



Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

CNL-18-111

December 13, 2018

10 CFR 72.30  
10 CFR 72.4

ATTN: Document Control Desk  
Director, Division of Spent Fuel Management  
Office of Nuclear Material Safety and Safeguards  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

Browns Ferry Nuclear Plant, Units 1, 2, and 3  
Renewed Facility Operating License Nos. DPR-33, DPR-52, and DPR-68  
NRC Docket Nos. 50-259, 50-260, 50-296, and 72-052

Sequoyah Nuclear Plant, Units 1 and 2  
Renewed Facility Operating License Nos. DPR-77 and DPR-79  
NRC Docket Nos. 50-327, 50-328, and 72-034

Watts Bar Nuclear Plant, Units 1 and 2  
Facility Operating License Nos. NPF-90 and NPF-96  
NRC Docket Nos. 50-390, 50-391 and 72-1048

Subject: **Triennial Decommissioning Funding Plans for Independent Spent Fuel Storage Installations (ISFSIs)**

In accordance with the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) 72.30, Tennessee Valley Authority (TVA) hereby submits for Nuclear Regulatory Commission (NRC) review and approval TVA's updated decommissioning funding plans for the Independent Spent Fuel Storage Installations (ISFSIs) at the Browns Ferry Nuclear Plant (BFN), the Sequoyah Nuclear Plant (SQN), and the Watts Bar Nuclear Plant (WBN).

The decommissioning funding plan for the ISFSI at BFN is provided in Enclosure 1. The decommissioning funding plan for the ISFSI at SQN is provided in Enclosure 2. The decommissioning funding plan for the ISFSI at WBN is provided in Enclosure 3.

There are no new regulatory commitments contained in this submittal. If you have any questions regarding this matter, please contact Michael A. Brown at 423-751-3275.

Respectfully,

E. K. Henderson  
Director, Nuclear Regulatory Affairs

Enclosures

cc: See Page 2

Enclosures

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1. Browns Ferry Nuclear Plant Independent Spent Fuel Storage Installation Decommissioning Funding Plan
2. Sequoyah Nuclear Plant Independent Spent Fuel Storage Installation Decommissioning Funding Plan
3. Watts Bar Nuclear Plant Independent Spent Fuel Storage Installation Decommissioning Funding Plan

cc:

NRC Project Manager – Browns Ferry Nuclear Plant  
NRC Senior Resident Inspector – Browns Ferry Nuclear Plant  
NRC Project Manager – Sequoyah Nuclear Plant  
NRC Senior Resident Inspector – Sequoyah Nuclear Plant  
NRC Project Manager – Watts Bar Nuclear Plant  
NRC Senior Resident Inspector – Watts Bar Nuclear Plant

## **Enclosure 1**

Browns Ferry Nuclear Plant  
Independent Spent Fuel Storage Installation  
Decommissioning Funding Plan

**BROWNS FERRY NUCLEAR PLANT  
Independent Spent Fuel Storage Installation  
Decommissioning Funding Plan**

**1. Background and Introduction**

The Nuclear Regulatory Commission (NRC) issued its final rule on Decommissioning Planning on June 17, 2011,<sup>[1]</sup> with the rule becoming effective on December 17, 2012. Subpart 72.30, "Financial assurance and recordkeeping for decommissioning," requires that each holder of, or applicant for, a license under this part must submit for NRC review and approval a decommissioning funding plan that contains information on how reasonable assurance will be provided that funds will be available to decommission the Independent Spent Fuel Storage Installation (ISFSI).

In accordance with the rule, this enclosure provides a detailed cost estimate for decommissioning the ISFSI at the Browns Ferry Nuclear Plant (Browns Ferry) in an amount reflecting:

1. The work is performed by an independent contractor;
2. An adequate contingency factor; and
3. Release of the facility and dry storage systems for unrestricted use, as specified in 10 CFR Part 20.1402.

This enclosure also provides:

1. Identification of and justification for using the key assumptions contained in the cost estimate;
2. A description of the method of assuring funds for decommissioning, including means for adjusting the cost estimate and associated funding levels periodically over the life of the facility; and
3. The volume of onsite subsurface material containing residual radioactivity, if any, that will require remediation to meet the criteria for license termination.

The material in Sections 1 through 6, and Tables 1 and 2, herein, were prepared based on evaluations conducted by TLG Services, Inc. Section 7, containing the financial assurance information, was prepared by the Tennessee Valley Authority (TVA).

**2. Spent Fuel Management Strategy**

The operating licenses for Browns Ferry Units 1, 2 and 3 are currently set to expire on December 20, 2033, June 28, 2034, and July 2, 2036, respectively. Approximately 24,604 spent fuel assemblies are currently projected to be generated

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<sup>1</sup> U.S. Code of Federal Regulations, Title 10, Parts 20, 30, 40, 50, 70 and 72 "Decommissioning Planning," Nuclear Regulatory Commission, Federal Register Volume 76, Number 117 (p 35512 et seq.), June 17, 2011

over the life of the three units. In the absence of a firm plan by the Department of Energy (DOE) for removing spent fuel from the site, an ISFSI has been constructed to support continued plant operations. Based upon the current projection of the DOE's ability to remove spent fuel from the site, this estimate includes, for financial planning purposes, future construction of three additional ISFSI pads to support both operations and decommissioning of Browns Ferry Units 1, 2 and 3. The ISFSI is operated under a Part 50 General License (in accordance with 10 CFR 72, Subpart K<sup>[2]</sup>).

Because the DOE has not yet begun removing spent fuel from the site, it is envisioned that the spent fuel pools will contain a significant number of spent fuel assemblies at the time of expiration of the current operating licenses in 2033 for Unit 1, 2034 for Unit 2 and 2036 for Unit 3, assuming the units operate to those dates, and including assemblies off-loaded from the reactor vessels. To facilitate immediate dismantling operations or safe-storage operations, the fuel is assumed to be packaged in dry storage casks for interim storage at the ISFSI. Once the spent fuel pools are emptied, the spent fuel pool systems and fuel pool areas can be either decontaminated and dismantled or prepared for long-term storage.

Completion of the ISFSI decommissioning process is dependent upon the DOE's ability to remove spent fuel from the site. DOE's repository program assumes that spent fuel allocations will be accepted for disposal from the nation's commercial nuclear plants, with limited exceptions, in the order (the "queue") in which it was discharged from the reactor.<sup>[3]</sup> The current TVA spent fuel management plan for Browns Ferry spent fuel assumes that the last of the spent fuel will be removed from the site within approximately fifty years of the shutdown of Unit 1. This ensures that spent fuel is off site prior to commencing decommissioning operations in the SAFSTOR alternative.

TVA's position is that the DOE has a contractual obligation to accept the spent fuel earlier than the projections set out above consistent with its contract commitments. No assumption made in this submittal should be interpreted to be inconsistent with this claim.

### **3. ISFSI Decommissioning Strategy**

At the conclusion of the spent fuel transfer process, the ISFSI pads will be promptly decommissioned (similar to the power reactor DECON alternative).

For purposes of the funding plan, financial assurance is provided on the basis of a prompt ISFSI decommissioning scenario, i.e., independent of other station decommissioning strategies. ISFSI decommissioning is considered an independent project, regardless of the decommissioning alternative identified for the nuclear power plant.

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<sup>2</sup> U.S. Code of Federal Regulations, Title 10, Part 72, Subpart K, "General License for Storage of Spent Fuel at Power Reactor Sites."

<sup>3</sup> U.S. Code of Federal Regulations, Title 10, Part 961.11, Article IV – Responsibilities of the Parties, B. DOE Responsibilities, 5.(a) ... DOE shall issue an annual acceptance priority ranking for receipt of SNF and/or HLW at the DOE repository. This priority ranking shall be based on the age of SNF and/or HLW as calculated from the date of discharge of such materials from the civilian nuclear power reactor. The oldest fuel or waste will have the highest priority for acceptance, except as ..."

#### 4. ISFSI Description

The ISFSI at Browns Ferry is comprised of numerous contiguous pads that, for the purpose of the ISFSI decommissioning estimate, are considered a single pad. It is assumed that this ISFSI area will be expanded with three additional pads added to provide sufficient storage capacity. The design and capacity of the dry storage modules on the pads is based upon the Holtec HI-STORM 100S, and the Holtec HI-STORM FW dry cask storage systems. The systems consist of multi-purpose canisters (MPCs), with nominal capacities of 68 and 89 fuel assemblies, respectively. The MPCs are contained within steel-lined concrete storage overpacks.

The MPCs are assumed to be transferred directly to the DOE and not returned to the station. Some of the overpacks are assumed to have residual radioactivity due to some minor level of neutron-induced activation as a result of the long-term storage of the fuel. The cost to dispose of residual radioactivity, and to verify that the remaining facility and surrounding environs meet the NRC's radiological limits established for unrestricted use, forms the basis of the ISFSI decommissioning estimate.

TVA's current spent fuel management plan for Browns Ferry spent fuel would result in 288 MPCs and overpacks being placed on the storage pads at the site. This represents 100% of the total spent fuel projected to be generated during the currently licensed operating period. This scenario would allow the spent fuel storage pools to be emptied within approximately five and one-half years following the permanent cessation of operations.

The 288 casks projected to be on the ISFSI pads after shutdown excludes any additional casks that may be used for Greater-than-Class-C (GTCC) storage. The storage overpacks used for the GTCC canisters (estimated quantity of 15) are not expected to have any interior contamination or residual activation and can be reused or disposed of by conventional means after a final status survey.

Table 1 provides the significant quantities and physical dimensions used as the basis in developing the ISFSI decommissioning estimate.

#### 5. Key Assumptions / Estimating Approach

The decommissioning estimate is based on the configuration of the ISFSI expected after all spent fuel and GTCC material has been removed from the site. The configuration of the ISFSI is based on Browns Ferry operating until the end of its current licenses (2033, 2034 and 2036) and the DOE's spent fuel acceptance assumptions, as previously described.

The dry storage vendor, Holtec International, does not expect the overpacks to have any interior or exterior radioactive surface contamination. Any neutron activation of the steel and concrete is expected to be extremely small.<sup>[4,5]</sup> This assumption is adopted for this analysis.

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<sup>4</sup> HI-STORM 100 FSAR, Holtec International, Report HI-2002444, Rev.13 , at page 2-205 (ML16138A100)

<sup>5</sup> HI-STORM FW FSAR, Holtec International, Report HI-2114830, Rev.0 , at page 2-83 (ML11270A045)

The decommissioning estimate is based on the premise that some of the concrete overpacks will contain low levels of neutron-induced residual radioactivity that would necessitate remediation at the time of decommissioning. As an allowance, 26 of the 288 overpacks are assumed to be affected, i.e., contain residual radioactivity. The allowance quantity is based upon the number of casks required for the final core off-load (i.e., 764 offloaded assemblies per reactor, 89 assemblies per cask, 3 reactors) which results in 26 overpacks. It is assumed that the casks containing low levels of neutron-induced residual radioactivity are the final casks offloaded; consequently they have the least time for radioactive decay of the neutron activation products. The overpacks will be segmented and packaged for disposal as low-level radioactive waste.

Holtec does not expect any residual contamination to be left on the concrete ISFSI pad.<sup>[6, 7]</sup> It would be expected that this assumption would be confirmed as a result of good radiological practice of surveying potentially impacted areas after each spent fuel transfer campaign. It is assumed for this analysis that the ISFSI pads will not be contaminated. As such, only verification surveys are included for the pads in the decommissioning estimate. An allowance is also included for surveying any transfer equipment.

The MPC transfer cask, cask transporter, and ISFSI equipment storage building are also assumed to not contain any residual contamination, and to require only verification surveys to free release these items.

The estimate is limited to costs necessary to terminate the ISFSI's NRC license and meet the §20.1402 criteria for unrestricted use. Disposition of released material and structures is outside the scope of the estimate.

Based on TVA's review of the records maintained in accordance with §50.75(g)(1), there is no known subsurface material containing residual radioactivity in the proximity of the ISFSI that would require remediation. As such, there is no allowance for soil remediation in the estimate to decommission the ISFSI.

Low-level radioactive waste disposal costs are based on TVA's negotiated rates with *EnergySolutions*.

Decommissioning is assumed to be performed by an independent contractor. As such, labor, equipment, and material costs are based on national averages, i.e., costs from national publications such as R.S. Means' Building Construction Cost Data (adjusted for regional variations), and laboratory service costs are based on vendor price lists. TVA, as licensee, will oversee the site activities.

Contingency has been added at an overall rate of 25%. This is consistent with the

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<sup>6</sup> HI-STORM 100 FSAR, Holtec International, Report HI-2002444, Rev.13 , at page 2-205 (ML16138A100)

<sup>7</sup> HI-STORM FW FSAR, Holtec International, Report HI-2114830, Rev.0 , at page 2-84 (ML11270A045)

contingency evaluation criteria referenced by the NRC in NUREG-1757.<sup>[8]</sup>

Costs are reported in 2018 dollars. Where 2018 dollars were not available, the ISFSI DCE values from the 2016 Browns Ferry DCE were escalated using U.S. Bureau of Labor escalation indices for Consumer Price Index, Services.<sup>[9]</sup>

The effects, if any, since the last submittal of the ISFSI decommissioning funding plan of the following events listed in 10 CFR 72.30 (c) (1)- (4) have been specifically considered in the decommissioning cost estimate:

- (1) Spills of radioactive material producing additional residual radioactivity in onsite subsurface material: There have been no spills at the ISFSI.
- (2) Facility modifications: There have been no facility modifications in the past three years that affect the decommissioning cost estimate.
- (3) Changes in authorized possession limits: There are no changes in authorized possession limits that affect the decommissioning cost estimate.
- (4) Actual remediation costs that exceed the previous cost estimate: No actual remediation costs have been incurred, so no actual remediation costs exceed the previous cost estimate.

## 6. Cost Considerations

The estimated cost to decommission the ISFSI and release the facility for unrestricted use is provided in Table 2. The cost includes an initial planning phase. During this phase the empty overpacks, ISFSI pads, transfer cask and transporter, ISFSI Equipment Storage Building, and surrounding environs are characterized, and the activity specifications and work procedures for the decontamination (shield overpack disposition) are developed.

The next phase includes the cost for craft labor to remove the activated overpacks, package in certified waste containers, transportation to the Clive, Utah site, disposal, as well as the costs for the supporting equipment, materials and supplies.

The final phase includes the cost for the license termination survey, verification survey, and the associated equipment and laboratory support.

The estimate also contains costs for the NRC (and NRC contractor), TVA's oversight staff, site security (industrial), and other site operating costs.

For estimating purposes it is conservatively assumed that all expenditures will be incurred in the year 2085 (the year following fuel removal).

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<sup>8</sup> "Consolidated Decommissioning Guidance, Financial Assurance, Recordkeeping, and Timeliness," U.S. Nuclear Regulatory Commission's Office of Federal and State Materials and Environmental Management Programs, NUREG-1757, Volume 3, Revision 1, February 2012

<sup>9</sup> Bureau of Labor Statistics, Consumer Price Index - All Urban Consumers, Services, Series ID: CUUR0000SAS



## **7. Financial Assurance**

TVA has provided a statement of intent indicating that funds for decommissioning will be obtained when necessary. This method for assuring ISFSI decommissioning funding is provided for in § 72.30(e)(4) in the case of Federal, State, or local government licensees. Under the provisions of the Tennessee Valley Authority Act of 1933, as amended, 16 U.S.C. §§ 831-831ee (2012), TVA is a corporate agency and instrumentality of the United States Government.

As shown in Table 2, the cost to decommission the ISFSI at Browns Ferry Nuclear Plant is estimated to be \$22,925,000. A statement of intent for this amount is provided in Attachment A. Additionally, as required by § 72.30(b)(6), a certification of financial assurance is provided in Attachment B.

TVA will adjust the cost estimate every three years to account for changes in the costs and the extent of contamination. Following changes to the cost estimate, funding levels will be evaluated to determine if additional funding or use of a different funding mechanism is warranted.

**Table 1**  
**Significant Quantities and Physical Dimensions**

ISFSI Pad			
Item	Length (ft)	Width (ft)	Residual Radioactivity
ISFSI Pad (includes approach pad, assumed size at shutdown)	866	246	No
ISFSI Storage Overpack			
Item	HOLTEC FW	Holtec HI-STORM 100S	Notes
Overall Height (inches)	218.5	218.5	Dimensions are nominal
Outside Diameter (inches)	139.0	132.5	Dimensions are nominal
Inside Diameter (inches)	77.0	73.5	Dimensions are nominal
Inner Liner Thickness (inches)	1.0	1.0	Dimensions are nominal
Quantity (total)	258	45	15 FWs used for GTCC disposal
Quantity (Holtec FW, Holtec HI-STORM 100S) (total)	303	288 spent fuel + 15 GTCC	
Quantity (with residual radioactivity)	26	Equivalent to the number of overpacks used to store last complete core offload	
Packaged Waste Quantities			
Inner Activated Liner Removal (cubic feet)	5,509		
Outer Activated Liner Removal (cubic feet)	9,399		
Activated Concrete and cask lid (cubic feet)	40,878		
Cask Lid (cubic feet)	4,281		
Filters and DAW Waste (cubic feet)	152		
<b>Total Low-Level Radioactive Waste (cubic feet)</b>	<b>60,219</b>		
Low-Level Radioactive Waste (packaged density)	110	Average weight density	
Other Potentially Impacted Items			
Item	Value	Notes	
Transfer Cask	1	No residual radioactivity	
Cask Transporter	1	No residual radioactivity	
ISFSI Equipment Storage Building	1	No residual radioactivity	

**Table 2**  
**ISFSI Decommissioning Costs and Waste Volumes**

	Costs (thousands, 2018 dollars)						Waste Volume (ft3)	Person-Hours	
	Removal	Packaging	Transport	Disposal	Other	Total		Craft	Oversight and Contractor Manhours
<b>Decommissioning Contractor</b>									
Planning (characterization, specs and procedures)	-	-	-	-	712	712	-	-	1,576
Decontamination (activated disposition)	574	417	3,157	8,405	42	12,596	60,219	6,592	-
License Termination (radiological surveys)	-	-	-	-	3,872	3,872	-	34,124	-
<b>Subtotal</b>	<b>574</b>	<b>417</b>	<b>3,157</b>	<b>8,405</b>	<b>4,626</b>	<b>17,179</b>	<b>60,219</b>	<b>40,716</b>	<b>1,576</b>
<b>Supporting Costs</b>									
NRC and NRC Contractor Fees and Costs					519	519	-	-	1,153
Insurance					74	74	-	-	-
Security (industrial)					145	145	-	-	7,065
TVA Oversight Staff					424	424	-	-	5,360
<b>Subtotal</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1,161</b>	<b>1,161</b>	<b>-</b>	<b>-</b>	<b>13,577</b>
<b>Total (w/o contingency)</b>	<b>574</b>	<b>417</b>	<b>3,157</b>	<b>8,405</b>	<b>5,787</b>	<b>18,340</b>	<b>60,219</b>	<b>40,716</b>	<b>15,153</b>
<b>Total (w/25% contingency)</b>						<b>22,925</b>			

**ATTACHMENT A**

Tennessee Valley Authority  
400 West Summit Hill Drive  
Knoxville, TN 37902  
(865) 632-2101

Browns Ferry Nuclear Plant, Units 1, 2, and 3  
Renewed Facility Operating License Nos. DPR-33, DPR-52, and DPR-68  
NRC Docket Nos. 50-259, 50-260, 50-296, and 72-052

**STATEMENT OF INTENT**

The Tennessee Valley Authority (TVA) is a corporate agency and instrumentality of the United States Government created pursuant to the Tennessee Valley Authority Act of 1933, as amended, 16 U.S.C. §§ 831-831ee (2012). Pursuant to 10 CFR § 72.30(e)(4), TVA states that it will obtain the funds for decommissioning the Browns Ferry Nuclear Plant ISFSI, estimated to be \$22,925,000 as described in the Decommissioning Plan, when necessary. These funds will be obtained and made available sufficiently in advance of decommissioning to prevent the delay of required activities.

A copy of the Delegation of Authority from the Chief Executive Officer to the Chief Nuclear Officer is provided in Exhibit A as evidence that I am authorized to represent TVA in this transaction. The TVA Board Practice Amendments referenced in the Delegation of Authority are included as an attachment to Exhibit A.

Timothy S. Rausch  
Chief Nuclear Officer  
Tennessee Valley Authority  
December 12, 2018

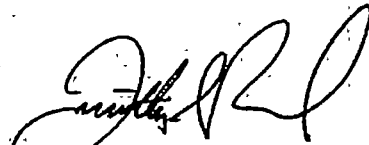


Exhibit A: Memo Delegating Authority from the Chief Executive Officer to the Chief Nuclear Officer

**ATTACHMENT B**

Tennessee Valley Authority  
400 West Summit Hill Drive  
Knoxville, TN 37902  
(865) 632-2101

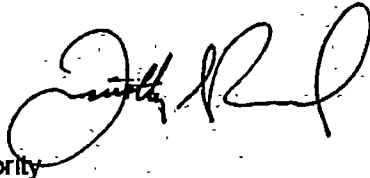
Browns Ferry Nuclear Plant, Units 1, 2, and 3  
Renewed Facility Operating License Nos. DPR-33, DPR-52, and DPR-68  
NRC Docket Nos. 50-259, 50-260, 50-296, and 72-052

**CERTIFICATION OF FINANCIAL ASSURANCE**

In accordance with 10 CFR 72.30(b)(6), I certify that financial assurance in the amount of \$22,925,000 will be made available when necessary to decommission the Browns Ferry Nuclear Plant Independent Spent Fuel Storage Installation using the financial assurance method set forth in 10 CFR 72.30(e)(4).

Should additional information be needed regarding this certification of financial assurance by the Tennessee Valley Authority, contact Erin K. Henderson, Director, Nuclear Regulatory Affairs, at (423) 751-7620.

Timothy S. Rausch  
Chief Nuclear Officer  
Tennessee Valley Authority  
December 12, 2018



## **Enclosure 2**

Sequoyah Nuclear Plant  
Independent Spent Fuel Storage Installation  
Decommissioning Funding Plan

**SEQUOYAH NUCLEAR PLANT  
Independent Spent Fuel Storage Installation  
Decommissioning Funding Plan**

**1. Background and Introduction**

The Nuclear Regulatory Commission (NRC) issued its final rule on Decommissioning Planning on June 17, 2011,<sup>[1]</sup> with the rule becoming effective on December 17, 2012. Subpart 72.30, "Financial assurance and recordkeeping for decommissioning," requires that each holder of, or applicant for, a license under this part must submit for NRC review and approval a decommissioning funding plan that contains information on how reasonable assurance will be provided that funds will be available to decommission the Independent Spent Fuel Storage Installation (ISFSI).

In accordance with the rule, this enclosure provides a detailed cost estimate for decommissioning the ISFSI at Sequoyah Nuclear Plant (Sequoyah) in an amount reflecting:

1. The work is performed by an independent contractor;
2. An adequate contingency factor; and
3. Release of the facility and dry storage systems for unrestricted use, as specified in 10 CFR Part 20.1402.

This enclosure also provides:

1. Identification of and justification for using the key assumptions contained in the cost estimate;
2. A description of the method of assuring funds for decommissioning, including means for adjusting the cost estimate and associated funding levels periodically over the life of the facility; and
3. The volume of onsite subsurface material containing residual radioactivity, if any, that will require remediation to meet the criteria for license termination.

The material in Sections 1 through 6, and Tables 1 and 2, herein, were prepared based on evaluations conducted by TLG Services, Inc. Section 7, containing the financial assurance information, was prepared by the Tennessee Valley Authority (TVA).

**2. Spent Fuel Management Strategy**

The operating licenses for Sequoyah Units 1 and 2 are currently set to expire on September 17, 2040, and September 15, 2041, respectively. Approximately 6,353

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<sup>1</sup> U.S. Code of Federal Regulations, Title 10, Parts 20, 30, 40, 50, 70 and 72 "Decommissioning Planning," Nuclear Regulatory Commission, Federal Register Volume 76, Number 117 (p 35512 et seq.), June 17, 2011

spent fuel assemblies are currently projected to be generated over the life of the two units. In the absence of a firm plan by the Department of Energy (DOE) for removing spent fuel from the site, an ISFSI has been constructed to support continued plant operations. Based upon the current projection of the DOE's ability to remove spent fuel from the site, this estimate includes, for financial planning purposes, future construction of a second pad to support both operations and decommissioning of Sequoyah Units 1 and 2. The ISFSI is operated under a Part 50 General License (in accordance with 10 CFR 72, Subpart K<sup>[2]</sup>).

Because the DOE has not yet begun removing spent fuel from the site, it is envisioned that the spent fuel pool will contain a significant number of spent fuel assemblies at the time of expiration of the current operating licenses in 2040 for Unit 1 and 2041 for Unit 2, assuming the units operate to those dates, and including assemblies off-loaded from the reactor vessels. To facilitate immediate dismantling operations or safe-storage operations, the fuel is assumed to be packaged in dry storage casks for interim storage at the ISFSI. Once the spent fuel pool is emptied, the spent fuel pool systems and fuel pool areas can be either decontaminated and dismantled or prepared for long-term storage.

Completion of the ISFSI decommissioning process is dependent upon the DOE's ability to remove spent fuel from the site. DOE's repository program assumes that spent fuel allocations will be accepted for disposal from the nation's commercial nuclear plants, with limited exceptions, in the order (the "queue") in which it was discharged from the reactor.<sup>[3]</sup> The current TVA spent fuel management plan for Sequoyah spent fuel assumes that the last of the spent fuel will be removed from the site within approximately fifty years of the shutdown of Unit 1. This ensures that spent fuel is off site prior to commencing decommissioning operations in the SAFSTOR alternative.

TVA's position is that the DOE has a contractual obligation to accept the spent fuel earlier than the projections set out above consistent with its contract commitments. No assumption made in this submittal should be interpreted to be inconsistent with this claim.

### **3. ISFSI Decommissioning Strategy**

At the conclusion of the spent fuel transfer process the ISFSI pad will be promptly decommissioned (similar to the power reactor DECON alternative).

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<sup>2</sup> U.S. Code of Federal Regulations, Title 10, Part 72, Subpart K, "General License for Storage of Spent Fuel at Power Reactor Sites."

<sup>3</sup> U.S. Code of Federal Regulations, Title 10, Part 961.11, Article IV – Responsibilities of the Parties, B. DOE Responsibilities, 5.(a) ... DOE shall issue an annual acceptance priority ranking for receipt of SNF and/or HLW at the DOE repository. This priority ranking shall be based on the age of SNF and/or HLW as calculated from the date of discharge of such materials from the civilian nuclear power reactor. The oldest fuel or waste will have the highest priority for acceptance, except as ..."



For purposes of the funding plan, financial assurance is provided on the basis of a prompt ISFSI decommissioning scenario, i.e., independent of other station decommissioning strategies. ISFSI decommissioning is considered an independent project, regardless of the decommissioning alternative identified for the nuclear power plant.

#### **4. ISFSI Description**

The ISFSI at Sequoyah is comprised of numerous contiguous pads that, for the purpose of the ISFSI decommissioning estimate, are considered a single pad. It is assumed that this ISFSI area will be expanded with an additional pad added to provide sufficient storage capacity. The design and capacity of the dry storage modules on the pads is based upon the Holtec HI-STORM 100S, and the Holtec HI-STORM FW dry cask storage systems. The systems consist of multi-purpose canisters (MPCs), with nominal capacities of 32 and 37 fuel assemblies, respectively. The MPCs are contained within steel-lined concrete storage overpacks.

The MPCs are assumed to be transferred directly to the DOE and not returned to the station. Some of the overpacks are assumed to have residual radioactivity due to some minor level of neutron-induced activation as a result of the long-term storage of the fuel. The cost to dispose of residual radioactivity, and to verify that the remaining facility and surrounding environs meet the NRC's radiological limits established for unrestricted use, forms the basis of the ISFSI decommissioning estimate.

TVA's current spent fuel management plan for Sequoyah spent fuel would result in 178 MPCs and overpacks being placed on the storage pad at the site. This represents 100% of the total spent fuel projected to be generated during the currently licensed operating period. This scenario would allow the spent fuel storage pools to be emptied within approximately five and one-half years following the permanent cessation of operations.

The 178 casks projected to be on the ISFSI pad after shutdown excludes any additional casks that may be used for Greater-than-Class-C (GTCC) storage. The storage overpacks used for the GTCC canisters (estimated quantity of 10) are not expected to have any interior contamination or residual activation and can be reused or disposed of by conventional means after a final status survey.

Table 1 provides the significant quantities and physical dimensions used as the basis in developing the ISFSI decommissioning estimate.

## 5. Key Assumptions / Estimating Approach

The decommissioning estimate is based on the configuration of the ISFSI expected after all spent fuel and GTCC material has been removed from the site. The configuration of the ISFSI is based on Sequoyah operating until the end of its current licenses (2040 and 2041) and the DOE's spent fuel acceptance assumptions, as previously described.

The dry storage vendor, Holtec International, does not expect the overpacks to have any interior or exterior radioactive surface contamination. Any neutron activation of the steel and concrete is expected to be extremely small.<sup>[4,5]</sup> This assumption is adopted for this analysis.

The decommissioning estimate is based on the premise that some of the concrete overpacks will contain low levels of neutron-induced residual radioactivity that would necessitate remediation at the time of decommissioning. As an allowance, 11 of the 178 overpacks are assumed to be affected, i.e., contain residual radioactivity. The allowance quantity is based upon the number of casks required for the final core off-load (i.e., 193 offloaded assemblies per reactor, 37 assemblies per cask, 2 reactors) which results in 11 overpacks. It is assumed that the casks containing low levels of neutron-induced residual radioactivity are the final casks offloaded; consequently they have the least time for radioactive decay of the neutron activation products. The overpacks will be segmented and packaged for disposal as low-level radioactive waste.

Holtec does not expect any residual contamination to be left on the concrete ISFSI pad.<sup>[6, 7]</sup> It would be expected that this assumption would be confirmed as a result of good radiological practice of surveying potentially impacted areas after each spent fuel transfer campaign. It is assumed for this analysis that the ISFSI pad will not be contaminated. As such, only verification surveys are included for the pad in the decommissioning estimate. An allowance is also included for surveying any transfer equipment.

The MPC transfer cask, cask transporter, and ISFSI equipment storage building are also assumed to not contain any residual contamination, and to require only verification surveys to free release these items.

The estimate is limited to costs necessary to terminate the ISFSI's NRC license and meet the §20.1402 criteria for unrestricted use. Disposition of released material and structures is outside the scope of the estimate.

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<sup>4</sup> HI-STORM 100 FSAR, Holtec International, Report HI-2002444, Rev.13 , at page 2-205 (ML16138A100)

<sup>5</sup> HI-STORM FW FSAR, Holtec International, Report HI-2114830, Rev.0 , at page 2-83 (ML11270A045)

<sup>6</sup> HI-STORM 100 FSAR, Holtec International, Report HI-2002444, Rev.13 , at page 2-205 (ML16138A100)

<sup>7</sup> HI-STORM FW FSAR, Holtec International, Report HI-2114830, Rev.0 , at page 2-84 (ML11270A045)

Based on TVA's review of the records maintained in accordance with §50.75(g)(1), there is no known subsurface material containing residual radioactivity in the proximity of the ISFSI that would require remediation. As such, there is no allowance for soil remediation in the estimate to decommission the ISFSI.

Low-level radioactive waste disposal costs are based on TVA's negotiated rates with EnergySolutions.

Decommissioning is assumed to be performed by an independent contractor. As such, labor, equipment, and material costs are based on national averages, i.e., costs from national publications such as R.S. Means' Building Construction Cost Data (adjusted for regional variations), and laboratory service costs are based on vendor price lists. TVA, as licensee, will oversee the site activities.

Contingency has been added at an overall rate of 25%. This is consistent with the contingency evaluation criteria referenced by the NRC in NUREG-1757.<sup>[8]</sup>

Costs are reported in 2018 dollars. Where 2018 dollars were not available, the ISFSI DCE values from the 2016 Sequoyah DCE were escalated using U.S. Bureau of Labor escalation indices for Consumer Price Index, Services.<sup>[9]</sup>

The effects, if any, since the last submittal of the ISFSI decommissioning funding plan of the following events listed in 10 CFR 72.30 (c) (1)- (4) have been specifically considered in the decommissioning cost estimate:

- (1) Spills of radioactive material producing additional residual radioactivity in onsite subsurface material: There have been no spills at the ISFSI.
- (2) Facility modifications: There have been no facility modifications in the past three years that affect the decommissioning cost estimate.
- (3) Changes in authorized possession limits: There are no changes in authorized possession limits that affect the decommissioning cost estimate.
- (4) Actual remediation costs that exceed the previous cost estimate: No actual remediation costs have been incurred, so no actual remediation costs exceed the previous cost estimate.

## 6. Cost Considerations

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<sup>8</sup> "Consolidated Decommissioning Guidance, Financial Assurance, Recordkeeping, and Timeliness," U.S. Nuclear Regulatory Commission's Office of Federal and State Materials and Environmental Management Programs, NUREG-1757, Volume 3, Revision 1, February 2012

<sup>9</sup> Bureau of Labor Statistics, Consumer Price Index - All Urban Consumers, Services, Series ID: CUUR0000SAS

The estimated cost to decommission the ISFSI and release the facility for unrestricted use is provided in Table 2. The cost includes an initial planning phase. During this phase the empty overpacks, ISFSI pads, transfer cask and transporter, ISFSI Equipment Storage Building, and surrounding environs are characterized, and the activity specifications and work procedures for the decontamination (shield overpack disposition) are developed.

The next phase includes the cost for craft labor to remove the activated overpacks, package in certified waste containers, transportation to the Clive, Utah site, disposal, as well as the costs for the supporting equipment, materials and supplies.

The final phase includes the cost for the license termination survey, verification survey, and the associated equipment and laboratory support.

The estimate also contains costs for the NRC (and NRC contractor), TVA's oversight staff, site security (industrial), and other site operating costs.

For estimating purposes it is conservatively assumed that all expenditures will be incurred in the year 2083 (the year following fuel removal).

## **7. Financial Assurance**

TVA has provided a statement of intent indicating that funds for decommissioning will be obtained when necessary. This method for assuring ISFSI decommissioning funding is provided for in §72.30(e)(4) in the case of Federal, State, or local government licensees. Under the provisions of the Tennessee Valley Authority Act of 1933, as amended, 16 U.S.C. §§ 831-831ee (2012), TVA is a corporate agency and instrumentality of the United States Government.

As shown in Table 2, the cost to decommission the ISFSI at Sequoyah Nuclear Plant is estimated to be \$13,126,000. A statement of intent for this amount is provided in Attachment A. Additionally, as required by §72.30(b)(6), a certification of financial assurance is provided in Attachment B.

TVA will adjust the cost estimate every three years to account for changes in the costs and the extent of contamination. Following changes to the cost estimate, funding levels will be evaluated to determine if additional funding or use of a different funding mechanism is warranted.

**Table 1**  
**Significant Quantities and Physical Dimensions**

ISFSI Pad			
Item	Length (ft)	Width (ft)	Residual Radioactivity
ISFSI Pad, aprons, haul road	729	115	No

**ISFSI Storage Overpack**

Item	HOLTEC FW	Holtec HI-STORM 100S	Notes
Overall Height (inches)	209	218.5	Dimensions are nominal
Outside Diameter (inches)	139.0	132.5	Dimensions are nominal
Inside Diameter (inches)	77.0	73.5	Dimensions are nominal
Inner Liner Thickness (inches)	1.0	1.0	Dimensions are nominal
Quantity (total)	144	44	10 FWs used for GTCC disposal
Quantity (Holtec FW, Holtec HI-STORM 100S) (total)	188	178 spent fuel + 10 GTCC	
Quantity (with residual radioactivity)	11	Equivalent to the number of overpacks used to store last complete core offload	
<b>Packaged Waste Quantities</b>			
Inner Activated Liner Removal (cubic feet)	2,331		
Outer Activated Liner Removal (cubic feet)	3,804		
Activated Concrete and cask lid (cubic feet)	18,354		
Activated overpack miscellaneous steel (cubic feet)	210		
Filters and DAW Waste (cubic feet)	98		
<b>Total Low-Level Radioactive Waste (cubic feet)</b>	<b>24,797</b>		
Low-Level Radioactive Waste (packaged density)	132	Average weight density	

**Other Potentially Impacted Items**

Item	Value	Notes
Transfer Cask	1	No residual radioactivity
Cask Transporter	1	No residual radioactivity
ISFSI Equipment Storage Building	1	No residual radioactivity

**Table 2**  
**ISFSI Decommissioning Costs and Waste Volumes**

	Costs (thousands, 2018 dollars)						Waste Volume (ft3)	Person-Hours	
	Removal	Packaging	Transport	Disposal	Other	Total		Craft	Oversight and Contractor
<b>Decommissioning Contractor</b>									
Planning (characterization, specs and procedures)	-	-	-	-	513	513	-	-	1,336
Decontamination (activated disposition)	264	237	1,604	4,025	42	6,173	24,797	2,751	-
License Termination (radiological surveys)	-	-	-	-	2,883	2,883	-	24,384	-
<b>Subtotal</b>	<b>264</b>	<b>237</b>	<b>1,604</b>	<b>4,025</b>	<b>3,438</b>	<b>9,569</b>	<b>24,797</b>	<b>27,135</b>	<b>1,336</b>
<b>Supporting Costs</b>									
NRC and NRC Contractor Fees and Costs					502	502	-	-	1,153
Insurance					74	74	-	-	-
Security (industrial)					93	93	-	-	4,349
TVA Oversight Staff					263	263	-	-	3,322
<b>Subtotal</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>932</b>	<b>932</b>	<b>-</b>	<b>-</b>	<b>8,824</b>
<b>Total (w/o contingency)</b>	<b>264</b>	<b>237</b>	<b>1,604</b>	<b>4,025</b>	<b>4,370</b>	<b>10,500</b>	<b>24,797</b>	<b>27,135</b>	<b>10,160</b>
<b>Total (w/25% contingency)</b>						<b>13,126</b>			

**ATTACHMENT A**

Tennessee Valley Authority  
400 West Summit Hill Drive  
Knoxville, TN 37902  
(865) 632-2101

Sequoyah Nuclear Plant, Units 1 and 2  
Renewed Facility Operating License Nos. DPR-77 and DPR-79  
NRC Docket Nos. 50-327, 50-328, and 72-034

**STATEMENT OF INTENT**

The Tennessee Valley Authority (TVA) is a corporate agency and instrumentality of the United States Government created pursuant to the Tennessee Valley Authority Act of 1933, as amended, 16 U.S.C. §§ 831-831ee (2012). Pursuant to 10 CFR § 72.30(e)(4), TVA states that it will obtain the funds for decommissioning the Sequoyah Nuclear Plant ISFSI, estimated to be \$13,126,000 as described in the Decommissioning Plan, when necessary. These funds will be obtained and made available sufficiently in advance of decommissioning to prevent the delay of required activities.

A copy of the Delegation of Authority from the Chief Executive Officer to the Chief Nuclear Officer is provided in Exhibit A as evidence that I am authorized to represent TVA in this transaction. The TVA Board Practice Amendments referenced in the Delegation of Authority are included as an attachment to Exhibit A.

Timothy S. Rausch  
Chief Nuclear Officer  
Tennessee Valley Authority  
December 12, 2018

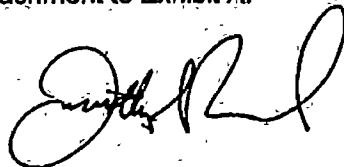


Exhibit A: Memo Delegating Authority from the Chief Executive Officer to the Chief Nuclear Officer

**ATTACHMENT B**

Tennessee Valley Authority  
400 West Summit Hill Drive  
Knoxville, TN 37902  
(865) 632-2101

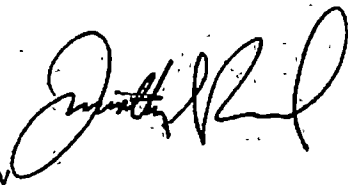
Sequoyah Nuclear Plant, Units 1 and 2  
Renewed Facility Operating License Nos. DPR-77 and DPR-79  
NRC Docket Nos. 50-327, 50-328, and 72-034

**CERTIFICATION OF FINANCIAL ASSURANCE**

In accordance with 10 CFR 72.30(b)(6), I certify that financial assurance in the amount of \$13,126,000 will be made available when necessary to decommission the Sequoyah Nuclear Plant Independent Spent Fuel Storage Installation using the financial assurance method set forth in 10 CFR 72.30(e)(4).

Should additional information be needed regarding this certification of financial assurance by the Tennessee Valley Authority, contact Erin K. Henderson, Director, Nuclear Regulatory Affairs, at (423) 751-7620.

Timothy S. Rausch  
Chief Nuclear Officer  
Tennessee Valley Authority  
December 12, 2018





## **Enclosure 3**

Watts Bar Nuclear Plant  
Independent Spent Fuel Storage Installation  
Decommissioning Funding Plan

**WATTS BAR NUCLEAR PLANT  
Independent Spent Fuel Storage Installation  
Decommissioning Funding Plan**

**1. Background and Introduction**

The Nuclear Regulatory Commission (NRC) issued its final rule on Decommissioning Planning on June 17, 2011,<sup>[1]</sup> with the rule becoming effective on December 17, 2012. Subpart 72.30, "Financial assurance and recordkeeping for decommissioning," requires that each holder of, or applicant for, a license under this part must submit for NRC review and approval a decommissioning funding plan that contains information on how reasonable assurance will be provided that funds will be available to decommission the Independent Spent Fuel Storage Installation (ISFSI).

In accordance with the rule, this enclosure provides a detailed cost estimate for decommissioning the ISFSI at Watts Bar Nuclear Plant (Watts Bar) in an amount reflecting:

1. The work is performed by an independent contractor;
2. An adequate contingency factor; and
3. Release of the facility and dry storage systems for unrestricted use, as specified in 10 CFR Part 20.1402.

This enclosure also provides:

1. Identification of and justification for using the key assumptions contained in the cost estimate;
2. A description of the method of assuring funds for decommissioning, including means for adjusting the cost estimate and associated funding levels periodically over the life of the facility; and
3. The volume of onsite subsurface material containing residual radioactivity, if any, that will require remediation to meet the criteria for license termination.

The material in Sections 1 through 6, and Tables 1 and 2, herein, were prepared based on evaluations conducted by TLG Services, Inc. Section 7, containing the financial assurance information, was prepared by the Tennessee Valley Authority (TVA).

**2. Spent Fuel Management Strategy**

The operating licenses for Watts Bar Units 1 and 2 are currently set to expire on November 9, 2035, and October 21, 2055, respectively. Approximately 5,010 spent fuel assemblies are currently projected to be generated over the life of the two units. In the absence of a firm plan by the Department of Energy (DOE) for removing spent

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<sup>1</sup> U.S. Code of Federal Regulations, Title 10, Parts 20, 30, 40, 50, 70 and 72 "Decommissioning Planning," Nuclear Regulatory Commission, Federal Register Volume 76, Number 117 (p 35512 et seq.), June 17, 2011

fuel from the site, an ISFSI has been constructed to support continued plant operations. Based upon the current projection of the DOE's ability to remove spent fuel from the site, this estimate includes, for financial planning purposes, future construction of a second pad to support both operations and decommissioning of Watts Bar Units 1 and 2. The ISFSI is operated under a Part 50 General License (in accordance with 10 CFR 72, Subpart K<sup>[2]</sup>).

Because the DOE has not yet begun removing spent fuel from the site, it is envisioned that the spent fuel pool will contain a significant number of spent fuel assemblies at the time of expiration of the current operating licenses in 2035 for Unit 1 and 2055 for Unit 2, assuming the units operate to those dates, and including assemblies off-loaded from the reactor vessels. To facilitate immediate dismantling operations or safe-storage operations, the fuel is assumed to be packaged in dry storage casks for interim storage at the ISFSI. Once the spent fuel pool is emptied, the spent fuel pool systems and fuel pool areas can be either decontaminated and dismantled or prepared for long-term storage.

Completion of the ISFSI decommissioning process is dependent upon the DOE's ability to remove spent fuel from the site. DOE's repository program assumes that spent fuel allocations will be accepted for disposal from the nation's commercial nuclear plants, with limited exceptions, in the order (the "queue") in which it was discharged from the reactor.<sup>[3]</sup> The current TVA spent fuel management plan for Watts Bar spent fuel assumes that the last of the spent fuel will be removed from the site within approximately fifty years of the shutdown of Unit 1. This ensures that spent fuel is off site prior to commencing decommissioning operations in the SAFSTOR alternative.

TVA's position is that the DOE has a contractual obligation to accept the spent fuel earlier than the projections set out above consistent with its contract commitments. No assumption made in this submittal should be interpreted to be inconsistent with this claim.

### **3. ISFSI Decommissioning Strategy**

At the conclusion of the spent fuel transfer process the ISFSI pad will be promptly decommissioned (similar to the power reactor DECON alternative).

For purposes of the funding plan, financial assurance is provided on the basis of a prompt ISFSI decommissioning scenario, i.e., independent of other station decommissioning strategies. ISFSI decommissioning is considered an independent project, regardless of the decommissioning alternative identified for the nuclear power plant.

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<sup>2</sup> U.S. Code of Federal Regulations, Title 10, Part 72, Subpart K, "General License for Storage of Spent Fuel at Power Reactor Sites."

<sup>3</sup> U.S. Code of Federal Regulations, Title 10, Part 961.11, Article IV – Responsibilities of the Parties, B. DOE Responsibilities, 5.(a) ... DOE shall issue an annual acceptance priority ranking for receipt of SNF and/or HLW at the DOE repository. This priority ranking shall be based on the age of SNF and/or HLW as calculated from the date of discharge of such materials from the civilian nuclear power reactor. The oldest fuel or waste will have the highest priority for acceptance, except as ..."

#### 4. ISFSI Description

The ISFSI at Watts Bar is currently comprised of numerous contiguous pads that, for the purpose of the ISFSI decommissioning estimate, are considered a single pad. It is assumed that this ISFSI area will be expanded with an additional pad added to provide sufficient storage capacity. The design and capacity of the dry storage modules on the pads is based upon the Holtec HI-STORM FW dry cask storage system. The system consists of multi-purpose canisters (MPCs), with nominal capacities of 37 fuel assemblies. The MPCs are contained within steel-lined concrete storage overpacks.

The MPCs are assumed to be transferred directly to the DOE and not returned to the station. Some of the overpacks are assumed to have residual radioactivity due to some minor level of neutron-induced activation as a result of the long-term storage of the fuel. The cost to dispose of residual radioactivity, and to verify that the remaining facility and surrounding environs meet the NRC's radiological limits established for unrestricted use, forms the basis of the ISFSI decommissioning estimate.

TVA's current spent fuel management plan for Watts Bar spent fuel would result in 136 MPCs and overpacks being placed on the storage pad at the site. This represents 100% of the total spent fuel projected to be generated during the currently licensed operating period. This scenario would allow the spent fuel storage pool to be emptied within approximately five and one-half years following the permanent cessation of operations.

The 136 casks projected to be on the ISFSI pad after shutdown excludes any additional casks that may be used for Greater-than-Class-C (GTCC) storage. The storage overpacks used for the GTCC canisters (estimated quantity of 10) are not expected to have any interior contamination or residual activation and can be reused or disposed of by conventional means after a final status survey.

Table 1 provides the significant quantities and physical dimensions used as the basis in developing the ISFSI decommissioning estimate.

#### 5. Key Assumptions / Estimating Approach

The decommissioning estimate is based on the configuration of the ISFSI expected after all spent fuel and GTCC material has been removed from the site. The configuration of the ISFSI is based on Watts Bar operating until the end of its current licenses (2035 and 2055) and the DOE's spent fuel acceptance assumptions, as previously described.

The dry storage vendor, Holtec International, does not expect the overpacks to have any interior or exterior radioactive surface contamination. Any neutron activation of the steel and concrete is expected to be extremely small.<sup>[4,5]</sup> This assumption is adopted for this analysis.

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<sup>4</sup> HI-STORM 100 FSAR, Holtec International, Report HI-2002444, Rev.13, at page 2-205 (ML16138A100)

The decommissioning estimate is based on the premise that some of the concrete overpacks will contain low levels of neutron-induced residual radioactivity that would necessitate remediation at the time of decommissioning. As an allowance, 11 of the 136 overpacks are assumed to be affected, i.e., contain residual radioactivity. The allowance quantity is based upon the number of casks required for the final core off-load (i.e., 193 offloaded assemblies per reactor, 37 assemblies per cask, 2 reactors) which results in 11 overpacks. It is assumed that the casks containing low levels of neutron-induced residual radioactivity are the final casks offloaded; consequently they have the least time for radioactive decay of the neutron activation products. The overpacks will be segmented and packaged for disposal as low-level radioactive waste.

Holtec does not expect any residual contamination to be left on the concrete ISFSI pad.<sup>[6, 7]</sup> It would be expected that this assumption would be confirmed as a result of good radiological practice of surveying potentially impacted areas after each spent fuel transfer campaign. It is assumed for this analysis that the ISFSI pad will not be contaminated. As such, only verification surveys are included for the pad in the decommissioning estimate. An allowance is also included for surveying any transfer equipment.

The MPC transfer casks, crawler, and ISFSI equipment storage building are also assumed to not contain any residual contamination, and to require only verification surveys to free release these items.

The estimate is limited to costs necessary to terminate the ISFSI's NRC license and meet the §20.1402 criteria for unrestricted use. Disposition of released material and structures is outside the scope of the estimate.

Based on TVA's review of the records maintained in accordance with §50.75(g)(1), there is no known subsurface material containing residual radioactivity in the proximity of the ISFSI that would require remediation. As such, there is no allowance for soil remediation in the estimate to decommission the ISFSI.

Low-level radioactive waste disposal costs are based on TVA's negotiated rates with EnergySolutions. The estimate assumes that the waste from the affected overpack concrete and steel is disposed of at the bulk rate.

Decommissioning is assumed to be performed by an independent contractor. As such, labor, equipment, and material costs are based on national averages, i.e., costs from national publications such as R.S. Means' Building Construction Cost Data (adjusted for regional variations), and laboratory service costs are based on vendor price lists. TVA, as licensee, will oversee the site activities.

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<sup>5</sup> HI-STORM FW FSAR, Holtec International, Report HI-2114830, Rev.0 , at page 2-83 (ML11270A045)

<sup>6</sup> HI-STORM 100 FSAR, Holtec International, Report HI-2002444, Rev.13 , at page 2-205 (ML16138A100)

<sup>7</sup> HI-STORM FW FSAR, Holtec International, Report HI-2114830, Rev.0 , at page 2-84 (ML11270A045)

Contingency has been added at an overall rate of 25%. This is consistent with the contingency evaluation criteria referenced by the NRC in NUREG-1757.<sup>[8]</sup>

Costs are reported in 2018 dollars. Where 2018 dollars were not available, the ISFSI DCE values from the 2016 Watts Bar DCE were escalated using U.S. Bureau of Labor escalation indices for Consumer Price Index, Services.<sup>[9]</sup>

The effects, if any, since the last submittal of the ISFSI decommissioning funding plan of the following events listed in 10 CFR 72.30 (c) (1)- (4) have been specifically considered in the decommissioning cost estimate:

- (1) Spills of radioactive material producing additional residual radioactivity in onsite subsurface material: There have been no spills at the ISFSI.
- (2) Facility modifications: There have been no facility modifications in the past three years that affect the decommissioning cost estimate.
- (3) Changes in authorized possession limits: There are no changes in authorized possession limits that affect the decommissioning cost estimate.
- (4) Actual remediation costs that exceed the previous cost estimate: No actual remediation costs have been incurred, so no actual remediation costs exceed the previous cost estimate.

## 6. Cost Considerations

The estimated cost to decommission the ISFSI and release the facility for unrestricted use is provided in Table 2. The cost includes an initial planning phase. During this phase the empty overpacks, ISFSI pads, transfer casks and crawler, Crawler Building, and surrounding environs are characterized, and the activity specifications and work procedures for the decontamination (shield overpack disposition) are developed.

The next phase includes the cost for craft labor to remove the activated overpacks, package in certified waste containers, transportation to the Clive, Utah site, disposal, and the costs for the supporting equipment, materials and supplies.

The final phase includes the cost for the license termination survey, verification survey, and the associated equipment and laboratory support.

The estimate also contains costs for the NRC (and NRC contractor), TVA's oversight staff, site security (industrial), and other site operating costs.

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<sup>8</sup> "Consolidated Decommissioning Guidance, Financial Assurance, Recordkeeping, and Timeliness," U.S. Nuclear Regulatory Commission's Office of Federal and State Materials and Environmental Management Programs, NUREG-1757, Volume 3, Revision 1, February 2012

<sup>9</sup> Bureau of Labor Statistics, Consumer Price Index - All Urban Consumers, Services, Series ID: CUUR0000SAS

For estimating purposes it is conservatively assumed that all expenditures will be incurred in the year 2089 (the year following fuel removal).

## **7. Financial Assurance**

TVA has provided a statement of intent indicating that funds for decommissioning will be obtained when necessary. This method for assuring ISFSI decommissioning funding is provided for in §72.30(e)(4) in the case of Federal, State, or local government licensees. Under the provisions of the Tennessee Valley Authority Act of 1933, as amended, 16 U.S.C. §§ 831-831ee (2012), TVA is a corporate agency and instrumentality of the United States Government.

As shown in Table 2, the cost to decommission the ISFSI at Watts Bar Nuclear Plant is estimated to be \$12,709,000. A statement of intent for this amount is provided in Attachment A. Additionally, as required by §72.30(b)(6), a certification of financial assurance is provided in Attachment B.

TVA will adjust the cost estimate every three years to account for changes in the costs and the extent of contamination. Following changes to the cost estimate, funding levels will be evaluated to determine if additional funding or use of a different funding mechanism is warranted.

**Table 1  
Significant Quantities and Physical Dimensions**

ISFSI Pad			
Item	Length (ft)	Width (ft)	Residual Radioactivity
ISFSI Pad (assumed size at shutdown)	295	181	No

ISFSI Storage Overpack			
Item	HOLTEC FW	Notes	
Overall Height (inches)	209.0	Dimensions are nominal	
Outside Diameter (inches)	139.0	Dimensions are nominal	
Inside Diameter (inches)	77.0	Dimensions are nominal	
Inner Liner Thickness (inches)	1.0	Dimensions are nominal	
Quantity (total)	136		
Quantity (Holtec FW) (total)	146	146 spent fuel + 10 GTCC	
Quantity (with residual radioactivity)	11	Equivalent to the number of overpacks used to store last complete core offload	
<b>Packaged Waste Quantities</b>			
Inner Activated Liner Removal (cubic feet)	2,331		
Outer Activated Liner Removal (cubic feet)	3,804		
Activated Concrete and cask lid (cubic feet)	18,354		
Activated overpack miscellaneous steel (cubic feet)	210		
Filters and DAW Waste (cubic feet)	98		
<b>Total Low-Level Radioactive Waste (cubic feet)</b>	<b>24,797</b>		
Low-Level Radioactive Waste (packaged density)	132	Average weight density	

Other Potentially Impacted Items		
Item	Quantity	Notes
Transfer Cask	2	No residual radioactivity
Cask Crawler	1	No residual radioactivity
Crawler Building	1	No residual radioactivity
Approach Slab & Fabrication Pad	1	No residual radioactivity



**Table 2**  
**ISFSI Decommissioning Costs and Waste Volumes**

	Costs (thousands, 2018 dollars)						Waste Volume (ft3)	Person-Hours	
	Removal	Packaging	Transport	Disposal	Other	Total		Craft	Oversight and Contractor Manhours
<b>Decommissioning Contractor</b>									
Planning (Characterization, specs and procedures)	-	-	-	-	432	432	-	-	1,240
Decontamination (activated disposition)	264	240	1,585	4,025	170	6,285	24,797	2,751	-
License Termination (radiological surveys)	-	-	-	-	2,024	2,024	-	16,241	-
<b>Subtotal</b>	<b>264</b>	<b>240</b>	<b>1,585</b>	<b>4,025</b>	<b>2,625</b>	<b>8,740</b>	<b>24,797</b>	<b>18,992</b>	<b>1,240</b>
<b>Supporting Costs</b>									
NRC and NRC Contractor Fees and Costs					495	495	-	-	1,153
Insurance					153	153	-	-	-
Property taxes					-	-	-	-	-
Plant utilities budget					145	145	-	-	-
Corporate A&G					39	39	-	-	-
Security Staff Cost					244	244	-	-	6,032
Oversight Staff Cost					350	350	-	-	4,576
<b>Subtotal</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1,427</b>	<b>1,427</b>	<b>-</b>	<b>-</b>	<b>11,761</b>
<b>Total (w/o contingency)</b>	<b>264</b>	<b>240</b>	<b>1,585</b>	<b>4,025</b>	<b>4,052</b>	<b>10,167</b>	<b>24,797</b>	<b>18,992</b>	<b>13,001</b>
<b>Total (w/25% contingency)</b>						<b>12,709</b>			

**ATTACHMENT A**

Tennessee Valley Authority  
400 West Summit Hill Drive  
Knoxville, TN 37902  
(865) 632-2101

Watts Bar Nuclear Plant, Units 1 and 2  
Facility Operating License Nos. NPF-90 and NPF-96  
NRC Docket Nos. 50-390, 50-391 and 72-1048

**STATEMENT OF INTENT**

The Tennessee Valley Authority (TVA) is a corporate agency and instrumentality of the United States Government created pursuant to the Tennessee Valley Authority Act of 1933, as amended, 16 U.S.C. §§ 831-831ee (2012). Pursuant to 10 CFR § 72.30(e)(4), TVA states that it will obtain the funds for decommissioning the Watts Bar Nuclear Plant ISFSI, estimated to be \$12,709,000 as described in the Decommissioning Plan, when necessary. These funds will be obtained and made available sufficiently in advance of decommissioning to prevent the delay of required activities.

A copy of the Delegation of Authority from the Chief Executive Officer to the Chief Nuclear Officer is provided in Exhibit A as evidence that I am authorized to represent TVA in this transaction. The TVA Board Practice Amendments referenced in the Delegation of Authority are included as an attachment to Exhibit A.

Timothy S. Rausch  
Chief Nuclear Officer  
Tennessee Valley Authority  
December 12, 2018

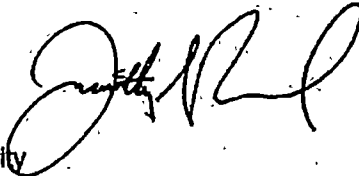


Exhibit A: Memo Delegating Authority from the Chief Executive Officer to the Chief Nuclear Officer

**ATTACHMENT B**

Tennessee Valley Authority  
400 West Summit Hill Drive  
Knoxville, TN 37902  
(865) 632-2101

Watts Bar Nuclear Plant, Units 1 and 2  
Facility Operating License Nos. NPF-90 and NPF-96  
NRC Docket Nos. 50-390, 50-391 and 72-1048

**CERTIFICATION OF FINANCIAL ASSURANCE**

In accordance with 10 CFR 72.30(b)(6), I certify that financial assurance in the amount of \$12,709,000 will be made available when necessary to decommission the Watts Bar Nuclear Plant Independent Spent Fuel Storage Installation using the financial assurance method set forth in 10 CFR 72.30(e)(4).

Should additional information be needed regarding this certification of financial assurance by the Tennessee Valley Authority, contact Erin K. Henderson, Director, Nuclear Regulatory Affairs, at (423) 751-7620.

Timothy S. Rausch  
Chief Nuclear Officer  
Tennessee Valley Authority  
December 12, 2018

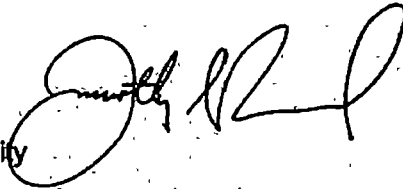


Exhibit A

TENNESSEE VALLEY AUTHORITY

Memo Delegating Authority  
from the Chief Executive Officer  
to the Chief Nuclear Officer

September 27, 2016

William D. Johnson, WT 7B-K

**FUNDING OF ESTIMATED COSTS FOR DECOMMISSIONING TENNESSEE VALLEY  
AUTHORITY INDEPENDENT SPENT FUEL STORAGE INSTALLATIONS AT BROWNS FERRY,  
SEQUOYAH AND WATTS BAR NUCLEAR PLANTS**

Tennessee Valley Authority is required to submit decommissioning funding plans to the Nuclear Regulatory Commission every three years. The purpose of the funding plans is to provide reasonable assurance that funds will be available to decommission the Independent Spent Fuel Storage Installations (ISFSIs) at the Browns Ferry Nuclear Plant, Sequoyah Nuclear Plant, and Watts Bar Nuclear Plant after the plants cease operation. The funding plans will contain a cost estimate for decommissioning each ISFSI, as well as a statement of intent indicating that sufficient funds for decommissioning will be obtained when necessary.

Authority to approve decommissioning projects is within your authority under the Tennessee Valley Authority Board Practice entitled, "Capital Projects Approvals" (originally approved by the Board on January 28, 2007 and amended on November 17, 2011). The Board Practice provides that the Chief Executive Officer has the authority to approve any capital project that does not exceed \$50 million. Additionally, with regard to the authority to contract for the ISFSIs, the TVA Board Practice on Procurement Contract Approvals (originally approved by the Board on November 30, 2006 and amended on November 17, 2011) authorizes the Chief Executive Officer to approve any procurement contract that does not exceed \$100 million if its term does not exceed 5 years, and any contract that does not exceed \$25 million if its term exceeds 5 years. The appropriate TVA Board Practice documents are attached for ease of reference.

Based upon the ISFSI decommissioning cost estimates, approval of the decommissioning activities for each project fall within the Chief Executive Officer's authority under the applicable TVA Board Practices. Accordingly, I request that you delegate to the Chief Nuclear Officer the authority to submit appropriate certification statements and statements of intent for the Browns Ferry Nuclear Plant, Sequoyah Nuclear Plant and Watts Bar Nuclear Plant Independent Spent Fuel Storage Installations in amounts not to exceed \$50 million in total.

Your signature below indicates your approval.



Joseph P. Grimes  
Executive Vice President and  
Chief Nuclear Officer

Approved: William D. Johnson FOR WDJ  
William D. Johnson, President and Chief Executive Officer

9.27.16  
Date

Attachments  
cc: See Page 2

**PROPOSED BOARD RESOLUTION**  
**(TVA Board Practice Amendments)**

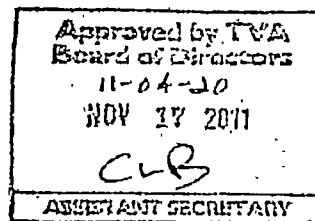
WHEREAS the Board has from time to time adopted certain practices to address various Board and Board Committee processes and activities or to provide guidance in interpreting provisions of the Bylaws of the Tennessee Valley Authority; and

WHEREAS the Board has reviewed the existing practices and desires to make amendments to reflect the functions of the various Board Committees rather than the formal Committee names; and

WHEREAS the Board believes it would be useful and appropriate to adopt a practice allowing the grouping of non-controversial, ministerial items together for Board consideration at a public board meeting when considered appropriate by the Chairman of the Board and the Chief Executive Officer;

BE IT RESOLVED, That the Board hereby amends the TVA Board Practices to make such administrative changes as reflected in the document attached hereto and filed with the records of the Board as Exhibit 11-17-11 R; and

BE IT RESOLVED, FURTHER, That the Board hereby adopts the TVA Board Practice entitled Consent Agenda as reflected in the same Exhibit.



Exh: 4: 11-17-11 R

**Resolution of**  
**The Board of Directors of the Tennessee Valley Authority**  
**(Establishing the Board Practice System)**

WHEREAS the Board, from time to time, may choose to adopt certain practices to govern various Board and Board Committee processes and activities or to interpret provisions of the *Bylaws of The Tennessee Valley Authority* in order to provide guidance to Board Members or the Chief Executive Officer in those cases where an amendment to the *Bylaws* to accomplish such purposes might not be necessary; and

WHEREAS the Board believes that it would be useful and appropriate to establish a system for compiling and maintaining these various practices that the Board may approve in the future;

BE IT RESOLVED, That the Board hereby establishes a *TVA Board Practices* system, into which all future actions by the Board in adopting such practices or providing such interpretative guidance regarding the *Bylaws of The Tennessee Valley Authority* shall be compiled, indexed, and maintained by the Corporate Secretary in a manner that shall assure convenient access for Board Members and for the Chief Executive Officer and TVA management.

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Approved by the Board of Directors of the Tennessee Valley Authority  
November 30, 2006

## ***TVA Board Practice***

### **Capital Projects Approvals**

#### **Background**

Section 3.2(i) of the *Bylaws of The Tennessee Valley Authority* provides, among other things, that TVA's Chief Executive Officer (CEO) has all authorities and duties "necessary or appropriate to carry out projects and activities approved by the Board of Directors or to maintain continuity and/or reliability of ongoing operations."

The Board acknowledges that a routine part of maintaining continuity and/or reliability of ongoing operations involves undertaking capital projects. By adopting this *TVA Board Practice*, the Board is providing more definitive guidance to the CEO as to what capital projects the Board generally considers to be within the CEO's approval authority under Section 3.2(i) of the *Bylaws*. It is intended by the Board to enable the CEO to assume authority to approve capital projects up to a specified dollar amount.

#### **Guidance**

- The CEO may approve a capital project that has been specified by line-item in a Board-approved budget, provided that capital projects in amounts greater than \$100 million will be presented for review to the committee with oversight responsibility for the budget ~~Operations, Environment, and Safety Committee~~ (in coordination with other Board Committees, as appropriate).
- The CEO may assume the authority to approve any capital project not specified by line-item in a Board-approved budget provided the project amount does not exceed \$50 million.

Notwithstanding the foregoing, the CEO may determine that a capital project should be submitted to the Board for its consideration and approval on the grounds that new, special, or novel considerations are involved.

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Approved by the Board of Directors of the Tennessee Valley Authority  
January 25, 2007



## ***TVA Board Practice***

### **Procurement Contract Approvals**

#### **Background**

Section 3.2(i) of the *Bylaws of The Tennessee Valley Authority* provides, among other things, that TVA's Chief Executive Officer (CEO) has all authorities and duties "necessary or appropriate to carry out projects and activities approved by the Board of Directors or to maintain continuity and/or reliability of ongoing operations."

The Board acknowledges that a routine part of carrying out approved projects and activities and maintaining continuity and/or reliability of ongoing operations involves committing TVA to contracts under which TVA purchases or sells products or services (Procurement Contracts). For the purposes of this *TVA Board Practice*, Procurement Contracts do not include contracts for fuel-related transactions or contracts for the purchase or sale of electric power.

The Board further acknowledges that, in the absence of guidance from the Board, many Procurement Contracts into which TVA enters could reasonably be considered to fall within the scope of the CEO's authorities under Section 3.2(i) of the *Bylaws*, regardless of the dollar amount to which the particular Procurement Contract would commit TVA or the length of its term.

By adopting this *TVA Board Practice*, the Board is providing more definitive guidance to the CEO as to what Procurement Contracts the Board generally considers to be within the CEO's approval authority under Section 3.2(i) of the *Bylaws*. It is intended by the Board to enable the CEO to assume authority to approve a Procurement Contract that commits TVA up to a specified dollar amount or for a term of up to a specified number of years.

#### **Guidance**

The CEO may approve any Procurement Contract which falls within the following parameters, as applicable:

- The contract amount does not exceed \$100 million and its term does not exceed 5 years.
- The contract amount does not exceed \$25 million and its term exceeds 5 years.

Notwithstanding the foregoing, the CEO may determine that a Procurement Contract, as described above, should be submitted to the Board for its consideration and approval on the grounds that new, special, or novel considerations are involved.

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Approved by the Board of Directors of the Tennessee Valley Authority  
November 30, 2006