October 19, 1987

Docket Nos. 50-327/328

Distribution		
Docket File	CWillis	EMcKenna
NRC PDR	BDLiaw	
Local PDR	EJordan	OGC-Bethesda
JAxelrad	GZech, RII	TBarnhart(8)
SEbneter	JPartlow	Wanda Jones
SRichardson	DHagan	JKelly
JZwolinski	GPA/PA	TRotella(2)
FMiraglia	ACRS(10)	CJamerson(2)
TVA-Bethesda	EButcher	LFMB
	Projects Rdg.	SQN File

Mr. S. A. White
Manager of Nuclear Power
Tennessee Valley Authority
6N 38A Lookout Place
1101 Market Street
Chattanooga, Tennessee 37402-2801

Dear Mr. White:

SUBJECT: TECHNICAL SPECIFICATION CHANGE - SPENT FUEL PIT RADIATION MONITORS AND FUEL ENRICHMENT (TAC 60079, 60080, 62090, 62091)(TS 65)

Re: Sequoyah Nuclear Plant, Units 1 and 2

The Commission has issued the enclosed Amendment No. 60 to Facility Operating License No. DPR-77 and Amendment No. 52 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 October 22, 1985. Other changes requested in that letter were addressed in amendments 44 and 36 respectively.

The amendments change the Technical Specifications to increase the setpoint of the radiation monitors in the spent fuel area and to clarify the enrichment limits of fuel stored in the spent fuel pool and new fuel storage areas. The amendments are effective as of their date of issuance.

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

Sincerely,

Original signed by:
John A. Zwolinski, Assistant Director
for Projects
TVA Projects Division
Office of Special Projects

Enclosures:
1. Amendment No. 60 to License No. DPR-77
2. Amendment No. 52 to License No. DPR-79
3. Safety Evaluation

cc w/enclosures:
See next page

OSP:TVA/LA	OSP:TVA/PM	OGC-BETH	TVA:AD/P
CJamerson	EMcKenna:pw		JAZwolinski
10/6/87	10/6/87	10/14/87	10/19/87

October 19, 1987

Docket Nos. 50-327/328

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CJamerson	EMcKenna:pw		JAZwolinski
10/6/87	10/16/87	10/19/87	10/20/87

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

October 19, 1987

Docket Nos. 50-327/328

Mr. S. A. White
Manager of Nuclear Power
Tennessee Valley Authority
6N 38A Lookout Place
1101 Market Street
Chattanooga, Tennessee 37402-2801

Dear Mr. White:

SUBJECT: TECHNICAL SPECIFICATION CHANGE - SPENT FUEL PIT RADIATION MONITORS AND FUEL ENRICHMENT (TAC 60079, 60080, 62090, 62091)(TS 65)

Re: Sequoyah Nuclear Plant, Units 1 and 2

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The amendments change the Technical Specifications to increase the setpoint of the radiation monitors in the spent fuel area and to clarify the enrichment limits of fuel stored in the spent fuel pool and new fuel storage areas. The amendments are effective as of their date of issuance.

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Sincerely,

John A. Zwolinski, Assistant Director
for Projects
TVA Projects Division
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Enclosures:
1. Amendment No. 60 to License No. DPR-77
2. Amendment No. 52 to License No. DPR-79
3. Safety Evaluation

cc w/enclosures:
See next page

Mr. S. A. White
Tennessee Valley Authority

Sequoyah Nuclear Plant

cc:
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Tennessee Valley Authority
400 West Summit Hill Drive
E11 B33
Knoxville, Tennessee 37902

Mr. R. L. Gridley
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Knoxville, Tennessee 37902

County Judge
Hamilton County Courthouse
Chattanooga, Tennessee 37402

Regional Administrator, Region II
U.S. Nuclear Regulatory Commission
101 Marietta Street, N.W.
Atlanta, Georgia 30323

Resident Inspector/Sequoyah NP
c/o U.S. Nuclear Regulatory Commission
2600 Igou Ferry Road
Soddy Daisy, Tennessee 37379

Mr. Richard King
c/o U.S. GAO
1111 North Shore Drive
Suite 225, Box 194
Knoxville, Tennessee 37919

Tennessee Department of
Public Health
ATTN: Director, Bureau of
Environmental Health Services
Cordell Hull Building
Nashville, Tennessee 37219

Mr. Michael H. Mobley, Director
Division of Radiological Health
T.E.R.R.A. Building
150 9th Avenue North
Nashville, Tennessee 37203

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. 60
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 October 22, 1985, 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. 60 , 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

John A. Zwolinski, Assistant Director
for Projects
TVA Projects Division
Office of Special Projects

Attachment:
Changes to the Technical
Specifications

Date of Issuance: October 19, 1987

ATTACHMENT TO LICENSE AMENDMENT NO. 60

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. Overleaf pages* are provided to maintain document completeness.

REMOVE	INSERT
3/4 3-39	3/4 3-39*
3/4 3-40	3/4 3-40
5-5	5-5
5-6	5-6*

3/4.3.3 MONITORING INSTRUMENTATION

RADIATION MONITORING INSTRUMENTATION

LIMITING CONDITION FOR OPERATION

3.3.3.1 The radiation monitoring instrumentation channels shown in Table 3.3-6 shall be OPERABLE with their alarm/trip setpoints within the specified limits.

APPLICABILITY: As shown in Table 3.3-6.

ACTION:

a. With a radiation monitoring channel alarm/trip setpoint exceeding the value shown in Table 3.3-6, adjust the setpoint to within the limit within 4 hours or declare the channel inoperable.

b. With one or more radiation monitoring channels inoperable, take the ACTION shown in Table 3.3-6.

c. The provisions of Specifications 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.3.3.1 Each radiation monitoring instrumentation channel shall be demonstrated OPERABLE by the performance of the CHANNEL CHECK, CHANNEL CALIBRATION and CHANNEL FUNCTIONAL TEST operations during the modes and at the frequencies shown in Table 4.3-3.

TABLE 3.3-6

RADIATION MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	APPLICABLE MODES	ALARM/TRIP SETPOINT	MEASUREMENT RANGE	ACTION
1. AREA MONITORS					
a. Fuel Storage Pool Area	1	*	$\leq$ 200 mR/hr	10^{-1} -10^{4} mR/hr	26
b. Containment Area	1	1, 2, 3 and 4	N/A	1 - 10^{7} R/hr***	30
2. PROCESS MONITORS					
a. Containment Purge Air	1	1, 2, 3, 4 & 6	$\leq$ 8.5×10^{-3} µCi/cc	10 - 10^{7} cpm	28
b. Containment					
i. Gaseous Activity					
a)Ventilation Isolation	1	ALL MODES	$\leq$ 8.5×10^{-3} µCi/cc	10 - 10^{7} cpm	28
b)RCS Leakage Detection	1	1, 2, 3 & 4	N/A	10 - 10^{7} cpm	27
ii. Particulate Activity					
a)Ventilation Isolation	1	ALL MODES	$\leq$ 1.5×10^{-5} µCi/cc	10 - 10^{7} cpm	28
b)RCS Leakage Detection	1	1, 2, 3 & 4	N/A	10 - 10^{7} cpm	27
c. Control Room Isolation	1	ALL MODES	$\leq$ 400 cpm**	10 - 10^{7} cpm	29
d. Noble Gas Effluent Monitors					

*With fuel in the storage pool or building
**Equivalent to 1.0 x 10^{-5}µCi/cc
***Measurement range by extrapolation

5.6 FUEL STORAGE

CRITICALITY - SPENT FUEL

5.6.1.1 The spent fuel storage racks are designed for fuel enriched to 4.0 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 1.42% delta k/k for uncertainties.*

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

CRITICALITY - NEW FUEL

5.6.1.2 The new fuel pit storage racks are designed and shall be maintained with a nominal 21.0 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. New fuel enrichment is limited to 4.0 weight percent as noted in 5.3.1 and 5.6.1.1.

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.

*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.

TABLE 5.7.1

COMPONENT CYCLIC OR TRANSIENT LIMITS

COMPONENT	CYCLIC OR TRANSIENT LIMIT	DESIGN CYCLE OR TRANSIENT
Reactor Coolant System	200 heatup cycles at $\leq$ 100°F/hr and 200 cooldown cycles at $<$ 100°F/hr	Heatup cycle - T_{avg} from $\leq$ 200°F to $\geq$ 550°F. Cooldown cycle - T_{avg} from $\geq$ 550°F to $\leq$ 200°F.
	200 pressurizer cooldown cycles at $\leq$ 200°F/hr	Pressurizer cooldown cycle temperatures from $\geq$ 650°F to $\leq$ 200°F.
	80 loss of load cycles, without immediate turbine or reactor trip.	$>$ 15% of RATED THERMAL POWER to 0% of RATED THERMAL POWER.
	40 cycles of loss of offsite A.C. electrical power.	Loss of offsite A.C. electrical power source supplying the onsite ESF Electrical System.
	80 cycles of loss of flow in one reactor coolant loop.	Loss of only one reactor coolant pump.
	400 reactor trip cycles.	100% to 0% of RATED THERMAL POWER.
	12 spray actuation cycles.	Spray water temperature differential $>$ 320°F and $\leq$ 560°F.
	50 leak tests	Pressurized to 2485 psig
	5 hydrostatic pressure tests	Pressurized to 3105 psig
Secondary System	5 hydrostatic pressure tests	Pressurized to 1330 psig

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. 52
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 October 22, 1985, 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. 52 , 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

John A. Zwolinski, Assistant Director
for Projects
TVA Projects Division
Office of Special Projects

Attachment:
Changes to the Technical
Specifications

Date of Issuance: October 19, 1987

ATTACHMENT TO LICENSE AMENDMENT NO. 52

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. Overleaf pages* are provided to maintain document completeness.

REMOVE	INSERT
3/4 3-41	3/4 3-41
3/4 3-42	3/4 3-42*
5-5	5-5
5-6	5-6*

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b. Containment Area	1	1, 2, 3 & 4	N/A	1- 10^{7} R/hr***	30
2. PROCESS MONITORS					
a. Containment Purge Air	1	1, 2, 3, 4 & 6	$\leq 8.5 \times 10^{-3}$ µCi/cc	10 - 10^{7} cpm	28
b. Containment					
i. Gaseous Activity					
a)Ventilation Isolation	1	ALL MODES	$\leq 8.5 \times 10^{-3}$ µCi/cc	10 - 10^{7} cpm	28
b)RCS Leakage Detection	1	1, 2, 3 & 4	N/A	10 - 10^{7} cpm	27
ii. Particulate Activity					
a)Ventilation Isolation	1	ALL MODES	$\leq 1.5 \times 10^{-5}$ µCi/cc	10 - 10^{7} cpm	28
b)RCS Leakage Detection	1	1, 2, 3 & 4	N/A	10 - 10^{7} cpm	27
c. Control Room Isolation	1	ALL MODES	$\leq$ 400 cpm**	10 - 10^{7} cpm	29
d. Noble Gas Effluent Monitors					

* With fuel in the storage pool or building
** Equivalent to 1.0×10^{-5} µCi/cc.
*** Measurement range by extrapolation.

TABLE 3.3-6 (Continued)

ACTION STATEMENTS

ACTION 26 - With the number of OPERABLE channels less than required by the Minimum Channels OPERABLE requirement, perform area surveys of the monitored area with portable monitoring instrumentation at least once per 24 hours.

ACTION 27 - With the number of OPERABLE channels less than required by the Minimum Channels OPERABLE requirement, comply with the ACTION requirements of Specification 3.4.6.1.

ACTION 28 - With the number of OPERABLE channels less than required by the Minimum Channels OPERABLE requirement, comply with the ACTION requirements of Specification 3.9.9.

ACTION 29 - With the number of OPERABLE channels less than required by the Minimum Channels OPERABLE requirement, within 1 hour initiate and maintain operation of the control room emergency ventilation system in the recirculation mode of operation.

ACTION 30 - With the number of OPERABLE Channels less than the Minimum Channels OPERABLE requirement, restore the inoperable Channel(s) to OPERABLE Status within 7 days, or be in at least HOT STANDBY within the next 6 hours, and in at least HOT SHUTDOWN within the following 6 hours and in COLD SHUTDOWN within the subsequent 24 hours.

5.6 FUEL STORAGE

CRITICALITY - SPENT FUEL

5.6.1.1 The spent fuel storage racks are designed for fuel enriched to 4.0 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 1.42% delta k/k for uncertainties.*

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

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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. New fuel enrichment is limited to 4.0 weight percent, as noted in 5.3.1 and 5.6.1.1.

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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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COMPONENT	CYCLIC OR TRANSIENT LIMIT	DESIGN CYCLE OR TRANSIENT
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	200 pressurizer cooldown cycles at $\leq$ 200°F/hr.	Pressurizer cooldown cycle temperatures from $\geq$ 650°F to $\leq$ 200°F.
	80 loss of load cycles, without immediate turbine or reactor trip.	$\geq$ 15% of RATED THERMAL POWER to 0% of RATED THERMAL POWER.
	40 cycles of loss of offsite A.C. electrical power.	Loss of offsite A.C. electrical power source supplying the onsite ESF Electrical System.
	80 cycles of loss of flow in one reactor coolant loop.	Loss of only one reactor coolant pump.
	400 reactor trip cycles.	100% to 0% of RATED THERMAL POWER.
	12 spray actuation cycles.	Spray water temperature differential > 320°F and $\leq$ 560°F.
	50 leak tests.	Pressurized to 2485 psig.
	5 hydrostatic pressure tests.	Pressurized to 3105 psig.
Secondary System	5 hydrostatic pressure tests.	Pressurized to 1330 psig.

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

SAFETY EVALUATION BY THE OFFICE OF SPECIAL PROJECTS

SUPPORTING AMENDMENT NO. 60 TO FACILITY OPERATING LICENSE NO. DPR-77

AND AMENDMENT NO. 52 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 October 22, 1985 the Tennessee Valley Authority (TVA) requested several changes to the Technical Specifications for the Sequoyah Nuclear Plant, Units 1 and 2. This safety evaluation addresses the proposal to increase the setpoints of the radiation monitors in the spent fuel pool areas and to clarify the enrichment limits of the fuel stored in the spent fuel pool and new fuel storage areas.

2.0 EVALUATION

The purpose of the spent fuel pool radiation monitors (RM-90-102 and -103) is to automatically isolate the normal building ventilation system, which vents through the stack to atmosphere, and to initiate the auxiliary building gas treatment system, which filters building air through charcoal and HEPA filters, upon detection of high radiation in the auxiliary building. The intent is to limit doses outside the plant site to acceptable levels in the event of a radiation release in the building.

The present setpoint on radiation monitors RM-90-102 and -103 is 15mR/hr. When the setpoint is exceeded, an auxiliary building isolation (ABI) signal is generated and the building is isolated. The licensee has stated that the present setpoint is so low that 13 spurious ABI signals were generated just in 1984. This situation is undesirable so the licensee proposed to change the setpoint to 200 mR/hr.

The staff evaluated this proposed change by reviewing the fuel handling accident in accordance with Standard Review Plan, Section 15.7.4. The results, summarized in Table 1, show that the thyroid dose is acceptably low (not more than 75 rem) if the auxiliary building has been isolated. These results are consistent with the initial staff safety evaluation for the plant, NUREG-0011. Therefore, the staff evaluated the proposed setpoint to ensure that the revised setpoint is sufficiently sensitive to provide building isolation for this event. The gamma radiation level that could be expected to be associated with a fuel handling accident was evaluated and found to be capable of actuating the isolation signal at 100 hours, the time specified in the SRP

(Table 2). Furthermore, a comparison of the estimated gamma radiation levels in the fuel handling area, and the estimated off-site thyroid doses, indicated that as long as the radioiodines are capable of delivering doses corresponding to the 75 rem criterion, the noble gases will be capable of producing dose rates greater than 200 mR/hr (Table 3). The proposed change in setpoints will limit doses within the SRP acceptance criteria and, therefore, the change is acceptable.

Specification 5.6.1.1 would be altered to insert the value of the maximum enrichment of the fuel to be stored in the spent fuel racks. This value is 4.0 weight percent U-235 and has been previously approved in Amendments 13 and 4 to facility operating licenses DRP-77 and DPR-79, respectively, by letter dated May 4, 1982. This insertion clarifies the storage requirements and is acceptable.

The change to Specification 5.6.1.2 would add the caveat that new fuel enrichment is restricted to 4.0 weight percent of U-235. This restriction is inserted because although the new fuel storage area has been qualified for storage of fuel up to 4.5 weight percent U-235, other restrictions (TS 5.3.1 and 5.6.1.1) limit new reload fuel assemblies, which might be stored on these racks, to 4.0 weight percent U-235. The addition clarifies the storage requirements and is acceptable.

3.0 ENVIRONMENTAL CONSIDERATION

These amendments involve a change to a requirement with respect to the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The staff has determined that the amendments involve 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 these amendments involve no significant hazards consideration and there has been no public comment on such finding. Accordingly, the amendments meet 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 nor environmental assessment need be prepared in connection with the issuance of the amendments.

4.0 CONCLUSION

We have 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.

Principal Contributor: C. Willis and E. McKenna

Dated: October 19, 1987

Table 1

SEQUOYAH

Fuel Handling Accident Analysis

Power, MWt	3582
Assemblies in the core	193
Assemblies that fail	1
Radial peaking factor	1.65
Fraction of activity in the gap	0.1
Pool decontamination factor	100
Iodine fractions released from the pool	
Elemental	75 percent
Organic	25 percent
Filter Efficiencies for Iodine Removal	
Elemental	95%
Organic	95%
Hours decay before release	100
Atmospheric dispersion factor	0.0014
Thyroid dose, rem	19.1

Table 2

DOSE RATE vs TIME

Time, hours			Dose rate, Rem/Hr
0.00E+00	(0.00	Min)	4.30E+03
1.00E-01	(6.00	Min)	2.49E+03
2.00E-01	(12.00	Min)	2.06E+03
3.00E-01	(18.00	Min)	1.84E+03
5.00E-01	(30.00	Min)	1.58E+03
7.00E-01	(42.00	Min)	1.42E+03
1.00E+00	(1.00	Hours)	1.27E+03
2.00E+00	(2.00	Hours)	9.84E+02
3.00E+00	(3.00	Hours)	8.09E+02
5.00E+00	(5.00	Hours)	5.83E+02
7.00E+00	(7.00	Hours)	4.51E+02
1.00E+01	(10.00	Hours)	3.40E+02
2.00E+01	(20.00	Hours)	2.08E+02
2.40E+01	(1.00	Days)	1.86E+02
3.00E+01	(1.25	Days)	1.64E+02
5.00E+01	(2.08	Days)	1.27E+02
7.00E+01	(2.92	Days)	1.10E+02
1.00E+02	(4.17	Days)	9.18E+01
1.50E+02	(6.25	Days)	6.94E+01
2.00E+02	(1.19	Weeks)	5.26E+01
2.50E+02	(1.49	Weeks)	4.00E+01
3.00E+02	(1.79	Weeks)	3.04E+01
5.00E+02	(2.98	Weeks)	1.02E+01
7.00E+02	(4.17	Weeks)	3.48E+00
1.00E+03	(1.39	Month)	7.26E-01
1.50E+03	(2.08	Month)	7.51E-02
2.00E+03	(2.78	Month)	1.98E-02
2.50E+03	(3.47	Month)	1.22E-02
3.00E+03	(4.17	Month)	1.04E-02
5.00E+03	(6.94	Month)	9.64E-03
7.00E+03	(9.72	Month)	9.50E-03
1.00E+04	(1.14	Years)	9.29E-03
1.50E+04	(1.71	Years)	8.95E-03

Gamma dose rate 35 feet from noble gases from 3.1 MWt.

Table 3

TIME VARIATION OF GAMMA AND IODINE

TIME, HR	GAMMA DOSE mrem/hour	IODINE DOSE rem thyroid	RATIO
0.00E+00	4.30E+06	8.22E+02	5.23E+03
1.00E-01	2.49E+06	8.20E+02	3.04E+03
2.00E-01	2.06E+06	8.19E+02	2.52E+03
3.00E-01	1.84E+06	8.17E+02	2.25E+03
5.00E-01	1.58E+06	8.14E+02	1.94E+03
7.00E-01	1.42E+06	8.10E+02	1.76E+03
1.00E+00	1.27E+06	8.06E+02	1.57E+03
2.00E+00	9.84E+05	7.92E+02	1.24E+03
3.00E+00	8.09E+05	7.78E+02	1.04E+03
5.00E+00	5.83E+05	7.54E+02	7.74E+02
7.00E+00	4.51E+05	7.32E+02	6.16E+02
1.00E+01	3.40E+05	7.03E+02	4.83E+02
2.00E+01	2.08E+05	6.26E+02	3.32E+02
2.40E+01	1.86E+05	6.02E+02	3.09E+02
3.00E+01	1.64E+05	5.71E+02	2.87E+02
5.00E+01	1.27E+05	4.93E+02	2.58E+02
7.00E+01	1.10E+05	4.40E+02	2.50E+02
1.00E+02	9.18E+04	3.82E+02	2.40E+02
1.50E+02	6.94E+04	3.13E+02	2.21E+02
2.00E+02	5.26E+04	2.60E+02	2.02E+02
2.50E+02	4.00E+04	2.17E+02	1.84E+02
3.00E+02	3.04E+04	1.81E+02	1.68E+02
5.00E+02	1.02E+04	8.82E+01	1.16E+02
7.00E+02	3.48E+03	4.29E+01	8.11E+01
1.00E+03	7.26E+02	1.46E+01	4.97E+01
1.50E+03	7.51E+01	2.42E+00	3.10E+01
2.00E+03	1.98E+01	4.02E-01	4.92E+01
2.50E+03	1.22E+01	6.66E-02	1.82E+02
3.00E+03	1.04E+01	1.11E-02	9.44E+02
5.00E+03	9.64E+00	8.36E-06	1.15E+06
7.00E+03	9.50E+00	6.33E-09	1.50E+09
1.00E+04	9.29E+00	1.32E-13	7.05E+13
1.50E+04	8.95E+00	2.07E-21	4.31E+21

Half lives are from DOE/TIC-11026
Yields are from NEDO-12154-1 (1974)
Iodine dose factors are from Regulatory Guide 1.109
Gamma dose rate constants are from ORNL-RSIC-0045
X00 is .0014 seconds per cubic meter
Gamma dose rate is at 35 feet
Iodine penetration of the charcoal is 100 %