January 14, 2003

TVA-SQN-TS-02-08 10 CFR 50.90

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555

Gentlemen:

In the Matter of	)	Docket Nos. 50-327
Tennessee Valley Authority	)	50-328

SEQUOYAH NUCLEAR PLANT (SQN) - UNITS 1 AND 2 - TECHNICAL SPECIFICATION (TS) CHANGE 02-08, "PARTIAL SCOPE IMPLEMENTATION OF THE ALTERNATE SOURCE TERM AND REVISION OF REQUIREMENTS FOR CLOSURE OF THE CONTAINMENT BUILDING EQUIPMENT DOOR DURING MOVEMENT OF IRRADIATED FUEL"

Pursuant to 10 CFR 50.90, TVA is submitting a request for a TS change (TSC 02-08) to licenses DPR-77 and DPR-79 for SQN Units 1 and 2. The proposed TS change will revise applicability requirements for TS 3.3.9.4, "Containment Building Penetrations." This revision will modify the current applicability requirement associated with movement of "irradiated fuel" by adding a new applicability statement for the containment building equipment door (CBED). The new applicability requirement will limit the containment closure function of the CBED to only apply during movement of "recently irradiated fuel." The action for this specification is also revised to incorporate the recently irradiated limitations. This is accomplished by adding a new action that applies to the CBED and results in the suspension of operations that involve movement of "recently irradiated fuel." Westinghouse Electric Company has performed radiological dose evaluations to verify the acceptability of these proposed revisions.

This request is similar to the approved license amendment request by Duke Energy Corporation, Catawba Nuclear Station, Units 1 and 2, Amendment Nos. 198 and 191, respectively, issued April 23, 2002; Florida Power and Light Company, St. Lucie Nuclear Power Plant, Units 1 and 2, Amendment Nos. 184 and 127, respectively, issued August 30, 2002; and Entergy Nuclear Operations Incorporated, James A. FitzPatrick Nuclear Power Plant, Amendment No. 276 issued September 12, 2002. The major difference in the proposed TVA request to these precedents is that this request is specifically limited to the CBED. The above precedents also involve the application of the recently irradiated fuel applicability to other ventilation and radiation monitoring functions.

TVA has determined that there are no significant hazards considerations associated with the proposed change and that the TS change qualifies for categorical exclusion from environmental review pursuant to the provisions of 10 CFR 51.22 (c)(9). The SQN Plant Operations Review Committee and the SQN Nuclear Safety Review Board have reviewed this proposed change and determined that operation of SQN Units 1 and 2, in accordance with the proposed change, will not endanger the health and safety of the public. Additionally, in accordance with 10 CFR 50.91 (b)(1), TVA is sending a copy of this letter and enclosures to the Tennessee State Department of Public Health. As part of the proposed license amendment request, no commitments have been made by TVA.

The proposed TS change can benefit TVA by reducing the duration of refueling outages. In particular, the next Unit 1 outage, that will involve the replacement of the steam generators, can benefit from a cost and duration standpoint. Therefore, TVA requests approval of this TS change to support the Unit 1 Cycle 12 outage currently scheduled to begin in March 2003. TVA requests that the implementation of the revised TS be within 45 days of NRC approval. This letter is being sent in accordance with NRC RIS 2001-05.

If you have any questions about this change, please telephone me at (423) 843-7170 or J. D. Smith at (423) 843-6672.

Sincerely,

Pedro Salas
Licensing and Industry Affairs Manager

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 14 day of January, 2003.

Enclosures:
1. TVA Evaluation of the Proposed Changes
2. Proposed Technical Specifications Changes (mark-up)
3. Changes to Technical Specifications Bases pages
4. Westinghouse Electric Company Evaluation for Limited-Scope Application of the Alternate Source Term

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ENCLOSURE 1

TENNESSEE VALLEY AUTHORITY
SEQUOYAH PLANT (SQN)
UNITS 1 AND 2

TVA Evaluation of the Proposed Change

1. DESCRIPTION

This letter is a request to amend Operating Licenses DPR-77 and DPR-79 for SQN Units 1 and 2. The proposed change would revise the applicability and action provisions of Technical Specification (TS) 3.9.4, "Containment Building Penetrations," to provide modified requirements for the operability of penetrations. In addition, the associated TS Bases will be modified to be consistent with this revision. This proposed change will allow the containment building equipment door (CBED) to be open during movement of irradiated fuel provided the fuel has decayed for at least 100 hours since being in a critical reactor core.

2. PROPOSED CHANGE

This amendment request proposes the revision of the applicability and action requirements of TS 3.9.4, "Containment Building Penetrations," by adding new requirements applicable only to the CBED that replaces the phrase "movement of irradiated fuel" with the revised phrase "movement of recently irradiated fuel."

The associated TS Bases 3/4.9.4, "Containment Building Penetrations," will also be revised to appropriately insert the term "recently" consistent with the revision to TS 3.9.4. The Bases revision will also include a definition for the term "recently" as follows:

> *(i.e., fuel that has occupied part of a critical reactor core within the previous 100 hours)*

This definition will be added following the first use of the term "movement of recently irradiated fuel" in the Bases. The Bases will also include a description of appropriate measures that should be in place associated with an open CBED during the movement of irradiated fuel assemblies. This discussion is as follows:

> *During movement of irradiated fuel assemblies, a single normal or contingency method to promptly close the containment building equipment door will be in place. Such prompt methods need not completely block the*

penetration or be capable of resisting pressure. The purpose is to enable ventilation systems to draw the release from a postulated fuel handling accident in the proper directions such that it can be treated and monitored.

In summary, the requirements for CBED will be revised such that they will no longer apply during movement of irradiated fuel that has decayed for at least 100 hours. The Bases will be revised appropriately for consistency with the changes to the TSs. The Bases will also define the new "recently irradiated" terminology as well as describing the appropriate measures to consider during movement of fuel assemblies that have not been recently irradiated.

3. BACKGROUND

The requirements of TS 3.9.4 provide containment penetration closure limits that prevent releases of radioactivity that would exceed allowable values during refueling activities. These closure requirements are intended to minimize the transport of radioactive material from containment to the outside environs. The design requirements for containment penetrations are contained in Section 6.2.4 of the Updated Final Safety Analysis Report (UFSAR). During refueling activities, there are no postulated events that would result in the pressurization of the containment building. Therefore, the closure requirements are less restrictive than the containment integrity requirements for Modes 1 through 4. These refueling requirements only require containment closure capability without the need to resist pressure. In many cases these requirements only require a minimum amount of bolting or valve closures that do not require valve operators to be deenergized.

These requirements are only applicable during the movement of irradiated fuel in the containment building. This is based on only an fuel handling accident (FHA) having the potential to result in the release of radioactivity. The only postulated fuel handling event that results in the limiting release of radiation is a dropped fuel assembly that can only occur during movement of fuel. The dropped fuel assembly event assumes the rupture of all fuel rods in the assembly and the release of the contained radioactive gases. This event does not include a significant release of pressurized material or heating of the refueling water such that it would result in any measurable increase in containment pressure. Currently the TS 3.9.4 requirements are applicable during the movement of irradiated fuel assemblies consistent with these considerations that are described for an FHA in Sections 15.4.5 and 15.5.6 of the SQN UFSAR.

During the movement of irradiated fuel, the equipment door and other containment penetrations are required to be closed in the event an FHA occurs. These requirements often restrict refueling outage activities and result in longer outage durations. If the CBED could remain open during movement of irradiated fuel, outage durations could be reduced in many cases. Westinghouse Electric Company has performed new analyses utilizing the Regulatory Guide 1.183 methodology for alternate source term. This analysis has only been implemented for a limited scope and applied to the SQN Units 1 and 2 analysis for FHAs. The results of this analysis is that an FHA involving irradiated fuel, that has decayed for at least 100 hours after being in a critical reactor core, does not have sufficient radioactive material remaining that would result in unacceptable dose consequences with the CBED open.

There are precedents for allowing the proposed change during the movement of irradiated fuel to recently irradiated fuel for the CBED. Duke Energy Corporation, for the Catawba Nuclear Station Units 1 and 2, was issued Amendment Nos. 198 and 191, respectively, on April 23, 2002. These amendments implemented the same change for movement of recently irradiated fuel for the containment building penetrations. The Catawba effort also included the deletion of the core alterations portion that SQN has already implemented and selectively applied these changes to specifications for control room and fuel handling ventilation systems. SQN is not pursuing these changes at this time and is only applying the recently irradiated provision to the CBED.

Florida Power and Light Company, for the St. Lucie Nuclear Power Plant Units 1 and 2, was issued Amendment Nos. 184 and 127, respectively, on August 30, 2002. St. Lucie also implemented the recently irradiated change, as well as the core alteration deletion for containment building penetrations like the Catawba effort. The St. Lucie effort also selectively applied these changes to containment isolation, fuel pool ventilation, and containment ventilation that SQN is not pursuing. They also included two other changes for containment penetrations to be open under administrative controls and a clarification of personnel air-lock door requirements. The first provision is consistent with current SQN requirements but the second is not being considered at this time.

Entergy Nuclear Operations Incorporated, for the James A. FitzPatrick Nuclear Power Plant, was issued Amendment No. 276 on September 12, 2002. FitzPatrick implemented only the recently irradiated change in this effort but applied it only to systems that support a potential FHA in the secondary containment. This effort did not request a change to the containment building penetrations but uses the same justifications that apply to the SQN effort.

4. TECHNICAL ANALYSIS

The proposed change reduces the applicability for the CBED requirement and associated action to only apply when recently irradiated fuel is being moved. Westinghouse Electric Company has performed evaluations that apply the new guidance for alternate source terms to the SQN accident analysis for FHAs. This is a limited scope of the new methodology in Regulatory Guide 1.183 and is only being applied to the FHA event at this time. This analysis assumes that the irradiated fuel decays for at least 100 hours and utilizes dose conversion factors from the Environmental Protections Agency Federal Guidance Reports Nos. 11 and 12. The analysis does not assume closure of the CBED for FHAs inside containment or availability of the auxiliary building gas treatment system (ABGTS) for filtering of releases or isolation from any FHA. However, for the FHA in containment, the isolation function of the containment ventilation system is assumed without any credit for filtration prior to isolation. The analysis utilizes dispersion factors stated in Section 2.3, "Meteorology" of the UFSAR for the exclusion area boundary and low population zone efforts. The dispersion factors for the control room dose effort are based on a TVA calculation that was used for the NRC approved TS change for tritium production. This calculation was submitted to NRC in a letter dated August 30, 2002. This analysis assumes the rupture of all fuel rods, as well as the maximum number of tritium producing burnable absorber rods (24 rods).

The results of the dose analysis was compared to the acceptance criteria in Regulatory Guide 1.183 for offsite dose limits and General Design Criteria 19 for the control room dose limits. These limits are 6.3 roentgen equivalent man (rem) total effective dose equivalent (TEDE) and 5.0 rem TEDE, respectively. The resulting dose consequences are 4.5 rem TEDE at the exclusion area boundary and 0.8 rem TEDE at the low population zone for postulated FHAs. Control room dose consequences are 4.1 rem TEDE for an FHA in the auxiliary building and 4.2 rem TEDE for and FHA inside containment. These results are within the stated regulatory limits. The dose analysis is contained in Enclosure 4.

The proposed changes are consistent with changes approved by NRC in Technical Specification Task Force (TSTF) Item 51. TSTF-51 endorses the limitation of applicability requirements and actions for ventilation, actuation, and physical barrier functions that serve to limit the dose consequences of FHAs. These relaxations are to be based on dose analysis that verify acceptable dose consequences without the availability of these systems. The proposed change verifies that these requirements are met for the

CBED function. The proposed changes also include Bases revisions recommended by TSTF-51 that describe provisions during movement of any fuel assembly that are in place to reestablish containment closure to a reasonable degree such that ventilation and radiation monitoring systems can be effective in the recovery from an FHA. For the purpose of timely processing, and in support of the upcoming SQN Unit 1 refueling outage, TVA is only pursuing the revision of the CBED requirements at this time. The basis for this limited application is that the outage impact of the CBED requirement is more limiting than the other functions. TSTF-51 also provides the basis for reducing the applicability of these functions during core alterations. This provision has already been pursued and implemented for the SQN units in accordance with NRC approved Amendment Nos. 260 and 251 for Units 1 and 2, respectively.

In summary, the analysis verifies that the dose consequences of an FHA are within regulatory limits considering irradiated fuel that has decayed for at least 100 hours and without consideration for CBED closure or ABGTS isolation or filtration. The proposed change to revise applicability and action requirements for the containment building penetration specification to only apply during movement of recently irradiated fuel (fuel that has decayed less than 100 hours) for the CBED is acceptable and will not result in dose consequences in excess of established regulatory limits. This change is consistent with TSTF-51 and the latest version of the standard TSs. Implementation of the proposed TS change will maintain the necessary systems and functions to ensure that dose consequences for postulated FHAs will not exceed regulatory limits and will continue to minimize the risk to the health and safety of the public.

5. REGULATORY SAFETY ANALYSIS

This amendment request proposes the revision of the applicability and action requirements of TS 3.9.4, "Containment Building Penetrations," by adding new requirements applicable only to the containment building equipment door (CBED) that replaces the phrase "movement of irradiated fuel" with the revised phrase "movement of recently irradiated fuel."

The associated TS Bases 3/4.9.4, "Containment Building Penetrations," will also be revised to appropriately insert the term "recently" consistent with the revision to TS 3.9.4. The Bases revision will also include a definition for the term "recently" as follows:

> *(i.e., fuel that has occupied part of a critical reactor core within the previous 100 hours)*

This definition will be added following the first use of the term "movement of recently irradiated fuel" in the Bases. The Bases will also include a description of appropriate measures that should be in place associated with an open CBED during the movement of irradiated fuel assemblies.

5.1 **No Significant Hazards Consideration**

TVA has evaluated whether or not a significant hazards consideration is involved with the proposed amendment(s) by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No.

   The proposed change revises the applicability of the containment building penetration function and associated action. This change does not alter the function of the penetrations but does revise when the feature is required to be available for the mitigation of postulated accidents. These penetrations only function to minimize the release of radioactive material for accident mitigation and are not considered to be a source of any postulated accident. The analysis verifies that a fuel handling accident (FHA) occurring at least 100 hours after being critical in a reactor core will not result in dose consequences above the regulatory limits without the containment closure function provided by the CBED. The applicability and action for the CBED will not be changed when movement of recently irradiated fuel is in progress and this function ensures acceptable dose consequences. Therefore, the proposed change will not increase the probability of an accident because the penetration function has not been altered and this function is not a potential source for accidents. Additionally, the proposed change will not significantly increase the consequences of an accident because the analysis has verified that dose consequences will be maintained less than the required regulatory limits.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No.

The proposed change only modifies when containment building penetrations need to be available for accident mitigation and does not alter their function, design, or operation. These penetrations only serve to minimize the release of radioactive material in the event of postulated accidents and do not have the potential to create an accident. Since the function of the penetrations is not being changed and they do not have an accident generation potential, the possibility of a new or different kind of accident is not created.

3. Does the proposed change involve a significant reduction in a margin of safety?

   Response: No.

   The proposed change will not alter the function, design, or operation of the containment building penetrations for postulated accidents that require this feature for the mitigation of the event. The analysis has determined that the CBED availability can be limited to those activities that involve the movement of irradiated fuel that has been in a critical reactor core within the previous 100 hours. Therefore, not requiring the CBED to be available 100 hours or longer afterwards will not impact plant safety or result in dose consequences above established regulatory limits. The proposed change will not alter any setpoints or other functions that serve to maintain the safety limits. Therefore, the proposed change will not involve a significant reduction in a margin of safety.

Based on the above, TVA concludes that the proposed amendment(s) present no significant hazards consideration under the standards set forth in 10 CFR 50.92 (c), and accordingly, a finding of "no significant hazards consideration" is justified.

5.2 Applicable Regulatory Requirements/Criteria

Section 182a of the Atomic Energy Act requires applicants for nuclear power plant operating licenses to include TSs as part of the license. The Commission's regulatory requirements related to the content of the TS are contained in Title 10, Code of Federal Regulations (10 CFR), Section 50.36. The TS requirements in 10 CFR 50.36 include the following categories: (1) safety limits, limiting safety systems settings and control settings, (2) limiting conditions for operation, (3) surveillance requirements, (4) design features, and (5) administrative controls. The requirements for system operability during movement of irradiated fuel are included in the TS in accordance with 10 CFR 50.36(c)(2), "Limiting Conditions for Operation."

As stated in 10 CFR 50.59(c)(1)(i), a licensee is required to submit a license amendment pursuant to 10 CFR 50.90 if a change to the TS is required. Furthermore, the requirements of 10 CFR 50.59 necessitate that U.S. Nuclear Regulatory Commission (NRC) approve the TS changes before the TS changes are implemented. TVA's submittal meets the requirements of 10 CFR 50.59(c)(1)(i) and 10 CFR 50.90.

TVA proposes to revise the TS in accordance with TS Task Force (TSTF) Traveler 51. TSTF-51, Revision 2, was approved by the NRC on October 15, 1999. TSTF-51 allows removal of the TS requirements for engineered safety features (ESF) to be OPERABLE after sufficient radioactive decay has occurred to ensure off-site doses remain well within 10 CFR Part 100 limits. Fuel that is not sufficiently decayed to allow relaxation of OPERABILITY requirements is referred to as "recently" irradiated fuel. Recently irradiated fuel could still be moved but the appropriate ESF systems need to be OPERABLE.

The Reviewer's Note in TSTF-51 requires that licensees adding the term "recently" implement provisions consistent with draft NUMARC 93-01, Revision 3, Section 11.3.6, "Safety Assessment for Removal of Equipment from Service During Shutdown Conditions," subheading "Containment - Primary (PWR)/Secondary (BWR)." The provisions in the Reviewer's Note reads:

> *The following guidelines are included in the assessment of systems removed from service during movement of irradiated fuel:*
>
> > *During fuel handling/core alterations, ventilation system and radiation monitor availability (as defined in NUMARC 91-06) should be assessed, with respect to filtration and monitoring of releases from the fuel. Following shutdown, radioactivity in the fuel decays fairly rapidly. The basis of the Technical Specification operability amendment is the reduction in doses due to such decay. The goal of maintaining ventilation system and radiation monitor availability is to reduce doses even further below that provided by the natural decay.*
> >
> > *A single normal or contingency method to promptly close primary or secondary containment penetrations*

should be developed. Such prompt methods need not completely block the penetration or be capable of resisting pressure.

The purpose of the "prompt methods" mentioned above are to enable ventilation systems to draw the release from a postulated fuel handling accident in the proper direction such that it can be treated and monitored.

TVA proposes the addition of the above discussions, associated with containment closure expectations, to the SQN Bases. TVA currently has provisions that meet the closure expectations in this Reviewer's Note. TVA will continue the practice of tracking and providing closure capability for containment building penetrations during movement of fuel.

10 CFR 100, "Reactor Site Criteria," provides requirements for offsite dose limits. The analysis for the proposed revision has verified that the dose consequences for an FHA, involving irradiated fuel that has decayed for at least 100 hours, is well within the 10 CFR 100 limits without the CBED function. The proposed change to modify the applicability of the CBED to only apply to "recently" irradiated fuel movement will maintain the containment closure requirements when the fuel has not sufficiently decayed to remain within these limits.

NUREG-0800, Section 15.7.4, "Radiological Consequences of Fuel Handling Accidents," Revision 1, July 1981, provides considerations that should be applied to fuel handling accidents. This section describes the attributes that mitigation systems need to provide for this event. With respect to offsite dose consequences, this section establishes a well within criteria that is 25 percent of the 10 CFR 100 limits as an acceptable value for the FHA. With respect to the containment building penetrations, it describes the need for monitoring and automatic isolation to limit releases within the 25 percent criteria. For movement of recently irradiated fuel in containment, these criteria are and will be maintained by the SQN design and TS requirements. For non-recently irradiated fuel, the analysis has verified that the well within criteria will be met without the CBED function based on the decay of the fuel and atmospheric conditions at the site.

10 CFR Part 50 General Design Criteria (GDC) 61, "Control of releases of radioactive materials to the environment," requires appropriate containment, confinement, and filtering systems. The containment building penetration requirements

continue to be satisfied for movement of recently irradiated fuel and it has been shown by analysis that the CBED function is not necessary for fuel movement that involves fuel that has decayed for at least 100 hours. The requirements of this design criteria will be met for the proposed TS change.

10 CFR 50.67, "Accident Source Term," provides requirements for the revision of accident source terms in evaluating the dose consequences of postulated accidents. The new analysis has met these requirements in developing the proposed change for the CBED. The results of the revised analysis has shown that dose consequences are acceptable after 100 hours decay of fuel assemblies without the CBED function. The proposed change meets the requirements of 10 CFR 50.67.

Regulatory Guide 1.183, "Alternate Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," provides guidance for the use of alternate methods of evaluating source terms for postulated accidents. SQN has utilized this guidance on a limited scope basis for the FHA and to support the proposed TS change. The revised analysis, utilizing this alternate criteria, was performed by Westinghouse Electric Company and verified the acceptability for the SQN units. TVA is pursuing the use of this alternate methodology for the CBED function during movement of irradiated fuel that has decayed for at least 100 hours in the proposed TS change. The new analysis is consistent with and follows the guidance in Regulatory Guide 1.183.

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

6. ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in

10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 50.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

7. REFERENCES

1. Sequoyah Nuclear Plant, Final Safety Analysis Report (As Updated) Revision 17, Section 6.2.4, "Containment Isolation Systems"
2. Sequoyah Nuclear Plant Technical Specifications Bases 3/4.9.4, "Containment Building Penetrations"
3. Westinghouse Letter LTR-CRA-02-219, "Radiological Consequences of Fuel Handling Accidents for the Sequoyah Nuclear Plant Units 1 and 2," December 10, 2002
4. NRC approved Technical Specification Task Force Standard Technical Specification Change Traveler TSTF-51, Revision 2, "Revise containment requirements during handling irradiated fuel and core alterations," October 1, 1999
5. Duke Energy Corporation, Catawba Nuclear Station, Units 1 and 2, Amendment Nos. 198 and 191, respectively, issued April 23, 2002
6. Florida Power and Light Company, St. Lucie Nuclear Power Plant, Units 1 and 2, Amendment Nos. 184 and 127, respectively, issued August 30, 2002
7. Entergy Nuclear Operations Incorporated, James A. FitzPatrick Nuclear Power Plant, Amendment No. 276 issued September 12, 2002
8. TVA letter to NRC dated August 30, 2002, "Sequoyah Nuclear Plant (SQN) - Units 1 and 2 - Technical Specification (TS) Change No. 00-06, Response to Request for Additional Information (RAI) (TAC Nos. MB2972 and MB2973)"

ENCLOSURE 2

TENNESSEE VALLEY AUTHORITY
SEQUOYAH PLANT (SQN)
UNITS 1 AND 2

Proposed Technical Specification Changes (mark-up)

I. AFFECTED PAGE LIST

Unit 1

3/4 9-4

Unit 2

3/4 9-5

II. MARKED PAGES

See attached.

3/4.9.4 CONTAINMENT BUILDING PENETRATIONS

LIMITING CONDITION FOR OPERATION

3.9.4 The containment building penetrations shall be in the following status:

a. The equipment door closed and held in place by a minimum of four bolts,

b. A minimum of one door in each airlock is closed, and both doors of both containment personnel airlocks may be open if:

    1. One personnel airlock door in each airlock is capable of closure, and

    2. One train of the Auxiliary Building Gas Treatment System is OPERABLE in accordance with Technical Specification 3.9.12, and

c. Each penetration* providing direct access from the containment atmosphere to the outside atmosphere shall be either:

    1. Closed by an isolation valve, blind flange, manual valve, or equivalent, or

    2. Be capable of being closed by an OPERABLE automatic Containment Ventilation isolation valve.

APPLICABILITY: ~~During movement of irradiated fuel within the containment.~~
(Replace with Insert 1)

ACTION:

~~With the requirements of the above specification not satisfied, immediately suspend all operations involving movement of irradiated fuel in the containment building. The provisions of Specification 3.0.3 are not applicable.~~
(Replace with Insert 2)

SURVEILLANCE REQUIREMENTS

4.9.4 Each of the above required containment building penetrations shall be determined to be either in its required condition or capable of being closed by an OPERABLE automatic Containment Ventilation isolation valve once per 7 days during movement of irradiated fuel in the containment building by:

a. Verifying the penetrations are in their required condition, or

b. Testing the Containment Ventilation isolation valves per the applicable portions of Specification 4.6.3.2.

---

* Penetration flow path(s) providing direct access from the containment atmosphere that transverse and terminate in the Auxiliary Building Secondary Containment Enclosure may be unisolated under administrative controls.

3/4.9.4 CONTAINMENT BUILDING PENETRATIONS

LIMITING CONDITION FOR OPERATION

3.9.4 The containment building penetrations shall be in the following status:

a. The equipment door closed and held in place by a minimum of four bolts,

b. A minimum of one door in each airlock is closed, or both doors of both containment personnel airlocks may be open if:

   1. One personnel airlock door in each airlock is capable of closure, and

   2. One train of the Auxiliary Building Gas Treatment System is OPERABLE in accordance with Technical Specification 3.9.12, and

c. Each penetration* providing direct access from the containment atmosphere to the outside atmosphere shall be either:

   1. Closed by an isolation valve, blind flange, manual valve, or equivalent, or

   2. Be capable of being closed by an OPERABLE automatic Containment Ventilation isolation valve.

APPLICABILITY: ~~During movement of irradiated fuel within the containment.~~ |

(Replace with Insert 1)

ACTION:

~~With the requirements of the above specification not satisfied, immediately suspend all operations involving movement of irradiated fuel in the containment building. The provisions of Specification 3.0.3 are not applicable.~~ |

(Replace with Insert 2)

SURVEILLANCE REQUIREMENTS

4.9.4 Each of the above required containment building penetrations shall be determined to be either in its required condition or capable of being closed by an OPERABLE automatic Containment Ventilation isolation valve once per 7 days during movement of irradiated fuel in the containment building by:

a. Verifying the penetrations are in their required condition, or

b. Testing the Containment Ventilation isolation valves per the applicable portions of Specification 4.6.3.2.

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* Penetration flow path(s) providing direct access from the containment atmosphere that transverse and terminate in the Auxiliary Building Secondary Containment Enclosure may be unisolated under administrative controls.

Insert 1

APPLICABILTY:

3.9.4.a. Containment Building Equipment Door - During movement of recently irradiated fuel within the containment.

3.9.4.b. and c. Containment Building Airlock Doors and Penetrations - During movement of irradiated fuel within the containment.

Insert 2

ACTION:

1. With the requirements of the above specification not satisfied for the containment building equipment door, immediately suspend all operations involving movement of recently irradiated fuel in the containment building. The provisions of Specification 3.0.3 are not applicable.

2. With the requirements of the above specification not satisfied for containment airlock doors or penetrations, immediately suspend all operations involving movement of irradiated fuel in the containment building. The provisions of Specification 3.0.3 are not applicable.

ENCLOSURE 3

TENNESSEE VALLEY AUTHORITY
SEQUOYAH PLANT (SQN)
UNITS 1 AND 2

Changes To Technical Specifications Bases Pages

I. AFFECTED PAGE LIST

Unit 1

B3/4 9-1

Unit 2

B3/4 9-1

II. MARKED PAGES

See attached.

3/4.9.1 BORON CONCENTRATION

The limitations on reactivity conditions during REFUELING ensure that: 1) the reactor will remain subcritical during CORE ALTERATIONS, and 2) a uniform boron concentration is maintained for reactivity control in the water volume having direct access to the reactor vessel. Maintaining the listed valves in the closed position precludes an uncontrolled boron dilution accident by closing the flow paths for possible sources of unborated water. These limitations are consistent with the initial conditions assumed for the boron dilution incident in the accident analyses.

3/4.9.2 INSTRUMENTATION

The OPERABILITY of the source range neutron flux monitors ensures that redundant monitoring capability is available to detect changes in the reactivity condition of the core.

3/4.9.3 DECAY TIME

The minimum requirement for reactor subcriticality prior to movement of irradiated fuel assemblies in the reactor pressure vessel ensures that sufficient time has elapsed to allow the radioactive decay of the short lived fission products. This decay time is consistent with the assumptions used in the accident analyses.

Insert 1

3/4.9.4 CONTAINMENT BUILDING PENETRATIONS ***significant*** ⇓

The requirements on containment building penetration closure and OPERABILITY ensure that a release of radioactive material within containment will be restricted from leakage to the environment. The OPERABILITY and closure restrictions are sufficient to restrict radioactive material release from a fuel element rupture based upon the lack of containment pressurization potential while in the REFUELING MODE. Containment penetrations that provide direct access from containment atmosphere to outside atmosphere must be isolated on at least one side. Isolation may be achieved by an OPERABLE automatic isolation valve, or by a manual isolation valve, blind flange, or equivalent. Equivalent isolation methods must be approved and may include use of a material that can provide a temporary, atmospheric pressure, ventilation barrier for containment penetrations during fuel movements. Both sets of the containment personnel airlock doors may be open during movement of irradiated fuel in containment provided one train of Auxiliary Building Gas Treatment System (ABGTS) is available for manual operation. The basis of this is that SQN is analyzed for a fuel handling accident (FHA) in either the containment or the auxiliary building; however, a manual ABGTS start may be necessary for a containment FHA. The requirement for an airlock door to be capable of closure is provided to allow for long-term recovery from a FHA in containment.

Insert 2

The LCO is modified by a footnote allowing penetration flow paths with direct access from the containment atmosphere to the Auxiliary Building Secondary Containment Enclosure (ABSCE) to be unisolated under administrative controls. These flow paths must be within the ABSCE structure or in qualified piping that constitutes the ABSCE boundary and either terminate or have an isolation device within the ABSCE. Administrative controls ensure that 1) appropriate personnel are aware of the open status of the penetration flow path during movement of irradiated fuel assemblies within containment, 2) specified individuals are designated and readily available to isolate the flow path in the event of an FHA, and 3) one train of the ABGTS is OPERABLE in accordance with Technical Specification 3.9.12. As discussed above for the containment airlock doors, the basis for this allowance is the SQN analysis for an FHA in containment or the auxiliary building and the potential need for a manual start of the ABGTS for an FHA in containment. This allowance is not applicable to the containment ventilation isolation flow paths because of the potential motive force associated with the containment purge system that could result in additional releases of radioactivity. Additionally, this allowance is not applicable to those flow paths that terminate or are routed outside the ABSCE in piping that does not meet the requirements for an ABSCE boundary.

3/4.9.l BORON CONCENTRATION

The limitations on reactivity conditions during REFUELING ensure that: 1) the reactor will remain subcritical during CORE ALTERATIONS, and 2) a uniform boron concentration is maintained for reactivity control in the water volume having direct access to the reactor vessel. Maintaining the listed valves in the closed position precludes an uncontrolled boron dilution accident by closing the flow paths for possible sources of unborated water. These limitations are consistent with the initial conditions assumed for the boron dilution incident in the accident analyses.

3/4.9.2 INSTRUMENTATION

The OPERABILITY of the source range neutron flux monitors ensures that redundant monitoring capability is available to detect changes in the reactivity condition of the core.

3/4.9.3 DECAY TIME

The minimum requirement for reactor subcriticality prior to movement of irradiated fuel assemblies in the reactor pressure vessel ensures that sufficient time has elapsed to allow the radioactive decay of the short lived fission products. This decay time is consistent with the assumptions used in the accident analyses.

Insert 1

3/4.9.4 CONTAINMENT BUILDING PENETRATIONS **significant ⇓**

The requirements on containment building penetration closure and OPERABILITY ensure that a release of radioactive material within containment will be restricted from leakage to the environment. The OPERABILITY and closure restrictions are sufficient to restrict radioactive material release from a fuel element rupture based upon the lack of containment pressurization potential while in the REFUELING MODE. Containment penetrations that provide direct access from containment atmosphere to outside atmosphere must be isolated on at least one side. Isolation may be achieved by an OPERABLE automatic isolation valve, or by a manual isolation valve, blind flange, or equivalent. Equivalent isolation methods must be approved and may include use of a material that can provide a temporary, atmospheric pressure, ventilation barrier for containment penetrations during fuel movements. Both sets of the containment personnel airlock doors may be open during movement of irradiated fuel in containment provided one train of Auxiliary Building Gas Treatment System (ABGTS) is available for manual operation. The basis of this is that SQN is analyzed for a fuel handling accident (FHA) in either the containment or the auxiliary building; however, a manual ABGTS start may be necessary for a containment FHA. The requirement for an airlock door to be capable of closure is provided to allow for long-term recovery from a FHA in containment.

Insert 2

The LCO is modified by a footnote allowing penetration flow paths with direct access from the containment atmosphere to the Auxiliary Building Secondary Containment Enclosure (ABSCE) to be unisolated under administrative controls. These flow paths must be within the ABSCE structure or in qualified piping that constitutes the ABSCE boundary and either terminate or have an isolation device within the ABSCE. Administrative controls ensure that 1) appropriate personnel are aware of the open status of the penetration flow path during movement of irradiated fuel assemblies within containment, 2) specified individuals are designated and readily available to isolate the flow path in the event of an FHA, and 3) one train of the ABGTS is OPERABLE in accordance with Technical Specification 3.9.12. As discussed above for the containment airlock doors, the basis for this allowance is the SQN analysis for an FHA in containment or the auxiliary building and the potential need for a manual start of the ABGTS for an FHA in containment. This allowance is not applicable to the containment ventilation isolation flow paths because of the potential motive force associated with the containment purge system that could result in additional releases of radioactivity. Additionally, this allowance is not applicable to those flow paths that terminate or are routed outside the ABSCE in piping that does not meet the requirements for an ABSCE boundary.

Insert 1

during movement of irradiated fuel. The containment building equipment door must be closed during movement of recently irradiated fuel (i.e., fuel that has occupied part of a critical reactor core within the previous 100 hours)

Insert 2

During movement of irradiated fuel assemblies, a single normal or contingency method to promptly close the containment building equipment door will be in place. Such prompt methods need not completely block the penetration or be capable of resisting pressure. The purpose is to enable ventilation systems to draw the release from a postulated fuel handling accident in the proper directions such that it can be treated and monitored.

ENCLOSURE 4

TENNESSEE VALLEY AUTHORITY
SEQUOYAH PLANT (SQN)
UNITS 1 AND 2

Westinghouse Electric Company
Radiological Consequences of Fuel Handling Accidents for the Sequoyah Nuclear Plant Units 1 and 2

LTR-CRA-02-219

Westinghouse

Radiological Consequences of Fuel Handling Accidents for the Sequoyah Nuclear Plant Units 1 and 2

Addressing:
1) Implementation of Alternate Source Term
2) Permitting Open Equipment Hatch During Fuel Movement
3) No credit for Operation of the Auxiliary Building Gas Treatment System

Document ID: LTR-CRA-02-219

Prepared for Tennessee Valley Authority
by Westinghouse Electric Company
December 10, 2002

1.0 USE OF ALTERNATE SOURCE TERM METHODOLOGY

1.1 Introduction

Alternate source term (AST) methodology is described in Regulatory Guide 1.183 (Reference 1) and it is being implemented at Sequoyah Units 1 and 2 in a limited-scope application that will only affect the determination of design basis accident doses for the Fuel Handling Accident (occurring either outside containment or inside containment). With the use of the AST methodology, it can be demonstrated that handling of spent fuel assemblies and performing core alterations can take place with the containment equipment hatch open and with the Auxiliary Building Gas Treatment System out of service (no credit for filtration of releases).

1.2 Dose Models and Timing

Doses are determined at the exclusion area boundary (EAB) and at the low population zone boundary (LPZ) for the two-hour interval over which releases are assumed to take place and in the control room for an extended period of time after termination of releases in order to address the continued presence of activity in the control room atmosphere.

The accident doses were calculated using the dose model consistent with the use of the alternate source term methodology (Regulatory Guide 1.183) and are reported as Total Effective Dose Equivalent (TEDE).

The TEDE dose is the sum of the Committed Effective Dose Equivalent (CEDE) and the Effective Dose Equivalent (EDE) which are calculated using the following equations:

$$D_{CEDE} = (A)(X/Q)(BR)(DCF_{CEDE})$$

$$D_{EDE} = (A)(X/Q)(DCF_{EDE})$$

where: A = Activity of the nuclide released (Ci)

X/Q = atmospheric dispersion factor (sec/m^3)

BR = breathing rate (m^3/sec)

DCF_{CEDE} = CEDE dose conversion factor (rem/Ci inhaled)

DCF_{EDE} = EDE dose conversion factor (rem-m^3/Ci-s)

Nuclide data is provided in Table 1. The decay constants for the iodines and noble gases were provided by TVA. The dose conversion factors for the CEDE doses are taken from Table 2.1 of EPA Federal Guidance Report No. 11 (Reference 2). The dose conversion factors for the EDE doses are from Table III.1 of EPA Federal Guidance Report No. 12 (Reference 3). The tritium decay constant is derived from the half-life reported in ICRP Publication 38 (Reference 4).

2.0 FUEL HANDLING ACCIDENT ANALYSIS

A fuel assembly is assumed to be dropped and damaged during refueling. Activity released from the damaged assembly is released to the outside atmosphere through either the containment purge system or the fuel-handling building ventilation system to the plant vent.

2.1 Input Parameters and Assumptions

The analysis of the radiological consequences following a fuel handling accident (FHA) uses the methodology outlined in Regulatory Guide 1.183 (Reference 1). The major assumptions and parameters used in the analysis are itemized in Table 2.

It is assumed that all of the fuel rods in the equivalent of one fuel assembly are damaged to the extent that all the gap activity in the rods is released. Also, the assembly inventory is based on the assumption that the subject fuel assembly has been operated at 1.7 times core average power. The core fission product source term bounds operation with or without the presence of TPBARs (Tritium Producing Burnable Absorber Rods) in the reactor core.

The damaged fuel assembly is assumed to be one with 24 TPBARs which are also assumed to be damaged. Although the release of tritium to the water pool is expected to take place relatively slowly, it is conservatively assumed that all of the tritium is released from the TPBARs immediately. Since tritium in the gaseous form is not a significant dose contributor (minor beta radiation emitter with no retention in the body), it is assumed that all tritium is in the form of water – either as T_2O or HTO. In the water vapor form the tritium is readily absorbed into the body tissues where there can be a significant dose contribution.

The decay time prior to the accident is 100 hours.

The analysis assumes that the iodine released from the fuel is 99.85% elemental and 0.15% organic. This is consistent with Regulatory Guide 1.183. The water pool provides retention of a large portion of the elemental iodine but there is no retention of the organic iodine credited. From Regulatory Guide 1.183, a decontamination factor (DF) of 200 specified is applied to the overall iodine inventory released to the pool. No retention in the water pool is assumed for noble gases (DF = 1.0).

While the tritium is assumed to be chemically combined with oxygen to form tritiated water and would thus be readily retained in the water pool, no credit is taken for retention in the pool.

For the FHA occurring outside of containment, all of the activity released from the damaged fuel and not retained in the water pool is assumed to be released within two hours. No credit is taken for filtration of iodine in the release path. This allows the Auxiliary Building Gas Treatment System to be out of service during spent fuel handling operations.

For the FHA occurring inside containment it is assumed that only a small faction of the containment volume is included in the mixing volume and that the purge line is isolated within 30 seconds. No credit is taken for filtration of the purge flow. After isolation of the containment purge line, it is assumed that all of the activity remaining in the containment is released within two hours of the fuel damage occurrence.

2.2 Acceptance Criteria

The offsite dose limit is defined in Regulatory Guide 1.183 to be 6.3 rem TEDE and, from GDC 19, the dose limit for the control room is 5.0 rem TEDE.

2.3 Results

	FHA Occurring in the Auxiliary Building	FHA Occurring inside Primary Containment
EAB	4.5 rem TEDE	4.5 rem TEDE
LPZ	0.8 rem TEDE	0.8 rem TEDE
Control room	4.1 rem TEDE	4.2 rem TEDE

The doses are all within the acceptance criteria.

3.0 REFERENCES

1. Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," July 2000
2. EPA Federal Guidance Report No. 11, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion," EPA-520/1-88-020, September 1988
3. EPA Federal Guidance Report No. 12, "External Exposure to Radionuclides in Air, Water, and Soil," EPA 402-R-93-081, September 1993
4. ICRP Publication 38, "Radionuclide Transformations," 1983

Table 1: Nuclide Data

Nuclide	Decay Constant (hr^{-1})	Committed Effective Dose Equivalent DCF from EPA Federal Guidance Report No. 11 (rem/Ci inhaled)	Effective Dose Equivalent DCF from EPA Federal Guidance Report No.12 (rem-m^3/Ci-s)
I-131	3.5833E-3	3.29E4	6.734E-2
I-132	3.0401E-1	3.81E2	4.144E-1
I-133	3.3320E-2	5.85E3	1.088E-1
I-135	1.0486E-1	1.23E3	2.953E-1
Kr-85	7.3692E-6	N/A	4.403E-4
Xe-131m	2.4269E-3	N/A	1.439E-3
Xe-133m	1.2836E-2	N/A	5.069E-3
Xe-133	5.4594E-3	N/A	5.772E-3
Xe-135	7.5755E-2	N/A	4.403E-2
H-3 (tritium)	6.407E-6	64.01	1.225E-6

Table 2: Fuel Handling Accident Assumptions

Delay after shutdown before fuel movement		100 hours
Average fuel assembly activity at shutdown (no decay)[1]		
	I-131	4.90E5
	I-132	7.18E5
	I-133	1.01E6
	I-135	9.65E5
	Kr-85	5.35E3
	Xe-131m	5.43E3
	Xe-133m	3.19E4
	Xe-133	9.92E5
	Xe-135	3.33E5
	Te-131m	9.62E4
	Te-132	7.05E5
Radial peaking factor		1.7
Fuel rod gap fraction		
	I-131	0.08
	Kr-85	0.10
	Other iodines and noble gases	0.05
Fuel damaged		One assembly with 24 TPBARs
Iodine species split		
	Elemental	99.85%
	Organic	0.15%
Tritium release from 24 damaged TPBARs		84,000 Ci
Pool scrubbing factor		
	Iodine	200
	Noble gases	1
	Tritium	1
Breathing rate		3.47E-4 m^3/sec

[1] Only the iodines and noble gases having a significant presence after 100 hours are included in the list. The Te-131m and Te-132 are included since they produce I-131 and I-132 respectively as decay products.

Table 2 (continued)

Atmospheric dispersion factor	
EAB	8.59E-4 sec/m^3
LPZ outer boundary	1.39E-4 sec/m^3
<u>FHA Outside Containment</u>	
Release path filter efficiency for iodines	No credit assumed
Isolation of release path	None
Duration of releases	2 hours
<u>FHA Inside Containment</u>	
Mixing volume	32,550 ft^3
Purge flow rate	16,000 cfm
Release path filter efficiency for iodines	None
Isolation of purge release path	30 seconds
Duration of releases via the equipment hatch	30 sec – 2 hr
<u>Control Room Dose Analysis Parameters</u>	
Volume	2.6E5 cubic feet
Normal operation inflow (unfiltered)	3200 cfm
Air intake high radiation setpoint to actuate HVAC emergency mode	400 cpm
Time to switch to emergency mode after signal	5 min
Emergency mode filtered intake flow	1000 cfm
Emergency mode filtered recirculation flow	2600 cfm
Filter efficiency for iodine	95%
Unfiltered inleakage	51 cfm
Atmospheric dispersion factor (X/Q)	
FHA outside containment (0 – 2 hr)	1.80E-3 sec/m^3
FHA inside containment	
0 – 30 sec	5.63E-4 sec/m^3
30 sec – 2 hr	1.80E-3 sec/m^3
Occupancy factor	
0 – 24 hours	1.0
24 – 96 hours	0.6
96 – 720 hours	0.4
Breathing rate	3.47E-4 m^3/sec