UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

August 1, 1990

Docket Nos. 50-327
and 50-328

Mr. Oliver D. Kingsley, Jr.
Senior Vice President, Nuclear Power
Tennessee Valley Authority
6N 38A Lookout Place
1101 Market Street
Chattanooga, Tennessee 37402-2801

Dear Mr. Kingsley:

SUBJECT: INCREASE FUEL ENRICHMENT TO 5.0 WEIGHT PERCENT (TAC NOS. 76074, 76075, 76774, 76775) (TS 90-12) - SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2

The Commission has issued the enclosed Amendment No. 144 to Facility Operating License No. DPR-77 and Amendment No. 125 to Facility Operating License No. DPR-79 for the Sequoyah Nuclear Plant, Units 1 and 2, respectively. These amendments are in response to your application dated May 4, 1990.

The amendments modify the Sequoyah Nuclear Plant, Units 1 and 2, Technical Specifications (TSs) to increase the maximum enrichment of fuel allowed on the site from 4.0 to 5.0 weight percent (w/o) Uranium 235. Changes have been made to Section 5.0, Design Features, and Surveillance Requirement 4.9.1.4 on the boron concentration in the spent fuel storage pool has been added to the TSs. As stated in TS 5.6.1.2, new fuel with an enrichment greater than 4.5 weight percent may not be stored in the new fuel pit storage racks. This fuel may, based on these amendments, be stored in the spent fuel pool storage racks. Fuel assemblies with enrichments greater than 4.0 w/o and burnups less than 6750 MWD/MTU may be placed in spent fuel pool storage rack locations that face adjacent cells filled with water or fuel assemblies with at least 20,000 MWD/MTU of burnup. This amendment is based on the criticality analysis for the spent fuel storage pool which was submitted in your letter dated February 14, 1990.

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

DFol
1/1

In your application, you also requested changes to the TSs to allow the substitution of Zircaloy-4 or stainless steel filler rods, or of open water channels, for fuel rods in fuel assemblies. This request is still under staff review and will be the subject of a future letter.

Sincerely,

Jack N. Donohew, Project Manager
Project Directorate II-4
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Enclosures:
1. Amendment No. 144 to
   License No. DPR-77
2. Amendment No. 125 to
   License No. DPR-79
3. Safety Evaluation

cc w/enclosures:
See next page

w/changes as noted to SER

changes made JND 8/1/90

OFC	:PDII-4/LA	:PDII-4/PM	:OGC	:PDII-4/DD	:PDII-4/D	:
NAME	:MKrebs	:JDonohew:as	:	:SBlack	:FHebdon	:
DATE	:6/28/90	:6/20/90	:7/19/90	:7/31/90	:7/31/90	:

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AMENDMENT NO. 144 FOR SEQUOYAH UNIT NO. 1 - DOCKET NO. 50-327 and
AMENDMENT NO. 125 FOR SEQUOYAH UNIT NO. 2 - DOCKET NO. 50-328
DATED: August 1, 1990

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

TENNESSEE VALLEY AUTHORITY

DOCKET NO. 50-327

SEQUOYAH NUCLEAR PLANT, UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 144
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 May 4, 1990, as supported by the letter dated February 14, 1990, 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, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment and paragraph 2.C.(2) of Facility Operating License No. DPR-77 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 144, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Frederick J. Hebdon

Frederick J. Hebdon, Director
Project Directorate II-4
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: August 1, 1990

ATTACHMENT TO LICENSE AMENDMENT NO. 144

FACILITY OPERATING LICENSE NO. DPR-77

DOCKET NO. 50-327

Revise the Appendix A Technical Specifications by removing the pages identified below and inserting the enclosed pages. The revised pages are identified by the captioned amendment number and contain marginal lines indicating the area of change.

REMOVE	INSERT
3/4 9-1	3/4 9-1
--	3/4 9-1a
5/4	5/4
5-5	5-5

3/4.9 REFUELING OPERAIIONS

3/4.9.1 BORON CONCENTRATION

LIMITING CONDITION FOR OPERATION

3.9.1 With the reactor vessel head closure bolts less than fully tensioned or with the head removed. the boron concentration of all filled portions of the Reactor Coolant System and the refueling canal shall be maintained uniform and sufficient to ensure that the more restrictive of the following reactivity conditions is met:

a. Either a K_{eff} of 0.95 or less. which includes a 1% delta k/k conservative allowance for uncertainties, or
b. A boron concentration of greater than or equal to 2000 ppm, which includes a 50 ppm conservative allowance for uncertainties.

APPLICABILITY: MODE 6*

ACTION:

With the requirements of the above specification not satisfied, immediately suspend all operations involving CORE ALTERATIONS or positive reactivity changes and initiate and continue boration at greater than or equal to 10 gpm of a solution containing greater than or equal to 20.000 ppm boron or its equivalent until Keff is reduced to less than or equal to 0.95 or the boron concentration is restored to greater than or equal to 2000 ppm, whichever is the more restrictive. The provisions of Specification 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.9.1.1 The more restrictive of the above two reactivity conditions shall be determined prior to:

a. Removing or unbolting the reactor vessel head, and
b. Withdrawal of any full length control rod in excess of 3 feet from its fully inserted position within the reactor pressure vessel.

4.9.1.2 The boron concentration of the reactor coolant system and the refueling canal shall be determined by chemical analysis at least once per 72 hours.

*The reactor shall be maintained in MODE 6 whenever fuel is in the reactor vessel with the vessel head closure bolts less than fully tensioned or with the head removed.

SURVEILLANCE REQUIREMENTS (Continued)

4.9.1.3 One of the following valve combinations shall be verified closed under administrative control at least once per 72 hours:

Combination A	Combination B	Combination C	Combination D
a. 1-81-536	a. 1-81-536	a. 1-81-536	a. 1-81-536
b. 1-62-922	b. 1-62-922	b. 1-62-907	b. 1-62-907
c. 1-62-916	c. 1-62-916	c. 1-62-914	c. 1-62-914
d. 1-62-933	d. 1-62-940	d. 1-62-921	d. 1-62-921
	e. 1-62-696	e. 1-62-933	e. 1-62-940
	f. 1-62-929		f. 1-62-929
	g. 1"62-932		q. 1-62-932
	h. 1.FCV-62-128		h. 1-62-696
			i. 1-FCV-62-128

4.9.1.4 The boron concentration in the spent fuel pool shall be determined by chemical analysis to be greater than or equal to 2,000 parts per million (ppm) at least once per 72 hours during fuel movement and until the configuration of the assemblies in the storage racks is verified to comply with the criticality loading criteria specified in Design Feature 5.6.1.1.c

5.3 REACTOR CORE

FUEL ASSEMBLIES

5.3.1 The reactor core shall contain 193 fuel assemblies with each fuel assembly containing 264 fuel rods clad with Zircaloy-4. Each fuel rod shall have a nominal active fuel length of 144 inches. The initial core loading shall have a maximum enrichment of 3.15 weight percent U-235. Reload fuel shall be similar in physical design to the initial core loading and shall have a maximum enrichment of 5.0 weight percent U-235.

CONTROL ROD ASSEMBLIES

5.3.2 The reactor core shall contain 53 full length and no part length control rod assemblies. The full length control rod assemblies shall contain a nominal 142 inches of absorber material. The nominal values of absorber material shall be 80 percent silver, 15 percent indium and 5 percent cadmium. All control rods shall be clad with stainless steel tubing.

5.4 REACTOR COOLANT SYSTEM

DESIGN PRESSURE AND TEMPERATURE

5.4.1 The reactor coolant system is designed and shall be maintained:

a. In accordance with the code requirements specified in Section 5.2 of the FSAR, with allowance for normal degradation pursuant to the applicable Surveillance Requirements,

b. For a pressure of 2485 psig, and

c. For a temperature of 650°F, except for the pressurizer which is 680°F.

VOLUME

5.4.2 The total water and steam volume of the reactor coolant system is 12,612 $\pm$ 100 cubic feet at a nominal T_{avg} of 525°F.

5.5 METEOROLOGICAL TOWER LOCATION

5.5.1 The meteorological tower shall be located as shown on Figure 5.1-1.

5.6 FUEL STORAGE

CRITICALITY - SPENT FUEL

5.6.1.1 The spent fuel storage racks are designed for fuel enriched to 5.0 weight percent U-235 and shall be maintained with:

a. A k_{eff} equivalent to less than 0.95 when flooded with unborated water, which includes a conservative allowance of 3.06% delta k/k for uncertainties.*

b. A nominal 10.375 inch center-to-center distance between fuel assemblies placed in the storage racks.

c. Fuel assemblies with enrichment greater than 4.0 weight-percent U-235 and burnup less than 7,500 megawattday/metric ton (MWd/mtu) shall be placed in cells in the spent fuel storage racks that face adjacent cells containing either:

   1. Fuel assemblies with accumulated burnup of at least 22,000 MWd/mtu, or

   2. Water

CRITICALITY - NEW FUEL

5.6.1.2 The new fuel pit storage racks are designed and shall be maintained with a nominal 21.0 inch center-to-center distance between new fuel assemblies such that k_{eff} will not exceed 0.98 when fuel having an enrichment of 4.5 weight percent U-235 is in place and optimum achievable moderation is assumed.

DRAINAGE

5.6.2 The spent fuel pit is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 722 ft.

CAPACITY

5.6.3 The spent fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than 1386 fuel assemblies.

5.7 COMPONENT CYCLIC OR TRANSIENT LIMIT

5.7.1 The components identified in Table 5.7-1 are designed and shall be maintained within the cyclic or transient limits of Table 5.7-1.

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*For some accident conditions, the presence of dissolved boron in the pool water may be taken into account by applying the double contingency principle which requires two unlikely, independent, concurrent events to produce a criticality accident.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

TENNESSEE VALLEY AUTHORITY

DOCKET NO. 50-328

SEQUOYAH NUCLEAR PLANT, UNIT 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No.125
License No. DPR-79

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Tennessee Valley Authority (the licensee) dated May 4, 1990, as supported by the letter dated February 14, 1990, 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, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment and paragraph 2.C.(2) of Facility Operating License No. DPR-79 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 125 , are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Frederick J. Hebdon

Frederick J. Hebdon, Director
Project Directorate II-4
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: August 1, 1990

ATTACHMENT TO LICENSE AMENDMENT NO. 125

FACILITY OPERATING LICENSE NO. DPR-79

DOCKET NO. 50-328

Revise the Appendix A Technical Specifications by removing the pages identified below and inserting the enclosed pages. The revised pages are identified by the captioned amendment number and contain marginal lines indicating the area of change.

REMOVE	INSERT
3/4 9-2	3/4 9-2
5-4	5-4
5-5	5-5

SURVEILLANCE REQUIREMENTS (Continued)

4.9.1.2 The boron concentration of the reactor coolant system and the refueling canal shall be determined by chemical analysis at least once per 72 hours.

4.9.1.3 One of the following valve combinations shall be verified closed under administrative control at least once per 72 hours:

Combination A	Combination B	Combination C	Combination D
a. 2-81-536	a. 2-81-536	a. 2-81-536	a. 2-81-536
b. 2-62-922	b. 2-62-922	b. 2-62-907	b. 2-62-907
c. 2-62-916	c. 2-62-916	c. 2-62-914	c. 2-62-914
d. 2-62-933	d. 2-62-940	d. 2-62-921	d. 2-62-921
	e. 2-62-696	e. 2-62-933	e. 2-62-940
	f. 2-62-929		f. 2-62-929
	g. 2-62-932		g. 2-62-932
	h. 2-FCV-62-128		h. 2-62-696
			i. 2-FCV-62-128

4.9.1.4 The boron concentration in the spent fuel pool shall be determined by chemical analysis to be greater than or equal to 2000 ppm at least once per 72 hours during fuel movement and until the configuration of the assemblies in the storage racks is verified to comply with the criticality loading criteria specified in Design Feature 5.6.1.1.c.

5.3 REACTOR CORE

FUEL ASSEMBLIES

5.3.1 The reactor core shall contain 193 fuel assemblies with each fuel assembly containing 264 fuel rods clad with Zircaloy -4. Each fuel rod shall have a nominal active fuel length of 144 inches. The initial core loading shall have a maximum enrichment of 3.15 weight percent U-235. Reload fuel shall be similar in physical design to the initial core loading and shall have a maximum enrichment of 5.0 weight percent U-235.

CONTROL ROD ASSEMBLIES

5.3.2 The reactor core shall contain 53 full length and no part length control rod assemblies. The full length control rod assemblies shall contain a nominal 142 inches of absorber material. The nominal values of absorber material shall be 80 percent silver, 15 percent indium and 5 percent cadmium. All control rods shall be clad with stainless steel tubing.

5.4 REACTOR COOLANT SYSTEM

DESIGN PRESSURE AND TEMPERATURE

5.4.1 The reactor coolant system is designed and shall be maintained:

a. In accordance with the code requirements specified in Section 5.2 of the FSAR, with allowance for normal degradation pursuant to the applicable Surveillance Requirements,

b. For a pressure of 2485 psig, and

c. For a temperature of 650°F, except for the pressurizer which is 680°F.

VOLUME

5.4.2 The total water and steam volume of the reactor coolant system is 12,612 ± 100 cubic feet at a nominal T_{avg} of 525°F.

5.5 METEOROLOGICAL TOWER LOCATION

5.5.1 The meteorological tower shall be located as shown on Figure 5.1-1.

5.6 FUEL STORAGE

CRITICALITY - SPENT FUEL

5.6.1.1 The spent fuel storage racks are designed for fuel enriched to 5.0 weight percent U-235 and shall be maintained with:

a. A k_{eff} equivalent to less than 0.95 when flooded with unborated water, which includes a conservative allowance of 3.06% delta k/k for uncertainties.*

b. A nominal 10.375 inch center-to-center distance between fuel assemblies placed in the storage racks.

c. Fuel assemblies with enrichment greater than 4.0 weight-percent U-235 and burnup less than 7,500 megawattday/metric ton (MWd/mtu) shall be placed in cells in the spent fuel storage racks that face adjacent cells containing either:

   1. Fuel assemblies with accumulated burnup of at least 22,000 MWd/mtu, or

   2. Water

CRITICALITY - NEW FUEL

5.6.1.2 The new fuel pit storage racks are designed and shall be maintained with a nominal 21.0 inch center-to-center distance between new fuel assemblies such that k_{eff} will not exceed 0.98 when fuel having an enrichment of 4.5 weight percent U-235 is in place and optimum achievable moderation is assumed.

DRAINAGE

5.6.2 The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 722 ft.

CAPACITY

5.6.3 The spent fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than 1386 fuel assemblies.

5.7 COMPONENT CYCLIC OR TRANSIENT LIMIT

5.7.1 The components identified in Table 5.7-1 are designed and shall be maintained within the cyclic or transient limits of Table 5.7-1.

*For some accident conditions, the presence of dissolved boron in the pool water may be taken into account by applying the double contingency principle which requires two unlikely, independent, concurrent events to produce a criticality accident.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

ENCLOSURE 3

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION SUPPORTING AMENDMENT NO. 144 TO FACILITY OPERATING LICENSE NO. DPR-77 AND AMENDMENT NO. 125 TO FACILITY OPERATING LICENSE NO. DPR-79

TENNESSEE VALLEY AUTHORITY

SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2

DOCKET NOS. 50-327 AND 50-328

1.0 INTRODUCTION

By letter dated May 4, 1990, the Tennessee Valley Authority (TVA) proposed to modify the Sequoyah Nuclear Plant, Units 1 and 2, Technical Specifications (TSs). The proposed changes are to revise Section 5.0, Design Features, and to add Surveillance Requirement 4.9.1.4. The changes would allow the licensee to increase the maximum fuel enrichment for fuel on the site from the current 4.0 weight-percent (w/o) to 5.0 w/o Uranium (U)-235. In support of these proposed changes to the TSs, TVA submitted by letter dated February 14, 1990, a criticality analysis to justify the proposed increase in the enrichment limit of fuel stored in the Sequoyah spent fuel pool storage racks to 5.0 w/o U-235. The proposed changes would allow a fuel assembly with enrichment greater than 4.0 w/o U-235 and burnup less than 7500 MWD/MTU to be placed in locations in the spent fuel pool storage racks that face adjacent cells with water or fuel assemblies with at least 22,000 MWD/MTU of burnup.

In its application, TVA also requested changes to the TSs to allow the substitution of Zircaloy-4 or stainless steel filler rods, or of open water channels, for fuel rods in fuel assemblies. This request is still under staff review and will be the subject of a future evaluation.

The proposed changes do not increase the number of fuel assemblies currently allowed in the spent fuel or new fuel storage racks. The storage capacity of the spent fuel pool remains limited to 1386 fuel assemblies and the center-to-center distance between fuel assemblies in the spent fuel racks remains a nominal 10.375 inches. The storage of fresh fuel in the new fuel pit storage racks has not been reanalyzed and the maximum enrichment limit remains at 4.5 w/o U-235.

The reactivity analysis associated with these proposed changes is delineated below.

2.0 EVALUATION

Each core reload is confirmed by TVA to meet all of the design criteria and to be within the bounds of the accident analysis presented in Chapter 15 of the Sequoyah Final Safety Analysis Report (FSAR) by performance of a reload safety analysis prior to fuel loading. Revisions to this safety analysis for replacing fuel assemblies may be made after fuel loading. This analysis considers modifications to the plant design and any changes to fuel design, including increases in fuel enrichment, for the fuel to be burned during the operating cycle. The performance of the reload safety analysis ensures that the unit, with its specific core design and fuel enrichment, will operate within the prescribed Sequoyah safety limits. Any restriction on core operation is identified through the reload safety analysis process. Therefore, operation with this higher enrichment fuel will be justified for each fuel load and operating cycle.

2.1 Criticality

TVA has performed a criticality analysis to justify the storage of fuel assemblies in the spent fuel storage racks at Sequoyah with a maximum enrichment of 5.0 w/o U-235. This analysis is an enclosure to TVA letter dated February 14, 1990.

The spent fuel storage rack at Sequoyah is a high density storage rack manufactured by PaR Systems Corporation. The design incorporates the use of the neutron poison material Boral as a means of reducing the center-to-center spacing of the storage cells. The spent fuel storage cell consists of two concentric, square stainless steel tubes, seal welded at the ends. The Boral plate is located in the water-tight void existing between the tubes. The spent fuel is normally stored in pool water containing at least 2000 ppm of soluble boron which results in a significant reduction in reactivity. However, for conservatism, the spent fuel rack reactivity is calculated assuming that there is no soluble boron in the water.

The Sequoyah spent fuel pool currently is limited to using Westinghouse Electric Corporation (Westinghouse) Standard (STD) 17x17 fuel assemblies enriched to less than 4.0 w/o U-235. The new analysis, which takes credit for the reactivity decrease due to burnup of the stored fuel, evaluates the storage of Westinghouse 17x17 VANTAGE 5H (V5H) fuel assemblies with initial enrichments of up to 5.0 w/o U-235. The analysis is applicable to both the STD and V5H fuel assemblies since the V5H fuel results in a higher reactivity than the STD fuel for a given enrichment and, therefore, is conservative for the STD fuel.

The analysis uses KENO, a three-dimensional Monte Carlo theory computer code for reactivity calculations. However, since KENO does not have the capability to deplete fuel assemblies, the CASMO code was used for burnup-dependent reactivity calculations. CASMO is a two-dimensional integral transport theory code. Neutron cross sections were based on data from the ENDF/B-IV cross section library. The analytical methods and models were benchmarked against experimental data with characteristics similar to the Sequoyah spent fuel pool racks and were found to adequately reproduce the critical values. The staff concludes that these methods and models are acceptable.

The design basis for preventing criticality outside the reactor is that, including uncertainties, there is a 95 percent probability at a 95 percent confidence level (i.e., 95/95 probability/confidence) that the effective multiplication factor (k-eff) of the fuel assembly array will be no greater than 0.95. A full loading in the Sequoyah spent fuel storage racks of fresh fuel assemblies enriched to greater than 4.0 w/o U-235 would violate this acceptance criterion. Therefore, credit was taken for the reactivity decrease due to burnup in order to load V5H assemblies with initial U-235 enrichments greater than 4.0 w/o. Based on this, an assembly enriched to 4.0 w/o at zero burnup was found to have a reactivity equivalent to a 5.0 w/o assembly with accumulated burnup of 6750 MWD/MTU. Therefore, once a 5.0 w/o fuel assembly accumulates at least 6750 MWD/MTU of burnup, it can be stored anywhere in the spent fuel storage racks. This equivalent enrichment concept has been widely used in spent fuel rack analyses and is acceptable.

In order to store fresh 5.0 w/o fuel with no accumulated burnup in the spent fuel racks, restrictions must be placed on allowable storage configurations which effectively increase the center-to-center spacing of the assemblies. In Sequoyah, this is accomplished by requiring a checkerboard configuration for any fuel assemblies with initial enrichment greater than 4.0 w/o U-235 and burnup less than 6750 MWD/MTU.

TVA has analyzed the reactivity of the spent fuel racks for an infinite array of 5.0 w/o fresh fuel loaded in a checkerboard configuration alternating with 5.0 w/o fuel having accumulated burnup of 20,000 MWD/MTU. The resulting k-eff was 0.94416 including all appropriate biases and uncertainties at a 95/95 probability/confidence level. This meets the NRC acceptance criterion and is, therefore, acceptable. Calculations also showed that checkerboarding fresh 5.0 w/o fuel assemblies with adjacent cells filled with unborated water (i.e., vacant) does not increase the reactivity of the system. Therefore, any Westinghouse STD or V5H 17x17 fuel assembly with enrichment greater than 4.0 w/o, but less than 5.0 w/o, and burnup less than 6750 MWD/MTU may be placed in spent fuel storage rack locations that face adjacent cells filled with water or fuel assemblies with at least 20,000 MWD/MTU of burnup. Plant procedures will be relied upon to determine whether or not an assembly satisfies the burnup criterion. In order to allow for uncertainties in the determination of assembly burnup, the calculated exposure limits will be increased by 10 percent. For example, the procedures will reflect a criterion of 22,000 MWD/MTU for the assemblies that can be placed adjacent to fresh fuel assemblies which exceed 4.0 w/o enrichment. The staff finds this conservatism appropriate and acceptable.

It is possible to postulate events which could lead to an increase in storage rack reactivity, such as a dropped fuel assembly or misplaced fuel assemblies. However, for such events, credit may be taken for the 2000 ppm of boron in the spent fuel pool water by application of the double contingency principle of ANSI N16.1-1975. This states that one is not required to assume two unlikely, independent, concurrent events to provide for protection against a criticality accident. The staff concludes that this is acceptable since TS 3.9.1 requires that the boron concentration of the refueling canal (and, therefore, the spent fuel pool) be at least 2000 ppm during refueling operations. In addition, proposed Surveillance Requirement (SR) 4.9.1.4 would require the boron concentration in the spent fuel pool to be determined to be no less than 2000 ppm at least once every 72 hours during fuel movement until the configuration of the assemblies in the storage racks is verified to be correct. The reduction in k-eff caused by the borated water more than offsets any reactivity addition caused by credible accidents. Therefore, this change is acceptable.

2.2 Technical Specification Changes

Changes to the TSs were proposed in order to store fuel with enrichments greater than 4.0 w/o U-235 in the spent fuel pool. The proposed changes to TS 5.6.1.1 including adding a statement that any fuel assembly with enrichment greater than 4.0 w/o and burnup less than 7500 MWD/MTU may be placed in locations in the spent fuel storage racks provided that they face adjacent cells filled with water, or fuel assemblies with at least 22,000 MWD/MTU of burnup. The burnup requirements discussed above have been conservatively increased by 10 percent from 6750 MWD/MTU to 7500 MWD/MTU to allow for uncertainties in the determination of assembly burnup. The maximum U-235 enrichment of stored fuel shall be limited to 5.0 w/o. Reference to the 1.42 percent delta k/k uncertainty allowance has been increased to 3.06 percent delta k/k to conform to the revised criticality analysis for spent fuel storage. These proposed changes to TS 5.6.1.1 are consistent with the criticality analysis and, therefore, are acceptable.

A change has been proposed to TS 5.3.1 to increase the maximum enrichment of reload fuel from 4.0 to 5.0 w/o U-235. This is consistent with the criticality analysis and therefore, is acceptable. Although this is acceptable from a spent fuel storage viewpoint, plant operation using the higher enriched fuel must be demonstrated to be acceptable by a cycle specific reload safety evaluation prior to each fuel loading.

TVA proposed to add SR 4.9.1.4 to require the boron concentration in the spent fuel pool to be greater than or equal to 2000 ppm at least once per 72 hours during fuel movement and until the configuration of the assemblies in the storage racks is verified to comply with the criticality loading criteria specified in TS 5.6.1.1.c. This proposed change is consistent with the double contingency principle of ANSI N16.1-1975 and with the criticality analysis, and, therefore, is acceptable.

The proposed change to TS 5.6.1.2 is to delete the statement that the new fuel enrichment is limited to 4.0 w/o. The criticality analysis supports a new fuel enrichment of 5.0 w/o; therefore, the proposed change is acceptable. Because the storage of new fuel in the new fuel storage tanks has not been reanalyzed for higher enriched fuel, the maximum enrichment limit for the new fuel storage tanks remains at 4.5 w/o in TS 5.6.1.2.

2.3 Accident Analysis

In its application, TVA stated that each core reload will be within the bounds of each accident analysis presented in Chapter 15 of the Sequoyah FSAR. These accidents were evaluated by the staff and the consequences were found acceptable in Section 15 of NUREG-0011 dated March 1980, and of Supplement 2 to NUREG-0011 dated August 1980. The NUREG-0011 and its supplements were the safety evaluations that licensed Sequoyah, Units 1 and 2.

The activity inventory in the fuel may increase for long-lived radionuclides of concern as the fuel enrichment increases to 5.0 w/o U-235 and burnup increases to 60,000 MWD/MTU, but, the inventories of short-lived fission products will remain essentially the same. It should be noted that the fuel integrity should not be affected by the higher enrichment and extended burnup of the fuel. Therefore, there should not be a significant change to the doses calculated for the design basis accidents.

In reviewing the dose estimates for accidents, the staff agrees with TVA's conclusion that increasing the fuel enrichment to 5.0 w/o does not cause the consequences of the evaluated accidents to go beyond acceptable values. The effect of increasing the fuel enrichment to 5.0 w/o and burnups to 60,000 MWD/MTU would be to only increase the calculated thyroid dose for the postulated fuel handling accident by about 20%. There would be no effect on the estimated consequences of other postulated design basis accidents, which scale with power level rather than fuel enrichment or burnup. This is documented by the staff in the Environmental Assessment and Findings of No Significant Impact for Extended Burnup Fuel Use in Commercial Light Water Reactors (LWRs) (Federal Register, 53 FR 6040, February 29, 1988). Therefore, the staff concludes that the dose consequences for design basis accidents at Sequoyah for enrichments up to 5.0 w/o and burnups up to 60,000 MWD/MTU are acceptable.

2.5 Conclusion

Based on the above evaluation, the staff concludes that the Sequoyah spent fuel storage racks can accommodate Westinghouse STD or V5H 17x17 fuel assemblies with maximum enrichments of up to 5.0 w/o U-235 and the proposed changes to the TSs to allow up to 5.0 w/o enriched fuel are acceptable.

3.0 ENVIRONMENTAL CONSIDERATION

Pursuant to 10 CFR 51.21, 51.32, 51.35, an environmental assessment and findingof no significant impact has been prepared and published in the Federal Register on July 31, 1990 (55 FR 31112). Accordingly, based upon the environmental assessment, the Commission has determined that the issuance of these amendments will not have a significant effect on the quality of the human environment.

4.0 CONCLUSION

The Commission made a proposed determination that the amendment involves no significant hazards consideration which was published in the Federal Register (55 FR 24005) on June 13, 1990 and consulted with the State of Tennessee. No public comments were received and the State of Tennessee did not have any comments.

The staff 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, and (2) such activities will be conducted in compliance with the Commission's regulations, and the issuance of the amendments will not be inimical to the common defense and security nor to the health and safety of the public.

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