupture of the largest pipe in the RCS. TVA conservatively assumed that the entire tritium content of the 2256 TPBARs is released into containment during a postulated LOCA. Releasing this activity to the (1) control room boundary, (2) Exclusion Area Boundary over 2 hours, and (3) Low Population Zone over 30 days results in doses to the thyroid, skin (beta), whole body (gamma), and TEDE that are small percentages of regulatory limits.

8. Post-LOCA Hydrogen Generation Inside Containment

TVA's submittal of September 21, 2001, stated that TPBARs could release additional hydrogen to the containment following a large-break LOCA (LBLOCA). SQN has emergency operating procedures in place to start a hydrogen recombiner train when the containment volumetric percentage of hydrogen reaches 3 percent. A previous analysis for a conventional (non-TPBAR) core in the SQN UFSAR indicated that for an LBLOCA, with no recombiners started, the containment hydrogen concentration reached 3.75 percent 4 days following event initiation. With additional hydrogen from the TPBARs, TVA's analysis indicated that the containment hydrogen concentration would only slightly increase 2 days following event initiation. If one recombiner train is started 24 hours after event initiation for the TPBAR core, the peak containment hydrogen concentration is limited to less than 4 percent for up to 6 days. Having up to 24 hours to place a recombiner train in service to maintain the containment hydrogen concentration below 4 percent is adequate in satisfying NRC Regulatory Guide 1.7. Accordingly, reactor operation with the TPBARs will not be a significant contributor to the post-LOCA hydrogen inventory, and will not have a significant impact on the total hydrogen concentration within the containment when compared to the values associated with the non-

TPBAR core. The maximum containment hydrogen concentration can be maintained at less than the lower flammability limit of 4.0-volume-percent, with one recombiner train started at a 3-percent hydrogen concentration approximately 24 hours after an LBLOCA.

#### Summary

The Commission has completed its evaluation of the proposed action. The proposed action will not significantly increase the probability or consequences of accidents, no changes are being made in the types of effluents that may be released offsite, and there is no significant increase in occupational or public radiation exposure. Therefore, there are no significant radiological environmental impacts associated with the proposed action.

With regard to potential non-radiological impacts, the proposed action does not have a potential to affect historic sites. It does not affect non-radiological plant effluents and has no other environmental impact. Therefore, there are no significant non-radiological environmental impacts associated with the proposed action.

#### Environmental Impacts of the Alternatives to the Proposed Action:

As an alternative to the proposed action, the staff considered denial of the proposed action (i.e., the “no-action” alternative). Denial of the application would result in no significant change in current environmental impacts. However, because there are no significant environmental impacts associated with this action, and because PL 106-65 directs that DOE produce tritium at WBN or SQN, this is not considered a viable option.

#### Alternative Use of Resources:

DOE evaluated alternatives to the proposed action, including completing construction of one or both of the Bellefonte Nuclear Plant Units and construction of an accelerator facility at the Savannah River site and concluded that the proposed action has the least environmental impact of the options considered. The NRC has no reason to disagree with DOE’s decision.

#### Agencies and Persons Consulted:

On September 16, 2002, the staff consulted with the Tennessee State official, Elizabeth Flannagan of the Tennessee Bureau of Radiological Health, regarding the environmental impact of the proposed action. The State official had no comments.

#### FINDING OF NO SIGNIFICANT IMPACT

On the basis of the environmental assessment, the NRC concludes that the proposed action will not have a significant effect on the quality of the human environment. Accordingly, the NRC has determined not to prepare an environmental impact statement for the proposed action.

For further details with respect to the proposed action, see the licensee's letter dated September 21, 2001, as supplemented by letters dated June 11, July 19, August 9, August 30, September 5, and September 12, 2002. Documents may be examined, and/or copied for a fee, at the NRC's Public Document Room (PDR), located at One White Flint North, 11555 Rockville Pike (first floor), Rockville, Maryland. Publicly available records will be accessible electronically from the Agencywide Documents Access and Management System (ADAMS) Public Electronic Reading Room on the Internet at the NRC Web site, <http://www.nrc.gov/reading-rm/adams.html>. Persons who do not have access to ADAMS or who encounter problems in accessing the documents located in ADAMS, should contact the NRC PDR Reference staff by telephone at 1-800-397-4209 or 301-415-4737, or by e-mail to [pdr@nrc.gov](mailto:pdr@nrc.gov).

Dated at Rockville, Maryland, this 17th day of September 2002.

FOR THE NUCLEAR REGULATORY COMMISSION

**/RA/**

Ronald W. Hernan, Senior Project Manager, Section 2  
Project Directorate II  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Mr. J. A. Scalice  
Tennessee Valley Authority

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, Acting 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

## **SEQUOYAH NUCLEAR PLANT**

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

Dr. Gary Drinkard  
340 Drinkard Dr.  
Spring City, TN 37381

Ms. Vickie G. Davis  
TDEC-DOE Oversight Division  
761 Emory Valley Road  
Oak Ridge, TN 37830-7072

Heinz Mueller [5 copies]  
Environmental Review Coordinator  
US EPA Region 4  
61 Forsyth Street, SW.  
Atlanta, Georgia 30303-3104