BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

Application of Union Electric Company d/b/a Ameren Missouri for Acceptance of Its Triennial Filing of Cost Estimates for Callaway Energy Center Decommissioning, Including the Independent Spent Fuel Storage Installation, and Approval of the Funding Level of the Nuclear Decommissioning Trust Fund.	))))))))	File No. EO-2023-0448

APPLICATION FOR ACCEPTANCE OF DECOMMISSIONING COST ESTIMATES FOR CALLAWAY ENERGY CENTER, INCLUDING INDEPENDENT SPENT FUEL STORAGE INSTALLATION, AND APPROVAL OF FUNDING LEVEL FOR NUCLEAR DECOMMISSIONING TRUST FUND

COMES NOW Union Electric Company, d/b/a Ameren Missouri ("Ameren Missouri" or "Company"), and pursuant to 20 CSR 4240-20.070(4),[1] hereby respectfully requests that the Missouri Public Service Commission ("Commission") approve Ameren Missouri's decommissioning cost estimates for the Callaway Energy Center ("Callaway" or "Plant") and for the Callaway Independent Spent Fuel Storage Installation ("ISFSI"), as well as the continuation of the funding level of its nuclear decommissioning trust fund at the current $6,758,605 annual amount, with $6,082,745 allocated to plant decommissioning and $675,860 allocated to ISFSI decommissioning. Ameren Missouri further requests that the Commission find that the $6,758,605 annual funding level of its decommissioning trust fund be included in Ameren Missouri's current cost of service for ratemaking purposes and confirm that this funding level is based on the parameters and assumptions stated in this Application.

In support of its Application, Ameren Missouri states the following:

[1] In File No. EE-2024-0019, the Commission granted to Company's request to file the report on December 1, 2023.

I. INTRODUCTION

1. Ameren Missouri submits this *Application for Acceptance of Decommissioning Cost Estimates for Callaway Energy Center, Including Independent Spent Fuel Storage Installation, and Approval of Funding Level of Nuclear Decommissioning Trust Fund* ("*Application*") in compliance with the general application requirements of 20 CSR 4240-2.060(1) as well as the more specific requirements of 20 CSR 4240-20.070 (4), which provides, in part:

> Every three (3) years, utilities with decommissioning trust funds shall perform and file with the commission cost studies detailing the utilities' latest cost estimates for decommissioning their nuclear generating unit(s) along with the funding levels necessary to defray these decommissioning costs. These studies shall be filed along with appropriate tariff(s) effectuating the change in rates necessary to accomplish the funding required….

2. Accordingly, this *Application* will be divided into the following sections:

I. Introduction

II. 20 CSR 4240-2.060(1), (A) through (M)

III. 20 CSR 4240-20.070(4)

A. 2023 Cost Study

B. Required Annual Funding Level

C. Funding Adequacy Model Assumptions

D. Funding Adequacy Model Results

E. Contributions to the Tax-Qualified Decommissioning Trust

IV. Requested Findings and Orders

The information requested by both rules, as well as the additional findings the Company requests, are discussed in more detail below.

3. In summary, based upon the 2023 cost estimate and Ameren Missouri's analysis, the Company is not requesting any increase or decrease to the total current decommissioning contribution amount. The total proposed annual decommissioning contribution amount remains at $6,758,605. The allocation of this total amount between funding for the plant decommissioning and ISFSI decommissioning will be adjusted, but the total annual decommissioning expense and contribution amount of $6,758,605 remains adequate. Because the total costs remain unchanged, there should be no impact on Ameren Missouri's customers.

II. 20 CSR 4240-2.060(1), (A) through (M)

A. Paragraph (A) – Applicant

4. Company is a Missouri corporation doing business under the fictitious name of Ameren Missouri, organized and existing under the laws of the State of Missouri, in good standing in all respects, with its principal office and place of business located at One Ameren Plaza, 1901 Chouteau Avenue, Saint Louis, Missouri 63103. Company is engaged in providing electric and gas utility services in portions of Missouri as a public utility under the jurisdiction of the Commission. Ameren Missouri is the owner and operator of Callaway, a nuclear generating unit, and the ISFSI, a spent fuel storage installation at the Plant. The decommissioning cost estimates and decommissioning contributions to the nuclear decommissioning trust fund for Callaway and ISFSI are the subject of this application. Company is a subsidiary of Ameren Corporation.

B. Paragraph (B) – Articles of Incorporation; Paragraph (E) – Fictitious Name; Paragraph (G) – Information Previously Submitted; Paragraph (H) – Character of Business[2]

5. Company previously submitted to the Commission a certified copy of its Articles of Incorporation (*See* File No. EA-87-105). Company previously submitted its Fictitious Name

[2] Paragraphs (C), (D), and (F) do not apply to Ameren Missouri.

Registrations as filed with the Missouri Secretary of State's Office in File No. EN-2011-0069. Ameren Missouri submits with this *Application* an updated Certificate of Corporate Good Standing as Attachment 1. These documents are incorporated by reference and made a part of this *Application* for all purposes.

C. Paragraph (I) – Correspondence and Communication

6. Pleadings, notices, orders and other correspondence concerning this Application should be addressed to:

Steven M. Wills
Director, Regulatory Affairs
1901 Chouteau Avenue, MC-1450
P.O. Box 66149, MC-1450
St. Louis, Missouri 63101-6149
(314) 861-5416 (Telephone)
swills@ameren.com

D. Paragraph (K) – Actions, Judgments, and Decisions; Paragraph L - Fees[3]

7. Company has no final unsatisfied judgments or decisions against it from any state or federal agency or court that involve customer service or rates that have occurred within three years of the date of this *Application*. By the nature of its business, Company has, from time to time, pending actions in state and federal agencies and courts involving customer service or customer rates. Company has no annual report or assessment fees overdue to this Commission.

E. Paragraph (M) – Affidavit

8. An Affidavit in support of this application by an individual authorized by Ameren Missouri to execute such a document is included as Attachment 2 with this *Application*.

[3] Paragraph (J) does not apply to Ameren Missouri.

III. 20 CSR 4240-20.070(4)

A. 2023 Cost Study

9. Ameren Missouri contracted with TLG Services, Inc. ("TLG") to perform, under the direction of Ameren Missouri, the site specific cost study to determine the estimated cost for decommissioning the Callaway Energy Center Plant and ISFSI. Since 1982, TLG has provided engineering and field services for contaminated facilities including estimates of decommissioning costs for nuclear generating units. TLG is an industry leader in nuclear power plant decontamination and decommissioning planning, cost estimating, and project field supervision and has prepared and updated decommissioning cost estimates for the vast majority of nuclear generation units in the country. TLG also is the company that prepared the decommissioning cost estimates that were filed with and approved by the Commission in 1993, 1999, 2002, 2005, 2008, 2011, 2015, 2018, and 2020 as well as the ISFSI decommissioning cost estimate in 2015 and 2018.

10. Attachment 3, which is attached hereto and made a part hereof for all purposes, is the updated decommissioning cost estimate prepared by TLG, titled *Decommissioning Cost Analysis for the Callaway Energy Center*, and dated September 2023. This cost estimate is comprehensive in that it covers both the Plant and ISFSI decommissioning; however, the costs are segregated for each. TLG estimated the total cost to decommission Callaway and the ISFSI, employing the DECON alternative, as $1,097,947,000 in 2023 dollars. Of this total, $1,085,651,000 is attributable to Plant decommissioning and $12,296,000 is attributable to ISFSI decommissioning. The estimate is based on an assumed 60-year plant operating life, and reflects the use of off-site, low-level radioactive waste processing to minimize the volume designated for controlled disposal.

B. Required Annual Funding Level

11. Ameren Missouri's analysis of the required annual funding level for the Missouri jurisdictional sub-account is based on the premise that the current annual contribution to the decommissioning trust should be changed only if that annual contribution continued over the licensed life at Callaway does not result in a final trust account balance that is sufficient to cover the estimated decommissioning cost given in Attachment 3 under a reasonable set of economic, financial, and investment assumptions along with reasonable decommissioning rates of inflation.

12. The Company engaged Willis Towers Watson to develop a funding adequacy model that evaluates the current funding under various economic and market assumptions.[4] A summary of this model's findings is included in Attachment 4.

13. Attachment 4, Ameren Missouri's analysis of the required funding level, is attached hereto and made a part hereof for all purposes. Please note that the analysis contained in Attachment 4 requests neither an increase nor a decrease to the aggregate funding amount for the consolidated Plant and ISFSI decommissioning.

C. Funding Adequacy Model Assumptions

14. Willis Towers Watson's analyses considered the current funding amount of $6,758,605 and determined the probability there would be sufficient funds available for decommissioning Callaway and through decommissioning under various market and economic assumptions. These assumptions were varied under 5000 stochastic modeling scenarios.

15. The economic, financial and investment assumptions for the breakeven case used as the basis for the funding adequacy modeling are as follows:

[4] Ameren Missouri tested the reasonableness of this analysis against the analysis provided in past filings. Please refer to the workpapers for the analysis conducted by the Company.

Callaway Modeling Assumptions			
Assets - 6/30/2023	Plant*	ISFSI	TOTAL
Market Value of Assets	$ 1,070,850,000	$ 4,390,000	$ 1,075,240,000
Book Value of Assets	$ 566,141,000	$ 3,621,000	$ 569,762,000
After Tax Liquidation Value	$ 969,908,000	$ 4,236,000	$ 974,144,000
Liabilities -2023$			
Cost of Decommissioning	$ 1,085,651,000	$ 12,296,000	$ 1,097,947,000
* Includes Missouri and FERC			

16. The *Non-Unanimous Stipulation and Agreement* approved by the Commission Order in File No. EO-2012-0070, states:

> The Parties agree that, it is reasonable to use capital market return expectation information provided by Ameren Missouri's pension plan consultant, or the 2% real rate of return set forth in 10 CFR §50.75(e)(1)(ii), for purposes of developing expected portfolio returns for Ameren Missouri's nuclear decommissioning trust fund. The Parties agree that any proposed changes to the annual contribution to Ameren Missouri's nuclear decommissioning trust fund shall be based on capital market return expectation information provided by Ameren Missouri's pension plan consultant, or the aforementioned 2% real rate of return, unless the Parties agree to use a different source and/or methodology for capital market return expectations or the Commission finds in a contested case that different source and/or methodology for capital market return expectation are more appropriate.

17. The nominal return on bonds and equities indicated in the forgoing and utilized in the funding adequacy analysis are provided by Willis Towers Watson as shown in Attachment 4, page 4.

18. 10 CFR 50.75(e)(1)(ii) states, in part, as follows:

> (ii) External sinking fund. An external sinking fund is a fund established and maintained by setting funds aside periodically in an account segregated from licensee assets and outside the administrative control of the licensee and its subsidiaries or affiliates in which the total amount of funds would be sufficient to pay decommissioning costs at the time permanent termination of operations is expected . . . **A licensee that has collected funds based on a site-specific estimate under §50.75(b)(1) of this**

> **section may take credit for projected earnings on the external sinking funds using up to a 2 percent annual real rate of return from the time of future funds' collection through the decommissioning period, provided that the site-specific estimate is based on a period of safe storage that is specifically described in the estimate. This includes the periods of safe storage, final dismantlement, and license termination . . . A licensee may use a credit of greater than 2 percent if the licensee's rate-setting authority has specifically authorized a higher rate.** (Emphasis added.)

19. Consequently, the Company requests that the Commission authorize the return assumptions used in the Company's funding analysis on which the proposed decommissioning expense and contribution amount is based.

20. 10 CFR 50.75(e)(1)(ii) also states, in part, as follows:

> (ii) External sinking fund . . . This method may be used as the exclusive mechanism relied upon for providing financial assurance for decommissioning in the following circumstances:
>
> (A) By a licensee that recovers, either directly or indirectly, the estimated total cost of decommissioning through rates established by "cost of service" or similar ratemaking regulation. Public utility districts, municipalities, rural electric cooperatives, and State and Federal agencies, including associations of any of the foregoing, that establish their own rates and are able to recover their cost of service allocable to decommissioning, are assumed to meet this condition.

21. Consequently, in order for the Callaway decommissioning fund to continue to utilize the external sinking fund method of decommissioning funding, the Company requests that the Commission confirm that the current decommissioning costs for Callaway, including the ISFSI, are in Ameren Missouri's current Missouri retail cost of service and are reflected in its current retail rates for ratemaking purposes.

D. Funding Adequacy Model Results

22. As a basis for recommending that the current annual contribution amount remain unchanged at the current total aggregate annual funding level of $6,758,605, the Company using the analyses from Willis Towers Watson determined the probability under various market and economic assumptions that the current funding level would be sufficient. This conclusion is based on the fact that in nearly 67% of the 5000 modeling scenarios there will be sufficient funds available for decommissioning Callaway under the DECON method starting in 2044. This compares favorably with the peer universe of 31 other nuclear units analyzed by Willis Towers who had a median probability of successfully funding their decommissioning costs of 73%. The annualized pre-tax expense nominal return for the consolidated Plant and ISFSI fund, over the life of the fund, would be 5.2%.

23. The funding adequacy model output prepared by Willis Towers Watson is presented in Attachment 4:

- Page 2 of Attachment 4 provides the annual decommissioning cash flows for the Plant and for the ISFSI combined and illustrates the escalation of these decommissioning expense cash flows at the 4.7% decommissioning inflation rate under the breakeven cost scenario.
- Page 3 of Attachment 4 highlights the projected fund balances for the NDT Trust along with the net expense of decommissioning Callaway starting in 2044. In the breakeven case, the model shows a balance of $77 million in 2053 due to the uncertainty in stochastic modeling outcomes. Outcomes vary due to the dynamic mature of market and economic assumptions.

- Page 4 of Attachment 4 shows the Capital Market assumptions in the Willis Towers Watson Market Scenarios stochastic analysis that are consistent with the current investment guidelines.
- Page 5 of Attachment 4 shows the Asset Based Assumptions for the NDT Trust. It highlights the initial June 30, 2023, valuation of $1,075 billion and how this balance was adjusted over time given a federal tax rate assumption of 20% on realized gains annually. It also notes assets were rebalanced to the target 65% equity/35% fixed income asset allocation when assets exceeded 5% of the target weights. This page also highlights the asset allocation is de-risked within 5 years of decommissioning starting in 2040.
- Page 6 shows the probability of having enough money available at the time of decommissioning and through decommissioning given the current funding level and assumptions. The graphic shows Ameren's Callaway Plant has a 67% probability of success which compares favorably to other nuclear units analyzed by Willis Towers Watson with a median probability of success of 73%.
- Page 7 of Attachment 4 is an illustration of how the stochastic modeling performed by Willis Towers Watson projects future economic environments, projected costs at each future year and repeats these forecasts over 5000 times with varying market assumptions to determine the probability of success. This analysis confirms the annual funding and allocation of assets will provide enough money to decommission Callaway in 67% of the probable outcomes.
- Page 8 of Attachment 4 illustrates how the annualized compound return on assets is affected under the stochastic modeling of various scenarios. The band highlights

the overall rate of return tightens over time since these values are compounded to include all prior years and then annualized. Stochastic modeling produced 5,000 simulations and the chart shows the distribution between the worst-case (5th percentile) and best case (95th percentile) inclusive of all scenarios in-between, including the break-even case.

- Page 9 of Attachment 4 highlights that the current asset allocation of 65% equities/35% fixed income is the best allocation of assets to support the probability of having enough funds available to decommission Callaway in 2044. Allocating more of the assets to fixed income lowers this probability considerably while allocating less to fixed income does not appreciably change the likelihood of having enough funds to decommission the plant.

24. In conclusion, the modeling summaries set forth in Attachment 4 validate Ameren Missouri's request to continue funding the decommissioning trust fund using the same annual amount previously authorized by the Commission, with a 2044 operating license expiration and the economic and financial assumptions specified in the funding adequacy model and summarized in this application.

25. Because Ameren Missouri is not seeking a change to the funding level, there is no need for Ameren Missouri to file new tariffs. Because it is unnecessary for Ameren Missouri to change the funding level of the decommissioning trust, and unnecessary to file new tariffs, Ameren Missouri does not request a hearing, nor does it believe one is required.

E. Making Contributions to the Tax-Qualified Decommissioning Trust

26. In orders entered in early cases regarding the establishment of the decommissioning trust fund (File No. EO-85-17 and File No. ER-85-160), the Commission stated that it: "… requires that [the Company] establish the external fund to take the maximum advantage of the 1984 tax law and follow the requirements of the tax law in making investments for the fund." Consequently, Ameren Missouri is required by Commission order to fund the future decommissioning liability through contributions to the tax-qualified trust fund. In order to make the proposed contributions to the tax-qualified trust fund, Ameren Missouri must comply with section 468A of the Internal Revenue Code. Specifically, in order to make contributions to the tax-qualified trust, a schedule of ruling amounts must be applied for and obtained from the Internal Revenue Service ("IRS"). See 26 CFR 1.468A-3(a)(1) of the Treasury regulations, which reads, in part:

> Except as otherwise provided in paragraph (g) of this section or in § 1.468A–8 (relating to deductions for special transfers into a nuclear decommissioning fund), an electing taxpayer is allowed a deduction under section 468A(a) for the taxable year in which the taxpayer makes a cash payment (or is deemed to make a cash payment) to a nuclear decommissioning fund only if the taxpayer has received a schedule of ruling amounts for the nuclear decommissioning fund that includes a ruling amount for such taxable year. Except as provided in paragraph (a)(4) or (5) of this section, a schedule of ruling amounts for a nuclear decommissioning fund (schedule of ruling amounts) is a ruling (within the meaning of § 601.201(a)(2) of this chapter) specifying the annual payments (ruling amounts) that, over the taxable years remaining in the funding period as of the date the schedule first applies, will result in a projected balance of the nuclear decommissioning fund as of the last day of the funding period equal to (and in no event greater than) the amount of decommissioning costs allocable to the fund.

In order for the IRS to issue a schedule of ruling amounts, the assumptions upon which it is based must be reasonable. See 26 CFR 1.468A-3(a)(3) of the Treasury regulations, which reads, in part:

> The Internal Revenue Service (IRS) shall provide a schedule of ruling amounts that is identical to the schedule of ruling amounts proposed by the taxpayer in connection with the taxpayer's request for a schedule of ruling amounts (see paragraph (e)(2)(viii) of this

> section), but no schedule of ruling amounts shall be provided unless the taxpayer's proposed schedule of ruling amounts is consistent with the principles and provisions of this section and is based on reasonable assumptions.

Further, the Treasury Regulations provide, at 26 CFR 1.468A-3(a)(4), that Ameren Missouri can satisfy this obligation by documenting that the proposed contributions are calculated using the decommissioning assumptions used by the Commission in its most recent order:

> The taxpayer bears the burden of demonstrating that the proposed schedule of ruling amounts is consistent with the principles and provisions of this section and is based on reasonable assumptions. If a public utility commission established or approved the currently applicable rates for the furnishing or sale by the taxpayer of electricity from the plant, the taxpayer can generally satisfy this burden of proof by demonstrating that the schedule of ruling amounts is calculated using the assumptions used by the public utility commission in its most recent order.

27. Finally, 26 CFR 1.468A-3(e)(2)(v) of the Treasury Regulations indicates specific information that a taxpayer such as Ameren Missouri must disclose to the IRS when requesting a schedule of ruling amounts:

> (A) Whether the public utility commission has determined the amount of decommissioning costs to be included in the taxpayer's cost of service for ratemaking purposes;
>
> (B) The amount of decommissioning costs that are to be included in the taxpayer's cost of service for each taxable year under the current determination and amounts that otherwise are required to be included in the taxpayer's income under section 88 and the regulations thereunder;
>
> (C) A description of the assumptions, estimates and other factors used by the public utility commission to determine the amount of decommissioning costs;
>
> (D) A copy of such portions of any order or opinion of the public utility commission as pertain to the public utility commission's most recent determination of the amount of decommissioning costs to be included in cost of service; and
>
> (E) A copy of each engineering or cost study that was relied on or used by the public utility commission in determining the amount of decommissioning costs to be included in the taxpayer's cost of service under the current determination.

IV. REQUESTED FINDINGS AND ORDERS

28. In order for Ameren Missouri to comply with the requirements of the foregoing regulations, Ameren Missouri requests that the Commission:

- Find that the Company's Missouri retail jurisdiction annual decommissioning expense accruals and trust fund payments shall continue at the current level of $6,758,605. However, the breakdown of this total amount is changing to maintain the same funded status between the ratio of assets to total cost. The breakdown for Plant decommissioning is $6,082,745 and for ISFSI is $675,860;
- Find, in order for the Callaway decommissioning fund to continue to utilize the external sinking fund method of decommissioning funding, that the current decommissioning costs for Callaway, including the ISFSI, are in Ameren Missouri's current Missouri retail cost of service and are reflected in its current retail rates for ratemaking purposes;
- Approve, pursuant to 20 CSR 4240-20.070(5)(C), the use of a jurisdictional demand allocator of 100.00%;
- Recognize that Attachment 3, TLG's *Decommissioning Cost Analysis for the Callaway Energy Center*, dated September 2023, meets the requirements of 20 CSR 4240-20.070(4); and
- Acknowledge that this annual decommissioning expense and contribution amount is based on Attachment 3, the September 2023 *Decommissioning Cost Analysis for the Callaway Energy Center*, and on the parameters and assumptions contained in Attachment 4 and summarized as follows:
    - The after-tax value of Missouri jurisdictional sub-account of the Callaway Energy Center – Plant Tax-Qualified Nuclear Decommissioning Trust Fund as of June 30, 2023, was $969,908,000.
    - The after-tax value of Missouri jurisdictional sub-account of the ISFSI Decommissioning Trust Fund as of June 30, 2023, was $4,236,000.
    - The proposed expense and contribution amount and allocation between Plant and ISFSI is to be effective beginning with calendar year 2024.

- The Plant decommissioning cost estimate is $1,085,651,000 and the ISFSI decommissioning cost estimate is $12,296,000, both in terms of 2023 dollars.
- Operating license expiration date of October 18, 2044.
- The Missouri jurisdictional allocator is 100%.
- The federal income tax rate is 20%.
- The state income tax rate is 0%.
- The composite federal & state income tax rate is 20%.
- An asset allocation of 65% equities and 35% bonds will be maintained until such time as the fund will begin to derisk in 2040 by shifting the total projected 5 year forecast to decommission into 50% cash and 50% fixed income investments.
- Investment management and trust fees are estimated at 15 basis points annually.
- An inflation rate of 3.02% is assumed for general (CPI) inflation.
- The pre-tax & expense nominal return on bonds is assumed to be 3.91%.
- The pre-tax & expense nominal return on equities is assumed to be 5.56%.
- The pre-tax & expense nominal weighted-average return is assumed to be 5.2% for the life of the fund.
- Decommissioning cost escalation is assumed to be 4.7%.

WHEREFORE, Ameren Missouri requests that the Commission: (1) approve Attachments 3 and 4, which are Ameren Missouri's estimate of decommissioning costs and the funding level necessary for said costs; (2) specifically find that the annual funding level contributed to the decommissioning trust fund is included in Ameren Missouri's current cost of service for rate-making purposes, and is based on the parameters and assumptions contained in Attachment 4 and summarized above; and (3) make the specific findings outlined above, which are necessary to fully comply with NRC and IRS requirements and regulations.

Respectfully submitted,

/s/ Jennifer S. Moore
Jennifer S. Moore, # 75056
Senior Corporate Counsel
Wendy K. Tatro, #60261
Director and Assistant General Counsel
Ameren Missouri
P.O. Box 66149
St. Louis, MO 63166-6149
(314) 564-7231 (phone)
(314) 554-4014 (fax)
AmerenMOService@ameren.com

CERTIFICATE OF SERVICE

The undersigned hereby certifies that a true and copy of the foregoing was served via e-mail on counsel for all parties of record this 1st day of December, 2023.

/s/ Jennifer S. Moore
Jennifer S. Moore

STATE OF MISSOURI

John R. Ashcroft
Secretary of State

CORPORATION DIVISION
CERTIFICATE OF GOOD STANDING

I, JOHN R. ASHCROFT, Secretary of State of the State of Missouri, do hereby certify that the records in my office and in my care and custody reveal that

UNION ELECTRIC COMPANY
00040441

was created under the laws of this State on the 21st day of November, 1922, and is in good standing, having fully complied with all requirements of this office.

IN TESTIMONY WHEREOF, I hereunto set my hand and cause to be affixed the GREAT SEAL of the State of Missouri. Done at the City of Jefferson, this 13th day of June, 2023.

Secretary of State

Certification Number: CERT-06132023-0068

Attachment 1

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

Application of Union Electric Company d/b/a Ameren Missouri for Acceptance of Its Triennial Filing of Cost Estimates for Callaway Energy Center Decommissioning, Including the Independent Spent Fuel Storage Installation, and Approval of the Funding Level of the Nuclear Decommissioning Trust Fund.	)	File No. EO-2023-0448

AFFIDAVIT OF FADI M. DIYA

STATE OF MISSOURI)
) ss
CITY OF ST. LOUIS)

FADI M. DIYA, being first duly sworn on his oath, states:

1. My name is Fadi M. Diya. I work in the City of Fulton, Missouri, and I am employed by Union Electric Company d/b/a Ameren Missouri as Senior Vice President and Chief Nuclear Officer.

2. I have read the *Application for Acceptance of Decommissioning Cost Estimates for Callaway Energy Center, Including Independent Spent Fuel Storage Installation, and Approval of Funding Level for Nuclear Decommissioning Trust Fund*, and I declare under the penalty of perjury that the information contained therein is true and correct to the best of my knowledge and belief.

/s/ Fadi M. Diya
Fadi M. Diya

This 1st day of December, 2023.

Attachment 2

DECOMMISSIONING COST ANALYSIS

for the

CALLAWAY ENERGY CENTER

prepared for

Ameren Services Company

prepared by

TLG Services, LLC
Bridgewater, Connecticut

September 2023

APPROVALS

Project Manager	Corey J. Munz	9/1/2023 Date
Project Engineer	Jeffrey J. Martin	9/1/2023 Date
Technical Manager	Adam M. Kaczmarek	9/1/2023 Date

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

SECTION **PAGE**

TABLES

TABLE OF CONTENTS
(continued)

SECTION **PAGE**

FIGURES

APPENDICES

REVISION LOG

No.	Date	Item Revised	Reason for Revision
0	09-01-2023		Original Issue

EXECUTIVE SUMMARY

This report presents estimates of the cost to decommission the Callaway Energy Center (Callaway) for the selected decommissioning alternatives and scenarios following the scheduled cessation of plant operations. The estimates are designed to provide Ameren Services with sufficient information to assess its financial obligations, as they pertain to the eventual decommissioning of the nuclear unit.

The analysis relies upon site-specific, technical information from an evaluation prepared in 2020,[1] updated to reflect current assumptions pertaining to the disposition of the nuclear unit and relevant industry experience in undertaking such projects. The costs are based on several key assumptions in areas of regulation, component characterization, high-level radioactive waste management, low-level radioactive waste disposal, performance uncertainties (contingency), and site restoration requirements.

The analysis is not a detailed engineering evaluation, but represents estimates prepared in advance of the detailed engineering required to carry out the decommissioning of the nuclear unit. It may also not reflect the actual plan to decommission Callaway; the plan may differ from the assumptions made in this analysis based on facts that exist at the time of decommissioning.

The 2020 plant inventory, the basis for the decontamination and dismantling requirements and cost, and the decommissioning waste streams, was reviewed for this analysis. There have been no substantive changes made to the plant inventory that would impact the estimated decommissioning costs.

The costs to decommission Callaway for the base scenarios (disposal with low-level radioactive waste processing) are presented at the end of this section. Costs are reported in 2023 dollars and include monies anticipated to be spent for radiological remediation and operating license termination, spent fuel management, and site restoration activities.

A complete discussion of the assumptions relied upon in this analysis is provided in Section 3, along with schedules of annual expenditures for the base scenarios. A sequence of significant project activities is provided in Section 4 with a timeline for each scenario. Detailed cost reports used to generate the summary tables contained

1 "Decommissioning Cost Analysis for the Callaway Energy Center," Document A22-1782-001, Rev. 0, TLG Services, Inc., October 2020

within this document are provided in the appendices along with the costs for the alternative scenario (direct low-level radioactive waste disposal).

Consistent with the 2020 analysis, the current cost estimates assume that the shutdown of the nuclear unit is a scheduled and pre-planned event (e.g., there is no delay in transitioning the plant and workforce from operations or in obtaining regulatory relief from operating requirements, etc.). The estimates include the continued operation of the fuel building as an interim wet fuel storage facility for approximately five and one-half years after operations cease. During this period, it is assumed that the spent fuel residing in the pool will be transferred to a Department of Energy (DOE) federal facility (e.g., a monitored retrievable storage facility). All spent fuel stored on site in the independent spent fuel storage installation (ISFSI) will also be removed by the DOE during this time.

Alternatives and Regulations

The ultimate objective of the decommissioning process is to reduce the inventory of contaminated and activated material so that the license can be terminated. The Nuclear Regulatory Commission (NRC or Commission) provided initial decommissioning requirements in its rule adopted on June 27, 1988.[2] In this rule, the NRC set forth financial criteria for decommissioning licensed nuclear power facilities. The regulations addressed planning needs, timing, funding methods, and environmental review requirements for decommissioning. The rule also defined three decommissioning alternatives as being acceptable to the NRC: DECON, SAFSTOR, and ENTOMB.

> DECON is defined as "the alternative in which the equipment, structures, and portions of a facility and site containing radioactive contaminants are removed or decontaminated to a level that permits the property to be released for unrestricted use shortly after cessation of operations."[3]
>
> SAFSTOR is defined as "the alternative in which the nuclear facility is placed and maintained in a condition that allows the nuclear facility to be safely stored and subsequently decontaminated (deferred decontamination) to levels that permit release for unrestricted use."[4] Decommissioning is to be completed within 60 years, although longer

2 U.S. Code of Federal Regulations, Title 10, Parts 30, 40, 50, 51, 70 and 72 "General Requirements for Decommissioning Nuclear Facilities," Nuclear Regulatory Commission, Federal Register Volume 53, Number 123 (p 24018 et seq.), June 27, 1988

3 Ibid. Page FR24022, Column 3

4 Ibid.

periods will be considered when necessary to protect public health and safety.

ENTOMB is defined as "the alternative in which radioactive contaminants are encased in a structurally long-lived material, such as concrete; the entombed structure is appropriately maintained and continued surveillance is carried out until the radioactive material decays to a level permitting unrestricted release of the property."[5] As with the SAFSTOR alternative, decommissioning is currently required to be completed within 60 years, although longer time periods will also be considered when necessary to protect public health and safety.

The 60-year restriction has limited the practicality for the ENTOMB alternative at commercial reactors that generate significant amounts of long-lived radioactive material. In 1997, the Commission directed its staff to re-evaluate this alternative and identify the technical requirements and regulatory actions that would be necessary for entombment to become a viable option. The resulting evaluation provided several recommendations; however, rulemaking has been deferred pending the completion of additional research studies, for example, on engineered barriers. In a draft regulatory basis document published in March 2017 in support of rulemaking that would amend NRC regulations concerning nuclear plant decommissioning, the NRC staff proposes removing any discussion of the ENTOMB option from existing guidance documents since the method is not deemed practically feasible.

In 1996, the NRC published revisions to the general requirements for decommissioning nuclear power plants to clarify ambiguities and codify procedures and terminology as a means of enhancing efficiency and uniformity in the decommissioning process.[6] The amendments allow for greater public participation and better define the transition process from operations to decommissioning. Regulatory Guide 1.184, issued in July 2000, (as revised in October 2013), further described the methods and procedures that are acceptable to the NRC staff for implementing the requirements of the 1996 revised rule that relate to the initial activities and the major phases of the decommissioning process. The costs and schedules presented in this analysis follow the general guidance and sequence in the amended regulations. The format and content of

---

5 Ibid. Page FR24023, Column 2

6 U.S. Code of Federal Regulations, Title 10, Parts 2, 50, and 51, "Decommissioning of Nuclear Power Reactors," Nuclear Regulatory Commission, Federal Register Volume 61, (p 39278 et seq.), July 29, 1996

the estimates is also consistent with the recommendations of Regulatory Guide 1.202, issued in February 2005.[7]

In 2011, the NRC issued regulations to improve decommissioning planning and thereby reduce the likelihood that any current operating facility will become a legacy site.[8] The regulations require licensees to report additional details in their decommissioning cost estimate, including a decommissioning estimate for any on-site ISFSI. Since an ISFSI is required to support continued operation at Callaway, a representative decommissioning cost is included within the DECON and SAFSTOR estimates, and reported separately in Appendix G.

Decommissioning Scenarios

Two decommissioning alternatives were evaluated for the Callaway Energy Center. The scenarios selected are representative of alternatives currently available to the owner and are defined as follows:

1. The first scenario assumes that the nuclear unit is promptly decommissioned (DECON alternative) upon the expiration of the current operating license in 2044. Following the permanent cessation of operations, and over the first five and one-half years, the spent fuel is transferred directly from the wet storage pool to the DOE (the fuel stored on the ISFSI is also removed from the site during this time period). Concurrently, the majority of the plant components, including the nuclear steam supply system components, are removed. Once the spent fuel stored in the fuel pool has been transferred off-site, the remaining portions of the power block are decommissioned and the surrounding site is remediated. Following the termination of the operating license, non-essential structures (not designated for reuse) are dismantled.

2. In the second scenario, the nuclear unit is placed into safe-storage (SAFSTOR alternative) upon the expiration of the current operating license in 2044. As with the first scenario, the spent fuel is removed from the site (transferred to the DOE) during the first five and one-half years following the permanent cessation of operations. The facility is then placed into safe-storage (with non-essential systems de-energized and

---

7 "Standard Format and Content of Decommissioning Cost Estimates for Nuclear Power Reactors," Regulatory Guide 1.202, Nuclear Regulatory Commission, February 2005

8 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, (p 35512 et seq.), June 17, 2011

buildings secured). The start of decontamination and dismantling activities is deferred to the maximum extent (approximately 50 years from the cessation of operations) such that the license is terminated within the required 60-year period post cessation of operations.

In addition to the two decommissioning alternatives, two low-level radioactive waste disposal options were assessed for each decommissioning alternative: one assuming the use of radioactive waste processing; the other assuming all radioactive waste is directly disposed of by burial. Off-site processing of a portion of the radioactive waste stream is presented as the base option. This option considers the off-site processing of the plant equipment and commodities with low levels of radiological contamination and/or material suspected to be contaminated for volume reduction, decontamination, or segmentation and removal of clean portions prior to disposal as radioactive waste.

The direct disposal option assumes that all contaminated and suspect material is packaged at the site for disposal at a regulated disposal facility. The scenarios are summarized as follows.

Alternative	Low-Level Radioactive Waste Options	Cost Summaries and/or Detailed Estimates
DECON	Recycling	Sections 3, 6, Appendix C
	Direct Disposal	Appendix E
SAFSTOR	Recycling	Sections 3, 6, Appendix D
	Direct Disposal	Appendix F

Methodology

The methodology used to develop the estimates described within this document follows the basic approach originally presented in the cost estimating guidelines[9] developed by the Atomic Industrial Forum (now Nuclear Energy Institute). This reference describes a unit factor method for determining decommissioning activity costs. The unit factors used in this analysis incorporate site-specific costs and the latest available information on worker productivity in decommissioning.

An activity duration critical path is used to determine the total decommissioning program schedule. The schedule is relied upon in calculating the carrying costs, which include program management, administration, field engineering, equipment rental, and support services, such as quality control and security.

9 T.S. LaGuardia et al., "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates," AIF/NESP-036, May 1986

The estimates also reflect lessons learned from TLG's involvement in the Shippingport Station Decommissioning Project, completed in 1989, as well as the decommissioning of the Cintichem reactor, hot cells and associated facilities, completed in 1997. In addition, the planning and engineering for the Rancho Seco, Trojan, Yankee Rowe, Big Rock Point, Maine Yankee, Humboldt Bay-3, Oyster Creek, Connecticut Yankee, Crystal River, Vermont Yankee, Fort Calhoun, Pilgrim, and Indian Point nuclear units have provided additional insight into the process, the regulatory aspects, and the technical challenges of decommissioning commercial nuclear units.

Contingency

Consistent with cost estimating practice, contingencies are applied to the decontamination and dismantling costs developed as "specific provision for unforeseeable elements of cost within the defined project scope, particularly important where previous experience relating estimates and actual costs has shown that unforeseeable events which will increase costs are likely to occur."[10] The cost elements in the estimates are based on ideal conditions; therefore, the types of unforeseeable events that are almost certain to occur in decommissioning, based on industry experience, are addressed through a percentage contingency applied on a line-item basis. This contingency factor is a nearly universal element in all large-scale construction and demolition projects. It should be noted that contingency, as used in this analysis, does not account for price escalation and inflation in the cost of decommissioning over the remaining operating life of the station.

Contingency funds are expected to be fully expended throughout the program. As such, inclusion of contingency is necessary to provide assurance that sufficient funding will be available to accomplish the intended tasks.

Low-Level Radioactive Waste Disposal

The contaminated and activated material generated in the decontamination and dismantling of a commercial nuclear reactor is classified as low-level (radioactive) waste, although not all of the material is suitable for "shallow-land" disposal. With the passage of the "Low-Level Radioactive Waste Policy Act" in 1980,[11] and its Amendments of 1985,[12] the states became ultimately responsible for the disposition of low-level radioactive waste generated within their own borders.

---

10 Project and Cost Engineers' Handbook, Second Edition, American Association of Cost Engineers, Marcel Dekker, Inc., New York, New York, p. 239

11 "Low-Level Radioactive Waste Policy Act of 1980," Public Law 96-573, 1980

12 "Low-Level Radioactive Waste Policy Amendments Act of 1985," Public Law 99-240, 1986

With the exception of Texas, no new compact facilities have been successfully sited, licensed, and constructed. The Texas Compact disposal facility is assumed operational and waste is being accepted from generators within the Compact by the operator, Waste Control Specialists (WCS). The facility, located in Andrews, Texas, is also assumed able to accept limited volumes of non-Compact waste.

Disposition of the various waste streams produced by the decommissioning process considered all options and services currently available to Ameren Services. The majority of the low-level radioactive waste designated for controlled disposal (Class A[13]) can be sent to Energy*Solutions*' facility in Clive, Utah. Therefore, disposal costs for Class A waste were based upon Ameren Services' agreement with Energy*Solutions*. This facility is not licensed to receive the higher activity portion (Classes B and C) of the decommissioning waste stream.

The WCS facility is able to receive the Class B and C waste. As such, for this analysis, Class B and C waste was assumed to be shipped to the WCS facility for disposal. Disposal costs were based upon Ameren Services' current agreement with WCS.

The dismantling of the components residing closest to the reactor core generates radioactive waste that may be considered unsuitable for shallow-land disposal (i.e., low-level radioactive waste with concentrations of radionuclides that exceed the limits established by the NRC for Class C radioactive waste, Greater than Class C waste (GTCC)). The Low-Level Radioactive Waste Policy Amendments Act of 1985 assigned the federal government the responsibility for the disposal of this material. The Act also stated that the beneficiaries of the activities resulting in the generation of such radioactive waste bear all reasonable costs of disposing of such waste.

The DOE issued its Final Environmental Impact Statement for the disposal of GTCC on January 2016. [14]The study evaluated the potential environmental impacts associated with constructing and operating a new facility or using an existing facility, disposal methods, and locations. DOE is awaiting Congressional action on the report and its recommendations. At this time, the federal government has not identified a specific cost for disposing of GTCC or a schedule for acceptance.

For purposes of this analysis only, the GTCC radioactive waste is assumed to be packaged and disposed of in a similar manner as high-level waste and at a cost equivalent to that envisioned for the spent fuel. The GTCC is packaged in canisters compatible with the spent fuel dry storage system and either stored on site or shipped directly to a federal facility as it is generated (depending upon the timing of the decommissioning and whether the spent fuel has been removed from the site prior to

13 Waste is classified in accordance with U.S. Code of Federal Regulations, Title 10, Part 61.55

14 "Final Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste (DOE/EIS-0375)," January 2016

the start of decommissioning).

A significant portion of the waste material generated during decommissioning may only be potentially contaminated by radioactive materials. This material can be analyzed on site or shipped off site to licensed facilities for further analysis, for processing and/or for conditioning/recovery. Reduction in the volume of low-level radioactive waste requiring direct disposal in a licensed low-level radioactive waste disposal facility can be accomplished through a variety of methods, including analyses and surveys or decontamination to eliminate the portion of waste that does not require disposal as radioactive waste, compaction, incineration or metal melt. The estimates for the base case scenarios reflect the savings from waste recovery/volume reduction.

High-Level Radioactive Waste Management

Congress passed the "Nuclear Waste Policy Act"[15] (NWPA) in 1982, assigning the federal government's long-standing responsibility for disposal of the spent nuclear fuel created by the commercial nuclear generating plants to the DOE. The DOE was to begin accepting spent fuel by January 31, 1998; however, to date no progress in the removal of spent fuel from commercial generating sites has been made.

Today, the country is at an impasse on high-level waste disposal, despite DOE's submittal of its License Application for a geologic repository to the NRC in 2008. The Obama administration eliminated the budget for the repository program while promising to "conduct a comprehensive review of policies for managing the back end of the nuclear fuel cycle … and make recommendations for a new plan."[16] Towards this goal, the Obama administration appointed a Blue Ribbon Commission on America's Nuclear Future (Blue Ribbon Commission) to make recommendations for a new plan for nuclear waste disposal. The Blue Ribbon Commission's charter included a requirement that it consider "[o]ptions for safe storage of used nuclear fuel while final disposition pathways are selected and deployed."[17]

On January 26, 2012, the Blue Ribbon Commission issued its "Report to the Secretary of Energy" containing a number of recommendations on nuclear waste disposal. Two of the recommendations that may impact decommissioning planning are:

---

15 "Nuclear Waste Policy Act of 1982 and Amendments," DOE's Office of Civilian Radioactive Management, 1982

16 "Advisory Committee Charter, Blue Ribbon Commission on America's Nuclear Future," Appendix A, January 2012

17 Ibid.

- "[T]he United States [should] establish a program that leads to the timely development of one or more consolidated storage facilities"[18]
- "[T]he United States should undertake an integrated nuclear waste management program that leads to the timely development of one or more permanent deep geological facilities for the safe disposal of spent fuel and high-level nuclear waste."[19]

In January 2013, the DOE issued the "Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste," in response to the recommendations made by the Blue Ribbon Commission and as "a framework for moving toward a sustainable program to deploy an integrated system capable of transporting, storing, and disposing of used nuclear fuel..."[20] This document states:

"With the appropriate authorizations from Congress, the Administration currently plans to implement a program over the next 10 years that:

- Sites, designs and licenses, constructs and begins operations of a pilot interim storage facility by 2021 with an initial focus on accepting used nuclear fuel from shut-down reactor sites;
- Advances toward the siting and licensing of a larger interim storage facility to be available by 2025 that will have sufficient capacity to provide flexibility in the waste management system and allows for acceptance of enough used nuclear fuel to reduce expected government liabilities; and
- Makes demonstrable progress on the siting and characterization of repository sites to facilitate the availability of a geologic repository by 2048."[21]

The NRC's review of DOE's license application to construct a geologic repository at Yucca Mountain was suspended in 2011 when the Obama administration significantly reduced the budget for completing that work. However, the US Court of Appeals for the District of Columbia Circuit issued a writ of mandamus (in August 2013)[22] ordering NRC to comply with federal law and resume its review of DOE's Yucca Mountain repository license application, to the extent allowed by previously

---

18 "Blue Ribbon Commission on America's Nuclear Future, Report to the Secretary of Energy," http://www.brc.gov/sites/default/files/documents/brc_finalreport_jan2012.pdf, p. 32, January 2012 32, January 2012

19 Ibid., p.27

20 "Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste," U.S. DOE, January 11, 2013

21 Ibid., p.2

22 U.S. Court of Appeals for the District Of Columbia Circuit, In Re: Aiken County, et al, Aug. 2013

appropriated funding for the review. That review was completed with the publication of the five-volume safety evaluation report. A supplement to DOE's environmental impact statement and adjudicatory hearing on the contentions filed by interested parties must be completed before a licensing decision can be made. Although the DOE proposed it would start fuel acceptance in 2025, no progress has been made in the repository program since DOE's 2013 strategy was issued except for the completion of the Yucca Mountain safety evaluation report.

Holtec International submitted a license application to the NRC on March 30, 2017 for a consolidated interim spent fuel storage facility in southeast New Mexico called HI-STORE CISF (Consolidated Interim Storage Facility) under the provisions of 10 CFR Part 72. In May 2023, the NRC issued a license to Holtec to construct and operate a facility to receive, possess, store, and transfer spent nuclear fuel at the HI–STORE CISF.

Waste Control Specialists submitted an application to the NRC on April 28, 2016, to construct and operate a Consolidated Interim Storage Facility (CISF) at its West Texas facility. On April 18, 2017, WCS requested that the NRC temporarily suspend all safety and environmental review activities, as well as public participation activities associated with WCS's license application. In March 2018, WCS and Orano USA, announced their intent to form a joint venture to license the facility. The joint venture, named Interim Storage Partners (ISP), requested that the NRC resume its review of the original CISF license application. Subsequently, in September, 2021, NRC issued a license to ISP for its WCS CISF to construct and operate the facility for spent nuclear fuel and GTCC storage. However, the facility is not yet operational.

Completion of the decommissioning process is dependent upon the DOE's ability to remove spent fuel from the site in a timely manner. In June 2011, Ameren Services and the DOE reached an agreement on a settlement. The terms include payment to Ameren Services for spent fuel storage and related costs through 2010, and thereafter, annual payment of such costs after they are incurred.

It is generally necessary that spent fuel be cooled and stored for a minimum period at the generating site prior to transfer. As such, the NRC requires that licensees establish a program to manage and provide funding for the management of all irradiated fuel at the reactor site until title of the fuel is transferred to the DOE, pursuant to 10 CFR Part 50.54(bb).[23] The post-shutdown costs incurred to satisfy this requirement include the isolation and continued operation of the spent fuel pool and the ISFSI during the five and one-half years following the cessation of plant operations.

---

23 U.S. Code of Federal Regulations, Title 10, Part 50, "Domestic Licensing of Production and Utilization Facilities," Subpart 54 (bb), "Conditions of Licenses"

At shutdown, the spent fuel pool is expected to contain freshly discharged assemblies (from the most recent refueling cycles) as well as the final reactor core. Over the following five and one-half years all the assemblies are packaged into canisters for transfer to the DOE. It is assumed that this period provides the necessary cooling for the final core to meet the transportation system requirements for decay heat.

Costs are included within the decommissioning estimates for offloading the pool. These costs include the loading of DOE-provided Transport/Aging/Disposal Canister (TADs) and the associated campaign costs to load the canisters into the DOE-provided transport vehicle.

Removal of the fuel from the ISFSI is expected to be fully reimbursable and therefore not addressed in this study. However, the eventual decommissioning of the ISFSI is included.

The estimates described in this analysis were developed with the assumption that the DOE would give priority to removing spent fuel from shutdown sites. The estimates further assume that the spent fuel would be removed from the Callaway site within five and one-half years of the cessation of plant operations (i.e., five and one-half years would provide sufficient cooling time for the spent fuel to meet DOE transportation requirements).

Site Restoration

The efficient removal of the contaminated materials at the site may result in damage to many of the site structures. Blasting, coring, drilling, and the other decontamination activities can substantially damage power block structures, potentially weakening the footings and structural supports. It is unreasonable to anticipate that these structures would be repaired and preserved after the radiological contamination is removed. The cost to dismantle site structures with a work force already mobilized is more efficient and less costly than if the process is deferred.

Consequently, this study assumes that non-essential site structures addressed by this analysis are removed, once remediation is complete, to a nominal depth of three feet below the local grade level, wherever possible. The site is then graded and stabilized.

Summary

The estimates to decommission Callaway assume the removal of all contaminated and activated plant components and structural materials such that the owner may then have unrestricted use of the site with no further requirements for an operating license.

Low-level radioactive waste, other than GTCC waste, is sent to a commercial processor for treatment/conditioning or directly to a controlled disposal facility.

Decommissioning is accomplished within the 60-year period following permanent cessation of operations required by current NRC regulations. Regardless of the timing of the decommissioning activities, the estimates assume the eventual removal of all the contaminated and activated plant components and structural materials, such that the facility operator may then have unrestricted use of the site with no further requirement for an operating license.

The decommissioning scenarios are described in Section 2. The assumptions are presented in Section 3, along with schedules of annual expenditures for the base case scenario. The major cost contributors are identified in Section 6, with detailed activity costs, waste volumes, and associated workforce requirements delineated in the appendices to this report. The major cost components are also identified in the cost summary provided at the end of this section.

The cost elements in the estimates for the DECON and SAFSTOR alternatives are assigned to one of three subcategories: NRC License Termination (radiological remediation), Spent Fuel Management, and Site Restoration. The subcategory "NRC License Termination" is used to accumulate costs that are consistent with "decommissioning" as defined by the NRC in its financial assurance regulations (i.e., 10 CFR Part 50.75). The cost reported for this subcategory is generally sufficient to terminate the unit's operating license, recognizing that there may be some additional cost impact from spent fuel management. The License Termination cost subcategory also includes costs to decommission the ISFSI (as required by 10 CFR §72.30). Section 3.4.1 provides the basis for the ISFSI decommissioning cost.

The "Spent Fuel Management" subcategory is used to accumulate costs associated with operation of the fuel storage pool and the management of the ISFSI until such time that the transfer is complete. It does not include any spent fuel management expenses incurred prior to the cessation of plant operations, nor does it include any costs related to the final disposal of the spent fuel.

"Site Restoration" is used to capture costs associated with the dismantling and demolition of buildings and facilities demonstrated to be free from contamination. This includes structures never exposed to radioactive materials, as well as those facilities that have been decontaminated to appropriate levels. Structures are removed to a depth of three feet below grade and backfilled to conform to local grade.

It should be noted that the costs assigned to these subcategories are allocations. Delegation of cost elements is for the purposes of comparison (e.g., with NRC financial guidelines) or to permit specific financial treatment (e.g., Asset Retirement Obligation

determinations). In reality, there can be considerable interaction between the activities in the three subcategories. For example, an owner may decide to remove non-contaminated structures early in the project to improve access to highly contaminated facilities or plant components. In these instances, the non-contaminated removal costs could be reassigned from Site Restoration to an NRC License Termination support activity. However, in general, the allocations represent a reasonable accounting of those costs that can be expected to be incurred for the specific subcomponents of the total estimated program cost, if executed as described.

As noted within this document, the estimates were developed and costs are presented in 2023 dollars. As such, the estimates do not reflect the escalation of costs (due to inflationary and market forces) over the remaining operating life of the reactor or during the decommissioning period.

For the purposes of this analysis, the costs presented in the following tables reflect the use of off-site low-level radioactive waste processing to minimize the volume designated for controlled disposal. Costs for the direct disposal of the low-level radioactive waste (without processing) are presented in the appendices (E and F).

DECON COST SUMMARY
DECOMMISSIONING COST ELEMENTS [1]
(thousands of 2023 dollars)

Cost Element	Cost
Decontamination	24,795
Removal	206,170
Packaging	35,292
Transportation	25,123
Waste Disposal	130,929
Off-site Waste Processing [1]	37,057
Program Management [2]	359,753
Security	100,102
Corporate Allocations	9,270
Spent Fuel Pool Isolation	16,480
Spent Fuel Management [3]	78,615
Insurance and Regulatory Fees	18,310
Energy	13,975
Characterization and Licensing Surveys	32,090
Property Taxes	1,112
Miscellaneous Equipment	8,875
Total [4]	1,097,947

Cost Element	Cost
License Termination (excluding ISFSI)	891,881
ISFSI Decommissioning (License Termination)	10,556
Spent Fuel Management [3]	78,615
Site Restoration (excluding ISFSI)	115,155
ISFSI Demolition (Site Restoration)	1,740
Total [4]	1,097,947

[1] Assumes low-level radioactive waste processing for volume reduction
[2] Includes engineering costs
[3] Direct costs only. Excludes program management costs (staffing) but includes costs for spent fuel loading/spent fuel pool O&M and Emergency Planning fees
[4] Columns may not add due to rounding

SAFSTOR COST SUMMARY
DECOMMISSIONING COST ELEMENTS [1]
(thousands of 2023 dollars)

Cost Element	Cost
Decontamination	22,031
Removal	210,552
Packaging	29,078
Transportation	20,724
Waste Disposal	99,601
Off-site Waste Processing [1]	40,909
Program Management [2]	471,962
Security	279,243
Corporate Allocations	14,255
Spent Fuel Pool Isolation	16,480
Spent Fuel Management [3]	78,615
Insurance and Regulatory Fees	58,283
Energy	28,359
Characterization and Licensing Surveys	32,222
Property Taxes	8,114
Miscellaneous Equipment	24,989
Total [4]	1,435,417

Cost Element	Cost
License Termination (excluding ISFSI)	1,212,752
ISFSI Decommissioning (License Termination)	10,556
Spent Fuel Management [5]	96,323
Site Restoration (excluding ISFSI)	114,046
ISFSI Demolition (Site Restoration)	1,740
Total [4]	1,435,417

[1] Assumes low-level radioactive waste processing for volume reduction
[2] Includes engineering costs
[3] Direct costs only. Excludes program management costs (staffing) but includes costs for spent fuel loading/spent fuel pool O&M and Emergency Planning fees
[4] Columns may not add due to rounding
[5] Includes percentage of Period 2a (dormancy) plant operating costs until spent fuel pool is emptied, in addition to the direct costs.

1. INTRODUCTION

This report presents estimates of the costs to decommission the Callaway Energy Center (Callaway) for the selected decommissioning alternatives and scenarios following the scheduled cessation of plant operations. The estimates are designed to provide Ameren Services with sufficient information to assess its financial obligations, as they pertain to the eventual decommissioning of the nuclear unit.

The analysis relies upon site-specific, technical information from an earlier evaluation prepared in 2020,[1]* updated to reflect current assumptions pertaining to the disposition of the nuclear station and relevant industry experience in undertaking such projects. The costs are based on several key assumptions in areas of regulation, component characterization, high-level radioactive waste management, low-level radioactive waste disposal, performance uncertainties (contingency), and site restoration requirements.

The analysis is not a detailed engineering evaluation, but rather estimates prepared in advance of the detailed engineering required to carry out the decommissioning of the nuclear unit. It may also not reflect the actual plan to decommission Callaway; the plan may differ from the assumptions made in this analysis based on facts that exist at the time of decommissioning.

The 2020 plant inventory, the basis for the decontamination and dismantling requirements and cost, and the decommissioning waste streams, were reviewed for this analysis. There were no substantive changes made to the plant inventory (that would impact decommissioning).

1.1 OBJECTIVES OF STUDY

The objectives of this study were to prepare comprehensive estimates of the costs to decommission Callaway, to provide a sequence or schedule for the associated activities, and to develop waste stream projections from the decontamination and dismantling activities.

An operating license was issued for Callaway in 1984 for a 40 year operating period. On December 19, 2011, Ameren Services submitted a request for renewal of the operating license for an additional period of 20 years. On March 6, 2015, the Nuclear Regulatory Commission (NRC) renewed the operating license through October 18, 2044.

* References provided in Section 7 of the document

For the purpose of this analysis, the base estimates reflect plant decommissioning at the expiration of its current operating license (2044) and the use of off-site low-level radioactive waste processing to minimize the volume designated for controlled disposal.

1.2 SITE DESCRIPTION

The nuclear unit is located in Callaway County, Missouri, approximately 80 miles west of the St. Louis metropolitan area. The nearest population center is Jefferson City, 25 miles west-southwest of the plant site. The station is a 1,171 MWe (net design electrical rating) pressurized water reactor with supporting facilities.

Westinghouse Electric Company designed the nuclear steam supply system (NSSS). The NSSS consists of a pressurized water reactor with four independent primary coolant loops, each of which contains a reactor coolant pump and a steam generator. An electrically heated pressurizer and connecting piping complete the system. The NSSS is rated at a thermal power level of 3,579 MWt (3,565 MWt reactor core plus 14 MWt for reactor coolant pumps), with a corresponding turbine-generator gross output of 1,284 MWe. The system is housed within a containment structure, a pre-stressed, post-tensioned concrete structure with cylindrical wall, a hemispherical dome, and a flat foundation slab. The wall and dome form a pre-stressed post-tensioned system. The inside surface of the structure is covered with a carbon steel liner, providing a leak tight membrane.

A power conversion system converts heat produced in the reactor to electrical energy. This system converts the thermal energy of the steam into mechanical shaft power and then into electrical energy. The turbine-generator is a tandem compound, six-flow, four element, 1800-rpm unit. The unit consists of one high pressure and three low-pressure turbine elements driving a directly coupled generator. The turbine is operated in a closed feedwater cycle that condenses the steam; the feedwater is returned to the steam generators. Heat rejected in the main condensers is removed by the circulating water system.

The circulating water system supplies cooling water to the main condenser, condensing the steam exhausted from the turbine. Cooling for the condenser circulating water system is supplied by a large natural draft cooling tower. Makeup water for the cooling tower is drawn from the Missouri River.

1.3 REGULATORY GUIDANCE

The Nuclear Regulatory Commission (NRC or Commission) provided initial decommissioning requirements in its rule "General Requirements for Decommissioning Nuclear Facilities," issued in June 1988.[2] This rule set forth financial criteria for decommissioning licensed nuclear power facilities. The regulation addressed decommissioning planning needs, timing, funding methods, and environmental review requirements. The intent of the rule was to ensure that decommissioning would be accomplished in a safe and timely manner and that adequate funds would be available for this purpose. Subsequent to the rule, the NRC issued Regulatory Guide 1.159, "Assuring the Availability of Funds for Decommissioning Nuclear Reactors,"[3] which provided additional guidance to the licensees of nuclear facilities on the financial methods acceptable to the NRC staff for complying with the requirements of the rule. The regulatory guide addressed the funding requirements and provided guidance on the content and form of the financial assurance mechanisms indicated in the rule.

The rule defined three decommissioning alternatives as being acceptable to the NRC: DECON, SAFSTOR, and ENTOMB. The DECON alternative assumes that any contaminated or activated portion of the plant's systems, structures and facilities are removed or decontaminated to levels that permit the site to be released for unrestricted use shortly after the cessation of plant operations. The rule also placed limits on the time allowed to complete the decommissioning process. For SAFSTOR, the process is restricted in overall duration to 60 years, unless it can be shown that a longer duration is necessary to protect public health and safety. The guidelines for ENTOMB are similar, providing the NRC with both sufficient leverage and flexibility to ensure that these deferred options are only used in situations where it is reasonable and consistent with the definition of decommissioning. At the conclusion of a 60-year dormancy period (or longer for ENTOMB if the NRC approves such a case), the site would still require significant remediation to meet the unrestricted release limits for license termination.

The ENTOMB alternative has not been viewed as a viable option for power reactors due to the significant time required to isolate the long-lived radionuclides for decay to permissible levels. However, with rulemaking permitting the controlled release of a site,[4] the NRC has re-evaluated this alternative. The resulting feasibility study, based upon an assessment by Pacific Northwest National Laboratory, concluded that the method did have conditional merit for some, if not most reactors. However, the staff also found that additional rulemaking would be needed before this option could be treated as a generic alternative. The NRC had considered rulemaking to alter the 60-year time for

completing decommissioning and to clarify the use of engineered barriers for reactor entombments.[5]

The NRC's staff has recommended that rulemaking be deferred, based upon several factors, e.g., no licensee has committed to pursuing the entombment option, and the NRC's current priorities, at least until after the additional research studies are complete. The NRC concurred with the staff's recommendation. In a draft regulatory basis document published in March 2017 in support of rulemaking that would amend NRC regulations concerning nuclear plant decommissioning, the NRC staff proposes removing any discussion of the ENTOMB option from existing guidance documents since the method is not deemed practically feasible.

In 1996, the NRC published revisions to the general requirements for decommissioning nuclear power plants.[6] When the decommissioning regulations were adopted in 1988, it was assumed that the majority of licensees would decommission at the end of the facility's operating licensed life. Since that time, several licensees permanently and prematurely ceased operations. Exemptions from certain operating requirements were required once the reactor was defueled to facilitate the decommissioning. Each case was handled individually, without clearly defined generic requirements. The NRC amended the decommissioning regulations in 1996 to clarify ambiguities and codify procedures and terminology as a means of enhancing efficiency and uniformity in the decommissioning process. The amendments allow for greater public participation and better define the transition process from operations to decommissioning.

Under the revised regulations, licensees will submit written certification to the NRC within 30 days after the decision to cease operations. Certification will also be required once the fuel is permanently removed from the reactor vessel. Submittal of these notices will entitle the licensee to a fee reduction and eliminate the obligation to follow certain requirements needed only during operation of the reactor. Within two years of submitting notice of permanent cessation of operations, the licensee is required to submit a Post-Shutdown Decommissioning Activities Report (PSDAR) to the NRC. The PSDAR describes the planned decommissioning activities, the associated sequence and schedule, and an estimate of expected costs. Prior to completing decommissioning, the licensee is required to submit an application to the NRC to terminate the license, which will include a license termination plan (LTP).

In 2011, the NRC issued regulations to improve decommissioning planning and thereby reduce the likelihood that any current operating facility will become a legacy site.[7] The regulations require licensees to report additional details in

their decommissioning cost estimate including a decommissioning estimate for the ISFSI. This estimate is provided in Appendix G.

1.3.1 High-Level Radioactive Waste Management

Congress passed the "Nuclear Waste Policy Act"[8] (NWPA) in 1982, assigning the federal government's long-standing responsibility for disposal of the spent nuclear fuel created by the commercial nuclear generating plants to the U.S. Department of Energy (DOE). The DOE was to begin accepting spent fuel by January 31, 1998; however, to date no progress in the removal of spent fuel from commercial generating sites has been made.

Today, the country is at an impasse on high-level waste disposal, even with the License Application for a geologic repository submitted by the DOE to the NRC in 2008. The Obama administration has cut the budget for the repository program while promising to "conduct a comprehensive review of policies for managing the back end of the nuclear fuel cycle … and make recommendations for a new plan." Towards this goal, the Obama administration appointed a Blue Ribbon Commission on America's Nuclear Future (Blue Ribbon Commission) to make recommendations for a new plan for nuclear waste disposal. The Blue Ribbon Commission's charter includes a requirement that it consider "[o]ptions for safe storage of used nuclear fuel while final disposition pathways are selected and deployed."[9]

On January 26, 2012, the Blue Ribbon Commission issued its "Report to the Secretary of Energy" containing a number of recommendations on nuclear waste disposal. Two of the recommendations that may impact decommissioning planning are:

- "[T]he United States [should] establish a program that leads to the timely development of one or more consolidated storage facilities"
- "[T]he United States should undertake an integrated nuclear waste management program that leads to the timely development of one or more permanent deep geological facilities for the safe disposal of spent fuel and high-level nuclear waste."[10]

In January 2013, the DOE issued the "Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste," in response to the recommendations made by the Blue Ribbon Commission

and as "a framework for moving toward a sustainable program to deploy an integrated system capable of transporting, storing, and disposing of used nuclear fuel..."[11]

"With the appropriate authorizations from Congress, the Administration currently plans to implement a program over the next 10 years that:

- Sites, designs and licenses, constructs and begins operations of a pilot interim storage facility by 2021 with an initial focus on accepting used nuclear fuel from shut-down reactor sites;
- Advances toward the siting and licensing of a larger interim storage facility to be available by 2025 that will have sufficient capacity to provide flexibility in the waste management system and allows for acceptance of enough used nuclear fuel to reduce expected government liabilities; and
- Makes demonstrable progress on the siting and characterization of repository sites to facilitate the availability of a geologic repository by 2048."

The NRC's review of DOE's license application to construct a geologic repository at Yucca Mountain was suspended in 2011 when the Obama administration significantly reduced the budget for completing that work. However, the US Court of Appeals for the District of Columbia Circuit issued a writ of mandamus (in August 2013)[12] ordering NRC to comply with federal law and resume its review of DOE's Yucca Mountain repository license application, to the extent allowed by previously appropriated funding for the review. That review is now complete with the publication of the five-volume safety evaluation report. A supplement to DOE's environmental impact statement and adjudicatory hearing on the contentions filed by interested parties must be completed before a licensing decision can be made. Although the DOE proposed it would start fuel acceptance in 2025, no progress has been made in the repository program since DOE's 2013 strategy was issued except for the completion of the Yucca Mountain safety evaluation report.

Holtec International submitted a license application to the NRC on March 30, 2017 for a consolidated interim spent fuel storage facility in southeast New Mexico called HI-STORE CISF (Consolidated Interim Storage Facility) under the provisions of 10 CFR Part 72. In May 2023, the NRC issued a license to Holtec to construct and operate a facility to receive, possess, store, and transfer spent nuclear fuel at the HI–STORE CISF.

Waste Control Specialists (WCS) submitted an application to the NRC on April 28, 2016, to construct and operate a Consolidated Interim Storage Facility (CISF) at its West Texas facility. On April 18, 2017, WCS requested that the NRC temporarily suspend all safety and environmental review activities, as well as public participation activities associated with WCS's license application. In March 2018, WCS and Orano USA, announced their intent to form a joint venture to license the facility. The joint venture, named Interim Storage Partners (ISP), requested that the NRC resume its review of the original CISF license application. Subsequently, in September, 2021, NRC issued a license to ISP for its WCS CISF to construct and operate the facility for spent nuclear fuel and Greater than Class C waste (GTCC) storage. However, the facility is not yet operational.

Completion of the decommissioning process is dependent upon the DOE's ability to remove spent fuel from the site in a timely manner. In June 2011, Ameren Services and the DOE reached an agreement on a settlement. The terms include payment to Ameren Services for spent fuel storage and related costs through 2010, and thereafter, annual payment of such costs after they are incurred.

It is generally necessary that spent fuel be cooled and stored for a minimum period at the generating site prior to transfer. As such, the NRC requires that licensees establish a program to manage and provide funding for the management of all irradiated fuel at the reactor site until title of the fuel is transferred to the DOE, pursuant to 10 CFR Part 50.54(bb).[13] The post-shutdown costs incurred to satisfy this requirement include the isolation and continued operation of the spent fuel pool and the ISFSI during the five and one-half years following the cessation of plant operations.

At shutdown, the spent fuel pool is expected to contain freshly discharged assemblies (from the most recent refueling cycles) as well as the final reactor core. During the next five and one-half years, the assemblies are packaged into Transportation, Aging, and Disposal canisters (TADs) for transfer to the DOE. It is assumed that this period provides the necessary cooling for the final core to meet the transportation system requirements for decay heat.

Costs are included within the decommissioning estimates for offloading the pool. These costs include the loading of DOE-provided TADs and the associated campaign costs to load the canisters into the DOE-provided transport vehicle.

Removal of the fuel from the ISFSI is expected to be fully reimbursable and therefore not addressed in this study. However, the eventual decommissioning of the ISFSI is included.

The estimates described in this analysis were developed with the assumption that the DOE would give priority to removing spent fuel from shutdown sites. The estimates further assume that the spent fuel would be removed from the Callaway site within five and one-half years of the cessation of plant operations (i.e., five and one-half years would provide sufficient cooling time for the spent fuel to meet DOE transportation requirements).

1.3.2 Low-Level Radioactive Waste Disposal

The contaminated and activated material generated in the decontamination and dismantling of a commercial nuclear reactor is classified as low-level (radioactive) waste, although not all of the material is suitable for "shallow-land" disposal. With the passage of the "Low-Level Radioactive Waste Policy Act" in 1980,[14] and its Amendments of 1985,[15] the states became ultimately responsible for the disposition of low-level radioactive waste generated within their own borders.

With the exception of Texas, no new compact facilities have been successfully sited, licensed, and constructed. The Texas Compact disposal facility is assumed operational and waste is being accepted from generators within the Compact by the operator, Waste Control Specialists (WCS). The facility, located in Andrews, Texas, is also assumed able to accept limited quantities of non-Compact waste.

Disposition of the various waste streams produced by the decommissioning process considered all options and services currently available to Ameren Services. The majority of the low-level radioactive waste designated for controlled disposal (Class A[16]) can be sent to Energy*Solutions*' facility in Clive, Utah. Therefore, disposal costs for Class A waste were based upon Ameren Services' agreement with Energy*Solutions*. This facility is not licensed to receive the higher activity portion (Classes B and C) of the decommissioning waste stream.

The WCS facility is able to receive the Class B and C waste. As such, for this analysis, Class B and C waste was assumed to be shipped to the WCS facility for disposal. Disposal costs were based upon Ameren Services' current agreement with WCS.

The dismantling of the components residing closest to the reactor core generates radioactive waste that may be considered unsuitable for shallow-land disposal (i.e., low-level radioactive waste with concentrations of radionuclides that exceed the limits established by the NRC for Class C radioactive waste (GTCC)). The Low-Level Radioactive Waste Policy Amendments Act of 1985 assigned the federal government the responsibility for the disposal of this material. The Act also stated that the beneficiaries of the activities resulting in the generation of such radioactive waste bear all reasonable costs of disposing of such waste.

The DOE issued its Final Environmental Impact Statement for the disposal of GTCC on January 2016.[17] The study evaluated the potential environmental impacts associated with constructing and operating a new facility or using an existing facility, disposal methods, and locations. DOE is awaiting congressional action on the report and its recommendations. At this time, the federal government has not identified a specific cost for disposing of GTCC or a schedule for acceptance.

For purposes of this analysis only, the GTCC radioactive waste is assumed to be packaged and disposed of in a similar manner as high-level waste and at a cost equivalent to that envisioned for the spent fuel. The GTCC is packaged in the same canisters used for spent fuel and shipped to a DOE facility.

A significant portion of the waste material generated during decommissioning may only be potentially contaminated by radioactive materials. This material can be analyzed on site or shipped off site to licensed facilities for further analysis, for processing and/or for conditioning/recovery. Reduction in the volume of low-level radioactive waste requiring disposal in a licensed low-level radioactive waste disposal facility can be accomplished through a variety of methods, including analyses and surveys or decontamination to eliminate the portion of waste that does not require disposal as radioactive waste, compaction, incineration or metal melt. The estimates for the base case scenarios reflect the savings from waste recovery/volume reduction.

1.3.3 Radiological Criteria for License Termination

In 1997, the NRC published Subpart E, "Radiological Criteria for License Termination,"[18] amending 10 CFR Part 20. This subpart provides radiological criteria for releasing a facility for unrestricted use. The regulation states that the site can be released for unrestricted use if radioactivity levels are such that the average member of a critical group

would not receive a Total Effective Dose Equivalent (TEDE) in excess of 25 millirem per year, and provided that residual radioactivity has been reduced to levels that are As Low As Reasonably Achievable (ALARA). The decommissioning estimates assume that the Callaway site will be remediated to a residual level consistent with the NRC-prescribed level.

It should be noted that the NRC and the Environmental Protection Agency (EPA) differ on the amount of residual radioactivity considered acceptable in site remediation. The EPA has two limits that apply to radioactive materials. An EPA limit of 15 millirem per year is derived from criteria established by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund).[19] An additional and separate limit of 4 millirem per year, as defined in 40 CFR §141.16, is applied to drinking water.[20]

On October 9, 2002, the NRC signed an agreement with the EPA on the radiological decommissioning and decontamination of NRC-licensed sites. The Memorandum of Understanding (MOU)[21] provides that EPA will defer exercise of authority under CERCLA for the majority of facilities decommissioned under NRC authority. The MOU also includes provisions for NRC and EPA consultation for certain sites when, at the time of license termination, (1) groundwater contamination exceeds EPA-permitted levels; (2) NRC contemplates restricted release of the site; and/or (3) residual radioactive soil concentrations exceed levels defined in the MOU.

The MOU does not impose any new requirements on NRC licensees and should reduce the involvement of the EPA with NRC licensees who are decommissioning. Most sites are expected to meet the NRC criteria for unrestricted use, and the NRC believes that only a few sites will have groundwater or soil contamination in excess of the levels specified in the MOU that trigger consultation with the EPA. However, if there are other hazardous materials on the site, the EPA may be involved in the cleanup. As such, the possibility of dual regulation remains for certain licensees. The present study does not include any costs for this occurrence.

2. DECOMMISSIONING ALTERNATIVES

Two decommissioning alternatives, DECON and SAFSTOR, were evaluated for the Callaway Energy Center. Although the alternatives differ with respect to technique, process, cost, and schedule, they attain the same result: the ultimate release of the site for unrestricted use. The scenarios selected are representative of alternatives currently available to the owner and are defined as follows:

1. The first scenario assumes that the nuclear unit is promptly decommissioned (DECON alternative) upon the expiration of the current operating license in 2044. Following the permanent cessation of operations, and over the first five and one-half years, the spent fuel is transferred directly from the wet storage pool to the DOE (the fuel stored on the ISFSI is also removed from the site during this time period). Concurrently, the majority of the plant components, including the nuclear NSSS components, are removed. Once the spent fuel stored in the fuel pool has been transferred off-site, the remaining portions of the power block are decommissioned and the surrounding site remediated. Following the termination of the operating license, all remaining site structures are dismantled.

2. In the second scenario, the nuclear unit is placed into safe storage (SAFSTOR alternative) upon the expiration of the current operating license in 2044. As with the first scenario, the spent fuel is removed from the site (transferred to the DOE) during the first five and one-half years following the permanent cessation of operations. The facility is then placed into safe storage (with non-essential systems de-energized and buildings secured). The start of decontamination and dismantling activities is deferred to the maximum extent (approximately 50 years from the cessation of operations) such that the license is terminated within the required 60-year period following permanent cessation of operations.

The following sections describe the basic activities associated with each alternative. Although detailed procedures for each activity identified are not provided, and the actual sequence of work may vary, the activity descriptions provide a basis not only for estimating but also for the expected scope of work, i.e., engineering and planning at the time of decommissioning.

In addition to the two decommissioning alternatives, two disposal options were assessed: recycling and direct disposal. Recycling is presented as the base option and considers the off-site processing of plant equipment and commodities with low levels of radiological contamination and/or material suspected to be contaminated for

volume reduction prior to disposal. The direct disposal option assumes that all contaminated and suspect material is packaged at the site for disposal at a regulated disposal facility. The scenarios are summarized as follows.

Alternative	Low-Level Radioactive Waste Options	Cost Summaries and/or Detailed Estimates
DECON	Recycling	Sections 3, 6, Appendix C
	Direct Disposal	Appendix E
SAFSTOR	Recycling	Sections 3, 6, Appendix D
	Direct Disposal	Appendix F

The conceptual approach that the NRC has described in its regulations divides decommissioning into three phases. The initial phase commences with the effective date of permanent cessation of operations and involves the transition of both plant and licensee from reactor operations (i.e., power production) to facility de-activation and closure. During the first phase, notification is to be provided to the NRC certifying the permanent cessation of operations and the removal of fuel from the reactor vessel. The licensee is then prohibited from reactor operation.

The second phase encompasses activities during the storage period or during major decommissioning activities, or a combination of the two. The third phase pertains to the activities involved in license termination. The decommissioning estimates developed for Callaway are also divided into phases or periods; however, demarcation of the phases is based upon major milestones within the project or significant changes in the projected expenditures.

2.1 DECON

The DECON alternative, as defined by the NRC, is "the alternative in which the equipment, structures, and portions of a facility and site containing radioactive contaminants are removed or decontaminated to a level that permits the property to be released for unrestricted use shortly after cessation of operations." This study does not address the cost to dispose of the spent fuel residing at the site; such costs are funded through a surcharge on electrical generation. The study also assumes that the costs incurred with the removal of the spent fuel from the ISFSI are fully reimbursable, and are also not included.

2.1.1 Period 1 - Preparations

In anticipation of the cessation of plant operations, detailed preparations are undertaken to provide a smooth transition from plant operations to site decommissioning. Through implementation of a staffing transition

plan, the organization required to manage the intended decommissioning activities is assembled from available plant staff and outside resources. Preparations include the planning for permanent defueling of the reactor, revision of technical specifications applicable to the operating conditions and requirements, a characterization of the facility and major components, and the development of the PSDAR.

Engineering and Planning

The PSDAR, required prior to or within two years of permanent cessation of operations, provides a description of the licensee's planned decommissioning activities, a timetable, and the associated financial requirements of the intended decommissioning program. Upon receipt of the PSDAR, the NRC will make the document available to the public for comment in a local hearing to be held in the vicinity of the reactor site. Ninety days following submittal and NRC receipt of the PSDAR, the licensee may begin to perform major decommissioning activities under a modified 10 CFR §50.59 procedure, i.e., without specific NRC approval. Major activities are defined as any activity that results in permanent removal of major radioactive components, permanently modifies the structure of the containment, or results in dismantling components (for shipment) containing GTCC, as defined by 10 CFR §61. Major components are further defined as comprising the reactor vessel and internals, large bore reactor coolant system piping, and other large components that are radioactive. The NRC includes the following additional criteria for use of the §50.59 process in decommissioning. The proposed activity must not:

- foreclose release of the site for possible unrestricted use,
- significantly increase decommissioning costs,
- cause any significant environmental impact, or
- violate the terms of the licensee's existing license.

Existing operational technical specifications are reviewed and modified to reflect plant conditions and the safety concerns associated with permanent cessation of operations. The environmental impact associated with the planned decommissioning activities is also considered. Typically, a licensee will not be allowed to proceed if the consequences of a particular decommissioning activity are greater than that bounded by previously evaluated environmental assessments or impact statements. In this instance, the licensee would have to submit a license amendment for the specific activity and update the environmental report.

The decommissioning program outlined in the PSDAR will be designed to accomplish the required tasks within the ALARA guidelines (as defined in 10 CFR §20) for protection of personnel from exposure to radiation hazards. It will also address the continued protection of the health and safety of the public and the environment during the dismantling activity. Consequently, with the development of the PSDAR, activity specifications, cost-benefit and safety analyses, work packages and procedures, would be assembled to support the proposed decontamination and dismantling activities.

Site Preparations

Following final plant shutdown, and in preparation for actual decommissioning activities, the following activities are initiated:

- Characterization of the site and surrounding environs. This includes radiation surveys of work areas, major components (including the reactor vessel and its internals), internal piping, and primary shield cores.
- Isolation of the spent fuel storage pool and fuel handling systems, such that decommissioning operations can commence on the balance of the plant. The pool will remain operational for approximately five and one-half years following the cessation of operations before the inventory resident at shutdown can be transferred to the ISFSI.
- Specification of transport and disposal requirements for activated materials and/or hazardous materials, including shielding and waste stabilization.
- Development of procedures for occupational exposure control, control and release of liquid and gaseous effluent, processing of radwaste (including dry-active waste, resins, filter media, metallic and non-metallic components generated in decommissioning), site security and emergency programs, and industrial safety.

2.1.2 Period 2 - Decommissioning Operations

This period includes the physical decommissioning activities associated with the removal and disposal of contaminated and activated components and structures, including the successful termination of the 10 CFR §50 operating license. Significant decommissioning activities in this phase include:

- Construction of temporary facilities and/or modification of existing facilities to support dismantling activities. This may include a centralized processing area to facilitate equipment removal and component preparations for off-site disposal.
- Reconfiguration and modification of site structures and facilities as needed to support decommissioning operations. This may include the upgrading of roads (on- and off-site) to facilitate hauling and transport. Modifications may be required to the containment structure to facilitate access of large/heavy equipment. Modifications may also be required to the refueling area of the reactor building to support the segmentation of the reactor vessel internals and component extraction.
- Design and fabrication of temporary and permanent shielding to support removal and transportation activities, construction of contamination control envelopes, and the procurement of specialty tooling.
- Procurement (lease or purchase) of shipping canisters, cask liners, and industrial packages for the disposition of low-level radioactive waste.
- Decontamination of components and piping systems as required to control (minimize) worker exposure.
- Removal of piping and components no longer essential to support decommissioning operations.
- Removal of control rod drive housings and the head service structure from the reactor vessel head. Segmentation of the vessel closure head.
- Removal and segmentation of the upper internals assemblies. Segmentation will maximize the loading of the shielded transport casks, i.e., by weight and activity. The operations are conducted under water using remotely operated tooling and contamination controls.
- Disassembly and segmentation of the remaining reactor internals, including the core shroud and lower core support assembly. Some material is expected to exceed Class C disposal requirements. As such, the segments will be packaged in modified fuel storage canisters for geologic disposal.
- Segmentation of the reactor vessel. A shielded platform is installed for segmentation as cutting operations are performed in-air using remotely operated equipment within a contamination control envelope. The water level is maintained just below the cut to minimize the working area dose rates. Segments are transferred in-air to containers that are stored under water, for example, in an isolated area of the refueling canal.

- Removal of the activated portions of the concrete biological shield and accessible contaminated concrete surfaces. If dictated by the steam generator and pressurizer removal scenarios, those portions of the associated cubicles necessary for access and component extraction are removed.
- Removal of the steam generators and pressurizer for material recovery and controlled disposal. The steam generators will be moved to an on-site processing center, the steam domes removed and the internal components segregated for recycling. The lower shell and tube bundle will be packaged for direct disposal. These components can serve as their own burial containers provided that all penetrations are properly sealed and the internal contaminants are stabilized, e.g., with grout. Steel shielding will be added, as necessary, to those external areas of the package to meet transportation limits and regulations. The pressurizer is disposed of intact.

At least two years prior to the anticipated date of license termination, an LTP is required. Submitted as a supplement to the Final Safety Analysis Report or its equivalent, the plan must include: a site characterization, description of the remaining dismantling activities, plans for site remediation, procedures for the final radiation survey, designation of the end use of the site, an updated cost estimate to complete the decommissioning, and any associated environmental concerns. The NRC will notice the receipt of the plan, make the plan available for public comment, and schedule a local hearing. LTP approval will be subject to any conditions and limitations as deemed appropriate by the Commission. The licensee may then commence with the final remediation of site facilities and services, including:

- Removal of remaining plant systems and associated components as they become nonessential to the decommissioning program or worker health and safety (e.g., waste collection and treatment systems, electrical power and ventilation systems).
- Removal of the steel liners from refueling canal, disposing of the activated and contaminated sections as radioactive waste. Removal of any activated/ contaminated concrete.
- Surveys of the decontaminated areas of the containment structure.
- Remediation and removal of the contaminated equipment and material from the fuel building and any other contaminated facility. Radiation and contamination controls will be utilized until residual levels indicate that the structures and equipment can be released for

unrestricted access and conventional demolition. This activity may necessitate the dismantling and disposition of most of the systems and components (both clean and contaminated) located within these buildings. This activity facilitates surface decontamination and subsequent verification surveys required prior to obtaining release for demolition.

- Routing of material removed in the decontamination and dismantling to a central processing area. Material certified to be free of contamination is released for unrestricted disposition, e.g., as scrap, recycle, or general disposal. Contaminated material is characterized and segregated for additional off-site processing (disassembly, chemical cleaning, volume reduction, and waste treatment), and/or packaged for controlled disposal at a low-level radioactive waste disposal facility.

Incorporated into the LTP is the Final Survey Plan. This plan identifies the radiological surveys to be performed once the decontamination activities are completed and is developed using the guidance provided in the "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)."[22] This document incorporates the statistical approaches to survey design and data interpretation used by the EPA. It also identifies state-of-the-art, commercially available instrumentation and procedures for conducting radiological surveys. Use of this guidance ensures that the surveys are conducted in a manner that provides a high degree of confidence that applicable NRC criteria are satisfied. Once the survey is complete, the results are provided to the NRC in a format that can be verified. The NRC then reviews and evaluates the information, performs an independent confirmation of radiological site conditions, and makes a determination on the requested change to the operating license (that would release the property for unrestricted use).

The NRC will amend the operating licenses if it determines that site remediation has been performed in accordance with the LTP, and that the terminal radiation survey and associated documentation demonstrate that the property is suitable for release.

2.1.3 Period 3 - Site Restoration

Following completion of decommissioning operations, site restoration activities will begin. Efficient removal of the contaminated materials and verification that residual radionuclide concentrations are below the NRC limits will result in substantial damage to many of the structures. Although performed in a controlled, safe manner, blasting, coring,

drilling, scarification (surface removal), and the other decontamination activities will substantially degrade power block structures including the reactor, auxiliary, fuel, and radwaste buildings. Under certain circumstances, verifying that subsurface radionuclide concentrations meet NRC site release requirements will require removal of grade slabs and lower floors, potentially weakening footings and structural supports. This removal activity will be necessary for those facilities and plant areas where historical records, when available, indicate the potential for radionuclides having been present in the soil, where system failures have been recorded, or where it is required to confirm that subsurface process and drain lines were not breached over the operating life of the station.

It is not currently anticipated that these structures would be repaired and preserved after the radiological contamination is removed. The cost to dismantle site structures, once remediation is complete, with a work force already mobilized on site is more efficient than if the process is deferred.

This cost study presumes that non-essential structures and site facilities are dismantled as a continuation of the decommissioning activity. Foundations and exterior walls are removed to a nominal depth of three feet below grade. The three-foot depth allows for the placement of gravel for drainage, as well as topsoil, so that vegetation can be established for erosion control. Site areas affected by the dismantling activities are restored and the plant area graded as required to prevent ponding and inhibit the refloating of subsurface materials.

Non-contaminated concrete rubble produced by demolition activities is processed to remove reinforcing steel and miscellaneous embedments. The processed material is then used on site to backfill foundation voids. Excess non-contaminated materials are trucked to an off-site area for disposal as construction debris.

2.2 SAFSTOR

The NRC defines SAFSTOR as "the alternative in which the nuclear facility is placed and maintained in a condition that allows the nuclear facility to be safely stored and subsequently decontaminated (deferred decontamination) to levels that permit release for unrestricted use." The facility is left intact (during the dormancy period), with structures maintained in a sound condition. Systems that are not required to support the spent fuel pool or site surveillance and security are drained, de-energized, and secured. Minimal cleaning/removal of loose contamination and/or fixation and sealing of remaining contamination is

performed. Access to contaminated areas is secured to provide controlled access for inspection and maintenance.

The engineering and planning requirements are similar to those for the DECON alternative, although a shorter period is expected for these activities due to the more limited work scope. Site preparations are also similar to those for the DECON alternative. However, with the exception of the required radiation surveys and site characterizations, the mobilization and preparation of site facilities is less extensive.

2.2.1 Period 1 - Preparations

Preparations for long-term storage include the planning for permanent defueling of the reactor, revision of technical specifications appropriate to the operating conditions and requirements, a characterization of the facility and major components, and the development of the PSDAR.

The process of placing the plant in safe-storage includes, but is not limited to, the following activities:

- Isolation of the spent fuel storage services and fuel handling systems so that safe-storage operations may commence on the balance of the plant. This activity may be carried out by plant personnel in accordance with existing operating technical specifications. Activities are scheduled around the fuel handling systems to the greatest extent possible.
- Transfer of all spent fuel from the storage pool and the ISFSI to the DOE by the end of the minimum required cooling period.
- Draining and de-energizing of the non-contaminated systems not required to support continued site operations or maintenance.
- Disposing of contaminated filter elements and resin beds not required for processing wastes from layup activities for future operations.
- Draining of the reactor vessel, with the internals left in place and the vessel head secured.
- Draining and de-energizing non-essential, contaminated systems with decontamination as required for future maintenance and inspection.
- Preparing lighting and alarm systems whose continued use is required; de-energizing portions of fire protection, electric power, and HVAC systems whose continued use is not required.

- Cleaning of the loose surface contamination from building access pathways.
- Performing an interim radiation survey of plant, posting warning signs where appropriate.
- Erecting physical barriers and/or securing all access to radioactive or contaminated areas, except as required for inspection and maintenance.
- Installing security and surveillance monitoring equipment and relocating security fence around secured structures, as required.

2.2.2 Period 2 - Dormancy

The second phase identified by the NRC in its rule addresses licensed activities during a storage period and is applicable to the dormancy phases of the deferred decommissioning alternative. Dormancy activities include a 24-hour security force, preventive and corrective maintenance on security systems, area lighting, general building maintenance, heating and ventilation of buildings, routine radiological inspections of contaminated structures, maintenance of structural integrity, and a site environmental and radiation monitoring program. Resident maintenance personnel perform equipment maintenance, inspection activities, routine services to maintain safe conditions, adequate lighting, heating, and ventilation, and periodic preventive maintenance on essential site services.

An environmental surveillance program is carried out during the dormancy period to ensure that releases of radioactive material to the environment are prevented and/or detected and controlled. Appropriate emergency procedures are established and initiated for potential releases that exceed prescribed limits. The environmental surveillance program constitutes an abbreviated version of the program in effect during normal plant operations.

Security during the dormancy period is conducted primarily to prevent unauthorized entry and to protect the public from the consequences of its own actions. The security fence, sensors, alarms, and other surveillance equipment provide security. Fire and radiation alarms are also monitored and maintained.

Consistent with the DECON scenario, the spent fuel storage pool is emptied within five and one-half years of the cessation of operations. The

pool is secured for storage and decommissioned along with the power block structures in Period 4.

After a period of storage (such that license termination is accomplished within 60 years of final shutdown), it is required that the licensee submit an application to terminate the license, along with an LTP (described in Section 2.1.2), thereby initiating the third phase.

2.2.3 Periods 3 and 4 - Delayed Decommissioning

Prior to the commencement of decommissioning operations, preparations are undertaken to reactivate site services and prepare for decommissioning. Preparations include engineering and planning, a detailed site characterization, and the assembly of a decommissioning management organization. Final planning for activities and the writing of activity specifications and detailed procedures are also initiated at this time.

Much of the work in developing a termination plan is relevant to the development of the detailed engineering plans and procedures. The activities associated with this phase and the follow-on decontamination and dismantling processes are detailed in Sections 2.1.1 and 2.1.2. The primary difference between the sequences anticipated for the DECON and this deferred scenario is the absence, in the latter, of any constraint on the availability of the fuel storage facilities for decommissioning.

Variations in the length of the dormancy period are expected to have little effect upon the quantities of radioactive wastes generated from system and structure removal operations. Given the levels of radioactivity and spectrum of radionuclides expected from sixty years of plant operation, no plant process system identified as being contaminated upon final shutdown will become releasable due to the decay period alone, i.e., there is no significant reduction in the waste generated from the decommissioning activities. However, due to the lower activity levels, a greater percentage of the waste volume can be designated for off-site processing and recovery.

The delay in decommissioning also yields lower working area radiation levels. As such, the estimate for this delayed scenario incorporates reduced ALARA controls for the SAFSTOR's lower occupational exposure potential.

Although the initial radiation levels due to ^{60}Co will decrease during the dormancy period, the internal components of the reactor vessel will still exhibit sufficiently high radiation dose rates to require remote sectioning under water due to the presence of long-lived radionuclides such as ^{94}Nb, ^{59}Ni, and ^{63}Ni. Therefore, the dismantling procedures described for the DECON alternative would still be employed during this scenario. Portions of the biological shield will still be radioactive due to the presence of activated trace elements with long half-lives (^{152}Eu and ^{154}Eu). Decontamination will require controlled removal and disposal. It is assumed that radioactive corrosion products on inner surfaces of piping and components will not have decayed to levels that will permit unrestricted use or allow conventional removal. These systems and components will be surveyed as they are removed and disposed of in accordance with the existing radioactive release criteria.

2.2.4 Period 5 - Site Restoration

Following completion of decommissioning operations, site-restoration activities can begin. Dismantling, as a continuation of the decommissioning process, is clearly the most appropriate and cost-effective option, as described in Section 2.1.3. The basis for the dismantling cost in this scenario is consistent with that described for DECON, presuming the removal of structures and site facilities to a nominal depth of three feet below grade and the limited restoration of the site.

3. COST ESTIMATE

The cost estimates prepared for decommissioning Callaway consider the unique features of the site, including the NSSS, power generation systems, support services, site buildings, and ancillary facilities. The basis of the estimates, including the sources of information relied upon, the estimating methodology employed, site-specific considerations, and other pertinent assumptions, is described in this section.

3.1 BASIS OF ESTIMATE

The current estimates were developed using the site-specific, technical information relied upon in the decommissioning analysis prepared in 2020. This information was reviewed for the current analysis and updated as deemed appropriate. The site-specific considerations and assumptions used in the previous evaluation were also revisited. Modifications were incorporated where new information was available or experience from ongoing decommissioning programs provided viable alternatives or improved processes.

3.2 METHODOLOGY

The methodology used to develop the estimates follows the basic approach originally presented in the AIF/NESP-036 study report, "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates,"[23] and the DOE "Decommissioning Handbook."[24] These documents present a unit factor method for estimating decommissioning activity costs, which simplifies the estimating calculations. Unit factors for concrete removal ($/cubic yard), steel removal ($/ton), and cutting costs ($/inch) are developed using local labor rates. The activity-dependent costs are estimated with the item quantities (cubic yards and tons), developed from plant drawings and inventory documents. Removal rates and material costs for the conventional disposition of components and structures rely upon information available in the industry publication, "Building Construction Cost with RSMeans Data," by Gordian.[25]

The unit factor method provides a demonstrable basis for establishing reliable cost estimates. The detail provided in the unit factors, including activity duration, labor costs (by craft), and equipment and consumable costs, ensures that essential elements have not been omitted. Appendix A presents the detailed development of a typical unit factor. Appendix B provides the values contained within one set of factors developed for this analysis.

Regulatory Guide 1.184 [26] Revision 1, issued in October 2013, describes the methods and procedures that are acceptable to the NRC staff for implementing

the requirements that relate to the initial activities and the major phases of the decommissioning process. The costs and schedules presented in this analysis follow the general guidance and sequence in the regulations. The format and content of the estimates is also consistent with the recommendations of Regulatory Guide 1.202,[27] issued February 2005.

This analysis reflects lessons learned from TLG's involvement in the Shippingport Station Decommissioning Project, completed in 1989, as well as the decommissioning of the Cintichem reactor, hot cells and associated facilities, completed in 1997. In addition, the planning and engineering for the Rancho Seco, Trojan, Yankee Rowe, Big Rock Point, Maine Yankee, Humboldt Bay-3, Oyster Creek, Connecticut Yankee, Crystal River, Vermont Yankee, Fort Calhoun and Pilgrim, and Indian Point nuclear units have provided additional insight into the process, the regulatory aspects, and the technical challenges of decommissioning commercial nuclear units.

Work Difficulty Factors

TLG has historically applied work difficulty adjustment factors (WDFs) to account for the inefficiencies in working in a power plant environment. WDFs are assigned to each unique set of unit factors, commensurate with the inefficiencies associated with working in confined, hazardous environments. The ranges used for the WDFs are as follows:

- Access Factor 10% to 20%
- Respiratory Protection Factor 10% to 50%
- Radiation/ALARA Factor 10% to 37%
- Protective Clothing Factor 10% to 30%
- Work Break Factor 8.33%

The factors and their associated range of values were developed in conjunction with the AIF/NESP-036 study. The application of the factors is discussed in more detail in that publication.

Scheduling Program Durations

The unit factors, adjusted by the WDFs as described above, are applied against the inventory of materials to be removed in the radiological controlled areas. The resulting person-hours, or crew-hours, are used in the development of the decommissioning program schedule, using resource loading and event sequencing considerations. The scheduling of conventional removal and

dismantling activities is based upon productivity information available from the "Building Construction Cost Data" publication.

An activity duration critical path is used to determine the total decommissioning program schedule. The schedule is relied upon in calculating the carrying costs, which include program management, administration, field engineering, equipment rental, and support services such as quality control and security. This systematic approach for assembling decommissioning estimates ensures a high degree of confidence in the reliability of the resulting costs.

3.3 FINANCIAL COMPONENTS OF THE COST MODEL

TLG's proprietary decommissioning cost model, DECCER, produces a number of distinct cost elements. These direct expenditures, however, do not comprise the total cost to accomplish the project goal, i.e., license termination and site restoration.

Inherent in any cost estimate that does not rely on historical data is the inability to specify the precise source of costs imposed by factors such as tool breakage, accidents, illnesses, weather delays, and labor stoppages. In the DECCER cost model, contingency fulfills this role. Contingency is added to each line item to account for costs that are difficult or impossible to develop analytically. Such costs are historically inevitable over the duration of a job of this magnitude; therefore, this cost analysis includes funds to cover these types of expenses.

3.3.1 Contingency

The activity- and period-dependent costs are combined to develop the total decommissioning cost. A contingency is then applied on a line-item basis, using one or more of the contingency types listed in the AIF/NESP-036 study. "Contingencies" are defined in the American Association of Cost Engineers "Project and Cost Engineers' Handbook"[28] as "specific provision for unforeseeable elements of cost within the defined project scope; particularly important where previous experience relating estimates and actual costs has shown that unforeseeable events which will increase costs are likely to occur." The cost elements in this analysis are based upon ideal conditions and maximum efficiency; therefore, consistent with industry practice, contingency is included. In the AIF/NESP-036 study, the types of unforeseeable events that are likely to occur in decommissioning are discussed and guidelines are provided for percentage contingency in each category. It should be noted that contingency, as used in this analysis, does not account for price escalation

and inflation in the cost of decommissioning over the remaining operating life of the station.

Contingency funds are an integral part of the total cost to complete the decommissioning process. Exclusion of this component puts at risk a successful completion of the intended tasks and, potentially, subsequent related activities. For this study, TLG examined the major activity-related problems (decontamination, segmentation, equipment handling, packaging, transport, and waste disposal) that necessitate a contingency. Individual activity contingencies ranged from 10% to 75%, depending on the degree of difficulty judged to be appropriate from TLG's actual decommissioning experience. The contingency values used in this study are as follows:

- Decontamination 50%
- Contaminated Component Removal 25%
- Contaminated Component Packaging 10%
- Contaminated Component Transport 15%
- Low-Level Radioactive Waste Disposal 25%

- Low-Level Radioactive Waste Processing 15%
- Reactor Segmentation 75%
- NSSS Component Removal 25%
- Reactor Waste Packaging 25%
- Reactor Waste Transport 25%

- Reactor Vessel Component Disposal 50%
- GTCC Disposal 15%
- Staffing 15%
- Spent Fuel Management 15%
- Non-Radioactive Component Removal 15%

- Heavy Equipment and Tooling 15%
- Supplies 25%
- Engineering 15%
- Energy 15%
- Insurance and Fees 10%

- Characterization and Termination Surveys 30%
- Operations and Maintenance Expense 15%
- Construction 15%
- Property Taxes 10%
- ISFSI Decommissioning 25%

The contingency values are applied to the appropriate components of the estimates on a line item basis. A composite value is then reported at the end of each detailed estimate (as provided in Appendix C, D, E and F). A contingency of 25% is applied to the subtotal of the ISFSI decommissioning costs, as shown in Appendix G Table G-2 for ISFSI 72.30 decommissioning and license termination activities.

3.3.2 Financial Risk

In addition to the routine uncertainties addressed by contingency, another cost element that is sometimes necessary to consider when bounding decommissioning costs relates to uncertainty, or risk. Examples can include changes in work scope, pricing, job performance, and other variations that could conceivably, but not necessarily, occur. Consideration is sometimes necessary to generate a level of confidence in the estimate, within a range of probabilities. TLG considers these types of costs under the broad term "financial risk." Included within the category of financial risk are:

- Transition activities and costs: ancillary expenses associated with eliminating 50% to 80% of the site labor force shortly after the cessation of plant operations, added cost for worker separation packages throughout the decommissioning program, national or company-mandated retraining, and retention incentives for key personnel.
- Delays in approval of the decommissioning plan due to intervention, public participation in local community meetings, legal challenges, and national and local hearings.
- Changes in the project work scope from the baseline estimate, involving the discovery of unexpected levels of contaminants, contamination in places not previously expected, contaminated soil previously undiscovered (either radioactive or hazardous material contamination), variations in plant inventory or configuration not indicated by the as-built drawings.
- Regulatory changes, for example, affecting worker health and safety, site release criteria, waste transportation, and disposal.
- Policy decisions altering national commitments (e.g., in the ability to accommodate certain waste forms for disposition), or in the timetable for such, for example, the start and rate of acceptance of spent fuel by the DOE.

- Pricing changes for basic inputs such as labor, energy, materials, and disposal. Items subject to widespread price competition (such as materials) may not show significant variation; however, others such as waste disposal could exhibit large pricing uncertainties, particularly in markets where limited access to services is available.

However this cost study does not add any additional costs to the estimate for financial risk, since there is insufficient historical data from which to project future liabilities. Consequently, the areas of uncertainty or risk are revisited periodically and addressed through repeated revisions or updates of the estimates.

3.4 SITE-SPECIFIC CONSIDERATIONS

There are a number of site-specific considerations that affect the method for dismantling and removal of equipment from the site and the degree of restoration required. The cost impact of the considerations identified below is included in this cost study.

3.4.1 Spent Fuel Management

The cost to dispose the spent fuel generated from plant operations is not reflected within the estimates to decommission Callaway. Ultimate disposition of the spent fuel is within the province of the DOE's Waste Management System, as defined by the Nuclear Waste Policy Act. Any delay in the transfer of spent fuel may increase the on-site management costs. As such, the disposal cost was being financed by a 1 mill/kWhr surcharge on nuclear generated energy delivered to customers, the fee being paid into the DOE's waste fund during operations. The D.C. Circuit ruling on November 19, 2013, ordered the DOE to submit a proposal to Congress to suspend the Nuclear Waste Fund fee "until such time as either the Secretary chooses to comply with the Act as it is currently written, or until Congress enacts an alternative waste management plan." The fee was reduced to 0.0 mill/kWh as of May 16, 2014. The fee is expected to be reinstated in the future.

The NRC requires licensees to establish a program to manage and provide funding for the management of all irradiated fuel at the reactor until title of the fuel is transferred to the Secretary of Energy. This funding requirement is fulfilled through inclusion of certain high-level waste cost elements within the estimates, as described below.

For estimating purposes, Ameren Services has assumed that all spent fuel will be transferred to the DOE within five and one-half years after shutdown. This will allow Ameren Services to proceed with decommissioning (or safe-storage) operations in the shortest time possible. A delay in the start of fuel pickup, or a decrease in the spent fuel acceptance rate, will correspondingly prolong the transfer process and result in the fuel remaining at the Callaway site longer.

It is assumed that the five and one-half years provides the necessary cooling period for the final core to meet DOE's transport system requirements for decay heat. Once the pool is emptied, the spent fuel storage and handling facilities are available for decommissioning. Operation and maintenance costs for the spent fuel pool are included within the estimate as well as the costs to transfer the spent fuel from the pool to the DOE.

Storage Canister Design

A vertical underground dry storage system is used as a cost basis. The system consists of Holtec HI-STORM UMAX technology transportable Multi-Purpose Canisters (MPCs) stored within an underground metal and concrete structure, collectively known as Vertical Ventilated Modules (VVMs). A canister capacity of 37 pressurized water reactor fuel assemblies was assumed. All canisters are assumed to be in place at the time of decommissioning.

Canister Loading and Transfer

The estimates include the cost for the labor and equipment to load and transfer to the DOE the spent fuel assemblies projected to reside in the pool at the cessation of plant operations. Costs for transfer of spent fuel from the ISFSI to the DOE are not included in this estimate. In addition, any capital cost associated with the dry storage system (including cask purchases) is not included in the estimates.

Operations and Maintenance

The estimates include the cost of operating and maintaining the spent fuel pool for approximately five and one half years after the cessation of operations.

ISFSI Decommissioning

In accordance with 10 CFR §72.30, licensees must have a proposed decommissioning plan for the ISFSI site and facilities that includes a cost estimate for the plan. The plan needs to contain sufficient information on the proposed practices and procedures for the decontamination of the ISFSI and for the disposal of residual radioactive materials after the spent fuel has been removed.

For purposes of this study only, the decommissioning cost for the ISFSI was included in the DECON and SAFSTOR estimates. The decommissioning estimate is based on the conservative premise that a small percentage of the VVMs would contain very low levels of neutron-induced residual radioactivity that would necessitate remediation at the time of decommissioning. As an allowance, 6 of the 48 VVMs are assumed to be affected, i.e., contain residual radioactivity. The allowance quantity is based upon the number of MPCs required for the final core off-load (i.e., 193 offloaded assemblies, 37 assemblies per MPC) which results in a total of 6 VVMs that contain residual radioactivity.

No contamination or activation of the balance of the ISFSI structures are assumed. 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. As such, only verification surveys are included for the ISFSI in the decommissioning estimate. The estimate is limited to costs necessary to terminate the ISFSI's NRC license and meet the §20.1402 criteria for unrestricted use.

In accordance with the specific requirements of 10 CFR §72.30 for the ISFSI work scope, the cost estimate for decommissioning the ISFSI reflects: 1) the cost of an independent contractor performing the decommissioning activities; 2) an adequate contingency factor; and 3) the cost of meeting the criteria for unrestricted use.

GTCC

The dismantling of the reactor internals is expected to generate radioactive waste considered unsuitable for shallow land disposal (i.e., low-level radioactive waste with concentrations of radionuclides that exceed the limits established by the NRC for Class C radioactive waste (GTCC)). The Low-Level Radioactive Waste Policy Amendments Act of 1985 assigned the federal government the responsibility for the disposal of this material. The Act also stated that the beneficiaries of the activities

resulting in the generation of such radioactive waste bear all reasonable costs of disposing of such waste. Although the DOE is responsible for disposing of GTCC waste, any costs for that service have not been determined. For purposes of this estimate, the GTCC radioactive waste has been assumed to be packaged in the same canisters used to store spent fuel and disposed of as high-level waste, at a cost equivalent to that envisioned for the spent fuel. The number of canisters required and the packaged volume for GTCC was based upon experience at Maine Yankee (e.g., the payload constraints as identified in the canister's certificate of compliance).

For purposes of this study, GTCC is packaged into five transportable storage containers. It will be disposed of as it is generated during reactor vessel segmentation operations, and shipped to the DOE.

3.4.2 Reactor Vessel and Internal Components

The reactor pressure vessel and internal components are segmented for disposal in shielded, reusable transportation casks. Segmentation is performed in the refueling canal, where a turntable and remote cutter are installed. The vessel is segmented in place, using a mast-mounted cutter supported off the lower head and directed from a shielded work platform installed overhead in the reactor cavity. Transportation cask specifications and transportation regulations dictate the segmentation and packaging methodology.

Intact disposal of reactor vessel shells has been successfully demonstrated at several of the sites currently being decommissioned. Access to navigable waterways has allowed these large packages to be transported to the Barnwell, South Carolina and Hanford, Washington disposal sites with minimal overland travel. Intact disposal of the reactor vessel and internal components can provide savings in cost and worker exposure by eliminating the complex segmentation requirements, isolation of the GTCC material, and transport/storage of the resulting waste packages. Portland General Electric (PGE) was able to dispose of the Trojan reactor as an intact package (including the internals). However, its location on the Columbia River simplified the transportation analysis since:

- the reactor package could be secured to the transport vehicle for the entire journey, i.e., the package was not lifted during transport,

- there were no man-made or natural terrain features between the plant site and the disposal location that could produce a large drop, and
- transport speeds were very low, limited by the overland transport vehicle and the river barge.

As a member of the Northwest Compact, PGE had a site available for disposal of the package - the US Ecology facility in Washington State. The characteristics of this arid site proved favorable in demonstrating compliance with land disposal regulations.

It is not known whether this option will be available when Callaway ceases operation. Future viability of this option will depend upon the ultimate location of the disposal site, as well as the disposal site licensee's ability to accept highly radioactive packages and effectively isolate them from the environment. Consequently, the study assumes the reactor vessel will require segmentation, as a bounding condition.

3.4.3 Primary System Components

In the DECON scenario, the reactor coolant system components are assumed to be decontaminated using chemical agents prior to the start of dismantling operations. This type of decontamination can be expected to have a significant ALARA impact, since in this scenario the removal work is done within the first few years of shutdown. A decontamination factor (average reduction) of 10 is assumed for the process. In the SAFSTOR scenario, radionuclide decay is expected to provide the same benefit and, therefore, a chemical decontamination is not included.

The following discussion deals with the removal and disposition of the steam generators, but the techniques involved are also applicable to other large components, such as heat exchangers, component coolers, and the pressurizer. The steam generators' size and weight, as well as their location within the reactor building, will ultimately determine the removal strategy.

A trolley crane is set up for the removal of the generators. It can also be used to move portions of the steam generator cubicle walls and floor slabs from the reactor building to a location where they can be decontaminated and transported to the material handling area. Interferences within the work area, such as grating, piping, and other components are removed to create sufficient laydown space for processing these large components.

The generators are rigged for removal, disconnected from the surrounding piping and supports, and maneuvered into the open area where they are lowered onto a dolly. Each generator is rotated into the horizontal position for extraction from the containment and placed onto a multi-wheeled vehicle for transport to an on-site processing and storage area.

The generators are disassembled on-site with the steam dome and lightly contaminated subassemblies designated for off-site recycling. The more highly contaminated tube sheet and tube bundle are packaged for direct disposal. The interior volume is filled with low-density cellular concrete for stabilization of the internal contamination.

Reactor coolant piping is cut from the reactor vessel once the water level in the vessel (used for personnel shielding during dismantling and cutting operations in and around the vessel) is dropped below the nozzle zone. The piping is boxed and transported by shielded van. The reactor coolant pumps and motors are lifted out intact, packaged, and transported for processing and/or disposal.

3.4.4 Retired Components

The estimate includes the cost to dispose of four retired steam generators expected to be in storage at the site upon the cessation of plant operations. The components are processed for disposal in the same manner as described for the installed units.

A retired reactor closure head, with service structure, is also included in the decommissioning waste inventory. The component is currently stored in the steam generator storage facility.

3.4.5 Main Turbine and Condenser

The main turbine is dismantled using conventional maintenance procedures. The turbine rotors and shafts are removed to a laydown area. The lower turbine casings are removed from their anchors by controlled demolition. The main condensers are also disassembled and moved to a laydown area. Material is then prepared for transportation to an off-site recycling facility where it is surveyed and designated for either decontamination or volume reduction, conventional disposal, or controlled disposal. Components are packaged and readied for transport in accordance with the intended disposition.

3.4.6 Transportation Methods

Contaminated piping, components, and structural material other than the highly activated reactor vessel and internal components will qualify as LSA-I, II or III or Surface Contaminated Object, SCO-I or II, as described in Title 49.[29] The contaminated material will be packaged in Industrial Packages (IP-1, IP-2, or IP-3, as defined in subpart 173.411) for transport unless demonstrated to qualify as their own shipping containers. The reactor vessel and internal components are expected to be transported in accordance with Part 71, as Type B. It is conceivable that the reactor, due to its limited specific activity, could qualify as LSA II or III. However, the high radiation levels on the outer surface would require that additional shielding be incorporated within the packaging so as to attenuate the dose to levels acceptable for transport.

Any fuel cladding failure that occurred during the lifetime of the plant is assumed to have released fission products at sufficiently low levels that the buildup of quantities of long-lived isotopes (e.g., ^{137}Cs, ^{90}Sr, or transuranics) has been prevented from reaching levels exceeding those that permit the major reactor components to be shipped under current transportation regulations and disposal requirements.

Transport of the highly activated metal, produced in the segmentation of the reactor vessel and internal components, will be by shielded truck cask. Cask shipments may exceed 95,000 pounds, including vessel segment(s), supplementary shielding, cask tie-downs, and tractor-trailer. The maximum level of activity per shipment assumed permissible was based upon the license limits of the available shielded transport casks. The segmentation scheme for the vessel and internal segments is designed to meet these limits.

The transport of large intact components (e.g., large heat exchangers and other oversized components) will be by a combination of truck, rail, and/or multi-wheeled transporter.

Transportation costs for Class A radioactive material requiring controlled disposal are based upon the mileage to the Energy*Solutions* facility in Clive, Utah. Transportation costs for the higher activity Class B and C radioactive material are based upon the mileage to the WCS facility in Andrews County, Texas. The transportation cost for the GTCC material is assumed to be contained within the disposal cost. Transportation costs for off-site waste processing are based upon the mileage to Oak Ridge,

Tennessee. Truck transport costs were developed from published tariffs from Tri-State Motor Transit.[30]

3.4.7 Low-Level Radioactive Waste Disposal

To the greatest extent practical, metallic material generated in the decontamination and dismantling processes is processed to reduce the total cost of controlled disposal. Material meeting the regulatory and/or site release criterion, is released as scrap, requiring no further cost consideration. Conditioning (preparing the material to meet the waste acceptance criteria of the disposal site) and recovery of the waste stream is performed off site at a licensed processing center. Any material leaving the site is subject to a survey and release charge, at a minimum.

The mass of radioactive waste generated during the various decommissioning activities at the site is shown on a line-item basis in the appendices and summarized in Section 5. The quantified waste summaries shown in these tables are consistent with 10 CFR Part 61 classifications. Commercially available steel containers are presumed to be used for the disposal of piping, small components, and concrete. Larger components can serve as their own containers, with proper closure of all openings, access ways, and penetrations. The volumes are calculated based on the exterior package dimensions for containerized material or a specific calculation for components serving as their own waste containers.

The more highly activated reactor components will be shipped in reusable, shielded truck casks with disposable liners. In calculating disposal costs, the burial fees are applied against the liner volume, as well as the special handling requirements of the payload. Packaging efficiencies are lower for the highly activated materials (greater than Type A quantity waste), where high concentrations of gamma-emitting radionuclides limit the capacity of the shipping canisters.

The cost to dispose of the lowest level waste and the majority of the material generated from the decontamination and dismantling activities is based upon the current cost for disposal at Energy*Solutions* facility in Clive, Utah. Disposal costs for the higher activity waste (Class B and C) were based upon Ameren Services' current agreement with WCS for the Andrews County facility.

3.4.8 Site Conditions Following Decommissioning

The NRC will terminate the site license when it determines that site remediation has been performed in accordance with the license termination plan, and that the terminal radiation survey and associated documentation demonstrate that the facility is suitable for release. The NRC's involvement in the decommissioning process will end at this point. Local building codes and state environmental regulations will dictate the next step in the decommissioning process, as well as the owner's own future plans for the site.

The estimates presented herein include the dismantling of the major structures to three feet below grade level, backfilling and the collapsing of below grade voids, and regrading such that the site upon which the power block and supplemental structures are located is transformed into a "grassy plain."

Concrete rubble generated from demolition activities is processed and made available as clean fill for the power block foundations. Additional fill is brought in to cap the power block excavations and to permit seeding for erosion control.

A significant amount of the below grade piping is located around the perimeter of the power block. The estimate includes a cost to excavate this area to an average depth of six feet so as to expose the piping, duct bank, conduit, and any near-surface grounding grid. The overburden is surveyed and stockpiled on site for future use in backfilling the below grade voids.

The existing electrical switchyard and access roads will remain in support of the electrical transmission and distribution system. Site restoration does not include the remediation of the water treatment plant's settling basins, if required.

Sludge removed from the sewage treatment plant lagoon was assumed to contain low levels of contamination that would require controlled disposal. As such, 3,600 cubic feet of material from the lagoon was designated for disposition at Energy*Solutions*' facility.

The existing and replacement cooling tower discharge pipes will be left in place and assumed to be flow-filled with suitable material to prevent the pipes from collapsing. The intake line will also be filled.

The estimates do not assume the remediation of any significant volume of contaminated soil. This assumption may be affected by continued plant operations and/or future regulatory actions, such as the development of site-specific release criteria.

3.5 ASSUMPTIONS

The following are the major assumptions made in the development of the estimates for decommissioning the site.

3.5.1 Estimating Basis

Decommissioning costs are reported in the year of projected expenditure; however, the values are provided in 2023 dollars. Costs are not inflated, escalated, or discounted over the periods of performance.

The estimates rely upon the physical plant inventory that was the basis for the 2020 analysis. There were no substantive changes made to the plant inventory (that would impact decommissioning).

The study follows the principles of ALARA through the use of work duration adjustment factors. These factors address the impact of activities such as radiological protection instruction, mock-up training, and the use of respiratory protection and protective clothing. The factors lengthen a task's duration, increasing costs and lengthening the overall schedule. ALARA planning is considered in the costs for engineering and planning, and in the development of activity specifications and detailed procedures. Changes to worker exposure limits may impact the decommissioning cost and project schedule.

3.5.2 Labor Costs

Ameren Services, as the operator, will continue to provide site operations support, including decommissioning program management, licensing, radiological protection, and site security. A Decommissioning Operations Contractor (DOC) will provide the supervisory staff needed to oversee the labor subcontractors, consultants, and specialty contractors needed to perform the work required for the decontamination and dismantling effort. The DOC will also provide the engineering services needed to develop activity specifications, detailed procedures, detailed activation analyses, and support field activities such as structural modifications.

Personnel costs are based upon average salary information provided by Ameren Services. Overhead costs were also provided by Ameren Services for site and corporate support; they are reduced commensurate with the staffing of the project.

The craft labor required to decontaminate and dismantle the nuclear unit is acquired through standard site contracting practices. The current cost of labor at the site is used as an estimating basis.

Security, while reduced from operating levels, is maintained throughout the decommissioning for access control, material control, and to safeguard the spent fuel.

A profile of the staffing levels for decommissioning, including contractors and craft, is provided in Figures 3.1 and 3.2 for the DECON and SAFSTOR scenarios, respectively. Utility staffing levels will gradually decrease after completing the removal of physical systems. Staffing levels and management support will vary based upon the amount and type of decommissioning work. Craft workforce levels decrease after systems removal and structures decontamination. Craft levels continue to decrease during the site restoration period as the work associated with structures demolition completes.

3.5.3 Design Conditions

Any fuel cladding failure that occurred during the lifetime of the plant is assumed to have released fission products at sufficiently low levels that the buildup of quantities of long-lived isotopes (e.g., ^{137}Cs, ^{90}Sr, or transuranics) has been prevented from reaching levels exceeding those that permit the major NSSS components to be shipped under current transportation regulations and disposal requirements.

The curie contents of the vessel and internals at final shutdown are derived from those listed in NUREG/CR-3474.[31] Actual estimates are derived from the curie/gram values contained therein and adjusted for the different mass of the Callaway components, projected operating life, and different periods of decay. Additional short-lived isotopes are derived from CR-0130[32] and CR-0672,[33] and benchmarked to the long-lived values from CR-3474.

The control elements are disposed of along with the spent fuel, i.e., there is no additional cost provided for their disposal.

Activation of the containment building structure is confined to the biological shield.

3.5.4 General

Transition Activities

Existing warehouses are cleared of non-essential material and remain for use by Ameren Services and its subcontractors. The plant operating staff performs the following activities at no additional cost or credit to the project during the transition period:

- Drain and collect fuel oils, lubricating oils, and transformer oils for recycle and/or sale.
- Drain and collect acids, caustics, and other chemical stores for recycle and/or sale.
- Process operating waste inventories, i.e., the estimates do not address the disposition of any legacy wastes; the disposal of operating wastes during this initial period is not considered a decommissioning expense.

Scrap and Salvage

The existing plant equipment is considered obsolete and suitable for scrap as deadweight quantities only. Ameren Services will make economically reasonable efforts to salvage equipment following final plant shutdown. However, dismantling techniques assumed by TLG for equipment in this analysis are not consistent with removal techniques required for salvage (resale) of equipment. Experience has indicated that some buyers wanted equipment stripped down to very specific requirements before they would consider purchase. This requires expensive rework after the equipment had been removed from its installed location. Since placing a salvage value on this machinery and equipment would be speculative, and the value would be small in comparison to the overall decommissioning expenses, this analysis does not attempt to quantify the value that an owner may realize based upon those efforts.

It is assumed, for purposes of this analysis, that any value received from the sale of scrap generated in the dismantling process would be more than offset by the on-site processing costs. The dismantling techniques assumed in the decommissioning estimates do not include the additional cost for size reduction and preparation to meet “furnace ready” conditions.

For example, the recovery of copper from electrical cabling may require the removal and disposition of any contaminated insulation, an added expense. With a volatile market, the potential profit margin in scrap recovery is highly speculative, regardless of the ability to free release this material. This assumption is an implicit recognition of scrap value in the disposal of clean metallic waste at no additional cost to the project.

Furniture, tools, mobile equipment such as forklifts, trucks, bulldozers, and other property is removed at no cost or credit to the decommissioning project. Disposition may include relocation to other facilities. Spare parts are also made available for alternative use.

Energy

For estimating purposes, the plant is assumed to be de-energized, with the exception of those facilities associated with spent fuel storage. Replacement power costs are used to calculate the cost of energy consumed during decommissioning for tooling, lighting, ventilation, and essential services.

Insurance

Costs for continuing coverage (nuclear liability and property insurance) following cessation of plant operations and during decommissioning are included and based upon current operating premiums. Reductions in premiums, throughout the decommissioning process, are based upon the guidance provided in SECY-00-0145, "Integrated Rulemaking Plan for Nuclear Power Plant Decommissioning"[34] The NRC's financial protection requirements are based on various reactor (and spent fuel) configurations.

Taxes

Property tax payments are included for the land only and will continue through the decommissioning project.

Site Modifications

The perimeter fence and in-plant security barriers will be moved, as appropriate, to conform to the Site Security Plan in force during the various stages of the project.

3.6 COST ESTIMATE SUMMARY

Schedules of expenditures for the base case are provided in Tables 3.1 and 3.2. The tables delineate the cost contributors by year of expenditures as well as cost contributor (labor, equipment and materials, energy, radioactive waste disposal, and other costs).

The cost elements are also assigned to one of three subcategories: "License Termination," "Spent Fuel Management," and "Site Restoration." The subcategory "License Termination" is used to accumulate costs that are consistent with "decommissioning" as defined by the NRC in its financial assurance regulations (i.e., 10 CFR §50.75). The cost reported for this subcategory is generally sufficient to terminate the unit's operating license, recognizing that there may be some additional cost impact from spent fuel management. These costs are identified in Tables 3.1a and 3.2a.

The "Spent Fuel Management" subcategory contains costs associated with the five and one-half years of post-shutdown pool operations and the transfer of the fuel from the pool to the DOE. These costs are identified in Tables 3.1b and 3.2b.

"Site Restoration" is used to capture costs associated with the dismantling and demolition of buildings and facilities demonstrated to be free from contamination. This includes structures never exposed to radioactive materials, as well as those facilities that have been decontaminated to appropriate levels. Structures are removed to a depth of three feet below grade and backfilled to conform to local grade. These costs are identified in Tables 3.1c and 3.2c.

It should be noted that the costs assigned to these subcategories are allocations. Delegation of cost elements is for the purposes of comparison (e.g., with NRC financial guidelines) or to permit specific financial treatment (e.g., Asset Retirement Obligation determinations). In reality, there can be considerable interaction between the activities in the three subcategories. For example, an owner may decide to remove non-contaminated structures early in the project to improve access to highly contaminated facilities or plant components. In these instances, the non-contaminated removal costs could be reassigned from Site Restoration to an NRC License Termination support activity. However, in general, the allocations represent a reasonable accounting of those costs that can be expected to be incurred for the specific subcomponents of the total estimated program cost, if executed as described.

As discussed in Section 3.4.1, while designated for disposal at the geologic repository along with the spent fuel, GTCC waste is still classified as low-level radioactive waste and, as such, included as a "License Termination" expense.

The estimates were developed and costs are presented in 2023 dollars. As such, the estimates do not reflect the escalation of costs (due to inflationary and market forces) over the remaining operating life of the reactor or during the decommissioning period. The schedules are based upon the detailed activity costs reported in Appendices C and D, along with the timeline presented in Section 4.

For the purposes of this analysis, the costs presented in the following tables reflect plant decommissioning at the expiration of its current license (2044) and the use of off-site low-level radioactive waste processing to minimize the volume designated for controlled disposal. Costs for the "direct disposal only" scenarios are presented in the appendices (E and F).

TABLE 3.1
DECON ALTERNATIVE
TOTAL ANNUAL EXPENDITURES
(thousands, 2023 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other [1]	Total [2]
Plant Costs						
2044	17,586	2,333	485	9	2,165	22,579
2045	88,781	15,072	2,846	1,145	17,266	125,110
2046	99,301	39,361	2,983	39,686	28,894	210,225
2047	98,521	43,581	2,243	54,284	22,769	221,397
2048	88,689	20,973	1,787	20,573	9,735	141,757
2049	88,193	20,345	1,771	19,666	9,379	139,353
2050	63,283	13,032	1,167	13,173	6,649	97,305
2051	39,977	9,504	405	25	3,197	53,107
2052	30,715	26,325	237	0	4,259	61,535
2053	6,630	5,682	51	0	919	13,282
Plant Subtotal	621,674	196,208	13,975	148,562	105,231	1,085,651
ISFSI 72.30 Costs						
2050	768	279	0	4,433	5,075	10,556
ISFSI Subtotal	768	279	0	4,433	5,075	10,556
ISFSI Site Restoration Costs [3]						
2051	192	116	0	0	21	330
2052	676	409	0	0	75	1,160
2053	146	88	0	0	16	250
Subtotal ISFSI SR	1,014	614	0	0	112	1,740
Total	**623,457**	**197,101**	**13,975**	**152,995**	**110,418**	**1,097,947**

[1] Includes property taxes, insurance, fees, surveys, and GTCC disposal
[2] Columns may not add due to rounding
[3] These costs reflect direct ISFSI restoration costs associated with restoring the ISFSI and associated structures/property. Supporting costs detailed in Table G-3 of this report are included in the Plant costs in the table above.

TABLE 3.1a
DECON ALTERNATIVE
LICENSE TERMINATION EXPENDITURES
(thousands, 2023 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other [1]	Total [2]
Plant Costs						
2044	16,821	546	485	9	1,536	19,398
2045	84,767	6,393	2,846	1,145	14,202	109,353
2046	93,476	30,308	2,983	39,686	26,307	192,760
2047	92,403	34,344	2,243	54,284	20,386	203,660
2048	80,365	11,403	1,787	20,573	6,877	121,005
2049	79,836	10,793	1,771	19,666	6,517	118,582
2050	60,833	10,232	1,167	13,173	5,810	91,216
2051	31,303	2,024	338	25	1,987	35,676
2052	190	0	0	0	0	190
2053	41	0	0	0	0	41
Plant Subtotal	540,035	106,043	13,620	148,562	83,621	891,881
ISFSI 72.30 Costs						
2050	768	279	0	4,433	5,075	10,556
ISFSI Subtotal	768	279	0	4,433	5,075	10,556
Total	**540,803**	**106,322**	**13,620**	**152,995**	**88,696**	**902,437**

[1] Includes property taxes, insurance, fees, surveys, and GTCC disposal
[2] Columns may not add due to rounding

TABLE 3.1b
DECON ALTERNATIVE
SPENT FUEL MANAGEMENT EXPENDITURES
(thousands, 2023 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total [1]
2044	595	1,786	0	0	630	3,012
2045	2,893	8,679	0	0	3,064	14,637
2046	2,993	8,978	0	0	2,586	14,558
2047	3,043	9,130	0	0	2,383	14,556
2048	2,883	8,649	0	0	2,389	13,922
2049	2,871	8,613	0	0	2,383	13,867
2050	842	2,525	0	0	699	4,065
2051	0	0	0	0	0	0
2052	0	0	0	0	0	0
2053	0	0	0	0	0	0
Total	**16,120**	**48,360**	**0**	**0**	**14,135**	**78,615**

[1] Columns may not add due to rounding

TABLE 3.1c
DECON ALTERNATIVE
SITE RESTORATION EXPENDITURES
(thousands, 2023 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total [1]
Plant Costs						
2044	169	0	0	0	0	169
2045	1,120	0	0	0	0	1,120
2046	2,832	75	0	0	0	2,907
2047	3,074	107	0	0	0	3,181
2048	5,441	921	0	0	468	6,831
2049	5,486	939	0	0	479	6,904
2050	1,608	275	0	0	140	2,024
2051	8,674	7,480	67	0	1,210	17,431
2052	30,525	26,325	237	0	4,259	61,345
2053	6,589	5,682	51	0	919	13,241
Plant Subtotal	65,519	41,805	355	0	7,476	115,155
ISFSI Site Restoration Costs [2]						
2051	192	116	0	0	21	330
2052	676	409	0	0	75	1,160
2053	146	88	0	0	16	250
Subtotal ISFSI SR	1,014	614	0	0	112	1,740
Total	**66,533**	**42,419**	**355**	**0**	**7,588**	**116,895**

[1] Columns may not add due to rounding
[2] These costs reflect direct ISFSI restoration costs associated with restoring the ISFSI and associated structures/property. Supporting costs detailed in Table G-3 of this report are included in the Plant costs in the table above.

TABLE 3.2
SAFSTOR ALTERNATIVE
TOTAL ANNUAL EXPENDITURES
(thousands, 2023 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other [1]	Total [2]
Plant Costs						
2044	14,639	2,193	485	9	2,106	19,432
2045	74,519	14,760	2,361	644	23,857	116,141
2046	41,298	11,867	1,036	913	9,706	64,821
2047	28,119	9,498	472	17	4,734	42,841
2048	28,196	9,524	473	17	4,747	42,958
2049	28,119	9,498	472	17	4,734	42,841
2050	11,875	3,080	305	10	2,043	17,313
2051	5,138	418	236	8	927	6,726
2052	5,152	419	237	8	929	6,744
2053	5,138	418	236	8	927	6,726
2054	5,138	418	236	8	927	6,726
2055	5,138	418	236	8	927	6,726
2056	5,152	419	237	8	929	6,744
2057	5,138	418	236	8	927	6,726
2058	5,138	418	236	8	927	6,726
2059	5,138	418	236	8	927	6,726
2060	5,152	419	237	8	929	6,744
2061	5,138	418	236	8	927	6,726
2062	5,138	418	236	8	927	6,726
2063	5,138	418	236	8	927	6,726
2064	5,152	419	237	8	929	6,744
2065	5,138	418	236	8	927	6,726
2066	5,138	418	236	8	927	6,726
2067	5,138	418	236	8	927	6,726
2068	5,152	419	237	8	929	6,744
2069	5,138	418	236	8	927	6,726
2070	5,138	418	236	8	927	6,726
2071	5,138	418	236	8	927	6,726
2072	5,152	419	237	8	929	6,744
2073	5,138	418	236	8	927	6,726

TABLE 3.2 (continued)
SAFSTOR ALTERNATIVE
TOTAL ANNUAL EXPENDITURES
(thousands, 2023 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other [1]	Total [2]
2074	5,138	418	236	8	927	6,726
2075	5,138	418	236	8	927	6,726
2076	5,152	419	237	8	929	6,744
2077	5,138	418	236	8	927	6,726
2078	5,138	418	236	8	927	6,726
2079	5,138	418	236	8	927	6,726
2080	5,152	419	237	8	929	6,744
2081	5,138	418	236	8	927	6,726
2082	5,138	418	236	8	927	6,726
2083	5,138	418	236	8	927	6,726
2084	5,152	419	237	8	929	6,744
2085	5,138	418	236	8	927	6,726
2086	5,138	418	236	8	927	6,726
2087	5,138	418	236	8	927	6,726
2088	5,152	419	237	8	929	6,744
2089	5,138	418	236	8	927	6,726
2090	5,138	418	236	8	927	6,726
2091	5,138	418	236	8	927	6,726
2092	5,152	419	237	8	929	6,744
2093	5,138	418	236	8	927	6,726
2094	5,138	418	236	8	927	6,726
2095	5,138	418	236	8	927	6,726
2096	5,152	419	237	8	929	6,744
2097	5,138	418	236	8	927	6,726
2098	14,411	1,214	632	13	1,165	17,435
2099	56,305	5,282	2,361	39	2,257	66,243
2100	72,860	28,556	2,280	39,310	16,526	159,532
2101	75,567	30,455	2,103	45,582	18,294	172,001
2102	70,398	12,028	1,771	16,974	6,939	108,110
2103	70,398	12,028	1,771	16,974	6,939	108,110

TABLE 3.2 (continued)
SAFSTOR ALTERNATIVE
TOTAL ANNUAL EXPENDITURES
(thousands, 2023 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other [1]	Total [2]
2104	40,588	8,456	432	212	2,438	52,127
2105	30,621	26,247	236	0	3,502	60,606
2106	8,222	7,047	63	0	940	16,272
Plant Subtotal	907,769	211,387	28,359	121,087	154,519	1,423,121
ISFSI 72.30 Costs						
2101	99	36	0	569	651	1,354
2102	333	121	0	1,922	2,200	4,576
2103	333	121	0	1,922	2,200	4,576
2104	4	1	0	21	24	50
ISFSI Subtotal	768	279	0	4,433	5,075	10,556
ISFSI Site Restoration Costs [3]						
2104	159	96	0	0	18	273
2105	674	408	0	0	75	1,157
2106	181	110	0	0	20	311
Subtotal ISFSI SR	1,014	614	0	0	112	1,740
Total	**909,552**	**212,280**	**28,359**	**125,520**	**159,706**	**1,435,417**

[1] Includes property taxes, insurance, fees, surveys, and GTCC disposal
[2] Columns may not add due to rounding
[3] These costs reflect direct ISFSI restoration costs associated with restoring the ISFSI and associated structures/property. Supporting costs detailed in Table G-3 of this report are included in the Plant costs in the table above.

TABLE 3.2a
SAFSTOR ALTERNATIVE
LICENSE TERMINATION EXPENDITURES
(thousands, 2023 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other [1]	Total [2]
Plant Costs						
2044	14,044	407	485	9	1,476	16,421
2045	71,625	6,080	2,361	644	20,793	101,504
2046	35,432	3,095	871	913	7,119	47,431
2047	20,980	663	236	17	2,351	24,247
2048	21,037	664	237	17	2,358	24,313
2049	20,980	663	236	17	2,351	24,247
2050	9,782	490	236	10	1,344	11,862
2051	5,138	418	236	8	927	6,726
2052	5,152	419	237	8	929	6,744
2053	5,138	418	236	8	927	6,726
2054	5,138	418	236	8	927	6,726
2055	5,138	418	236	8	927	6,726
2056	5,152	419	237	8	929	6,744
2057	5,138	418	236	8	927	6,726
2058	5,138	418	236	8	927	6,726
2059	5,138	418	236	8	927	6,726
2060	5,152	419	237	8	929	6,744
2061	5,138	418	236	8	927	6,726
2062	5,138	418	236	8	927	6,726
2063	5,138	418	236	8	927	6,726
2064	5,152	419	237	8	929	6,744
2065	5,138	418	236	8	927	6,726
2066	5,138	418	236	8	927	6,726
2067	5,138	418	236	8	927	6,726
2068	5,152	419	237	8	929	6,744
2069	5,138	418	236	8	927	6,726
2070	5,138	418	236	8	927	6,726
2071	5,138	418	236	8	927	6,726
2072	5,152	419	237	8	929	6,744
2073	5,138	418	236	8	927	6,726

TABLE 3.2a (continued)
SAFSTOR ALTERNATIVE
LICENSE TERMINATION EXPENDITURES
(thousands, 2023 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other [1]	Total [2]
2074	5,138	418	236	8	927	6,726
2075	5,138	418	236	8	927	6,726
2076	5,152	419	237	8	929	6,744
2077	5,138	418	236	8	927	6,726
2078	5,138	418	236	8	927	6,726
2079	5,138	418	236	8	927	6,726
2080	5,152	419	237	8	929	6,744
2081	5,138	418	236	8	927	6,726
2082	5,138	418	236	8	927	6,726
2083	5,138	418	236	8	927	6,726
2084	5,152	419	237	8	929	6,744
2085	5,138	418	236	8	927	6,726
2086	5,138	418	236	8	927	6,726
2087	5,138	418	236	8	927	6,726
2088	5,152	419	237	8	929	6,744
2089	5,138	418	236	8	927	6,726
2090	5,138	418	236	8	927	6,726
2091	5,138	418	236	8	927	6,726
2092	5,152	419	237	8	929	6,744
2093	5,138	418	236	8	927	6,726
2094	5,138	418	236	8	927	6,726
2095	5,138	418	236	8	927	6,726
2096	5,152	419	237	8	929	6,744
2097	5,138	418	236	8	927	6,726
2098	14,249	1,214	632	13	1,165	17,273
2099	55,175	5,282	2,361	39	2,257	65,114
2100	69,529	28,469	2,280	39,310	16,526	156,115
2101	71,274	30,092	2,103	45,582	18,155	167,205
2102	64,997	11,103	1,771	16,974	6,468	101,313
2103	64,997	11,103	1,771	16,974	6,468	101,313

TABLE 3.2a (continued)
SAFSTOR ALTERNATIVE
LICENSE TERMINATION EXPENDITURES
(thousands, 2023 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other [1]	Total [2]
2104	33,359	2,262	376	212	1,608	37,817
2105	189	0	0	0	0	189
2106	51	0	0	0	0	51
Plant Subtotal	809,336	121,239	27,060	121,087	134,030	1,212,752
ISFSI 72.30 Costs						
2101	99	36	0	569	651	1,354
2102	333	121	0	1,922	2,200	4,576
2103	333	121	0	1,922	2,200	4,576
2104	4	1	0	21	24	50
ISFSI Subtotal	768	279	0	4,433	5,075	10,556
Total	**810,104**	**121,518**	**27,060**	**125,520**	**139,105**	**1,223,308**

[1] Includes property taxes, insurance, fees, surveys, and GTCC disposal
[2] Columns may not add due to rounding

TABLE 3.2b
SAFSTOR ALTERNATIVE
SPENT FUEL MANAGEMENT EXPENDITURES
(thousands, 2023 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total [1]
2044	595	1,786	0	0	630	3,012
2045	2,893	8,679	0	0	3,064	14,637
2046	5,866	8,772	166	0	2,586	17,390
2047	7,139	8,836	236	0	2,383	18,594
2048	7,159	8,860	237	0	2,389	18,645
2049	7,139	8,836	236	0	2,383	18,594
2050	2,093	2,590	69	0	699	5,451
Total	**32,884**	**48,360**	**944**	**0**	**14,135**	**96,323**

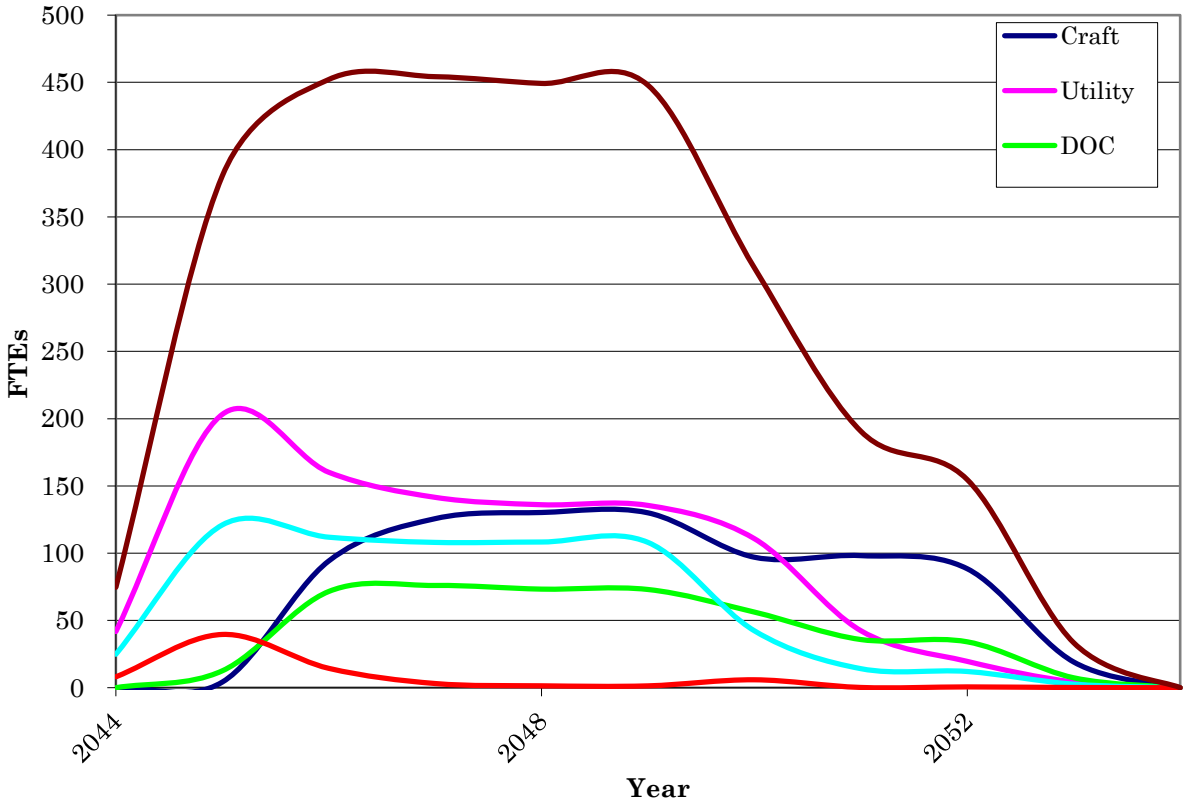
[1] Columns may not add due to rounding

TABLE 3.2c
SAFSTOR ALTERNATIVE
SITE RESTORATION EXPENDITURES
(thousands, 2023 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total [1]
Plant Costs						
2044-97	0	0	0	0	0	0
2098	162	0	0	0	0	162
2099	1,129	0	0	0	0	1,129
2100	3,331	87	0	0	0	3,417
2101	4,293	363	0	0	139	4,796
2102	5,401	925	0	0	471	6,797
2103	5,401	925	0	0	471	6,797
2104	7,229	6,194	56	0	830	14,310
2105	30,432	26,247	236	0	3,502	60,416
2106	8,171	7,047	63	0	940	16,221
Plant Subtotal	65,549	41,787	355	0	6,355	114,046
ISFSI Site Restoration Costs [2]						
2104	159	96	0	0	18	273
2105	674	408	0	0	75	1,157
2106	181	110	0	0	20	311
Subtotal ISFSI SR	1,014	614	0	0	112	1,740
Total	**66,563**	**42,401**	**355**	**0**	**6,467**	**115,786**

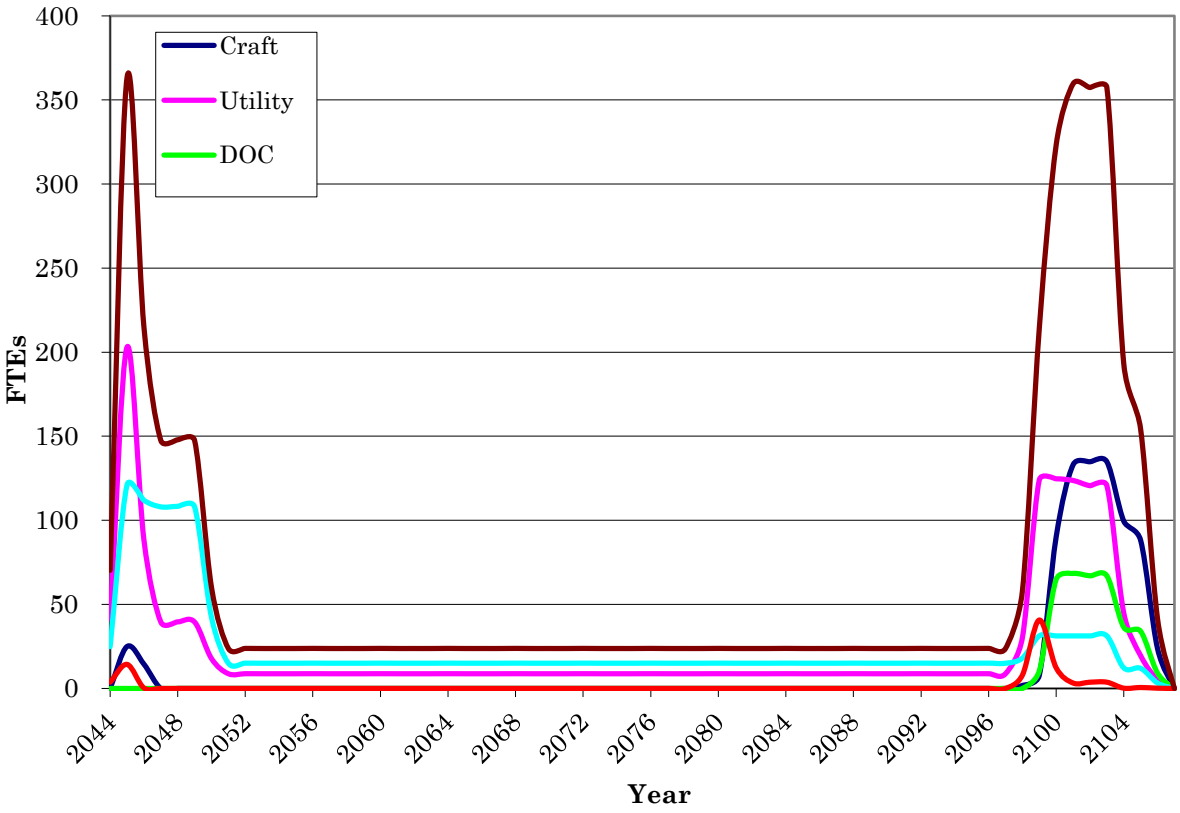
[1] Columns may not add due to rounding
[2] These costs reflect direct ISFSI restoration costs associated with restoring the ISFSI and associated structures/property. Supporting costs detailed in Table G-3 of this report are included in the Plant costs in the table above.

FIGURE 3.1
DECOMMISSIONING PERSONNEL LEVELS
DECON



Note that the labor hour basis of this chart was taken from Appendix C; however not all line items in Appendix C have labor hour values available (e.g. spent fuel canister loading estimates)

FIGURE 3.2
DECOMMISSIONING PERSONNEL LEVELS
SAFSTOR



Note that the labor hour basis of this chart was taken from Appendix D; however not all line items in Appendix D have labor hour values available (e.g. spent fuel canister loading estimates)

4. SCHEDULE ESTIMATE

The schedules for the decommissioning scenarios considered in this study follow the sequences presented in the AIF/NESP-036 study, with minor changes to reflect recent experience and site-specific constraints. In addition, the scheduling has been revised to reflect the spent fuel management plan described in Section 3.4.1.

A schedule or sequence of activities for the DECON alternative is presented in Figure 4.1. The scheduling sequence assumes that fuel is removed from the spent fuel pool within five and one-half years. The key activities listed in the schedule do not reflect a one-to-one correspondence with those activities in the cost tables, but reflect dividing some activities for clarity and combining others for convenience. The schedule was prepared using the "Microsoft Project Professional" computer software.[35]

4.1 SCHEDULE ESTIMATE ASSUMPTIONS

The schedule reflects the results of a precedence network developed for the site decommissioning activities, i.e., a PERT (Program Evaluation and Review Technique) Software Package. The work activity durations used in the precedence network reflect the actual person-hour estimates from the cost table, adjusted by stretching certain activities over their slack range and shifting the start and end dates of others. The following assumptions were made in the development of the decommissioning schedule:

- The fuel building is isolated until such time that all spent fuel has been transferred from the spent fuel pool to the DOE. Decontamination and dismantling of the storage pool is initiated once the transfer of spent fuel is complete (DECON option).
- All work (except vessel and internals removal) is performed during an 8-hour workday, 5 days per week, with no overtime. There are eleven paid holidays per year.
- Reactor and internals removal activities are performed by using separate crews for different activities working on different shifts, with a corresponding backshift charge for the second shift.
- Multiple crews work parallel activities to the maximum extent possible, consistent with optimum efficiency, adequate access for cutting, removal and laydown space, and with the stringent safety measures necessary during demolition of heavy components and structures.

- For plant systems removal, the systems with the longest removal durations in areas on the critical path are considered to determine the duration of the activity.

4.2 PROJECT SCHEDULE

The period-dependent costs presented in the detailed cost tables are based upon the durations developed in the schedules for decommissioning. Durations are established between several milestones in each project period; these durations are used to establish a critical path for the entire project. In turn, the critical path duration for each period is used as the basis for determining the period-dependent costs. A second critical path is shown for the spent fuel storage period, which determines the release of the fuel building for final decontamination.

Project timelines are provided in Figures 4.2 and 4.3 with milestone dates based on a 2044 shutdown date. The fuel pool is emptied approximately five and one-half years after shutdown. Deferred decommissioning in the SAFSTOR scenarios is assumed to commence so that the operating license is terminated within a 60-year period from the cessation of plant operations.

FIGURE 4.1
ACTIVITY SCHEDULE

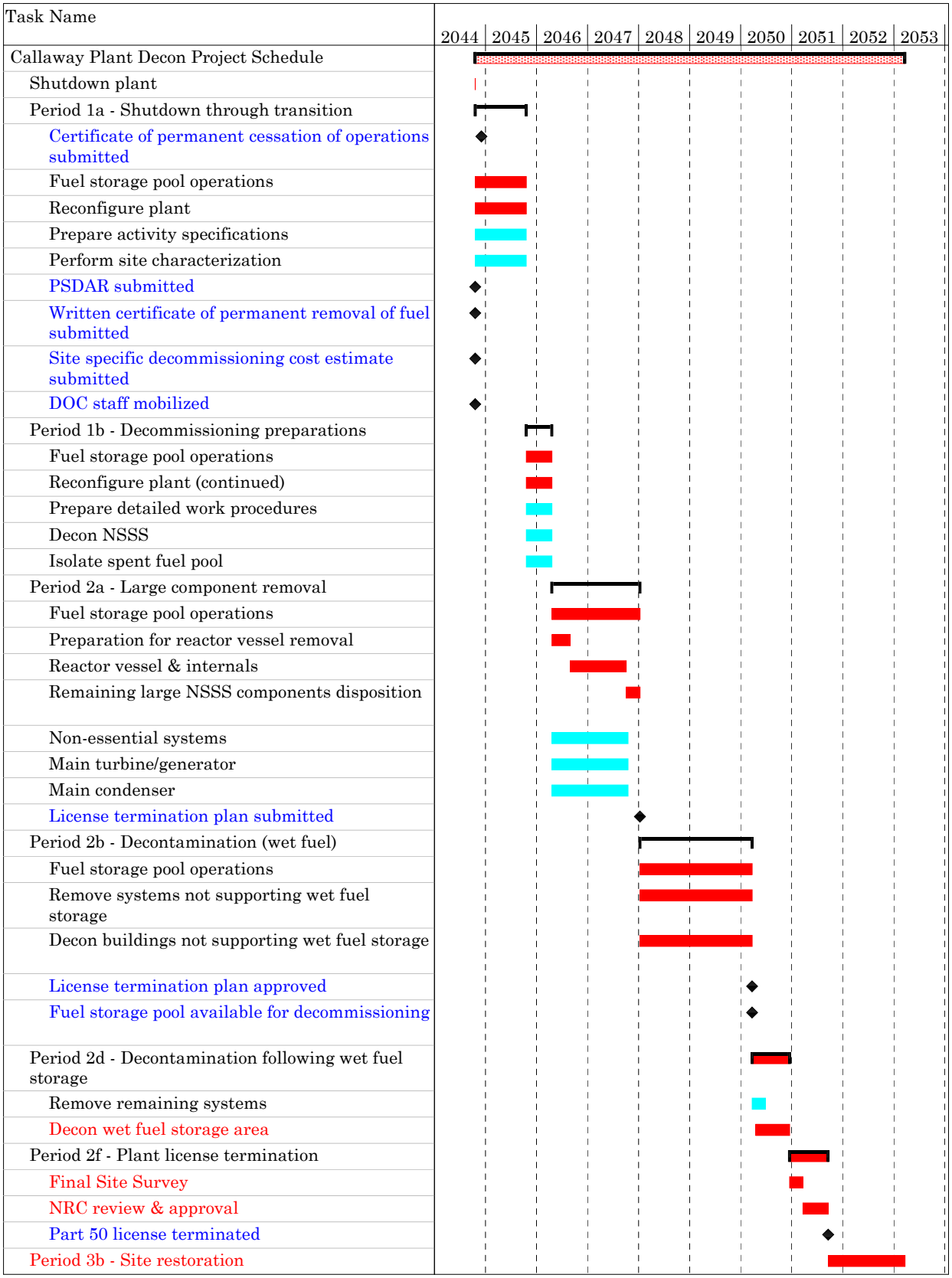


FIGURE 4.2
DECOMMISSIONING TIMELINE
DECON

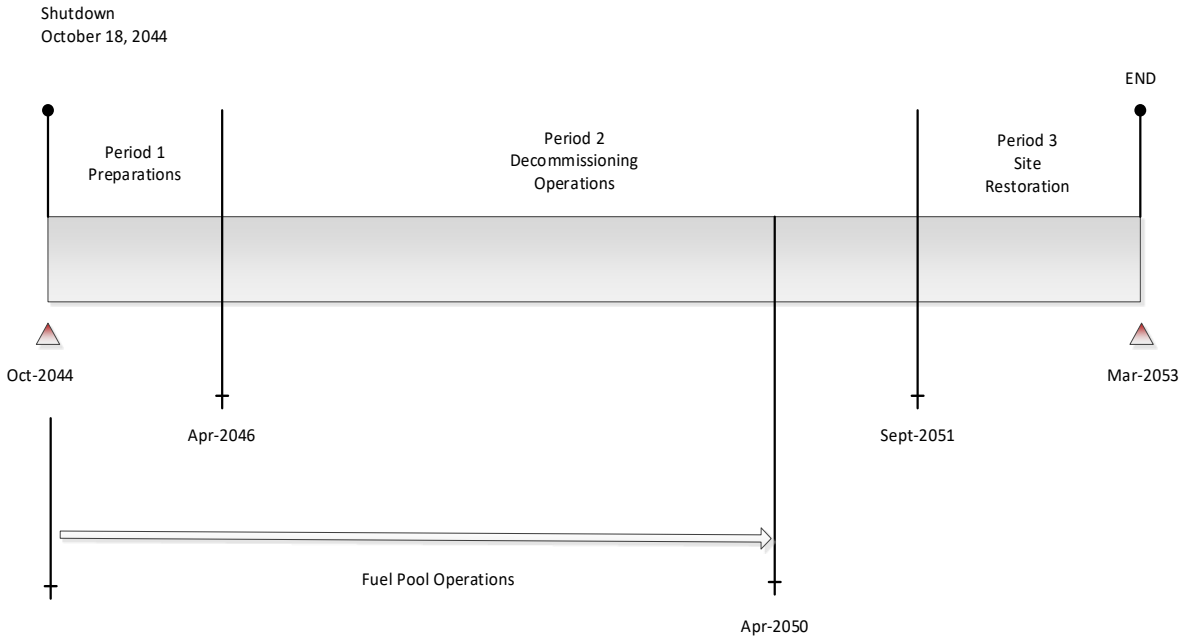
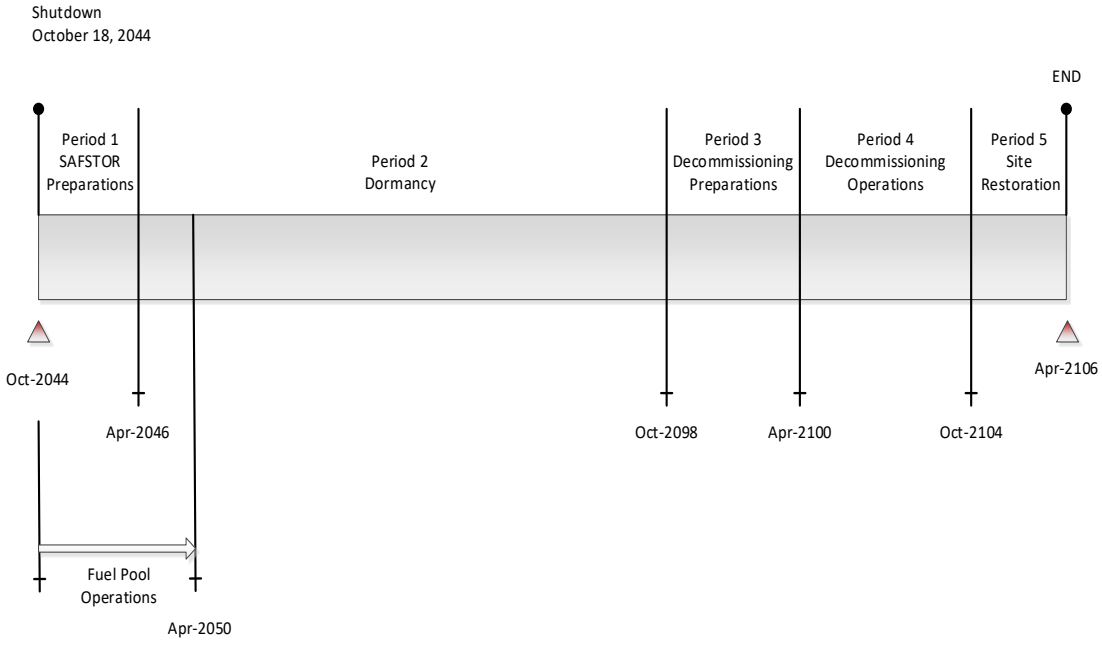


FIGURE 4.3
DECOMMISSIONING TIMELINE
SAFSTOR



5. RADIOACTIVE WASTES

The objectives of the decommissioning process are the removal of all radioactive material from the site that would restrict its future use and the termination of the NRC license. This currently requires the remediation of all radioactive material at the site in excess of applicable legal limits. Under the Atomic Energy Act,[36] the NRC is responsible for protecting the public from sources of ionizing radiation. Title 10 of the Code of Federal Regulations delineates the production, utilization, and disposal of radioactive materials and processes. In particular, Part 71 defines radioactive material as it pertains to transportation and Part 61 specifies its disposition.

Most of the materials being transported for controlled burial are categorized as Low Specific Activity (LSA) or Surface Contaminated Object (SCO) materials containing Type A quantities, as defined in 49 CFR Parts 173-178. Shipping containers are required to be Industrial Packages (IP-1, IP-2 or IP-3, as defined in 10 CFR §173.411). For this study, commercially available steel containers are presumed to be used for the disposal of piping, small components, and concrete. Larger components can serve as their own containers, with proper closure of all openings, access ways, and penetrations.

The destinations for the various waste streams from decommissioning are identified in Figures 5.1 and 5.2. The volumes of radioactive waste generated during the various decommissioning activities at the site are shown on a line-item basis in appendices, and summarized in Tables 5.1 and 5.2 (base case). The quantified waste volume summaries shown in these tables are consistent with Part 61 classifications. The volumes are calculated based on the exterior dimensions for containerized material and on the displaced volume of components serving as their own waste containers.

The reactor vessel and internals are categorized as large quantity shipments and, accordingly, will be shipped in reusable, shielded truck casks with disposable liners. In calculating disposal costs, the burial fees are applied against the liner volume, as well as the special handling requirements of the payload. Packaging efficiencies are lower for the highly activated materials (greater than Type A quantity waste), where high concentrations of gamma-emitting radionuclides limit the capacity of the shipping canisters.

No process system containing/handling radioactive substances at shutdown is presumed to meet material release criteria by decay alone (i.e., systems radioactive at shutdown will still be radioactive over the period during which the decommissioning is accomplished, due to the presence of long-lived radionuclides). While the dose rates decrease with time, radionuclides such as ^{137}Cs will still control the disposition requirements.

The waste material produced in the decontamination and dismantling of the nuclear units is primarily generated during Period 2 of DECON and Period 4 of SAFSTOR. Material that is considered potentially contaminated when removed from the radiological controlled area is sent to processing facilities in Tennessee for conditioning and disposal. Heavily contaminated components and activated materials are routed for controlled disposal. The disposal volumes reported in the tables reflect the savings resulting from processing and recycling.

For purposes of constructing the estimates, the cost for disposal at the Energy*Solutions* facility was used as a proxy for future disposal facilities. Separate rates were used for containerized waste and large components, including the steam generators and reactor coolant pump motors. Demolition debris including miscellaneous steel, scaffolding, and concrete was disposed of at a bulk rate. The decommissioning waste stream also included resins and dry active waste.

Since Energy*Solutions* is not currently able to receive the more highly radioactive components generated in the decontamination and dismantling of the reactor, disposal costs for the Class B and C material were based upon Ameren Services' current agreement with WCS for the Andrews County disposal facility.

A small quantity of material generated during the decommissioning will not be considered suitable for near-surface disposal, and is assumed to be disposed of in a geologic repository, in a manner similar to that envisioned for spent fuel disposal. This GTCC material, is estimated to require five spent fuel storage canisters (or the equivalent) to dispose of the most radioactive portions of the reactor vessel internals. The volume and weight reported in Tables 5.1 and 5.2 represent the packaged weight and volume of the GTCC storage canisters.

FIGURE 5.1
RADIOACTIVE WASTE DISPOSITION

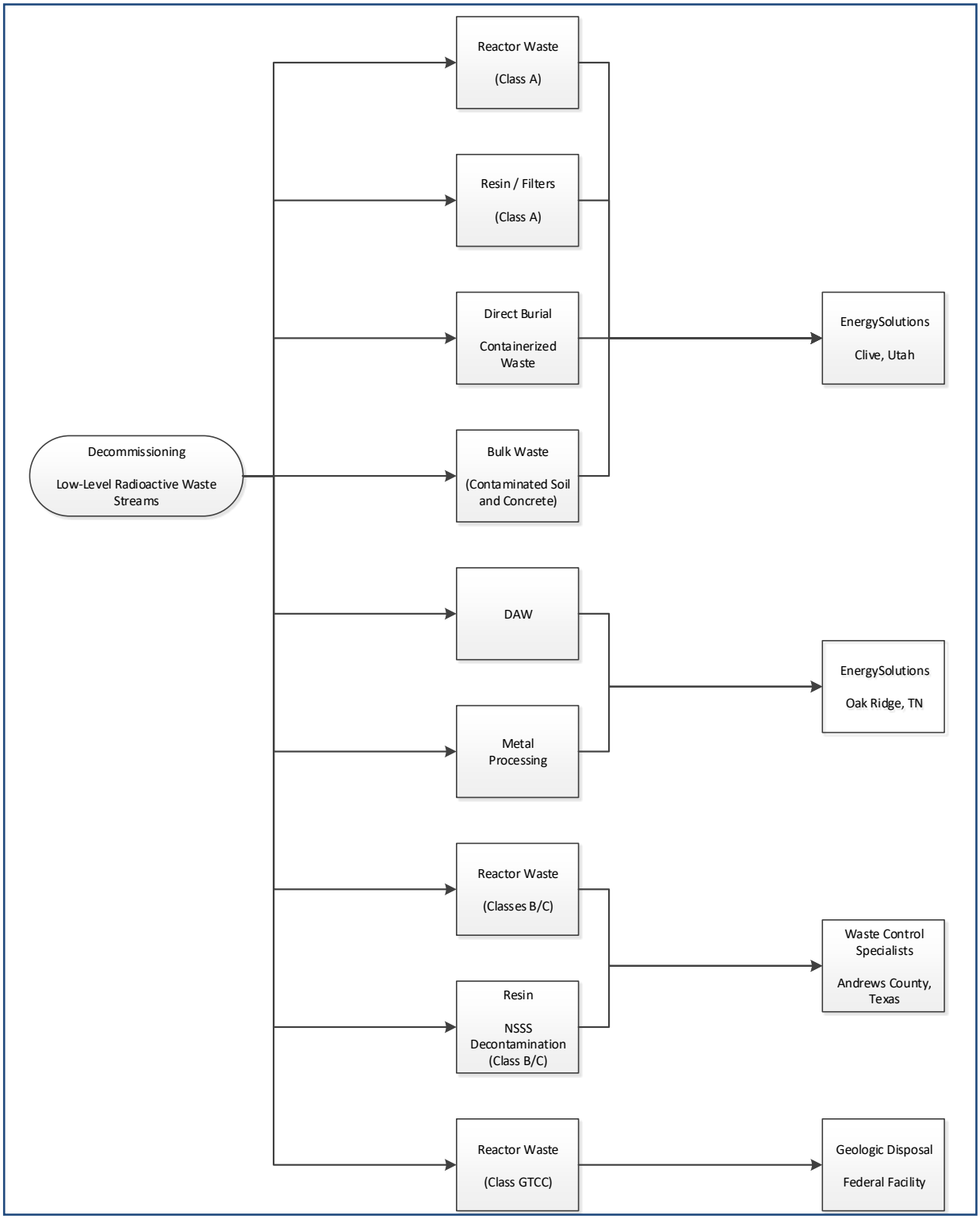


FIGURE 5.2
DECOMMISSIONING WASTE DESTINATIONS
RADIOLOGICAL

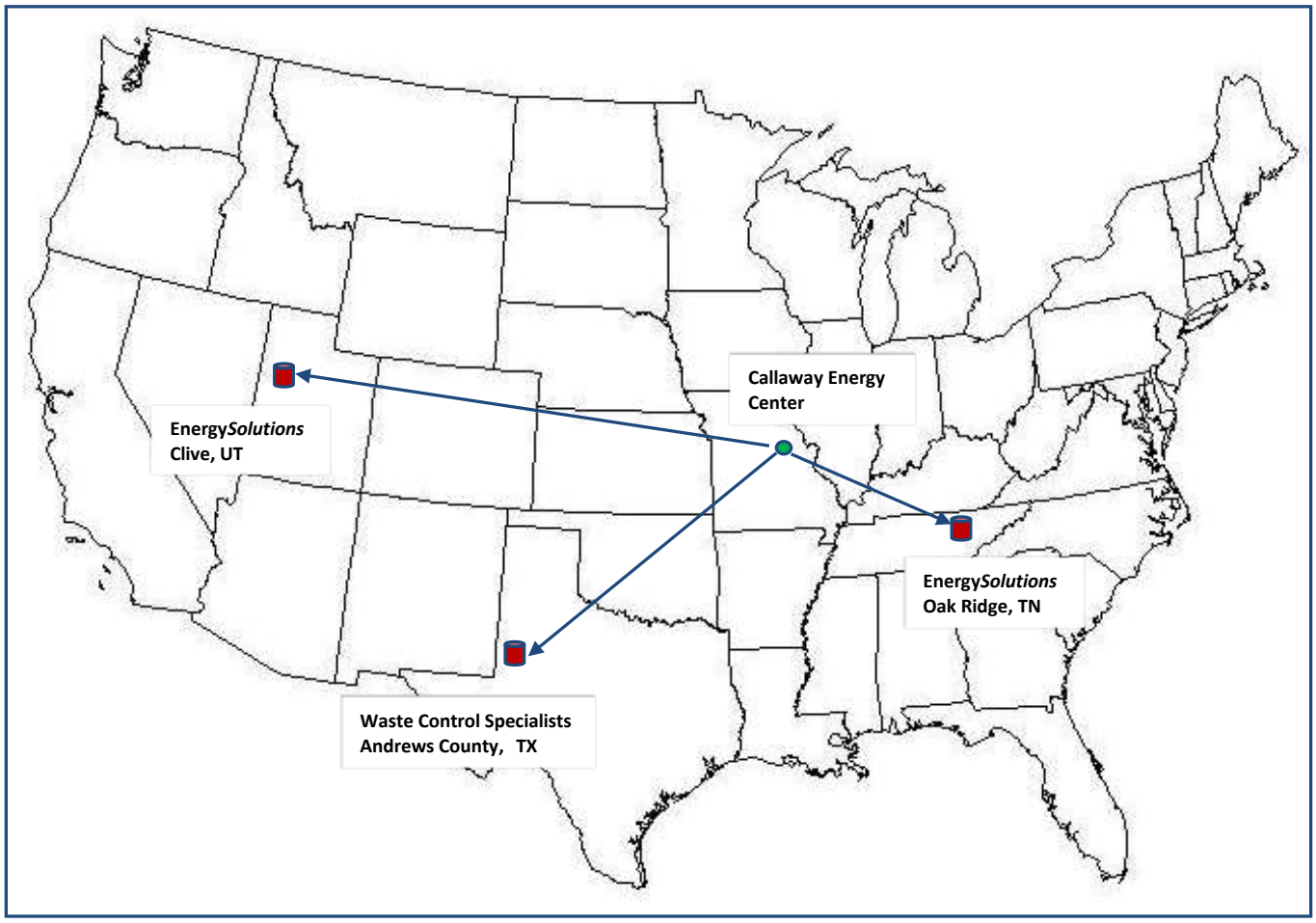


TABLE 5.1
DECON ALTERNATIVE
DECOMMISSIONING WASTE SUMMARY

Waste	Cost Basis	Class [1]	Waste Volume (cubic feet)	Mass (pounds)
Low-Level Radioactive Waste (near-surface disposal)	Energy*Solutions*	A	235,150	15,504,509
	WCS	B	2,268	254,539
	WCS	C	393	47,411
Greater than Class C (geologic repository)	Spent Fuel Equivalent	GTCC	2,217	433,180
Processed/Conditioned (off-site recycling center)	Recycling Vendors	A	286,777	10,886,250
Totals [2]			526,805	27,125,890

[1] Waste is classified according to the requirements delineated in Title 10 CFR, Part 61.55
[2] Columns may not add due to rounding.

TABLE 5.2
SAFSTOR ALTERNATIVE
DECOMMISSIONING WASTE SUMMARY

Waste	Cost Basis	Class [1]	Waste Volume (cubic feet)	Mass (pounds)
Low-Level Radioactive Waste (near-surface disposal)	Energy*Solutions*	A	196,099	12,966,272
	WCS	B	751	65,154
	WCS	C	406	46,747
Greater than Class C (geologic repository)	Spent Fuel Equivalent	GTCC	2,217	433,180
Processed/Conditioned (off-site recycling center)	Recycling Vendors	A	313,752	12,018,050
Totals [2]			513,224	25,529,404

[1] Waste is classified according to the requirements as delineated in Title 10 CFR, Part 61.55
[2] Columns may not add due to rounding.

6. RESULTS

The analysis to estimate the costs to decommission Callaway relied upon the site-specific, technical information developed for a previous analysis prepared in 2020. While not an engineering study, the estimates provide the plant owner with sufficient information to assess its financial obligations, as they pertain to the eventual decommissioning of the nuclear station.

The estimates described in this report are based on numerous fundamental assumptions, including regulatory requirements, project contingencies, low-level radioactive waste disposal practices, high-level radioactive waste management options, and site restoration requirements. The decommissioning scenarios assume continued operation of the station's spent fuel pool for a minimum of five and one-half years following the cessation of operations for continued cooling of the assemblies. Once sufficiently cooled, the spent fuel will be packaged into canisters and transferred to the DOE. The spent fuel stored at the ISFSI will also be transferred to DOE during this period.

The cost projected to promptly decommission (DECON) Callaway, assuming the use of off-site low-level radioactive waste processing to reduce the volume requiring controlled disposal, is estimated to be $1,097.9 million. The majority of this cost (approximately 82.2%) is associated with the physical decontamination and dismantling of the nuclear unit so that the operating license can be terminated. Another 7.2% is associated with the management, interim storage, and eventual transfer of the spent fuel. The remaining 10.6% is for the demolition of the designated structures and limited restoration of the site.

The cost projected for deferred decommissioning (SAFSTOR), assuming the use of off-site low-level radioactive waste processing to reduce the volume requiring controlled disposal, is estimated to be $1,435.4 million. The majority of this cost (approximately 85.2%) is associated with placing the unit in storage, ongoing caretaking of the unit during dormancy, and the eventual physical decontamination and dismantling of the nuclear unit so that the operating license can be terminated. Another 6.7% is associated with the management, interim storage, and eventual transfer of the spent fuel. The remaining 8.1% is for the demolition of the designated structures and limited restoration of the site.

The primary cost contributors, identified in Tables 6.1 and 6.2, are either labor-related or associated with the management and disposition of the radioactive waste. Program management is the largest single contributor to the overall cost. The magnitude of the expense is a function of both the size of the organization required to manage the decommissioning, as well as the duration of the program. It is

assumed, for purposes of this analysis, that Ameren Services will oversee the decommissioning program, using a DOC to manage the decommissioning labor force and the associated subcontractors. The size and composition of the management organization varies with the decommissioning phase and associated site activities. However, once the operating license is terminated, the staff is substantially reduced for the conventional demolition and restoration of the site (for the DECON alternative).

As described in this report, the spent fuel pool will remain operational for a minimum of five and one-half years following the cessation of operations. The pool will be isolated and an independent spent fuel island created. This will allow decommissioning operations to proceed in and around the pool area. Over the five and one-half year period, the spent fuel will be packaged into canisters and transferred to the DOE. The spent fuel stored at the ISFSI will also be transferred to DOE during this period.

The cost for waste disposal includes those costs associated with the controlled disposition of the low-level radioactive waste generated from decontamination and dismantling activities, including plant equipment and components, structural material, filters, resins and dry-active waste. As described in Section 5, disposition of the low-level radioactive material required controlled disposal is at the Energy*Solutions*' facility. Highly activated components, requiring additional isolation from the environment (GTCC), are packaged for geologic disposal. The cost of geologic disposal is based upon a cost equivalent for spent fuel.

A significant portion of the metallic waste is designated for additional processing and treatment at an off-site facility. Processing reduces the volume of material requiring controlled disposal through such techniques and processes as survey and sorting, decontamination, and volume reduction. The material that cannot be unconditionally released is packaged for controlled disposal at one of the currently operating facilities. The cost identified in the summary tables for processing is all-inclusive, incorporating the ultimate disposition of the material.

Removal costs reflect the labor-intensive nature of the decommissioning process, as well as the management controls required to ensure a safe and successful program. Decontamination and packaging costs also have a large labor component that is based upon prevailing union wages. Non-radiological demolition is a natural extension of the decommissioning process. The methods employed in decontamination and dismantling are generally destructive and indiscriminate in inflicting collateral damage. With a work force mobilized to support decommissioning operations, non-radiological demolition can be an integrated activity and a logical expansion of the work being performed in the process of terminating the operating license. Prompt

demolition reduces future liabilities and can be more cost effective than deferral, due to the deterioration of the facilities (and therefore the working conditions) with time.

The reported cost for transport includes the tariffs and surcharges associated with moving large components and/or overweight shielded casks overland, as well as the general expense, e.g., labor and fuel, of transporting material to the destinations identified in this report. For purposes of this analysis, material is primarily moved overland by truck.

Decontamination is used to reduce the plant radiation fields and minimize worker exposure. Slightly contaminated material or material located within a contaminated area is sent to an off-site processing center, i.e., this analysis does not assume that contaminated plant components and equipment can be decontaminated for uncontrolled release in-situ. Centralized processing centers have proven to be a more economical means of handling the large volumes of material produced in the dismantling of a nuclear unit.

License termination survey costs are associated with the labor intensive and complex activity of verifying that contamination has been removed from the site to the levels specified by the regulating agency. This process involves a systematic survey of all remaining plant surface areas and surrounding environs, sampling, isotopic analysis, and documentation of the findings. The status of any plant components and materials not removed in the decommissioning process will also require confirmation and will add to the expense of surveying the facilities alone.

The remaining costs include allocations for heavy equipment and temporary services, as well as for other expenses such as regulatory fees and the premiums for nuclear insurance. While site operating costs are greatly reduced following the final cessation of plant operations, certain administrative functions do need to be maintained either at a basic functional or regulatory level.

TABLE 6.1
DECON ALTERNATIVE
DECOMMISSIONING COST ELEMENTS
(thousands of 2023 dollars)

Cost Element	Total	Percentage
Decontamination	24,795	2.3
Removal	206,170	18.8
Packaging	35,292	3.2
Transportation	25,123	2.3
Waste Disposal	130,929	11.9
Off-site Waste Processing	37,057	3.4
Program Management [1]	359,753	32.8
Security	100,102	9.1
Corporate Allocations	9,270	0.8
Spent Fuel Pool Isolation	16,480	1.5
Spent Fuel Management [2]	78,615	7.2
Insurance and Regulatory Fees	18,310	1.7
Energy	13,975	1.3
Characterization and Licensing Surveys	32,090	2.9
Property Taxes	1,112	0.1
Miscellaneous Equipment	8,875	0.8
Total [3]	1,097,947	100.0

Cost Element	Total	Percentage
License Termination (excluding ISFSI)	891,881	81.2
ISFSI Decommissioning (License Termination)	10,556	1.0
Spent Fuel Management [2]	78,615	7.2
Site Restoration (excluding ISFSI)	115,155	10.5
ISFSI Demolition (Site Restoration)	1,740	0.2
Total [3]	1,097,947	100.0

[1] Includes engineering costs
[2] Direct costs only. Excludes program management costs (staffing) but includes costs for spent fuel loading/spent fuel pool O&M and Emergency Planning fees
[3] Columns may not add due to rounding

TABLE 6.2
SAFSTOR ALTERNATIVE
DECOMMISSIONING COST ELEMENTS
(thousands of 2023 dollars)

Cost Element	Total	Percentage
Decontamination	22,031	1.5
Removal	210,552	14.7
Packaging	29,078	2.0
Transportation	20,724	1.4
Waste Disposal	99,601	6.9
Off-site Waste Processing	40,909	2.9
Program Management [1]	471,962	32.9
Security	279,243	19.5
Corporate Allocations	14,255	1.0
Spent Fuel Pool Isolation	16,480	1.1
Spent Fuel Management [2]	78,615	5.5
Insurance and Regulatory Fees	58,283	4.1
Energy	28,359	2.0
Characterization and Licensing Surveys	32,222	2.2
Property Taxes	8,114	0.6
Miscellaneous Equipment	24,989	1.7
Total [3]	1,435,417	100.0

Cost Element	Total	Percentage
License Termination (excluding ISFSI)	1,212,752	84.5
ISFSI Decommissioning (License Termination)	10,556	0.7
Spent Fuel Management [4]	96,323	6.7
Site Restoration (excluding ISFSI)	114,046	7.9
ISFSI Demolition (Site Restoration)	1,740	0.1
Total [3]	1,435,417	100.0

[1] Includes engineering costs
[2] Direct costs only. Excludes program management costs (staffing) but includes costs for spent fuel loading/spent fuel pool O&M and Emergency Planning fees
[3] Columns may not add due to rounding
[4] Includes percentage of Period 2a (dormancy) plant operating costs until spent fuel pool is emptied, in addition to the direct costs.

7. REFERENCES

1. "Decommissioning Cost Analysis for the Callaway Energy Center," Document A22-1782-001, Rev. 0, TLG Services, Inc., October 2020

2. U.S. Code of Federal Regulations, Title 10, Parts 30, 40, 50, 51, 70 and 72, "General Requirements for Decommissioning Nuclear Facilities," Nuclear Regulatory Commission, 53 Fed. Reg. 24018, June 27, 1988 [Open]

3. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.159, "Assuring the Availability of Funds for Decommissioning Nuclear Reactors," Rev. 2, October 2011 [Open]

4. U.S. Code of Federal Regulations, Title 10, Part 20, Subpart E, "Radiological Criteria for License Termination" [Open]

5. U.S. Code of Federal Regulations, Title 10, Parts 20 and 50, "Entombment Options for Power Reactors," Advance Notice of Proposed Rulemaking, 66 Fed. Reg. 52551, October 16, 2001 [Open]

6. U.S. Code of Federal Regulations, Title 10, Parts 2, 50 and 51, "Decommissioning of Nuclear Power Reactors," Nuclear Regulatory Commission, 61 Fed. Reg. 39278, July 29, 1996 [Open]

7. 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, (p 35512 et seq.), June 17, 2011 [Open]

8. "Nuclear Waste Policy Act of 1982," 42 U.S. Code 10101, et seq. [Open]

9. Charter of the Blue Ribbon Commission on America's Nuclear Future, "Objectives and Scope of Activities" [Open]

10. "Blue Ribbon Commission on America's Nuclear Future, Report to the Secretary of Energy," p. 27, 32, January 2012 [Open]

11. "Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste," U.S. DOE, January 11, 2013 [Open]

12. United States Court of Appeals for the District of Columbia Circuit, In Re: Aiken County, Et Al., August 2013 [Open]

7. REFERENCES
(continued)

13. U.S. Code of Federal Regulations, Title 10, Part 50, "Domestic Licensing of Production and Utilization Facilities," Subpart 54 (bb), "Conditions of Licenses" [Open]

14. "Low-Level Radioactive Waste Policy Act," Public Law 96-573, 1980 [Open]

15. "Low-Level Radioactive Waste Policy Amendments Act of 1985," Public Law 99-240, January 15, 1986 [Open]

16. U.S. Code of Federal Regulations, Title 10, Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste" [Open]

17. "Final Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste," (DOE/EIS-0375), January 2016 [Open]

18. U.S. Code of Federal Regulations, Title 10, Part 20, Subpart E, "Final Rule, Radiological Criteria for License Termination," 62 Fed. Reg. 39058, July 21, 1997 [Open]

19. "Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination," EPA Memorandum OSWER No. 9200.4-18, August 22, 1997 [Open]

20. U.S. Code of Federal Regulations, Title 40, Part 141.66, "Maximum contaminant levels for radionuclides" [Open]

21. "Memorandum of Understanding Between the Environmental Protection Agency and the Nuclear Regulatory Commission: Consultation and Finality on Decommissioning and Decontamination of Contaminated Sites," OSWER 9295.8-06a, October 9, 2002 [Open]

22. "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)," NUREG-1575, Rev. 1, EPA 402-R-97-016, Rev. 1, August 2000 [Open]

23. T.S. LaGuardia et al., "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates," AIF/NESP-036, May 1986 [Open]

24. W.J. Manion and T.S. LaGuardia, "Decommissioning Handbook," U.S. Department of Energy, DOE/EV/10128-1, November 1980 [Open]

7. REFERENCES
(continued)

25. "Building Construction Cost with RSMeans Data 2023," Gordian, Rockland, Massachusetts [Open]

26. "Decommissioning of Nuclear Power Reactors," Regulatory Guide 1.184, Nuclear Regulatory Commission, October 2013 [Open]

27. "Standard Format and Content of Decommissioning Cost Estimates for Nuclear Power Reactors," Regulatory Guide 1.202, Nuclear Regulatory Commission, February 2005 [Open]

28. Project and Cost Engineers' Handbook, Second Edition, p. 239, American Association of Cost Engineers, Marcel Dekker, Inc., New York, New York, 1984 [Open]

29. U.S. Department of Transportation, Title 49 of the Code of Federal Regulations, "Transportation," Parts 173 through 178 [Open]

30. Tri-State Motor Transit Company, Radioactive Materials Tariffs, TSMT 7000, January 2023. [Open}

31. J.C. Evans et al., "Long-Lived Activation Products in Reactor Materials" NUREG/CR-3474, Pacific Northwest Laboratory for the Nuclear Regulatory Commission, August 1984 [Open]

32. R.I. Smith, G.J. Konzek, W.E. Kennedy, Jr., "Technology, Safety and Costs of Decommissioning a Reference Pressurized Water Reactor Power Station," NUREG/CR-0130 and addenda, Pacific Northwest Laboratory for the Nuclear Regulatory Commission, June 1978 [Open Main Report] [Open Appendices]

33. H.D. Oak, et al., "Technology, Safety and Costs of Decommissioning a Reference Boiling Water Reactor Power Station," NUREG/CR-0672 and addenda, Pacific Northwest Laboratory for the Nuclear Regulatory Commission, June 1980 [Open Main Report] [Open Appendices]

34. SECY-00-0145, "Integrated Rulemaking Plan for Nuclear Power Plant Decommissioning," June 2000 [Open]

35. "Microsoft Project Professional," Microsoft Corporation, Redmond, WA

36. "Atomic Energy Act of 1954," (68 Stat. 919) [Open]

APPENDIX A

UNIT COST FACTOR DEVELOPMENT

APPENDIX A
UNIT COST FACTOR DEVELOPMENT

Example: Unit Factor for Removal of Contaminated Heat Exchanger < 3,000 lbs.

1. SCOPE

Heat exchangers weighing < 3,000 lbs. will be removed in one piece using a crane or small hoist. They will be disconnected from the inlet and outlet piping. The heat exchanger will be sent to the waste processing area.

2. CALCULATIONS

Act ID	Activity Description	Activity Duration (minutes)	Critical Duration (minutes)*
a	Remove insulation	60	(b)
b	Mount pipe cutters	60	60
c	Install contamination controls	20	(b)
d	Disconnect inlet and outlet lines	60	60
e	Cap openings	20	(d)
f	Rig for removal	30	30
g	Unbolt from mounts	30	30
h	Remove contamination controls	15	15
i	Remove, wrap, send to waste processing area	60	60
	Totals (Activity/Critical)	355	255

Duration adjustment(s):	
+ Respiratory protection adjustment (50% of critical duration)	128
+ Radiation/ALARA adjustment (37% of critical duration)	95
Adjusted work duration	478
+ Protective clothing adjustment (30% of adjusted duration)	143
Productive work duration	621
+ Work break adjustment (8.33 % of productive duration)	52
Total work duration (minutes)	673

***** Total duration = 11.217 hour *****

* alpha designators indicate activities that can be performed in parallel

APPENDIX A
(continued)

3. LABOR REQUIRED

Crew	Number	Duration (hours)	Rate ($/hour)	Cost
Laborers	3.00	11.217	$52.10	$1,753.22
Craftsmen	2.00	11.217	$80.03	$1,795.39
Foreman	1.00	11.217	$82.29	$923.05
General Foreman	0.25	11.217	$84.55	$237.10
Fire Watch	0.05	11.217	$52.10	$29.22
Health Physics Technician	1.00	11.217	$50.85	$570.38
Total Labor Cost				$5,308.36

4. EQUIPMENT & CONSUMABLES COSTS

Equipment Costs	none
Consumables/Materials Costs	
• Universal Polypropylene Sorbent 50 @ $0.72/sq ft [1]	$36.00
• Tarpaulin, oil resistant, fire retardant 50 @ $0.44/sq ft [2]	$22.00
• Gas torch consumables 1 @ $21.31 1 /hr [3]	$21.31
Subtotal cost of equipment and materials	$79.31
Overhead & profit on equipment and materials @ 16.73%	$13.27
Total costs, equipment & material	$92.58

TOTAL COST:

Removal of contaminated **heat exchanger <3000 pounds:**	**$5,400.94**
Total labor cost:	$5,308.36
Total equipment/material costs:	$92.58
Total craft labor man-hours required per unit:	81.88

5. NOTES AND REFERENCES

- Work difficulty factors were developed in conjunction with the Atomic Industrial Forum's (now NEI) program to standardize nuclear decommissioning cost estimates and are delineated in Volume 1, Chapter 5 of the "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates," AIF/NESP-036, May 1986.

- References for equipment & consumables costs:

    1. www.mcmaster.com online catalog, McMaster Carr Spill Control (7193T88)
    2. R.S. Means (2023) Division 01 56, Section 13.60-0600, page 23
    3. R.S. Means (2023) Division 01 54 33, Section 40-6360, page 744

- Material and consumable costs were adjusted using the regional indices for Jefferson City, MO.

APPENDIX B

UNIT COST FACTOR LISTING
(DECON: Power Block Structures Only)

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of clean instrument and sampling tubing, $/linear foot	0.60
Removal of clean pipe 0.25 to 2 inches diameter, $/linear foot	6.28
Removal of clean pipe >2 to 4 inches diameter, $/linear foot	9.11
Removal of clean pipe >4 to 8 inches diameter, $/linear foot	18.46
Removal of clean pipe >14 to 20 inches diameter, $/linear foot	45.67
Removal of clean pipe >20 to 36 inches diameter, $/linear foot	67.18
Removal of clean pipe >36 inches diameter, $/linear foot	79.80
Removal of clean valve >2 to 4 inches	120.45
Removal of clean valve >4 to 8 inches	184.64
Removal of clean valve >8 to 14 inches	350.85
Removal of clean valve >14 to 20 inches	456.72
Removal of clean valve >20 to 36 inches	671.84
Removal of clean valve >36 inches	797.99
Removal of clean pipe hanger for small bore piping	41.11
Removal of clean pipe hanger for large bore piping	142.83
Removal of clean pump, <300 pound	312.62
Removal of clean pump, 300-1000 pound	882.17
Removal of clean pump, 1000-10,000 pound	3,453.50
Removal of clean pump, >10,000 pound	6,682.87
Removal of clean pump motor, 300-1000 pound	368.74
Removal of clean pump motor, 1000-10,000 pound	1,434.98
Removal of clean pump motor, >10,000 pound	3,228.72
Removal of clean heat exchanger <3000 pound	1,855.11
Removal of clean heat exchanger >3000 pound	4,675.28
Removal of clean feedwater heater/deaerator	13,174.84
Removal of clean moisture separator/reheater	27,077.94
Removal of clean tank, <300 gallons	401.98
Removal of clean tank, 300-3000 gallon	1,265.34
Removal of clean tank, >3000 gallons, $/square foot surface area	10.84

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of clean electrical equipment, <300 pound	149.62
Removal of clean electrical equipment, 300-1000 pound	530.96
Removal of clean electrical equipment, 1000-10,000 pound	1,061.94
Removal of clean electrical equipment, >10,000 pound	2,536.52
Removal of clean electrical transformer < 30 tons	1,761.58
Removal of clean electrical equipment, <300 pound	169.17
Removal of clean electrical equipment, 300-1000 pound	600.35
Removal of clean electrical equipment, 1000-10,000 pound	1,200.70
Removal of clean electrical equipment, >10,000 pound	2,867.96
Removal of clean electrical transformer < 30 tons	1,991.75
Removal of clean electrical transformer > 30 tons	5,735.93
Removal of clean standby diesel generator, <100 kW	2,034.41
Removal of clean standby diesel generator, 100 kW to 1 MW	4,540.94
Removal of clean standby diesel generator, >1 MW	9,400.66
Removal of clean electrical cable tray, $/linear foot	15.92
Removal of clean electrical conduit, $/linear foot	6.96
Removal of clean mechanical equipment, <300 pound	169.17
Removal of clean mechanical equipment, 300-1000 pound	600.35
Removal of clean mechanical equipment, 1000-10,000 pound	1,200.70
Removal of clean mechanical equipment, >10,000 pound	2,867.96
Removal of clean HVAC equipment, <300 pound	204.56
Removal of clean HVAC equipment, 300-1000 pound	721.37
Removal of clean HVAC equipment, 1000-10,000 pound	1,437.68
Removal of clean HVAC equipment, >10,000 pound	2,867.96
Removal of clean HVAC ductwork, $/pound	0.63
Removal of contaminated instrument and sampling tubing, $/linear foot	1.78
Removal of contaminated pipe 0.25 to 2 inches diameter, $/linear foot	25.82
Removal of contaminated pipe >2 to 4 inches diameter, $/linear foot	44.29
Removal of contaminated pipe >4 to 8 inches diameter, $/linear foot	71.40
Removal of contaminated pipe >8 to 14 inches diameter, $/linear foot	138.98

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of contaminated pipe >14 to 20 inches diameter, $/linear foot	166.71
Removal of contaminated pipe >20 to 36 inches diameter, $/linear foot	230.09
Removal of contaminated pipe >36 inches diameter, $/linear foot	271.62
Removal of contaminated valve >2 to 4 inches	531.15
Removal of contaminated valve >4 to 8 inches	648.16
Removal of contaminated valve >8 to 14 inches	1,322.05
Removal of contaminated valve >14 to 20 inches	1,678.96
Removal of contaminated valve >20 to 36 inches	2,233.24
Removal of contaminated valve >36 inches	2,648.50
Removal of contaminated pipe hanger for small bore piping	169.92
Removal of contaminated pipe hanger for large bore piping	561.77
Removal of contaminated pump, <300 pound	1,158.39
Removal of contaminated pump, 300-1000 pound	2,744.26
Removal of contaminated pump, 1000-10,000 pound	8,978.74
Removal of contaminated pump, >10,000 pound	21,870.01
Removal of contaminated pump motor, 300-1000 pound	1,174.62
Removal of contaminated pump motor, 1000-10,000 pound	3,661.60
Removal of contaminated pump motor, >10,000 pound	8,220.81
Removal of contaminated heat exchanger <3000 pound	5,400.94
Removal of contaminated heat exchanger >3000 pound	15,681.18
Removal of contaminated tank, <300 gallons	1,927.64
Removal of contaminated tank, >300 gallons, $/square foot	38.37
Removal of contaminated electrical equipment, <300 pound	892.43
Removal of contaminated electrical equipment, 300-1000 pound	2,227.72
Removal of contaminated electrical equipment, 1000-10,000 pound	4,290.73
Removal of contaminated electrical equipment, >10,000 pound	8,488.19
Removal of contaminated electrical cable tray, $/linear foot	43.18
Removal of contaminated electrical conduit, $/linear foot	21.09
Removal of contaminated mechanical equipment, <300 pound	992.80
Removal of contaminated mechanical equipment, 300-1000 pound	2,460.28

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of contaminated mechanical equipment, 1000-10,000 pound	4,730.94
Removal of contaminated mechanical equipment, >10,000 pound	8,488.19
Removal of contaminated HVAC equipment, <300 pound	992.80
Removal of contaminated HVAC equipment, 300-1000 pound	2,460.28
Removal of contaminated HVAC equipment, 1000-10,000 pound	4,730.94
Removal of contaminated HVAC equipment, >10,000 pound	8,488.19
Removal of contaminated HVAC ductwork, $/pound	2.55
Removal/plasma arc cut of contaminated thin metal components, $/linear in.	4.88
Additional decontamination of surface by washing, $/square foot	9.55
Additional decontamination of surfaces by hydrolasing, $/square foot	46.23
Decontamination rig hook up and flush, $/ 250 foot length	8,369.51
Chemical flush of components/systems, $/gallon	29.29
Removal of clean standard reinforced concrete, $/cubic yard	77.74
Removal of grade slab concrete, $/cubic yard	88.39
Removal of clean concrete floors, $/cubic yard	443.76
Removal of sections of clean concrete floors, $/cubic yard	1,336.96
Removal of clean heavily rein concrete w/#9 rebar, $/cubic yard	112.15
Removal of contaminated heavily rein concrete w/#9 rebar, $/cubic yard	2,614.89
Removal of clean heavily rein concrete w/#18 rebar, $/cubic yard	151.92
Removal of contaminated heavily rein concrete w/#18 rebar, $/cubic yard	3,460.01
Removal heavily rein concrete w/#18 rebar & steel embedments, $/cubic yard	607.92
Removal of below-grade suspended floors, $/cubic yard	212.95
Removal of clean monolithic concrete structures, $/cubic yard	1,122.15
Removal of contaminated monolithic concrete structures, $/cubic yard	2,602.37
Removal of clean foundation concrete, $/cubic yard	881.30
Removal of contaminated foundation concrete, $/cubic yard	2,424.29
Explosive demolition of bulk concrete, $/cubic yard	60.79
Removal of clean hollow masonry block wall, $/cubic yard	30.84
Removal of contaminated hollow masonry block wall, $/cubic yard	79.42
Removal of clean solid masonry block wall, $/cubic yard	30.84

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of contaminated solid masonry block wall, $/cubic yard	79.42
Backfill of below-grade voids, $/cubic yard	37.05
Removal of subterranean tunnels/voids, $/linear foot	132.38
Placement of concrete for below-grade voids, $/cubic yard	177.58
Excavation of clean material, $/cubic yard	3.41
Excavation of contaminated material, $/cubic yard	49.89
Removal of clean concrete rubble (tipping fee included), $/cubic yard	29.51
Removal of contaminated concrete rubble, $/cubic yard	31.53
Removal of building by volume, $/cubic foot	0.42
Removal of clean building metal siding, $/square foot	1.59
Removal of contaminated building metal siding, $/square foot	5.11
Removal of standard asphalt roofing, $/square foot	2.80
Removal of transite panels, $/square foot	2.73
Scarifying contaminated concrete surfaces (drill & spall), $/square foot	15.13
Scabbling contaminated concrete floors, $/square foot	9.25
Scabbling contaminated concrete walls, $/square foot	24.52
Scabbling contaminated ceilings, $/square foot	84.23
Scabbling structural steel, $/square foot	7.71
Removal of clean overhead crane/monorail < 10 ton capacity	857.58
Removal of contaminated overhead crane/monorail < 10 ton capacity	2,297.48
Removal of clean overhead crane/monorail >10-50 ton capacity	2,058.22
Removal of contaminated overhead crane/monorail >10-50 ton capacity	5,513.02
Removal of polar crane > 50 ton capacity	8,615.54
Removal of gantry crane > 50 ton capacity	32,025.59
Removal of structural steel, $/pound	0.32
Removal of clean steel floor grating, $/square foot	6.41
Removal of contaminated steel floor grating, $/square foot	17.73
Removal of clean free standing steel liner, $/square foot	16.25
Removal of contaminated free standing steel liner, $/square foot	44.84
Removal of clean concrete-anchored steel liner, $/square foot	8.13

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of contaminated concrete-anchored steel liner, $/square foot	52.28
Placement of scaffolding in clean areas, $/square foot	16.96
Placement of scaffolding in contaminated areas, $/square foot	28.62
Landscaping with topsoil, $/acre	27,052.63
Cost of CPC B-88 LSA box & preparation for use	2,132.80
Cost of CPC B-25 LSA box & preparation for use	1,832.59
Cost of CPC B-12V 12 gauge LSA box & preparation for use	1,662.57
Cost of CPC B-144 LSA box & preparation for use	10,445.35
Cost of LSA drum & preparation for use	380.87
Cost of cask liner for CNSI 8 120A cask (resins)	14,624.70
Cost of cask liner for CNSI 8 120A cask (filters)	10,523.30
Decontamination of surfaces with vacuuming, $/square foot	1.03

APPENDIX C
DETAILED COST ANALYSIS

DECON

with

LOW-LEVEL RADIOACTIVE WASTE PROCESSING

Table C
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
PERIOD 1a - Shutdown through Transition																					
Period 1a Direct Decommissioning Activities																					
1a.1.1	Prepare preliminary decommissioning cost	-	-	-	-	-	-	206	31	237	237	-	-	-	-	-	-	-	-	-	1,300
1a.1.2	Notification of Cessation of Operations									a											
1a.1.3	Remove fuel & source material									n/a											
1a.1.4	Notification of Permanent Defueling									a											
1a.1.5	Deactivate plant systems & process waste									a											
1a.1.6	Prepare and submit PSDAR	-	-	-	-	-	-	317	48	365	365	-	-	-	-	-	-	-	-	-	2,000
1a.1.7	Review plant dwgs & specs.	-	-	-	-	-	-	730	110	840	840	-	-	-	-	-	-	-	-	-	4,600
1a.1.8	Perform detailed rad survey									a											
1a.1.9	Estimate by-product inventory	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
1a.1.10	End product description	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
1a.1.11	Detailed by-product inventory	-	-	-	-	-	-	206	31	237	237	-	-	-	-	-	-	-	-	-	1,300
1a.1.12	Define major work sequence	-	-	-	-	-	-	1,190	179	1,369	1,369	-	-	-	-	-	-	-	-	-	7,500
1a.1.13	Perform SER and EA	-	-	-	-	-	-	492	74	566	566	-	-	-	-	-	-	-	-	-	3,100
1a.1.14	Prepare/submit Defueled Technical Specifications	-	-	-	-	-	-	1,190	179	1,369	1,369	-	-	-	-	-	-	-	-	-	7,500
1a.1.15	Perform Site-Specific Cost Study	-	-	-	-	-	-	794	119	913	913	-	-	-	-	-	-	-	-	-	5,000
1a.1.16	Prepare/submit Irradiated Fuel Management Plan	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
Activity Specifications																					
1a.1.17.1	Plant & temporary facilities	-	-	-	-	-	-	781	117	898	808	-	90	-	-	-	-	-	-	-	4,920
1a.1.17.2	Plant systems	-	-	-	-	-	-	661	99	761	684	-	76	-	-	-	-	-	-	-	4,167
1a.1.17.3	NSSS Decontamination Flush	-	-	-	-	-	-	79	12	91	91	-	-	-	-	-	-	-	-	-	500
1a.1.17.4	Reactor internals	-	-	-	-	-	-	1,127	169	1,296	1,296	-	-	-	-	-	-	-	-	-	7,100
1a.1.17.5	Reactor vessel	-	-	-	-	-	-	1,032	155	1,186	1,186	-	-	-	-	-	-	-	-	-	6,500
1a.1.17.6	Biological shield	-	-	-	-	-	-	79	12	91	91	-	-	-	-	-	-	-	-	-	500
1a.1.17.7	Steam generators	-	-	-	-	-	-	495	74	569	569	-	-	-	-	-	-	-	-	-	3,120
1a.1.17.8	Reinforced concrete	-	-	-	-	-	-	254	38	292	146	-	146	-	-	-	-	-	-	-	1,600
1a.1.17.9	Main Turbine	-	-	-	-	-	-	63	10	73	-	-	73	-	-	-	-	-	-	-	400
1a.1.17.10	Main Condensers	-	-	-	-	-	-	63	10	73	-	-	73	-	-	-	-	-	-	-	400
1a.1.17.11	Plant structures & buildings	-	-	-	-	-	-	495	74	569	285	-	285	-	-	-	-	-	-	-	3,120
1a.1.17.12	Waste management	-	-	-	-	-	-	730	110	840	840	-	-	-	-	-	-	-	-	-	4,600
1a.1.17.13	Facility & site closeout	-	-	-	-	-	-	143	21	164	82	-	82	-	-	-	-	-	-	-	900
1a.1.17	Total	-	-	-	-	-	-	6,004	901	6,904	6,080	-	825	-	-	-	-	-	-	-	37,827
Planning & Site Preparations																					
1a.1.18	Prepare dismantling sequence	-	-	-	-	-	-	381	57	438	438	-	-	-	-	-	-	-	-	-	2,400
1a.1.19	Plant prep. & temp. svces	-	-	-	-	-	-	4,000	600	4,600	4,600	-	-	-	-	-	-	-	-	-	-
1a.1.20	Design water clean-up system	-	-	-	-	-	-	222	33	256	256	-	-	-	-	-	-	-	-	-	1,400
1a.1.21	Rigging/Cont. Cntrl Envlps/tooling/etc.	-	-	-	-	-	-	2,800	420	3,220	3,220	-	-	-	-	-	-	-	-	-	-
1a.1.22	Procure casks/liners & containers	-	-	-	-	-	-	195	29	225	225	-	-	-	-	-	-	-	-	-	1,230
1a.1	Subtotal Period 1a Activity Costs	-	-	-	-	-	-	19,205	2,881	22,086	21,261	-	825	-	-	-	-	-	-	-	78,157
Period 1a Collateral Costs																					
1a.3.1	Spent Fuel Capital and Transfer	-	-	-	-	-	-	10,080	1,512	11,592	-	11,592	-	-	-	-	-	-	-	-	-
1a.3	Subtotal Period 1a Collateral Costs	-	-	-	-	-	-	10,080	1,512	11,592	-	11,592	-	-	-	-	-	-	-	-	-
Period 1a Period-Dependent Costs																					
1a.4.1	Insurance	-	-	-	-	-	-	3,972	397	4,370	4,370	-	-	-	-	-	-	-	-	-	-
1a.4.2	Property taxes	-	-	-	-	-	-	120	12	132	132	-	-	-	-	-	-	-	-	-	-
1a.4.3	Health physics supplies	-	888	-	-	-	-	-	222	1,110	1,110	-	-	-	-	-	-	-	-	-	-
1a.4.4	Heavy equipment rental	-	657	-	-	-	-	-	99	755	755	-	-	-	-	-	-	-	-	-	-
1a.4.5	Disposal of DAW generated	-	-	12	7	-	36	-	11	67	67	-	-	-	610	-	-	-	12,190	20	-
1a.4.6	Plant energy budget	-	-	-	-	-	-	2,053	308	2,361	2,361	-	-	-	-	-	-	-	-	-	-
1a.4.7	NRC Fees	-	-	-	-	-	-	1,321	132	1,453	1,453	-	-	-	-	-	-	-	-	-	-
1a.4.8	Emergency Planning Fees	-	-	-	-	-	-	1,620	162	1,782	-	1,782	-	-	-	-	-	-	-	-	-
1a.4.9	INPO Fees	-	-	-	-	-	-	358	54	411	411	-	-	-	-	-	-	-	-	-	-
1a.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	988	148	1,136	-	1,136	-	-	-	-	-	-	-	-	-
1a.4.11	ISFSI Operating Costs	-	-	-	-	-	-	127	19	146	-	146	-	-	-	-	-	-	-	-	-
1a.4.12	Corporate Allocations	-	-	-	-	-	-	1,000	100	1,100	1,100	-	-	-	-	-	-	-	-	-	-
1a.4.13	Security Staff Cost	-	-	-	-	-	-	15,699	2,355	18,054	18,054	-	-	-	-	-	-	-	-	-	251,680
1a.4.14	Utility Staff Cost	-	-	-	-	-	-	37,678	5,652	43,329	43,329	-	-	-	-	-	-	-	-	-	422,240
1a.4	Subtotal Period 1a Period-Dependent Costs	-	1,545	12	7	-	36	64,936	9,670	76,207	73,142	3,064	-	-	610	-	-	-	12,190	20	673,920
1a.0	TOTAL PERIOD 1a COST	-	1,545	12	7	-	36	94,221	14,063	109,884	94,403	14,656	825	-	610	-	-	-	12,190	20	752,077

Table C
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
PERIOD 1b - Decommissioning Preparations																					
Period 1b Direct Decommissioning Activities																					
Detailed Work Procedures																					
1b.1.1.1	Plant systems	-	-	-	-	-	-	751	113	864	778	-	86	-	-	-	-	-	-	-	4,733
1b.1.1.2	NSSS Decontamination Flush	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.3	Reactor internals	-	-	-	-	-	-	397	60	456	456	-	-	-	-	-	-	-	-	-	2,500
1b.1.1.4	Remaining buildings	-	-	-	-	-	-	214	32	246	62	-	185	-	-	-	-	-	-	-	1,350
1b.1.1.5	CRD cooling assembly	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.6	CRD housings & ICI tubes	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.7	Incore instrumentation	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.8	Reactor vessel	-	-	-	-	-	-	576	86	663	663	-	-	-	-	-	-	-	-	-	3,630
1b.1.1.9	Facility closeout	-	-	-	-	-	-	190	29	219	110	-	110	-	-	-	-	-	-	-	1,200
1b.1.1.10	Missile shields	-	-	-	-	-	-	71	11	82	82	-	-	-	-	-	-	-	-	-	450
1b.1.1.11	Biological shield	-	-	-	-	-	-	190	29	219	219	-	-	-	-	-	-	-	-	-	1,200
1b.1.1.12	Steam generators	-	-	-	-	-	-	730	110	840	840	-	-	-	-	-	-	-	-	-	4,600
1b.1.1.13	Reinforced concrete	-	-	-	-	-	-	159	24	183	91	-	91	-	-	-	-	-	-	-	1,000
1b.1.1.14	Main Turbine	-	-	-	-	-	-	248	37	285	-	-	285	-	-	-	-	-	-	-	1,560
1b.1.1.15	Main Condensers	-	-	-	-	-	-	248	37	285	-	-	285	-	-	-	-	-	-	-	1,560
1b.1.1.16	Auxiliary building	-	-	-	-	-	-	433	65	498	448	-	50	-	-	-	-	-	-	-	2,730
1b.1.1.17	Reactor building	-	-	-	-	-	-	433	65	498	448	-	50	-	-	-	-	-	-	-	2,730
1b.1.1	Total	-	-	-	-	-	-	5,276	791	6,068	4,927	-	1,141	-	-	-	-	-	-	-	33,243
1b.1.2	Decon primary loop	973	-	-	-	-	-	-	486	1,459	1,459	-	-	-	-	-	-	-	-	1,067	-
1b.1	Subtotal Period 1b Activity Costs	973	-	-	-	-	-	5,276	1,278	7,527	6,386	-	1,141	-	-	-	-	-	-	1,067	33,243
Period 1b Additional Costs																					
1b.2.1	Spent Fuel Pool Isolation	-	-	-	-	-	-	14,330	2,150	16,480	16,480	-	-	-	-	-	-	-	-	-	-
1b.2.2	Site Characterization	-	-	-	-	-	-	3,198	959	4,158	4,158	-	-	-	-	-	-	-	-	19,100	7,852
1b.2	Subtotal Period 1b Additional Costs	-	-	-	-	-	-	17,529	3,109	20,638	20,638	-	-	-	-	-	-	-	-	19,100	7,852
Period 1b Collateral Costs																					
1b.3.1	Decon equipment	1,193	-	-	-	-	-	-	179	1,371	1,371	-	-	-	-	-	-	-	-	-	-
1b.3.2	DOC staff relocation expenses	-	-	-	-	-	-	1,641	246	1,887	1,887	-	-	-	-	-	-	-	-	-	-
1b.3.3	Process decommissioning water waste	49	-	35	87	-	144	-	77	392	392	-	-	-	283	-	-	-	16,989	55	-
1b.3.4	Process decommissioning chemical flush waste	2	-	92	369	-	2,012	-	569	3,044	3,044	-	-	-	-	788	-	-	83,917	147	-
1b.3.5	Small tool allowance	-	2	-	-	-	-	-	0	3	3	-	-	-	-	-	-	-	-	-	-
1b.3.6	Pipe cutting equipment	-	1,400	-	-	-	-	-	210	1,610	1,610	-	-	-	-	-	-	-	-	-	-
1b.3.7	Decon rig	2,451	-	-	-	-	-	-	368	2,819	2,819	-	-	-	-	-	-	-	-	-	-
1b.3.8	Spent Fuel Capital and Transfer	-	-	-	-	-	-	5,040	756	5,796	-	5,796	-	-	-	-	-	-	-	-	-
1b.3	Subtotal Period 1b Collateral Costs	3,696	1,402	127	456	-	2,156	6,681	2,405	16,922	11,126	5,796	-	-	283	788	-	-	100,906	203	-
Period 1b Period-Dependent Costs																					
1b.4.1	Decon supplies	43	-	-	-	-	-	-	11	54	54	-	-	-	-	-	-	-	-	-	-
1b.4.2	Insurance	-	-	-	-	-	-	2,002	200	2,203	2,203	-	-	-	-	-	-	-	-	-	-
1b.4.3	Property taxes	-	-	-	-	-	-	60	6	66	66	-	-	-	-	-	-	-	-	-	-
1b.4.4	Health physics supplies	-	502	-	-	-	-	-	126	628	628	-	-	-	-	-	-	-	-	-	-
1b.4.5	Heavy equipment rental	-	331	-	-	-	-	-	50	381	381	-	-	-	-	-	-	-	-	-	-
1b.4.6	Disposal of DAW generated	-	-	7	4	-	21	-	7	39	39	-	-	-	360	-	-	-	7,197	12	-
1b.4.7	Plant energy budget	-	-	-	-	-	-	2,070	310	2,380	2,380	-	-	-	-	-	-	-	-	-	-
1b.4.8	NRC Fees	-	-	-	-	-	-	400	40	440	440	-	-	-	-	-	-	-	-	-	-
1b.4.9	Emergency Planning Fees	-	-	-	-	-	-	817	82	899	-	899	-	-	-	-	-	-	-	-	-
1b.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	498	75	573	-	573	-	-	-	-	-	-	-	-	-
1b.4.11	ISFSI Operating Costs	-	-	-	-	-	-	64	10	73	-	73	-	-	-	-	-	-	-	-	-
1b.4.12	Corporate Allocations	-	-	-	-	-	-	504	50	555	555	-	-	-	-	-	-	-	-	-	-
1b.4.13	Security Staff Cost	-	-	-	-	-	-	7,914	1,187	9,101	9,101	-	-	-	-	-	-	-	-	-	126,874
1b.4.14	DOC Staff Cost	-	-	-	-	-	-	7,234	1,085	8,319	8,319	-	-	-	-	-	-	-	-	-	63,961
1b.4.15	Utility Staff Cost	-	-	-	-	-	-	19,087	2,863	21,950	21,950	-	-	-	-	-	-	-	-	-	213,904
1b.4	Subtotal Period 1b Period-Dependent Costs	43	833	7	4	-	21	40,652	6,101	47,662	46,117	1,545	-	-	360	-	-	-	7,197	12	404,740
1b.0	TOTAL PERIOD 1b COST	4,711	2,236	134	460	-	2,178	70,137	12,893	92,748	84,266	7,341	1,141	-	643	788	-	-	108,103	20,381	445,835
PERIOD 1 TOTALS		4,711	3,780	146	467	-	2,214	164,358	26,956	202,633	178,670	21,997	1,966	-	1,253	788	-	-	120,293	20,401	1,197,911

Table C
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
PERIOD 2a - Large Component Removal																					
Period 2a Direct Decommissioning Activities																					
Nuclear Steam Supply System Removal																					
2a.1.1.1	Reactor Coolant Piping	244	244	39	136	-	768	-	399	1,830	1,830	-	-	-	2,046	-	-	-	142,726	6,863	-
2a.1.1.2	Pressurizer Relief Tank	41	34	11	38	-	217	-	90	432	432	-	-	-	578	-	-	-	40,338	1,077	-
2a.1.1.3	Reactor Coolant Pumps & Motors	124	125	185	267	-	1,483	-	523	2,708	2,708	-	-	-	3,386	-	-	-	816,140	4,188	100
2a.1.1.4	Pressurizer	-	80	839	208	-	1,638	-	545	3,310	3,310	-	-	-	3,739	-	-	-	293,734	1,666	1,875
2a.1.1.5	Steam Generators	-	8,305	4,689	3,380	3,735	10,171	-	6,155	36,436	36,436	-	-	40,262	23,217	-	-	-	3,619,368	23,279	3,500
2a.1.1.6	Retired Steam Generator Units	-	-	3,353	3,319	3,735	9,877	-	3,863	24,146	24,146	-	-	40,262	22,546	-	-	-	3,398,523	10,852	2,250
2a.1.1.7	CRDMs/ICIs/Service Structure Removal	207	353	230	141	-	783	-	432	2,145	2,145	-	-	-	3,881	-	-	-	145,494	7,976	-
2a.1.1.8	Reactor Vessel Internals	112	6,004	12,696	1,844	-	18,156	393	17,331	56,535	56,535	-	-	-	2,764	1,230	393	-	336,142	32,573	1,461
2a.1.1.9	Vessel & Internals GTCC Disposal	-	-	-	-	-	13,035	-	1,955	14,990	14,990	-	-	-	-	-	-	2,217	433,180	-	-
2a.1.1.10	Reactor Vessel	141	7,737	3,180	1,898	-	5,983	393	10,193	29,525	29,525	-	-	-	13,715	-	-	-	973,586	32,573	1,461
2a.1.1	Totals	870	22,883	25,222	11,231	7,470	62,111	785	41,486	172,058	172,058	-	-	80,523	75,872	1,230	393	2,217	10,199,230	121,047	10,648
Removal of Major Equipment																					
2a.1.2	Main Turbine/Generator	-	686	398	56	874	885	-	572	3,471	3,471	-	-	4,921	2,740	-	-	-	469,360	9,888	-
2a.1.3	Main Condensers	-	1,923	226	209	1,026	1,099	-	963	5,446	5,446	-	-	7,701	3,216	-	-	-	550,847	27,762	-
Cascading Costs from Clean Building Demolition																					
2a.1.4.1	Reactor	-	612	-	-	-	-	-	92	704	704	-	-	-	-	-	-	-	-	4,832	-
2a.1.4.2	Auxiliary	-	318	-	-	-	-	-	48	366	366	-	-	-	-	-	-	-	-	2,113	-
2a.1.4.3	Hot Machine Shop	-	1	-	-	-	-	-	0	1	1	-	-	-	-	-	-	-	-	7	-
2a.1.4.4	Radwaste	-	61	-	-	-	-	-	9	70	70	-	-	-	-	-	-	-	-	387	-
2a.1.4.5	Fuel Building	-	129	-	-	-	-	-	19	149	149	-	-	-	-	-	-	-	-	795	-
2a.1.4	Totals	-	1,121	-	-	-	-	-	168	1,290	1,290	-	-	-	-	-	-	-	-	8,134	-
Disposal of Plant Systems																					
2a.1.5.1	100 Aux.Bldg Non-System Specific RCA	-	920	15	80	917	-	-	381	2,313	2,313	-	-	7,629	-	-	-	-	309,812	13,471	-
2a.1.5.2	100 Auxiliary Bldg Non-System Specific	-	151	6	15	57	96	-	73	399	399	-	-	474	282	-	-	-	37,164	2,282	-
2a.1.5.3	AB - Main Steam	-	366	-	-	-	-	-	55	420	-	-	420	-	-	-	-	-	-	5,833	-
2a.1.5.4	AB - Main Steam RCA	-	103	4	23	259	-	-	68	458	458	-	-	2,156	-	-	-	-	87,550	1,515	-
2a.1.5.5	AC - Main Turbine	-	361	-	-	-	-	-	54	415	-	-	415	-	-	-	-	-	-	5,641	-
2a.1.5.6	AD - Condensate	-	401	-	-	-	-	-	60	461	-	-	461	-	-	-	-	-	-	6,144	-
2a.1.5.7	AE - Feedwater	-	275	-	-	-	-	-	41	316	-	-	316	-	-	-	-	-	-	4,271	-
2a.1.5.8	AF - Feedwater Heater Extraction	-	337	-	-	-	-	-	51	388	-	-	388	-	-	-	-	-	-	5,352	-
2a.1.5.9	AK - Condensate Demineralizer	-	125	-	-	-	-	-	19	143	-	-	143	-	-	-	-	-	-	1,944	-
2a.1.5.10	AL - Auxiliary Feedwater	-	54	-	-	-	-	-	8	63	-	-	63	-	-	-	-	-	-	852	-
2a.1.5.11	AQ - Condensate & Feedwater Chem Addtn	-	30	-	-	-	-	-	5	35	-	-	35	-	-	-	-	-	-	468	-
2a.1.5.12	BM - Steam Generator Blowdown	-	158	6	17	107	66	-	75	429	429	-	-	892	191	-	-	-	48,463	2,394	-
2a.1.5.13	BM - Steam Generator Blowdown - RCA	-	491	8	43	494	-	-	204	1,240	1,240	-	-	4,109	-	-	-	-	166,857	7,066	-
2a.1.5.14	BN - Borated Refueling Water Storage	-	457	22	78	663	183	-	273	1,675	1,675	-	-	5,512	533	-	-	-	257,802	6,939	-
2a.1.5.15	CA - Steam Seal	-	29	-	-	-	-	-	4	33	-	-	33	-	-	-	-	-	-	455	-
2a.1.5.16	CB - Main Turbine Lube Oil	-	82	-	-	-	-	-	12	95	-	-	95	-	-	-	-	-	-	1,207	-
2a.1.5.17	CC - Generator Hydrogen Seal & CO2	-	13	-	-	-	-	-	2	15	-	-	15	-	-	-	-	-	-	198	-
2a.1.5.18	CD - Generator Seal Oil	-	19	-	-	-	-	-	3	22	-	-	22	-	-	-	-	-	-	287	-
2a.1.5.19	CE - Stator Cooling Water	-	16	-	-	-	-	-	2	19	-	-	19	-	-	-	-	-	-	241	-
2a.1.5.20	CF - Lube Oil Storage Xfer & Prfication	-	53	-	-	-	-	-	8	61	-	-	61	-	-	-	-	-	-	812	-
2a.1.5.21	CG - Condenser Air Removal	-	43	-	-	-	-	-	6	49	-	-	49	-	-	-	-	-	-	657	-
2a.1.5.22	CH - Main Turbine Control Oil	-	85	-	-	-	-	-	13	97	-	-	97	-	-	-	-	-	-	1,219	-
2a.1.5.23	DA - Circulating Water	-	473	-	-	-	-	-	71	544	-	-	544	-	-	-	-	-	-	7,502	-
2a.1.5.24	DB - Cooling Tower Makeup & Blowdown	-	80	-	-	-	-	-	12	92	-	-	92	-	-	-	-	-	-	1,260	-
2a.1.5.25	DD - Cooling Water Chemical Control Sys	-	71	-	-	-	-	-	11	81	-	-	81	-	-	-	-	-	-	1,084	-
2a.1.5.26	DD - Cooling Wtr Chem Control RCA	-	361	7	37	427	-	-	161	993	993	-	-	3,555	-	-	-	-	144,376	4,951	-
2a.1.5.27	EJ - Residual Heat Removal	-	524	57	119	330	828	-	411	2,269	2,269	-	-	2,744	2,413	-	-	-	265,386	8,042	-
2a.1.5.28	EM - High Pressure Coolant Injection	-	438	18	38	158	224	-	197	1,074	1,074	-	-	1,315	648	-	-	-	95,068	6,633	-
2a.1.5.29	EN - Containment Spray	-	288	6	32	364	-	-	132	821	821	-	-	3,026	-	-	-	-	122,874	4,134	-
2a.1.5.30	EP - Accumulator Safety Injection	-	231	11	27	192	98	-	116	676	676	-	-	1,599	283	-	-	-	83,200	3,478	-
2a.1.5.31	FA - Auxiliary Steam Generator	-	32	-	-	-	-	-	5	37	-	-	37	-	-	-	-	-	-	521	-
2a.1.5.32	FB - Auxiliary Steam	-	133	-	-	-	-	-	20	152	-	-	152	-	-	-	-	-	-	2,106	-
2a.1.5.33	FB - Auxiliary Steam RCA	-	109	2	9	98	-	-	43	260	260	-	-	816	-	-	-	-	33,148	1,537	-
2a.1.5.34	FC - Auxiliary Turbines	-	87	-	-	-	-	-	13	100	-	-	100	-	-	-	-	-	-	1,320	-
2a.1.5.35	FE - Auxiliary Steam Chemical Addition	-	7	-	-	-	-	-	1	8	-	-	8	-	-	-	-	-	-	105	-
2a.1.5.36	GE - Turbine Building HVAC	-	240	-	-	-	-	-	36	276	-	-	276	-	-	-	-	-	-	3,957	-
2a.1.5.37	GS - Containment Hydrogen Control	-	101	4	11	79	36	-	48	280	280	-	-	658	104	-	-	-	33,502	1,559	-
2a.1.5.38	HE - Boron Recycle	529	668	39	80	313	487	-	616	2,733	2,733	-	-	2,600	1,411	-	-	-	196,130	16,660	-
2a.1.5.39	HF - Secondary Liquid Waste	975	1,319	87	185	744	1,104	-	1,241	5,655	5,655	-	-	6,186	3,203	-	-	-	456,359	31,896	-

Table C
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
2a.1.5.40	JA - Auxiliary Oil & Transfer	-	43	-	-	-	-	-	7	50	-	-	50	-	-	-	-	-	-	690	-
2a.1.5.41	KS - Bulk Chemical Storage	-	122	13	68	775	-	-	158	1,136	1,136	-	-	6,449	-	-	-	-	261,890	1,825	-
2a.1.5.42	LE - Oily Waste	-	246	-	-	-	-	-	37	282	-	-	282	-	-	-	-	-	-	3,865	-
2a.1.5.43	LE - Oily Waste RCA	-	313	4	24	271	-	-	123	735	735	-	-	2,256	-	-	-	-	91,628	4,296	-
2a.1.5.44	Turbine Bldg Non-System Specific	-	1,031	-	-	-	-	-	155	1,185	-	-	1,185	-	-	-	-	-	-	15,405	-
2a.1.5	Totals	1,504	11,484	311	885	6,248	3,123	-	5,032	28,587	23,148	-	5,440	51,976	9,068	-	-	-	2,691,208	192,076	-
2a.1.6	Scaffolding in support of decommissioning	-	2,067	27	18	164	37	-	556	2,871	2,871	-	-	1,233	109	-	-	-	62,391	36,741	-
2a.1	Subtotal Period 2a Activity Costs	2,374	40,164	26,185	12,400	15,782	67,255	785	48,778	213,724	208,284	-	5,440	146,354	91,005	1,230	393	2,217	13,973,040	395,647	10,648
Period 2a Additional Costs																					
2a.2.1	Remedial Action Surveys	-	-	-	-	-	-	1,824	547	2,372	2,372	-	-	-	-	-	-	-	-	35,877	-
2a.2	Subtotal Period 2a Additional Costs	-	-	-	-	-	-	1,824	547	2,372	2,372	-	-	-	-	-	-	-	-	35,877	-
Period 2a Collateral Costs																					
2a.3.1	Process decommissioning water waste	214	-	152	382	-	634	-	338	1,719	1,719	-	-	-	1,246	-	-	-	74,741	243	-
2a.3.2	Process decommissioning chemical flush waste	1	-	48	192	-	371	-	127	739	739	-	-	-	410	-	-	-	43,711	77	-
2a.3.3	Small tool allowance	-	449	-	-	-	-	-	67	516	465	-	52	-	-	-	-	-	-	-	-
2a.3.4	Spent Fuel Capital and Transfer	-	-	-	-	-	-	18,270	2,741	21,011	-	21,011	-	-	-	-	-	-	-	-	-
2a.3.5	On-site survey and release of 60.87 tons clean metallic waste	-	-	-	-	-	-	111	11	122	122	-	-	-	-	-	-	-	-	-	-
2a.3	Subtotal Period 2a Collateral Costs	215	449	200	574	-	1,004	18,381	3,284	24,107	3,045	21,011	52	-	1,656	-	-	-	118,451	320	-
Period 2a Period-Dependent Costs																					
2a.4.1	Decon supplies	147	-	-	-	-	-	-	37	184	184	-	-	-	-	-	-	-	-	-	-
2a.4.2	Insurance	-	-	-	-	-	-	1,169	117	1,286	1,286	-	-	-	-	-	-	-	-	-	-
2a.4.3	Property taxes	-	-	-	-	-	-	207	21	228	228	-	-	-	-	-	-	-	-	-	-
2a.4.4	Health physics supplies	-	5,120	-	-	-	-	-	1,280	6,399	6,399	-	-	-	-	-	-	-	-	-	-
2a.4.5	Heavy equipment rental	-	3,836	-	-	-	-	-	575	4,411	4,411	-	-	-	-	-	-	-	-	-	-
2a.4.6	Disposal of DAW generated	-	-	132	74	-	385	-	121	712	712	-	-	-	6,501	-	-	-	130,017	212	-
2a.4.7	Plant energy budget	-	-	-	-	-	-	3,366	505	3,871	3,871	-	-	-	-	-	-	-	-	-	-
2a.4.8	NRC Fees	-	-	-	-	-	-	1,246	125	1,370	1,370	-	-	-	-	-	-	-	-	-	-
2a.4.9	Emergency Planning Fees	-	-	-	-	-	-	1,728	173	1,900	-	1,900	-	-	-	-	-	-	-	-	-
2a.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	1,706	256	1,962	-	1,962	-	-	-	-	-	-	-	-	-
2a.4.11	ISFSI Operating Costs	-	-	-	-	-	-	218	33	251	-	251	-	-	-	-	-	-	-	-	-
2a.4.12	Corporate Allocations	-	-	-	-	-	-	1,726	173	1,899	1,899	-	-	-	-	-	-	-	-	-	-
2a.4.13	Security Staff Cost	-	-	-	-	-	-	25,225	3,784	29,008	29,008	-	-	-	-	-	-	-	-	-	387,735
2a.4.14	DOC Staff Cost	-	-	-	-	-	-	30,559	4,584	35,143	35,143	-	-	-	-	-	-	-	-	-	272,850
2a.4.15	Utility Staff Cost	-	-	-	-	-	-	46,358	6,954	53,311	53,311	-	-	-	-	-	-	-	-	-	508,004
2a.4	Subtotal Period 2a Period-Dependent Costs	147	8,955	132	74	-	385	113,507	18,735	141,936	137,823	4,113	-	-	6,501	-	-	-	130,017	212	1,168,590
2a.0	TOTAL PERIOD 2a COST	2,737	49,568	26,517	13,049	15,782	68,645	134,497	71,344	382,138	351,523	25,124	5,491	146,354	99,162	1,230	393	2,217	14,221,500	432,056	1,179,237
PERIOD 2b - Site Decontamination																					
Period 2b Direct Decommissioning Activities																					
Disposal of Plant Systems																					
2b.1.1.1	200 Reactor Bldg Non-System Specific	-	120	4	10	32	63	-	53	283	283	-	-	269	186	-	-	-	22,727	1,760	-
2b.1.1.2	200 Reactor Bldg Non-System Specific RCA	-	752	9	50	573	-	-	282	1,667	1,667	-	-	4,768	-	-	-	-	193,612	10,425	-
2b.1.1.3	300 Control Bldg Non-System Specific	-	236	4	22	257	-	-	101	621	621	-	-	2,139	-	-	-	-	86,849	3,413	-
2b.1.1.4	300 Control Bldg Non-System Specific Cln	-	1,836	-	-	-	-	-	275	2,111	-	-	2,111	-	-	-	-	-	-	29,076	-
2b.1.1.5	700 Radwaste Bldg Non-Sys Specific RCA	-	1,514	25	133	1,525	-	-	630	3,826	3,826	-	-	12,684	-	-	-	-	515,103	21,919	-
2b.1.1.6	700 Radwaste Bldg Non-System Specific	-	243	11	26	85	170	-	121	655	655	-	-	705	497	-	-	-	60,190	3,653	-
2b.1.1.7	AN - Demineralized Wtr Storage & Xfer	-	208	-	-	-	-	-	31	239	-	-	239	-	-	-	-	-	-	3,283	-
2b.1.1.8	AN - Demineralized Wtr Strg & Xfer RCA	-	53	1	3	38	-	-	19	114	114	-	-	314	-	-	-	-	12,759	740	-
2b.1.1.9	AP -HCST/Condensate Stor.& Transfr	-	275	-	-	-	-	-	41	316	-	-	316	-	-	-	-	-	-	4,018	-
2b.1.1.10	BB - Reactor Coolant System	-	453	39	82	218	577	-	306	1,674	1,674	-	-	1,812	1,685	-	-	-	180,839	7,074	-
2b.1.1.11	BG - Chemical & Volume Control	1,143	1,276	120	237	593	1,696	-	1,451	6,515	6,515	-	-	4,931	4,928	-	-	-	515,455	28,147	-
2b.1.1.12	BL - Reactor Makeup Water	-	408	24	52	232	293	-	220	1,229	1,229	-	-	1,928	850	-	-	-	132,796	6,136	-
2b.1.1.13	DE - Intake & Water Treatment	-	166	-	-	-	-	-	25	191	-	-	191	-	-	-	-	-	-	2,517	-
2b.1.1.14	DE - Intake & Water Treatment RCA	-	331	24	125	1,433	-	-	319	2,232	2,232	-	-	11,923	-	-	-	-	484,206	5,014	-
2b.1.1.15	EA - Service Water	-	197	-	-	-	-	-	30	227	-	-	227	-	-	-	-	-	-	3,145	-
2b.1.1.16	EA - Service Water RCA	-	59	2	13	150	-	-	39	264	264	-	-	1,248	-	-	-	-	50,693	839	-
2b.1.1.17	EB - Closed Cooling Water	-	80	-	-	-	-	-	12	92	-	-	92	-	-	-	-	-	-	1,267	-
2b.1.1.18	EF - Essential Service Water	-	458	-	-	-	-	-	69	527	-	-	527	-	-	-	-	-	-	7,244	-
2b.1.1.19	EF - Essential Service Water RCA	-	263	11	56	640	-	-	171	1,141	1,141	-	-	5,326	-	-	-	-	216,287	3,862	-
2b.1.1.20	EG - Component Cooling Water RCA	-	336	-	-	-	-	-	50	386	-	-	386	-	-	-	-	-	-	5,335	-
2b.1.1.21	GA - Plant Heating	-	120	-	-	-	-	-	18	138	-	-	138	-	-	-	-	-	-	1,912	-

Table C
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
2b.1.1.22	GA - Plant Heating RCA	-	126	1	7	77	-	-	44	255	255	-	-	638	-	-	-	-	25,924	1,765	-
2b.1.1.23	GB - Central Chilled Water	-	113	-	-	-	-	-	17	130	-	-	130	-	-	-	-	-	-	1,803	-
2b.1.1.24	GB - Central Chilled Water RCA	-	34	0	2	22	-	-	12	71	71	-	-	187	-	-	-	-	7,591	482	-
2b.1.1.25	GD - Essential Serv Wtr Pumphouse HVAC	-	25	-	-	-	-	-	4	29	-	-	29	-	-	-	-	-	-	427	-
2b.1.1.26	GF - Miscellaneous Building HVAC	-	155	4	21	245	-	-	79	504	504	-	-	2,034	-	-	-	-	82,602	2,026	-
2b.1.1.27	GH - Radwaste Building HVAC	-	240	7	29	291	34	-	117	717	717	-	-	2,425	98	-	-	-	104,702	3,455	-
2b.1.1.28	GK - Control Building HVAC	-	231	-	-	-	-	-	35	266	-	-	266	-	-	-	-	-	-	3,959	-
2b.1.1.29	GL - Auxiliary Building HVAC	-	592	15	62	609	78	-	270	1,625	1,625	-	-	5,064	228	-	-	-	220,197	8,491	-
2b.1.1.30	GM - Diesel Generator Building HVAC	-	40	-	-	-	-	-	6	46	-	-	46	-	-	-	-	-	-	695	-
2b.1.1.31	GN - Containment Cooling	-	661	27	101	886	220	-	371	2,267	2,267	-	-	7,367	643	-	-	-	340,122	9,601	-
2b.1.1.32	GP - Containment Intgratd Leak Rate Test	-	52	1	6	70	-	-	24	153	153	-	-	580	-	-	-	-	23,570	750	-
2b.1.1.33	GR - Containment Atmospheric Control	-	26	3	13	130	14	-	32	219	219	-	-	1,086	41	-	-	-	46,686	392	-
2b.1.1.34	GT - Containment Purge HVAC	-	155	7	27	234	58	-	93	574	574	-	-	1,948	170	-	-	-	89,946	2,259	-
2b.1.1.35	HA - Gaseous Radwaste	-	476	25	55	334	233	-	238	1,360	1,360	-	-	2,782	666	-	-	-	156,216	7,037	-
2b.1.1.36	HB - Liquid Radwaste	1,055	1,161	80	162	668	949	-	1,187	5,263	5,263	-	-	5,560	2,745	-	-	-	402,251	30,903	-
2b.1.1.37	HC - Solid Radwaste	-	495	37	78	254	511	-	305	1,681	1,681	-	-	2,114	1,487	-	-	-	180,874	7,445	-
2b.1.1.38	HD - Decontamination	-	138	6	17	118	59	-	70	409	409	-	-	983	171	-	-	-	50,973	2,051	-
2b.1.1.39	JE - Emergency Fuel Oil	-	86	-	-	-	-	-	13	99	-	-	99	-	-	-	-	-	-	1,260	-
2b.1.1.40	KA - Compressed Air	-	262	-	-	-	-	-	39	301	-	-	301	-	-	-	-	-	-	4,187	-
2b.1.1.41	KA - Compressed Air RCA	-	169	2	8	96	-	-	58	334	334	-	-	801	-	-	-	-	32,538	2,339	-
2b.1.1.42	KB - Breathing Air	-	33	-	-	-	-	-	5	38	-	-	38	-	-	-	-	-	-	516	-
2b.1.1.43	KB - Breathing Air RCA	-	26	0	1	9	-	-	8	43	43	-	-	71	-	-	-	-	2,874	402	-
2b.1.1.44	KC - Fire Protection	-	514	-	-	-	-	-	77	591	-	-	591	-	-	-	-	-	-	8,376	-
2b.1.1.45	KC - Fire Protection RCA	-	530	9	46	530	-	-	220	1,335	1,335	-	-	4,411	-	-	-	-	179,151	7,064	-
2b.1.1.46	KD - Domestic Water	-	239	-	-	-	-	-	36	275	-	-	275	-	-	-	-	-	-	3,837	-
2b.1.1.47	KD - Domestic Water RCA	-	34	0	3	30	-	-	13	80	80	-	-	247	-	-	-	-	10,039	459	-
2b.1.1.48	KE - Fuel Handling & Storage Rctor vssl	-	25	4	13	80	54	-	34	210	210	-	-	661	158	-	-	-	36,889	375	-
2b.1.1.49	KH - Service Gas (CO2 N2 H2 & O2)	-	76	-	-	-	-	-	11	87	-	-	87	-	-	-	-	-	-	1,226	-
2b.1.1.50	KH - Service Gas (CO2 N2 H2 & O2) RCA	-	333	5	25	292	-	-	131	787	787	-	-	2,433	-	-	-	-	98,813	4,481	-
2b.1.1.51	KJ - Standby Diesel Engine	-	454	-	-	-	-	-	68	523	-	-	523	-	-	-	-	-	-	6,749	-
2b.1.1.52	LA - Sanitary Drains	-	61	-	-	-	-	-	9	70	-	-	70	-	-	-	-	-	-	972	-
2b.1.1.53	LA - Sanitary Drains RCA	-	140	3	13	153	-	-	60	369	369	-	-	1,273	-	-	-	-	51,684	1,811	-
2b.1.1.54	LB - Roof Drains	-	81	-	-	-	-	-	12	93	-	-	93	-	-	-	-	-	-	1,276	-
2b.1.1.55	LB - Roof Drains RCA	-	190	4	22	257	-	-	90	563	563	-	-	2,139	-	-	-	-	86,858	2,694	-
2b.1.1.56	LD - Chemical & Detergent Waste	92	159	6	13	61	73	-	116	519	519	-	-	504	211	-	-	-	33,951	3,490	-
2b.1.1.57	LF - Floor & Equipment Drains	-	1,970	125	253	449	1,962	-	1,101	5,861	5,861	-	-	3,739	5,724	-	-	-	516,484	29,320	-
2b.1.1.58	RM - Process Sampling & Analysis	-	182	9	16	79	84	-	82	453	453	-	-	661	240	-	-	-	42,525	2,774	-
2b.1.1.59	SJ - Nuclear Sampling	-	106	6	11	51	65	-	53	292	292	-	-	423	184	-	-	-	29,191	1,620	-
2b.1.1.60	UB - Servces Stores Site Security Bldg	-	245	-	-	-	-	-	37	282	-	-	282	-	-	-	-	-	-	3,815	-
2b.1.1.61	Yard Non-System Specific	-	41	-	-	-	-	-	6	47	-	-	47	-	-	-	-	-	-	603	-
2b.1.1	Totals	2,290	20,061	662	1,814	11,802	7,193	-	9,449	53,270	46,167	-	7,104	98,179	20,912	-	-	-	5,324,166	323,967	-
2b.1.2	Scaffolding in support of decommissioning	-	2,584	34	23	205	46	-	695	3,588	3,588	-	-	1,541	136	-	-	-	77,989	45,926	-
Decontamination of Site Buildings																					
2b.1.3.1	Reactor	1,628	2,446	165	1,639	721	8,443	-	3,907	18,949	18,949	-	-	5,995	57,454	-	-	-	2,681,023	55,906	-
2b.1.3.2	Auxiliary	842	489	28	255	247	457	-	736	3,053	3,053	-	-	2,058	6,938	-	-	-	412,089	19,438	-
2b.1.3.3	Communication Corridor - Contaminated	19	8	1	5	2	10	-	15	59	59	-	-	17	152	-	-	-	7,854	395	-
2b.1.3.4	Hot Machine Shop	23	17	1	6	-	12	-	20	79	79	-	-	-	188	-	-	-	8,892	597	-
2b.1.3.5	RAM Storage Building	58	20	1	13	2	25	-	42	162	162	-	-	19	389	-	-	-	19,136	1,162	-
2b.1.3.6	Radioactive and Personnel Tunnel	8	16	0	4	-	7	-	10	44	44	-	-	-	106	-	-	-	5,022	335	-
2b.1.3.7	Radwaste	448	236	14	133	102	240	-	380	1,552	1,552	-	-	844	3,681	-	-	-	208,617	10,005	-
2b.1.3.8	Radwaste Drum Storage	50	24	1	15	8	27	-	41	167	167	-	-	66	413	-	-	-	22,243	1,093	-
2b.1.3.9	Reactor Head Assembly Building	44	-	-	-	-	-	-	22	66	66	-	-	-	-	-	-	-	-	691	-
2b.1.3.10	Steam Generator Replacement Bldgs	331	-	-	-	-	-	-	165	496	496	-	-	-	-	-	-	-	-	4,358	-
2b.1.3	Totals	3,450	3,257	211	2,070	1,082	9,219	-	5,338	24,628	24,628	-	-	8,999	69,322	-	-	-	3,364,877	93,979	-
2b.1.4	Prepare/submit License Termination Plan	-	-	-	-	-	-	650	98	748	748	-	-	-	-	-	-	-	-	-	4,096
2b.1.5	Receive NRC approval of termination plan									a											
2b.1	Subtotal Period 2b Activity Costs	5,740	25,902	907	3,907	13,089	16,459	650	15,580	82,234	75,130	-	7,104	108,720	90,370	-	-	-	8,767,032	463,873	4,096
Period 2b Additional Costs																					
2b.2.1	Remedial Action Surveys	-	-	-	-	-	-	2,401	720	3,121	3,121	-	-	-	-	-	-	-	-	47,209	-
2b.2.2	Sanitary Treatment Lagoon	-	7	92	235	-	540	-	181	1,054	1,054	-	-	-	4,608	-	-	-	392,140	423	-
2b.2.3	Cooling Tower Asbestos Panel Removal	-	6,512	-	305	-	-	641	1,119	8,576	-	-	8,576	-	-	-	-	-	-	71,419	-
2b.2.4	Operational Equipment	-	-	22	103	866	-	-	148	1,139	1,139	-	-	11,700	-	-	-	-	292,500	32	-
2b.2.5	Retired Reactor Closure Head	-	151	847	1,330	-	1,110	-	599	4,037	4,037	-	-	-	2,764	-	-	-	338,540	3,157	2,000
2b.2.6	Spent Fuel Pool Legacy Waste	-	108	163	67	-	2,617	14	710	3,680	3,680	-	-	-	-	250	-	-	14,900	1,333	53

Table C
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
2b.2	Subtotal Period 2b Additional Costs	-	6,778	1,124	2,039	866	4,267	3,056	3,477	21,606	13,031	-	8,576	11,700	7,372	250	-	-	1,038,080	123,574	2,053
Period 2b Collateral Costs																					
2b.3.1	Process decommissioning water waste	187	-	136	342	-	568	-	300	1,533	1,533	-	-	-	1,116	-	-	-	66,951	218	-
2b.3.2	Process decommissioning chemical flush waste	4	-	157	626	-	1,209	-	414	2,409	2,409	-	-	-	1,338	-	-	-	142,540	250	-
2b.3.3	Small tool allowance	-	583	-	-	-	-	-	87	670	670	-	-	-	-	-	-	-	-	-	-
2b.3.4	Spent Fuel Capital and Transfer	-	-	-	-	-	-	22,680	3,402	26,082	-	26,082	-	-	-	-	-	-	-	-	-
2b.3.5	On-site survey and release of 309.6 tons clean metallic waste	-	-	-	-	-	-	564	56	620	620	-	-	-	-	-	-	-	-	-	-
2b.3	Subtotal Period 2b Collateral Costs	190	583	292	969	-	1,776	23,244	4,260	31,314	5,232	26,082	-	-	2,453	-	-	-	209,491	468	-
Period 2b Period-Dependent Costs																					
2b.4.1	Decon supplies	1,889	-	-	-	-	-	-	472	2,362	2,362	-	-	-	-	-	-	-	-	-	-
2b.4.2	Insurance	-	-	-	-	-	-	1,539	154	1,693	1,693	-	-	-	-	-	-	-	-	-	-
2b.4.3	Property taxes	-	-	-	-	-	-	272	27	300	300	-	-	-	-	-	-	-	-	-	-
2b.4.4	Health physics supplies	-	6,870	-	-	-	-	-	1,717	8,587	8,587	-	-	-	-	-	-	-	-	-	-
2b.4.5	Heavy equipment rental	-	5,176	-	-	-	-	-	776	5,952	5,952	-	-	-	-	-	-	-	-	-	-
2b.4.6	Disposal of DAW generated	-	-	135	76	-	392	-	123	725	725	-	-	-	6,613	-	-	-	132,265	216	-
2b.4.7	Plant energy budget	-	-	-	-	-	-	3,497	525	4,022	4,022	-	-	-	-	-	-	-	-	-	-
2b.4.8	NRC Fees	-	-	-	-	-	-	1,639	164	1,803	1,803	-	-	-	-	-	-	-	-	-	-
2b.4.9	Emergency Planning Fees	-	-	-	-	-	-	2,273	227	2,501	-	2,501	-	-	-	-	-	-	-	-	-
2b.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	2,244	337	2,581	-	2,581	-	-	-	-	-	-	-	-	-
2b.4.11	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	566	85	651	651	-	-	-	-	-	-	-	-	-	-
2b.4.12	ISFSI Operating Costs	-	-	-	-	-	-	287	43	331	-	331	-	-	-	-	-	-	-	-	-
2b.4.13	Corporate Allocations	-	-	-	-	-	-	2,271	227	2,498	2,498	-	-	-	-	-	-	-	-	-	-
2b.4.14	Security Staff Cost	-	-	-	-	-	-	30,845	4,627	35,472	35,472	-	-	-	-	-	-	-	-	-	510,210
2b.4.15	DOC Staff Cost	-	-	-	-	-	-	38,792	5,819	44,611	44,611	-	-	-	-	-	-	-	-	-	344,864
2b.4.16	Utility Staff Cost	-	-	-	-	-	-	58,488	8,773	67,261	67,261	-	-	-	-	-	-	-	-	-	640,124
2b.4	Subtotal Period 2b Period-Dependent Costs	1,889	12,045	135	76	-	392	142,715	24,096	181,348	175,936	5,412	-	-	6,613	-	-	-	132,265	216	1,495,198
2b.0	TOTAL PERIOD 2b COST	7,820	45,308	2,458	6,990	13,955	22,894	169,665	47,413	316,502	269,328	31,494	15,680	120,420	106,808	250	-	-	10,146,870	588,130	1,501,347
PERIOD 2d - Decontamination Following Wet Fuel Storage																					
Period 2d Direct Decommissioning Activities																					
2d.1.1	Remove spent fuel racks	1,060	112	294	261	-	2,389	-	1,223	5,338	5,338	-	-	-	6,988	-	-	-	443,960	1,925	-
Disposal of Plant Systems																					
2d.1.2.1	600 Fuel Bldg Non-Specific Systems RCA	-	411	6	34	385	-	-	166	1,002	1,002	-	-	3,200	-	-	-	-	129,974	5,859	-
2d.1.2.2	600 Fuel Bldg Non-System Specific	-	64	3	6	20	41	-	31	165	165	-	-	170	120	-	-	-	14,568	954	-
2d.1.2.3	EC - Fuel Pool Cooling & Cleanup	-	535	28	68	313	374	-	287	1,606	1,606	-	-	2,602	1,090	-	-	-	175,237	8,051	-
2d.1.2.4	GA- Plant Heating Fuel Building	-	30	1	2	6	14	-	12	66	66	-	-	50	41	-	-	-	4,700	449	-
2d.1.2.5	GG - Fuel Building HVAC	-	326	10	45	448	53	-	170	1,053	1,053	-	-	3,729	155	-	-	-	161,297	4,673	-
2d.1.2.6	KC- Fire Protection Fuel Building	-	157	2	13	149	-	-	64	385	385	-	-	1,239	-	-	-	-	50,329	2,115	-
2d.1.2	Totals	-	1,523	51	168	1,321	483	-	730	4,276	4,276	-	-	10,991	1,407	-	-	-	536,105	22,102	-
Decontamination of Site Buildings																					
2d.1.3.1	Fuel Building	1,070	1,141	14	88	325	147	-	920	3,706	3,706	-	-	2,705	1,864	-	-	-	199,762	31,564	-
2d.1.3	Totals	1,070	1,141	14	88	325	147	-	920	3,706	3,706	-	-	2,705	1,864	-	-	-	199,762	31,564	-
2d.1.4	Scaffolding in support of decommissioning	-	517	7	5	41	9	-	139	718	718	-	-	308	27	-	-	-	15,598	9,185	-
2d.1	Subtotal Period 2d Activity Costs	2,130	3,292	366	521	1,687	3,028	-	3,013	14,038	14,038	-	-	14,004	10,287	-	-	-	1,195,425	64,776	-
Period 2d Additional Costs																					
2d.2.1	License Termination Survey Planning	-	-	-	-	-	-	1,778	533	2,311	2,311	-	-	-	-	-	-	-	-	-	12,480
2d.2.2	License Termination ISFSI	-	684	154	166	-	3,547	3,894	2,111	10,556	10,556	-	-	-	14,077	-	-	-	1,053,456	17,572	10,920
2d.2.3	Excavation of Underground Services	-	1,879	-	-	-	-	551	552	2,982	2,982	-	-	-	-	-	-	-	-	12,396	-
2d.2.4	Remedial Action Surveys	-	-	-	-	-	-	704	211	915	915	-	-	-	-	-	-	-	-	13,838	-
2d.2	Subtotal Period 2d Additional Costs	-	2,562	154	166	-	3,547	6,927	3,408	16,764	16,764	-	-	-	14,077	-	-	-	1,053,456	43,806	23,400
Period 2d Collateral Costs																					
2d.3.1	Process decommissioning water waste	100	-	73	184	-	306	-	161	824	824	-	-	-	601	-	-	-	36,064	117	-
2d.3.2	Process decommissioning chemical flush waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2d.3.3	Small tool allowance	-	114	-	-	-	-	-	17	131	131	-	-	-	-	-	-	-	-	-	-
2d.3.4	Decommissioning Equipment Disposition	-	-	133	101	799	181	-	194	1,408	1,408	-	-	6,000	529	-	-	-	303,608	147	-
2d.3	Subtotal Period 2d Collateral Costs	100	114	207	285	799	487	-	372	2,362	2,362	-	-	6,000	1,130	-	-	-	339,672	264	-

Table C
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Period 2d Period-Dependent Costs																					
2d.4.1	Decon supplies	276	-	-	-	-	-	-	69	345	345	-	-	-	-	-	-	-	-	-	-
2d.4.2	Insurance	-	-	-	-	-	-	451	45	496	496	-	-	-	-	-	-	-	-	-	-
2d.4.3	Property taxes	-	-	-	-	-	-	80	8	88	88	-	-	-	-	-	-	-	-	-	-
2d.4.4	Health physics supplies	-	1,388	-	-	-	-	-	347	1,735	1,735	-	-	-	-	-	-	-	-	-	-
2d.4.5	Heavy equipment rental	-	1,517	-	-	-	-	-	228	1,745	1,745	-	-	-	-	-	-	-	-	-	-
2d.4.6	Disposal of DAW generated	-	-	42	24	-	123	-	39	228	228	-	-	-	2,081	-	-	-	41,624	68	-
2d.4.7	Plant energy budget	-	-	-	-	-	-	547	82	629	629	-	-	-	-	-	-	-	-	-	-
2d.4.8	NRC Fees	-	-	-	-	-	-	454	45	499	499	-	-	-	-	-	-	-	-	-	-
2d.4.9	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	332	50	382	382	-	-	-	-	-	-	-	-	-	-
2d.4.10	Corporate Allocations	-	-	-	-	-	-	666	67	732	732	-	-	-	-	-	-	-	-	-	-
2d.4.11	Security Staff Cost	-	-	-	-	-	-	1,850	277	2,127	2,127	-	-	-	-	-	-	-	-	-	20,772
2d.4.12	DOC Staff Cost	-	-	-	-	-	-	7,766	1,165	8,931	8,931	-	-	-	-	-	-	-	-	-	69,238
2d.4.13	Utility Staff Cost	-	-	-	-	-	-	12,053	1,808	13,861	13,861	-	-	-	-	-	-	-	-	-	130,861
2d.4	Subtotal Period 2d Period-Dependent Costs	276	2,905	42	24	-	123	24,198	4,229	31,798	31,798	-	-	-	2,081	-	-	-	41,624	68	220,870
2d.0	TOTAL PERIOD 2d COST	2,505	8,873	770	996	2,487	7,184	31,124	11,022	64,962	64,962	-	-	20,004	27,575	-	-	-	2,630,177	108,914	244,270
PERIOD 2f - License Termination																					
Period 2f Direct Decommissioning Activities																					
2f.1.1	ORISE confirmatory survey	-	-	-	-	-	-	168	50	218	218	-	-	-	-	-	-	-	-	-	-
2f.1.2	Terminate license									a											
2f.1	Subtotal Period 2f Activity Costs	-	-	-	-	-	-	168	50	218	218	-	-	-	-	-	-	-	-	-	-
Period 2f Additional Costs																					
2f.2.1	License Termination Survey	-	-	-	-	-	-	10,211	3,063	13,274	13,274	-	-	-	-	-	-	-	-	153,878	6,240
2f.2	Subtotal Period 2f Additional Costs	-	-	-	-	-	-	10,211	3,063	13,274	13,274	-	-	-	-	-	-	-	-	153,878	6,240
Period 2f Collateral Costs																					
2f.3.1	DOC staff relocation expenses	-	-	-	-	-	-	1,641	246	1,887	1,887	-	-	-	-	-	-	-	-	-	-
2f.3	Subtotal Period 2f Collateral Costs	-	-	-	-	-	-	1,641	246	1,887	1,887	-	-	-	-	-	-	-	-	-	-
Period 2f Period-Dependent Costs																					
2f.4.1	Insurance	-	-	-	-	-	-	512	51	564	564	-	-	-	-	-	-	-	-	-	-
2f.4.2	Property taxes	-	-	-	-	-	-	91	9	100	100	-	-	-	-	-	-	-	-	-	-
2f.4.3	Health physics supplies	-	1,316	-	-	-	-	-	329	1,645	1,645	-	-	-	-	-	-	-	-	-	-
2f.4.4	Disposal of DAW generated	-	-	7	4	-	21	-	7	39	39	-	-	-	353	-	-	-	7,050	11	-
2f.4.5	Plant energy budget	-	-	-	-	-	-	310	47	357	357	-	-	-	-	-	-	-	-	-	-
2f.4.6	NRC Fees	-	-	-	-	-	-	546	55	601	601	-	-	-	-	-	-	-	-	-	-
2f.4.7	Corporate Allocations	-	-	-	-	-	-	756	76	832	832	-	-	-	-	-	-	-	-	-	-
2f.4.8	Security Staff Cost	-	-	-	-	-	-	2,101	315	2,416	2,416	-	-	-	-	-	-	-	-	-	23,592
2f.4.9	DOC Staff Cost	-	-	-	-	-	-	6,532	980	7,511	7,511	-	-	-	-	-	-	-	-	-	57,408
2f.4.10	Utility Staff Cost	-	-	-	-	-	-	7,153	1,073	8,226	8,226	-	-	-	-	-	-	-	-	-	74,709
2f.4	Subtotal Period 2f Period-Dependent Costs	-	1,316	7	4	-	21	18,001	2,941	22,290	22,290	-	-	-	353	-	-	-	7,050	11	155,709
2f.0	TOTAL PERIOD 2f COST	-	1,316	7	4	-	21	30,021	6,300	37,669	37,669	-	-	-	353	-	-	-	7,050	153,889	161,949
PERIOD 2 TOTALS		13,062	105,066	29,752	21,039	32,223	98,744	365,307	136,079	801,271	723,483	56,618	21,171	286,777	233,897	1,481	393	2,217	27,005,600	1,282,989	3,086,805
PERIOD 3b - Site Restoration																					
Period 3b Direct Decommissioning Activities																					
Demolition of Remaining Site Buildings																					
3b.1.1.1	Reactor	-	3,482	-	-	-	-	-	522	4,004	-	-	4,004	-	-	-	-	-	-	27,502	-
3b.1.1.2	Auxiliary	-	2,865	-	-	-	-	-	430	3,295	-	-	3,295	-	-	-	-	-	-	19,024	-
3b.1.1.3	Auxiliary Boiler	-	26	-	-	-	-	-	4	30	-	-	30	-	-	-	-	-	-	248	-
3b.1.1.4	Barge Facility	-	957	-	-	-	-	-	144	1,101	-	-	1,101	-	-	-	-	-	-	4,290	-
3b.1.1.5	Circulating & Service Water Pumphouse	-	233	-	-	-	-	-	35	268	-	-	268	-	-	-	-	-	-	1,996	-
3b.1.1.6	Communication Corridor - Clean	-	1,079	-	-	-	-	-	162	1,241	-	-	1,241	-	-	-	-	-	-	8,280	-
3b.1.1.7	Communication Corridor - Contaminated	-	35	-	-	-	-	-	5	40	-	-	40	-	-	-	-	-	-	184	-
3b.1.1.8	Cooling Tower Concrete	-	451	-	-	-	-	-	68	519	-	-	519	-	-	-	-	-	-	2,332	-
3b.1.1.9	Diesel Generator	-	329	-	-	-	-	-	49	378	-	-	378	-	-	-	-	-	-	2,185	-
3b.1.1.10	Essential Service Water Pumphouse	-	176	-	-	-	-	-	26	203	-	-	203	-	-	-	-	-	-	955	-
3b.1.1.11	Fire Water Pumphouse	-	23	-	-	-	-	-	3	26	-	-	26	-	-	-	-	-	-	151	-
3b.1.1.12	Flex Building Storage	-	337	-	-	-	-	-	51	388	-	-	388	-	-	-	-	-	-	1,972	-
3b.1.1.13	Hardened Condensate Storage Tank - HCST	-	243	-	-	-	-	-	36	279	-	-	279	-	-	-	-	-	-	1,870	-

Table C
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
3b.1.1.14	Hot Machine Shop	-	21	-	-	-	-	-	3	24	-	-	24	-	-	-	-	-	-	243	-
3b.1.1.15	Intake	-	219	-	-	-	-	-	33	252	-	-	252	-	-	-	-	-	-	1,411	-
3b.1.1.16	Misc. Structures	-	2,722	-	-	-	-	-	408	3,130	-	-	3,130	-	-	-	-	-	-	18,774	-
3b.1.1.17	Miscellaneous Site Foundations	-	194	-	-	-	-	-	29	223	-	-	223	-	-	-	-	-	-	1,011	-
3b.1.1.18	Outage Maintenance	-	140	-	-	-	-	-	21	161	-	-	161	-	-	-	-	-	-	1,570	-
3b.1.1.19	RAM Storage Building	-	59	-	-	-	-	-	9	68	-	-	68	-	-	-	-	-	-	624	-
3b.1.1.20	Radioactive and Personnel Tunnel	-	34	-	-	-	-	-	5	39	-	-	39	-	-	-	-	-	-	386	-
3b.1.1.21	Radwaste	-	1,196	-	-	-	-	-	179	1,375	-	-	1,375	-	-	-	-	-	-	8,111	-
3b.1.1.22	Radwaste Drum Storage	-	171	-	-	-	-	-	26	197	-	-	197	-	-	-	-	-	-	1,449	-
3b.1.1.23	Reactor Head Assembly Building	-	98	-	-	-	-	-	15	113	-	-	113	-	-	-	-	-	-	1,108	-
3b.1.1.24	Security Additions	-	1,655	-	-	-	-	-	248	1,903	-	-	1,903	-	-	-	-	-	-	6,051	-
3b.1.1.25	Service	-	522	-	-	-	-	-	78	600	-	-	600	-	-	-	-	-	-	3,485	-
3b.1.1.26	Sludge Pump Station & Lagoon	-	1,678	-	-	-	-	-	252	1,930	-	-	1,930	-	-	-	-	-	-	10,601	-
3b.1.1.27	Steam Generator Replacement Bldgs	-	976	-	-	-	-	-	146	1,122	-	-	1,122	-	-	-	-	-	-	6,874	-
3b.1.1.28	Turbine Building	-	4,906	-	-	-	-	-	736	5,642	-	-	5,642	-	-	-	-	-	-	47,075	-
3b.1.1.29	Turbine Pedestal	-	561	-	-	-	-	-	84	646	-	-	646	-	-	-	-	-	-	2,934	-
3b.1.1.30	U.H.S. Cooling Tower	-	343	-	-	-	-	-	51	395	-	-	395	-	-	-	-	-	-	1,814	-
3b.1.1.31	Water Treatment Plant	-	1	-	-	-	-	-	0	1	-	-	1	-	-	-	-	-	-	9	-
3b.1.1.32	Fuel Building	-	1,229	-	-	-	-	-	184	1,414	-	-	1,414	-	-	-	-	-	-	8,068	-
3b.1.1	Totals	-	26,963	-	-	-	-	-	4,044	31,007	-	-	31,007	-	-	-	-	-	-	192,587	-
	Site Closeout Activities																				
3b.1.2	Remove Rubble	-	1,558	-	-	-	-	-	234	1,792	-	-	1,792	-	-	-	-	-	-	7,233	-
3b.1.3	Grade & landscape site	-	129	-	-	-	-	-	19	148	-	-	148	-	-	-	-	-	-	592	-
3b.1.4	Final report to NRC	-	-	-	-	-	-	248	37	285	285	-	-	-	-	-	-	-	-	-	1,560
3b.1	Subtotal Period 3b Activity Costs	-	28,650	-	-	-	-	248	4,335	33,232	285	-	32,947	-	-	-	-	-	-	200,413	1,560
	Period 3b Additional Costs																				
3b.2.1	Concrete Crushing	-	1,546	-	-	-	-	19	235	1,800	-	-	1,800	-	-	-	-	-	-	6,035	-
3b.2.2	Mine Area Backfill	-	6,441	-	-	-	-	-	966	7,407	-	-	7,407	-	-	-	-	-	-	15,960	-
3b.2.3	Construction Debris	-	-	-	-	-	-	2,950	443	3,393	-	-	3,393	-	-	-	-	-	-	-	-
3b.2.4	Cooling Tower Discharge & Intake Pipe Flow Fill	-	5,020	-	-	-	-	-	753	5,772	-	-	5,772	-	-	-	-	-	-	9,588	-
3b.2.5	Cooling Tower Demolition	-	5,495	-	-	-	-	-	824	6,320	-	-	6,320	-	-	-	-	-	-	21,619	-
3b.2.6	Site Restoration ISFSI	-	1,416	-	-	-	-	97	227	1,740	-	-	1,740	-	-	-	-	-	-	10,514	160
3b.2	Subtotal Period 3b Additional Costs	-	19,918	-	-	-	-	3,067	3,448	26,432	-	-	26,432	-	-	-	-	-	-	63,716	160
	Period 3b Collateral Costs																				
3b.3.1	Small tool allowance	-	329	-	-	-	-	-	49	379	-	-	379	-	-	-	-	-	-	-	-
3b.3	Subtotal Period 3b Collateral Costs	-	329	-	-	-	-	-	49	379	-	-	379	-	-	-	-	-	-	-	-
	Period 3b Period-Dependent Costs																				
3b.4.1	Insurance	-	-	-	-	-	-	1,019	102	1,121	-	-	1,121	-	-	-	-	-	-	-	-
3b.4.2	Property taxes	-	-	-	-	-	-	180	18	198	-	-	198	-	-	-	-	-	-	-	-
3b.4.3	Heavy equipment rental	-	4,790	-	-	-	-	-	718	5,508	-	-	5,508	-	-	-	-	-	-	-	-
3b.4.4	Plant energy budget	-	-	-	-	-	-	309	46	355	-	-	355	-	-	-	-	-	-	-	-
3b.4.5	Corporate Allocations	-	-	-	-	-	-	1,504	150	1,655	-	-	1,655	-	-	-	-	-	-	-	-
3b.4.6	Security Staff Cost	-	-	-	-	-	-	3,412	512	3,924	-	-	3,924	-	-	-	-	-	-	-	37,543
3b.4.7	DOC Staff Cost	-	-	-	-	-	-	12,661	1,899	14,560	-	-	14,560	-	-	-	-	-	-	-	106,371
3b.4.8	Utility Staff Cost	-	-	-	-	-	-	5,808	871	6,679	-	-	6,679	-	-	-	-	-	-	-	61,007
3b.4	Subtotal Period 3b Period-Dependent Costs	-	4,790	-	-	-	-	24,893	4,317	34,000	-	-	34,000	-	-	-	-	-	-	-	204,920
3b.0	TOTAL PERIOD 3b COST	-	53,687	-	-	-	-	28,207	12,149	94,043	285	-	93,758	-	-	-	-	-	-	264,129	206,640
PERIOD 3 TOTALS		-	53,687	-	-	-	-	28,207	12,149	94,043	285	-	93,758	-	-	-	-	-	-	264,129	206,640
TOTAL COST TO DECOMMISSION		17,773	162,533	29,898	21,506	32,223	100,958	557,872	175,184	1,097,947	902,437	78,615	116,895	286,777	235,150	2,268	393	2,217	27,125,890	1,567,519	4,491,356

Table C
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			

TOTAL COST TO DECOMMISSION WITH 18.98% CONTINGENCY:	**$1,097,947**	**thousands of 2023 dollars**
TOTAL NRC LICENSE TERMINATION COST IS 82.19% OR:	**$902,437**	**thousands of 2023 dollars**
SPENT FUEL MANAGEMENT COST IS 7.16% OR:	**$78,615**	**thousands of 2023 dollars**
NON-NUCLEAR DEMOLITION COST IS 10.65% OR:	**$116,895**	**thousands of 2023 dollars**
TOTAL LOW-LEVEL RADIOACTIVE WASTE VOLUME BURIED (EXCLUDING GTCC):	**237,811**	**Cubic Feet**
TOTAL GREATER THAN CLASS C RADWASTE VOLUME GENERATED:	**2,217**	**Cubic Feet**
TOTAL SCRAP METAL REMOVED:	**71,073**	**Tons**
TOTAL CRAFT LABOR REQUIREMENTS:	**1,567,519**	**Man-hours**

End Notes:
n/a - indicates that this activity not charged as decommissioning expense
a - indicates that this activity performed by decommissioning staff
0 - indicates that this value is less than 0.5 but is non-zero
A cell containing " - " indicates a zero value

APPENDIX D
DETAILED COST ANALYSIS

SAFSTOR

with

LOW-LEVEL RADIOACTIVE WASTE PROCESSING

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
PERIOD 1a - Shutdown through Transition																					
Period 1a Direct Decommissioning Activities																					
1a.1.1	SAFSTOR site characterization survey	-	-	-	-	-	-	394	118	512	512	-	-	-	-	-	-	-	-	-	-
1a.1.2	Prepare preliminary decommissioning cost	-	-	-	-	-	-	206	31	237	237	-	-	-	-	-	-	-	-	-	1,300
1a.1.3	Notification of Cessation of Operations									a											
1a.1.4	Remove fuel & source material									n/a											
1a.1.5	Notification of Permanent Defueling									a											
1a.1.6	Deactivate plant systems & process waste									a											
1a.1.7	Prepare and submit PSDAR	-	-	-	-	-	-	317	48	365	365	-	-	-	-	-	-	-	-	-	2,000
1a.1.8	Review plant dwgs & specs.	-	-	-	-	-	-	206	31	237	237	-	-	-	-	-	-	-	-	-	1,300
1a.1.9	Perform detailed rad survey									a											
1a.1.10	Estimate by-product inventory	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
1a.1.11	End product description	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
1a.1.12	Detailed by-product inventory	-	-	-	-	-	-	238	36	274	274	-	-	-	-	-	-	-	-	-	1,500
1a.1.13	Define major work sequence	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
1a.1.14	Perform SER and EA	-	-	-	-	-	-	492	74	566	566	-	-	-	-	-	-	-	-	-	3,100
1a.1.15	Perform Site-Specific Cost Study	-	-	-	-	-	-	794	119	913	913	-	-	-	-	-	-	-	-	-	5,000
Activity Specifications																					
1a.1.16.1	Prepare plant and facilities for SAFSTOR	-	-	-	-	-	-	781	117	898	898	-	-	-	-	-	-	-	-	-	4,920
1a.1.16.2	Plant systems	-	-	-	-	-	-	661	99	761	761	-	-	-	-	-	-	-	-	-	4,167
1a.1.16.3	Plant structures and buildings	-	-	-	-	-	-	495	74	569	569	-	-	-	-	-	-	-	-	-	3,120
1a.1.16.4	Waste management	-	-	-	-	-	-	317	48	365	365	-	-	-	-	-	-	-	-	-	2,000
1a.1.16.5	Facility and site dormancy	-	-	-	-	-	-	317	48	365	365	-	-	-	-	-	-	-	-	-	2,000
1a.1.16	Total	-	-	-	-	-	-	2,572	386	2,958	2,958	-	-	-	-	-	-	-	-	-	16,207
Detailed Work Procedures																					
1a.1.17.1	Plant systems	-	-	-	-	-	-	188	28	216	216	-	-	-	-	-	-	-	-	-	1,183
1a.1.17.2	Facility closeout & dormancy	-	-	-	-	-	-	190	29	219	219	-	-	-	-	-	-	-	-	-	1,200
1a.1.17	Total	-	-	-	-	-	-	378	57	435	435	-	-	-	-	-	-	-	-	-	2,383
1a.1.18	Procure vacuum drying system	-	-	-	-	-	-	16	2	18	18	-	-	-	-	-	-	-	-	-	100
1a.1.19	Drain/de-energize non-cont. systems									a											
1a.1.20	Drain & dry NSSS									a											
1a.1.21	Drain/de-energize contaminated systems									a											
1a.1.22	Decon/secure contaminated systems									a											
1a.1	Subtotal Period 1a Activity Costs	-	-	-	-	-	-	6,090	973	7,063	7,063	-	-	-	-	-	-	-	-	-	35,890
Period 1a Collateral Costs																					
1a.3.1	Spent Fuel Capital and Transfer	-	-	-	-	-	-	10,080	1,512	11,592	-	11,592	-	-	-	-	-	-	-	-	-
1a.3	Subtotal Period 1a Collateral Costs	-	-	-	-	-	-	10,080	1,512	11,592	-	11,592	-	-	-	-	-	-	-	-	-
Period 1a Period-Dependent Costs																					
1a.4.1	Insurance	-	-	-	-	-	-	3,972	397	4,370	4,370	-	-	-	-	-	-	-	-	-	-
1a.4.2	Property taxes	-	-	-	-	-	-	120	12	132	132	-	-	-	-	-	-	-	-	-	-
1a.4.3	Health physics supplies	-	888	-	-	-	-	-	222	1,110	1,110	-	-	-	-	-	-	-	-	-	-
1a.4.4	Heavy equipment rental	-	657	-	-	-	-	-	99	755	755	-	-	-	-	-	-	-	-	-	-
1a.4.5	Disposal of DAW generated	-	-	12	7	-	36	-	11	67	67	-	-	-	610	-	-	-	12,190	20	-
1a.4.6	Plant energy budget	-	-	-	-	-	-	2,053	308	2,361	2,361	-	-	-	-	-	-	-	-	-	-
1a.4.7	NRC Fees	-	-	-	-	-	-	1,057	106	1,163	1,163	-	-	-	-	-	-	-	-	-	-
1a.4.8	Emergency Planning Fees	-	-	-	-	-	-	1,620	162	1,782	-	1,782	-	-	-	-	-	-	-	-	-
1a.4.9	INPO Fees	-	-	-	-	-	-	358	54	411	411	-	-	-	-	-	-	-	-	-	-
1a.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	988	148	1,136	-	1,136	-	-	-	-	-	-	-	-	-
1a.4.11	ISFSI Operating Costs	-	-	-	-	-	-	127	19	146	-	146	-	-	-	-	-	-	-	-	-
1a.4.12	Corporate Allocations	-	-	-	-	-	-	1,000	100	1,100	1,100	-	-	-	-	-	-	-	-	-	-
1a.4.13	Security Staff Cost	-	-	-	-	-	-	15,699	2,355	18,054	18,054	-	-	-	-	-	-	-	-	-	251,680
1a.4.14	Utility Staff Cost	-	-	-	-	-	-	37,678	5,652	43,329	43,329	-	-	-	-	-	-	-	-	-	422,240
1a.4	Subtotal Period 1a Period-Dependent Costs	-	1,545	12	7	-	36	64,672	9,644	75,916	72,852	3,064	-	-	610	-	-	-	12,190	20	673,920
1a.0	TOTAL PERIOD 1a COST	-	1,545	12	7	-	36	80,842	12,129	94,571	79,915	14,656	-	-	610	-	-	-	12,190	20	709,810

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
PERIOD 1b - SAFSTOR Limited DECON Activities																					
Period 1b Direct Decommissioning Activities																					
Decontamination of Site Buildings																					
1b.1.1.1	Reactor	1,604	-	-	-	-	-	-	802	2,407	2,407	-	-	-	-	-	-	-	24,102	-
1b.1.1.2	Auxiliary	792	-	-	-	-	-	-	396	1,188	1,188	-	-	-	-	-	-	-	12,527	-
1b.1.1.3	Communication Corridor - Contaminated	17	-	-	-	-	-	-	9	26	26	-	-	-	-	-	-	-	276	-
1b.1.1.4	Fuel Building	1,056	-	-	-	-	-	-	528	1,584	1,584	-	-	-	-	-	-	-	14,371	-
1b.1.1.5	Hot Machine Shop	22	-	-	-	-	-	-	11	33	33	-	-	-	-	-	-	-	344	-
1b.1.1.6	RAM Storage Building	55	-	-	-	-	-	-	27	82	82	-	-	-	-	-	-	-	865	-
1b.1.1.7	Radioactive and Personnel Tunnel	6	-	-	-	-	-	-	3	10	10	-	-	-	-	-	-	-	102	-
1b.1.1.8	Radwaste	422	-	-	-	-	-	-	211	633	633	-	-	-	-	-	-	-	6,671	-
1b.1.1.9	Radwaste Drum Storage	47	-	-	-	-	-	-	24	71	71	-	-	-	-	-	-	-	750	-
1b.1.1.10	Reactor Head Assembly Building	44	-	-	-	-	-	-	22	66	66	-	-	-	-	-	-	-	691	-
1b.1.1	Totals	4,067	-	-	-	-	-	-	2,033	6,100	6,100	-	-	-	-	-	-	-	60,700	-
1b.1	Subtotal Period 1b Activity Costs	4,067	-	-	-	-	-	-	2,033	6,100	6,100	-	-	-	-	-	-	-	60,700	-
Period 1b Additional Costs																					
1b.2.1	Spent Fuel Pool Isolation	-	-	-	-	-	-	14,330	2,150	16,480	16,480	-	-	-	-	-	-	-	-	-	-
1b.2	Subtotal Period 1b Additional Costs	-	-	-	-	-	-	14,330	2,150	16,480	16,480	-	-	-	-	-	-	-	-	-	-
Period 1b Collateral Costs																					
1b.3.1	Decon equipment	1,193	-	-	-	-	-	-	179	1,371	1,371	-	-	-	-	-	-	-	-	-	-
1b.3.2	Process decommissioning water waste	190	-	132	333	-	552	-	296	1,504	1,504	-	-	-	1,085	-	-	-	65,127	212	-
1b.3.3	Process decommissioning chemical flush waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1b.3.4	Small tool allowance	-	67	-	-	-	-	-	10	77	77	-	-	-	-	-	-	-	-	-	-
1b.3.5	Spent Fuel Capital and Transfer	-	-	-	-	-	-	2,520	378	2,898	-	2,898	-	-	-	-	-	-	-	-	-
1b.3	Subtotal Period 1b Collateral Costs	1,382	67	132	333	-	552	2,520	863	5,850	2,952	2,898	-	-	1,085	-	-	-	65,127	212	-
Period 1b Period-Dependent Costs																					
1b.4.1	Decon supplies	1,772	-	-	-	-	-	-	443	2,215	2,215	-	-	-	-	-	-	-	-	-	-
1b.4.2	Insurance	-	-	-	-	-	-	1,001	100	1,101	1,101	-	-	-	-	-	-	-	-	-	-
1b.4.3	Property taxes	-	-	-	-	-	-	30	3	33	33	-	-	-	-	-	-	-	-	-	-
1b.4.4	Health physics supplies	-	725	-	-	-	-	-	181	906	906	-	-	-	-	-	-	-	-	-	-
1b.4.5	Heavy equipment rental	-	166	-	-	-	-	-	25	190	190	-	-	-	-	-	-	-	-	-	-
1b.4.6	Disposal of DAW generated	-	-	15	9	-	45	-	14	82	82	-	-	-	752	-	-	-	15,043	25	-
1b.4.7	Plant energy budget	-	-	-	-	-	-	517	78	595	595	-	-	-	-	-	-	-	-	-	-
1b.4.8	NRC Fees	-	-	-	-	-	-	200	20	220	220	-	-	-	-	-	-	-	-	-	-
1b.4.9	Emergency Planning Fees	-	-	-	-	-	-	408	41	449	-	449	-	-	-	-	-	-	-	-	-
1b.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	249	37	286	-	286	-	-	-	-	-	-	-	-	-
1b.4.11	ISFSI Operating Costs	-	-	-	-	-	-	32	5	37	-	37	-	-	-	-	-	-	-	-	-
1b.4.12	Corporate Allocations	-	-	-	-	-	-	252	25	277	277	-	-	-	-	-	-	-	-	-	-
1b.4.13	Security Staff Cost	-	-	-	-	-	-	3,957	594	4,551	4,551	-	-	-	-	-	-	-	-	-	63,437
1b.4.14	Utility Staff Cost	-	-	-	-	-	-	9,497	1,425	10,921	10,921	-	-	-	-	-	-	-	-	-	106,428
1b.4	Subtotal Period 1b Period-Dependent Costs	1,772	890	15	9	-	45	16,144	2,990	21,866	21,093	772	-	-	752	-	-	-	15,043	25	169,865
1b.0	TOTAL PERIOD 1b COST	7,221	958	148	342	-	597	32,995	8,036	50,296	46,625	3,670	-	-	1,838	-	-	-	80,170	60,936	169,865
PERIOD 1c - Preparations for SAFSTOR Dormancy																					
Period 1c Direct Decommissioning Activities																					
1c.1.1	Prepare support equipment for storage	-	588	-	-	-	-	-	88	676	676	-	-	-	-	-	-	-	-	3,000	-
1c.1.2	Install containment pressure equal. lines	-	56	-	-	-	-	-	8	64	64	-	-	-	-	-	-	-	-	700	-
1c.1.3	Interim survey prior to dormancy	-	-	-	-	-	-	733	220	953	953	-	-	-	-	-	-	-	-	13,566	-
1c.1.4	Secure building accesses									a											
1c.1.5	Prepare & submit interim report	-	-	-	-	-	-	93	14	106	106	-	-	-	-	-	-	-	-	-	583
1c.1	Subtotal Period 1c Activity Costs	-	644	-	-	-	-	825	330	1,800	1,800	-	-	-	-	-	-	-	-	17,266	583
Period 1c Collateral Costs																					
1c.3.1	Process decommissioning water waste	206	-	144	363	-	602	-	322	1,637	1,637	-	-	-	1,183	-	-	-	70,953	231	-
1c.3.2	Process decommissioning chemical flush waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1c.3.3	Small tool allowance	-	5	-	-	-	-	-	1	6	6	-	-	-	-	-	-	-	-	-	-
1c.3.4	Spent Fuel Capital and Transfer	-	-	-	-	-	-	2,520	378	2,898	-	2,898	-	-	-	-	-	-	-	-	-
1c.3	Subtotal Period 1c Collateral Costs	206	5	144	363	-	602	2,520	701	4,541	1,643	2,898	-	-	1,183	-	-	-	70,953	231	-

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Period 1c Period-Dependent Costs																					
1c.4.1	Insurance	-	-	-	-	-	-	1,001	100	1,101	1,101	-	-	-	-	-	-	-	-	-	-
1c.4.2	Property taxes	-	-	-	-	-	-	30	3	33	33	-	-	-	-	-	-	-	-	-	-
1c.4.3	Health physics supplies	-	368	-	-	-	-	-	92	460	460	-	-	-	-	-	-	-	-	-	-
1c.4.4	Heavy equipment rental	-	166	-	-	-	-	-	25	190	190	-	-	-	-	-	-	-	-	-	-
1c.4.5	Disposal of DAW generated	-	-	3	2	-	9	-	3	17	17	-	-	-	154	-	-	-	3,073	5	-
1c.4.6	Plant energy budget	-	-	-	-	-	-	517	78	595	595	-	-	-	-	-	-	-	-	-	-
1c.4.7	NRC Fees	-	-	-	-	-	-	200	20	220	220	-	-	-	-	-	-	-	-	-	-
1c.4.8	Emergency Planning Fees	-	-	-	-	-	-	408	41	449	-	449	-	-	-	-	-	-	-	-	-
1c.4.9	Spent Fuel Pool O&M	-	-	-	-	-	-	249	37	286	-	286	-	-	-	-	-	-	-	-	-
1c.4.10	ISFSI Operating Costs	-	-	-	-	-	-	32	5	37	-	37	-	-	-	-	-	-	-	-	-
1c.4.11	Corporate Allocations	-	-	-	-	-	-	252	25	277	277	-	-	-	-	-	-	-	-	-	-
1c.4.12	Security Staff Cost	-	-	-	-	-	-	3,957	594	4,551	4,551	-	-	-	-	-	-	-	-	-	63,437
1c.4.13	Utility Staff Cost	-	-	-	-	-	-	9,497	1,425	10,921	10,921	-	-	-	-	-	-	-	-	-	106,428
1c.4	Subtotal Period 1c Period-Dependent Costs	-	533	3	2	-	9	16,144	2,447	19,138	18,366	772	-	-	154	-	-	-	3,073	5	169,865
1c.0	TOTAL PERIOD 1c COST	206	1,183	147	364	-	611	19,490	3,478	25,480	21,809	3,670	-	-	1,336	-	-	-	74,026	17,502	170,448
PERIOD 1 TOTALS		7,428	3,685	307	713	-	1,244	133,327	23,643	170,346	148,349	21,997	-	-	3,783	-	-	-	166,386	78,458	1,050,123
PERIOD 2a - SAFSTOR Dormancy with Wet Spent Fuel Storage																					
Period 2a Direct Decommissioning Activities																					
2a.1.1	Quarterly Inspection									a											
2a.1.2	Semi-annual environmental survey									a											
2a.1.3	Prepare reports									a											
2a.1.4	Bituminous roof replacement	-	-	-	-	-	-	326	49	374	374	-	-	-	-	-	-	-	-	-	-
2a.1.5	Maintenance supplies	-	-	-	-	-	-	615	154	769	769	-	-	-	-	-	-	-	-	-	-
2a.1	Subtotal Period 2a Activity Costs	-	-	-	-	-	-	941	203	1,143	1,143	-	-	-	-	-	-	-	-	-	-
Period 2a Collateral Costs																					
2a.3.1	Spent Fuel Capital and Transfer	-	-	-	-	-	-	40,950	6,143	47,093	-	47,093	-	-	-	-	-	-	-	-	-
2a.3	Subtotal Period 2a Collateral Costs	-	-	-	-	-	-	40,950	6,143	47,093	-	47,093	-	-	-	-	-	-	-	-	-
Period 2a Period-Dependent Costs																					
2a.4.1	Insurance	-	-	-	-	-	-	2,708	271	2,979	2,979	-	-	-	-	-	-	-	-	-	-
2a.4.2	Property taxes	-	-	-	-	-	-	479	48	527	527	-	-	-	-	-	-	-	-	-	-
2a.4.3	Health physics supplies	-	1,423	-	-	-	-	-	356	1,779	1,779	-	-	-	-	-	-	-	-	-	-
2a.4.4	Disposal of DAW generated	-	-	19	11	-	54	-	17	101	101	-	-	-	920	-	-	-	18,394	30	-
2a.4.5	Plant energy budget	-	-	-	-	-	-	1,641	246	1,887	944	944	-	-	-	-	-	-	-	-	-
2a.4.6	NRC Fees	-	-	-	-	-	-	1,304	130	1,434	1,434	-	-	-	-	-	-	-	-	-	-
2a.4.7	Emergency Planning Fees	-	-	-	-	-	-	4,001	400	4,401	-	4,401	-	-	-	-	-	-	-	-	-
2a.4.8	Spent Fuel Pool O&M	-	-	-	-	-	-	3,950	593	4,543	-	4,543	-	-	-	-	-	-	-	-	-
2a.4.9	ISFSI Operating Costs	-	-	-	-	-	-	506	76	582	-	582	-	-	-	-	-	-	-	-	-
2a.4.10	Corporate Allocations	-	-	-	-	-	-	3,997	400	4,397	4,397	-	-	-	-	-	-	-	-	-	-
2a.4.11	Security Staff Cost	-	-	-	-	-	-	56,070	8,410	64,480	54,035	10,446	-	-	-	-	-	-	-	-	897,945
2a.4.12	Utility Staff Cost	-	-	-	-	-	-	31,218	4,683	35,900	29,582	6,318	-	-	-	-	-	-	-	-	328,415
2a.4	Subtotal Period 2a Period-Dependent Costs	-	1,423	19	11	-	54	105,874	15,630	123,011	95,778	27,233	-	-	920	-	-	-	18,394	30	1,226,360
2a.0	TOTAL PERIOD 2a COST	-	1,423	19	11	-	54	147,765	21,975	171,247	96,921	74,326	-	-	920	-	-	-	18,394	30	1,226,360
PERIOD 2c - SAFSTOR Dormancy without Spent Fuel Storage																					
Period 2c Direct Decommissioning Activities																					
2c.1.1	Quarterly Inspection									a											
2c.1.2	Semi-annual environmental survey									a											
2c.1.3	Prepare reports									a											
2c.1.4	Bituminous roof replacement	-	-	-	-	-	-	3,955	593	4,548	4,548	-	-	-	-	-	-	-	-	-	-
2c.1.5	Maintenance supplies	-	-	-	-	-	-	7,471	1,868	9,338	9,338	-	-	-	-	-	-	-	-	-	-
2c.1	Subtotal Period 2c Activity Costs	-	-	-	-	-	-	11,425	2,461	13,886	13,886	-	-	-	-	-	-	-	-	-	-
Period 2c Collateral Costs																					
2c.3	Subtotal Period 2c Collateral Costs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Period 2c Period-Dependent Costs																					
2c.4.1	Insurance	-	-	-	-	-	-	20,383	2,038	22,422	22,422	-	-	-	-	-	-	-	-	-	-
2c.4.2	Property taxes	-	-	-	-	-	-	5,822	582	6,405	6,405	-	-	-	-	-	-	-	-	-	-
2c.4.3	Health physics supplies	-	7,889	-	-	-	-	-	1,972	9,862	9,862	-	-	-	-	-	-	-	-	-	-

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
2c.4.4	Disposal of DAW generated	-	-	101	57	-	293	-	92	541	541	-	-	-	4,942	-	-	-	98,844	161	-
2c.4.5	Plant energy budget	-	-	-	-	-	-	9,968	1,495	11,463	11,463	-	-	-	-	-	-	-	-	-	-
2c.4.6	NRC Fees	-	-	-	-	-	-	14,105	1,410	15,515	15,515	-	-	-	-	-	-	-	-	-	-
2c.4.7	Security Staff Cost	-	-	-	-	-	-	134,884	20,233	155,117	155,117	-	-	-	-	-	-	-	-	-	1,514,867
2c.4.8	Utility Staff Cost	-	-	-	-	-	-	79,438	11,916	91,353	91,353	-	-	-	-	-	-	-	-	-	883,672
2c.4	Subtotal Period 2c Period-Dependent Costs	-	7,889	101	57	-	293	264,601	39,739	312,679	312,679	-	-	-	4,942	-	-	-	98,844	161	2,398,539
2c.0	TOTAL PERIOD 2c COST	-	7,889	101	57	-	293	276,026	42,199	326,565	326,565	-	-	-	4,942	-	-	-	98,844	161	2,398,539
PERIOD 2 TOTALS		-	9,313	119	67	-	347	423,791	64,174	497,811	423,486	74,326	-	-	5,862	-	-	-	117,238	191	3,624,899
PERIOD 3a - Reactivate Site Following SAFSTOR Dormancy																					
Period 3a Direct Decommissioning Activities																					
3a.1.1	Prepare preliminary decommissioning cost	-	-	-	-	-	-	206	31	237	237	-	-	-	-	-	-	-	-	-	1,300
3a.1.2	Review plant dwgs & specs.	-	-	-	-	-	-	730	110	840	840	-	-	-	-	-	-	-	-	-	4,600
3a.1.3	Perform detailed rad survey									a											
3a.1.4	End product description	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
3a.1.5	Detailed by-product inventory	-	-	-	-	-	-	206	31	237	237	-	-	-	-	-	-	-	-	-	1,300
3a.1.6	Define major work sequence	-	-	-	-	-	-	1,190	179	1,369	1,369	-	-	-	-	-	-	-	-	-	7,500
3a.1.7	Perform SER and EA	-	-	-	-	-	-	492	74	566	566	-	-	-	-	-	-	-	-	-	3,100
3a.1.8	Prepare/submit Defueled Technical Specifications	-	-	-	-	-	-	1,190	179	1,369	1,369	-	-	-	-	-	-	-	-	-	7,500
3a.1.9	Perform Site-Specific Cost Study	-	-	-	-	-	-	794	119	913	913	-	-	-	-	-	-	-	-	-	5,000
3a.1.10	Prepare/submit Irradiated Fuel Management Plan	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
Activity Specifications																					
3a.1.11.1	Re-activate plant & temporary facilities	-	-	-	-	-	-	1,170	175	1,345	1,211	-	135	-	-	-	-	-	-	-	7,370
3a.1.11.2	Plant systems	-	-	-	-	-	-	661	99	761	684	-	76	-	-	-	-	-	-	-	4,167
3a.1.11.3	Reactor internals	-	-	-	-	-	-	1,127	169	1,296	1,296	-	-	-	-	-	-	-	-	-	7,100
3a.1.11.4	Reactor vessel	-	-	-	-	-	-	1,032	155	1,186	1,186	-	-	-	-	-	-	-	-	-	6,500
3a.1.11.5	Biological shield	-	-	-	-	-	-	79	12	91	91	-	-	-	-	-	-	-	-	-	500
3a.1.11.6	Steam generators	-	-	-	-	-	-	495	74	569	569	-	-	-	-	-	-	-	-	-	3,120
3a.1.11.7	Reinforced concrete	-	-	-	-	-	-	254	38	292	146	-	146	-	-	-	-	-	-	-	1,600
3a.1.11.8	Main Turbine	-	-	-	-	-	-	63	10	73	-	-	73	-	-	-	-	-	-	-	400
3a.1.11.9	Main Condensers	-	-	-	-	-	-	63	10	73	-	-	73	-	-	-	-	-	-	-	400
3a.1.11.10	Plant structures & buildings	-	-	-	-	-	-	495	74	569	285	-	285	-	-	-	-	-	-	-	3,120
3a.1.11.11	Waste management	-	-	-	-	-	-	730	110	840	840	-	-	-	-	-	-	-	-	-	4,600
3a.1.11.12	Facility & site closeout	-	-	-	-	-	-	143	21	164	82	-	82	-	-	-	-	-	-	-	900
3a.1.11	Total	-	-	-	-	-	-	6,313	947	7,260	6,391	-	870	-	-	-	-	-	-	-	39,777
Planning & Site Preparations																					
3a.1.12	Prepare dismantling sequence	-	-	-	-	-	-	381	57	438	438	-	-	-	-	-	-	-	-	-	2,400
3a.1.13	Plant prep. & temp. svces	-	-	-	-	-	-	4,000	600	4,600	4,600	-	-	-	-	-	-	-	-	-	-
3a.1.14	Design water clean-up system	-	-	-	-	-	-	222	33	256	256	-	-	-	-	-	-	-	-	-	1,400
3a.1.15	Rigging/Cont. Cntrl Envlps/tooling/etc.	-	-	-	-	-	-	2,800	420	3,220	3,220	-	-	-	-	-	-	-	-	-	-
3a.1.16	Procure casks/liners & containers	-	-	-	-	-	-	195	29	225	225	-	-	-	-	-	-	-	-	-	1,230
3a.1	Subtotal Period 3a Activity Costs	-	-	-	-	-	-	19,038	2,856	21,894	21,025	-	870	-	-	-	-	-	-	-	77,107
Period 3a Additional Costs																					
3a.2.1	Site Characterization	-	-	-	-	-	-	3,198	959	4,158	4,158	-	-	-	-	-	-	-	-	19,100	7,852
3a.2	Subtotal Period 3a Additional Costs	-	-	-	-	-	-	3,198	959	4,158	4,158	-	-	-	-	-	-	-	-	19,100	7,852
Period 3a Collateral Costs																					
3a.3	Subtotal Period 3a Collateral Costs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Period 3a Period-Dependent Costs																					
3a.4.1	Insurance	-	-	-	-	-	-	420	42	462	462	-	-	-	-	-	-	-	-	-	-
3a.4.2	Property taxes	-	-	-	-	-	-	120	12	132	132	-	-	-	-	-	-	-	-	-	-
3a.4.3	Health physics supplies	-	776	-	-	-	-	-	194	970	970	-	-	-	-	-	-	-	-	-	-
3a.4.4	Heavy equipment rental	-	657	-	-	-	-	-	99	755	755	-	-	-	-	-	-	-	-	-	-
3a.4.5	Disposal of DAW generated	-	-	10	6	-	30	-	10	56	56	-	-	-	514	-	-	-	10,287	17	-
3a.4.6	Plant energy budget	-	-	-	-	-	-	2,053	308	2,361	2,361	-	-	-	-	-	-	-	-	-	-
3a.4.7	NRC Fees	-	-	-	-	-	-	458	46	504	504	-	-	-	-	-	-	-	-	-	-
3a.4.8	Corporate Allocations	-	-	-	-	-	-	1,000	100	1,100	1,100	-	-	-	-	-	-	-	-	-	-
3a.4.9	Security Staff Cost	-	-	-	-	-	-	4,449	667	5,117	5,117	-	-	-	-	-	-	-	-	-	65,000
3a.4.10	Utility Staff Cost	-	-	-	-	-	-	23,216	3,482	26,699	26,699	-	-	-	-	-	-	-	-	-	257,920
3a.4	Subtotal Period 3a Period-Dependent Costs	-	1,433	10	6	-	30	31,716	4,960	38,156	38,156	-	-	-	514	-	-	-	10,287	17	322,920
3a.0	TOTAL PERIOD 3a COST	-	1,433	10	6	-	30	53,953	8,775	64,207	63,338	-	870	-	514	-	-	-	10,287	19,117	407,879

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
PERIOD 3b - Decommissioning Preparations																					
Period 3b Direct Decommissioning Activities																					
Detailed Work Procedures																					
3b.1.1.1	Plant systems	-	-	-	-	-	-	751	113	864	778	-	86	-	-	-	-	-	-	-	4,733
3b.1.1.2	Reactor internals	-	-	-	-	-	-	397	60	456	456	-	-	-	-	-	-	-	-	-	2,500
3b.1.1.3	Remaining buildings	-	-	-	-	-	-	214	32	246	62	-	185	-	-	-	-	-	-	-	1,350
3b.1.1.4	CRD cooling assembly	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
3b.1.1.5	CRD housings & ICI tubes	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
3b.1.1.6	Incore instrumentation	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
3b.1.1.7	Reactor vessel	-	-	-	-	-	-	576	86	663	663	-	-	-	-	-	-	-	-	-	3,630
3b.1.1.8	Facility closeout	-	-	-	-	-	-	190	29	219	110	-	110	-	-	-	-	-	-	-	1,200
3b.1.1.9	Missile shields	-	-	-	-	-	-	71	11	82	82	-	-	-	-	-	-	-	-	-	450
3b.1.1.10	Biological shield	-	-	-	-	-	-	190	29	219	219	-	-	-	-	-	-	-	-	-	1,200
3b.1.1.11	Steam generators	-	-	-	-	-	-	730	110	840	840	-	-	-	-	-	-	-	-	-	4,600
3b.1.1.12	Reinforced concrete	-	-	-	-	-	-	159	24	183	91	-	91	-	-	-	-	-	-	-	1,000
3b.1.1.13	Main Turbine	-	-	-	-	-	-	248	37	285	-	-	285	-	-	-	-	-	-	-	1,560
3b.1.1.14	Main Condensers	-	-	-	-	-	-	248	37	285	-	-	285	-	-	-	-	-	-	-	1,560
3b.1.1.15	Auxiliary building	-	-	-	-	-	-	433	65	498	448	-	50	-	-	-	-	-	-	-	2,730
3b.1.1.16	Reactor building	-	-	-	-	-	-	433	65	498	448	-	50	-	-	-	-	-	-	-	2,730
3b.1.1	Total	-	-	-	-	-	-	5,118	768	5,885	4,744	-	1,141	-	-	-	-	-	-	-	32,243
3b.1	Subtotal Period 3b Activity Costs	-	-	-	-	-	-	5,118	768	5,885	4,744	-	1,141	-	-	-	-	-	-	-	32,243
Period 3b Collateral Costs																					
3b.3.1	Decon equipment	1,193	-	-	-	-	-	-	179	1,371	1,371	-	-	-	-	-	-	-	-	-	-
3b.3.2	DOC staff relocation expenses	-	-	-	-	-	-	1,641	246	1,887	1,887	-	-	-	-	-	-	-	-	-	-
3b.3.3	Pipe cutting equipment	-	1,400	-	-	-	-	-	210	1,610	1,610	-	-	-	-	-	-	-	-	-	-
3b.3	Subtotal Period 3b Collateral Costs	1,193	1,400	-	-	-	-	1,641	635	4,868	4,868	-	-	-	-	-	-	-	-	-	-
Period 3b Period-Dependent Costs																					
3b.4.1	Decon supplies	43	-	-	-	-	-	-	11	54	54	-	-	-	-	-	-	-	-	-	-
3b.4.2	Insurance	-	-	-	-	-	-	342	34	376	376	-	-	-	-	-	-	-	-	-	-
3b.4.3	Property taxes	-	-	-	-	-	-	60	6	66	66	-	-	-	-	-	-	-	-	-	-
3b.4.4	Health physics supplies	-	431	-	-	-	-	-	108	539	539	-	-	-	-	-	-	-	-	-	-
3b.4.5	Heavy equipment rental	-	331	-	-	-	-	-	50	381	381	-	-	-	-	-	-	-	-	-	-
3b.4.6	Disposal of DAW generated	-	-	6	3	-	17	-	5	32	32	-	-	-	293	-	-	-	5,866	10	-
3b.4.7	Plant energy budget	-	-	-	-	-	-	1,035	155	1,190	1,190	-	-	-	-	-	-	-	-	-	-
3b.4.8	NRC Fees	-	-	-	-	-	-	231	23	254	254	-	-	-	-	-	-	-	-	-	-
3b.4.9	Corporate Allocations	-	-	-	-	-	-	504	50	555	555	-	-	-	-	-	-	-	-	-	-
3b.4.10	Security Staff Cost	-	-	-	-	-	-	2,243	336	2,579	2,579	-	-	-	-	-	-	-	-	-	32,767
3b.4.11	DOC Staff Cost	-	-	-	-	-	-	6,642	996	7,639	7,639	-	-	-	-	-	-	-	-	-	58,719
3b.4.12	Utility Staff Cost	-	-	-	-	-	-	11,704	1,756	13,459	13,459	-	-	-	-	-	-	-	-	-	130,020
3b.4	Subtotal Period 3b Period-Dependent Costs	43	762	6	3	-	17	22,761	3,531	27,124	27,124	-	-	-	293	-	-	-	5,866	10	221,506
3b.0	TOTAL PERIOD 3b COST	1,235	2,162	6	3	-	17	29,519	4,934	37,877	36,736	-	1,141	-	293	-	-	-	5,866	10	253,749
PERIOD 3 TOTALS		1,235	3,595	16	9	-	48	83,472	13,708	102,084	100,074	-	2,011	-	808	-	-	-	16,153	19,126	661,628
PERIOD 4a - Large Component Removal																					
Period 4a Direct Decommissioning Activities																					
Nuclear Steam Supply System Removal																					
4a.1.1.1	Reactor Coolant Piping	46	222	39	73	191	384	-	218	1,171	1,171	-	-	967	1,023	-	-	-	135,750	3,982	-
4a.1.1.2	Pressurizer Relief Tank	8	31	11	21	54	109	-	51	284	284	-	-	273	289	-	-	-	38,367	602	-
4a.1.1.3	Reactor Coolant Pumps & Motors	26	111	95	249	-	1,483	-	458	2,423	2,423	-	-	-	3,386	-	-	-	816,140	2,474	80
4a.1.1.4	Pressurizer	-	80	548	193	-	1,638	-	513	2,973	2,973	-	-	-	3,739	-	-	-	241,053	1,346	1,500
4a.1.1.5	Steam Generators	-	8,305	3,254	3,319	3,735	9,877	-	5,929	34,418	34,418	-	-	40,262	22,546	-	-	-	3,398,523	20,559	2,250
4a.1.1.6	Retired Steam Generator Units	-	-	3,254	3,319	3,735	9,877	-	3,853	24,037	24,037	-	-	40,262	22,546	-	-	-	3,398,523	10,852	2,250
4a.1.1.7	CRDMs/ICIs/Service Structure Removal	39	311	225	101	83	609	-	299	1,667	1,667	-	-	753	2,947	-	-	-	141,134	5,231	-
4a.1.1.8	Reactor Vessel Internals	48	5,349	11,276	1,031	-	11,929	306	13,123	43,063	43,063	-	-	-	5,623	501	406	-	342,863	24,523	1,139
4a.1.1.9	Vessel & Internals GTCC Disposal	-	-	-	-	-	13,035	-	1,955	14,990	14,990	-	-	-	-	-	-	2,217	433,180	-	-
4a.1.1.10	Reactor Vessel	-	7,025	2,076	1,382	-	6,848	306	9,603	27,239	27,239	-	-	-	15,631	-	-	-	979,036	24,523	1,139
4a.1.1	Totals	166	21,433	20,780	9,687	7,797	55,789	612	36,002	152,266	152,266	-	-	82,516	77,730	501	406	2,217	9,924,571	94,092	8,359

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Removal of Major Equipment																					
4a.1.2	Main Turbine/Generator	-	606	269	33	920	-	-	321	2,150	2,150	-	-	5,180	-	-	-	-	310,807	8,721	-
4a.1.3	Main Condensers	-	1,723	165	94	1,080	-	-	623	3,685	3,685	-	-	8,106	-	-	-	-	364,767	24,802	-
Cascading Costs from Clean Building Demolition																					
4a.1.4.1	Reactor	-	612	-	-	-	-	-	92	704	704	-	-	-	-	-	-	-	-	4,832	-
4a.1.4.2	Auxiliary	-	318	-	-	-	-	-	48	366	366	-	-	-	-	-	-	-	-	2,113	-
4a.1.4.3	Fuel Building	-	127	-	-	-	-	-	19	146	146	-	-	-	-	-	-	-	-	773	-
4a.1.4.4	Hot Machine Shop	-	1	-	-	-	-	-	0	1	1	-	-	-	-	-	-	-	-	7	-
4a.1.4.5	Radwaste	-	61	-	-	-	-	-	9	70	70	-	-	-	-	-	-	-	-	387	-
4a.1.4	Totals	-	1,119	-	-	-	-	-	168	1,287	1,287	-	-	-	-	-	-	-	-	8,113	-
Disposal of Plant Systems																					
4a.1.5.1	100 Aux.Bldg Non-System Specific RCA	-	920	15	80	917	-	-	381	2,313	2,313	-	-	7,629	-	-	-	-	309,812	13,471	-
4a.1.5.2	100 Auxiliary Bldg Non-System Specific	-	136	2	10	99	11	-	53	310	310	-	-	824	31	-	-	-	35,454	2,031	-
4a.1.5.3	AB - Main Steam	-	366	-	-	-	-	-	55	420	-	-	420	-	-	-	-	-	-	5,833	-
4a.1.5.4	AB - Main Steam RCA	-	103	4	23	259	-	-	68	458	458	-	-	2,156	-	-	-	-	87,550	1,515	-
4a.1.5.5	AC - Main Turbine	-	361	-	-	-	-	-	54	415	-	-	415	-	-	-	-	-	-	5,641	-
4a.1.5.6	AD - Condensate	-	401	-	-	-	-	-	60	461	-	-	461	-	-	-	-	-	-	6,144	-
4a.1.5.7	AE - Feedwater	-	275	-	-	-	-	-	41	316	-	-	316	-	-	-	-	-	-	4,271	-
4a.1.5.8	AF - Feedwater Heater Extraction	-	337	-	-	-	-	-	51	388	-	-	388	-	-	-	-	-	-	5,352	-
4a.1.5.9	AK - Condensate Demineralizer	-	125	-	-	-	-	-	19	143	-	-	143	-	-	-	-	-	-	1,944	-
4a.1.5.10	AL - Auxiliary Feedwater	-	54	-	-	-	-	-	8	63	-	-	63	-	-	-	-	-	-	852	-
4a.1.5.11	AQ - Condensate & Feedwater Chem Addtn	-	30	-	-	-	-	-	5	35	-	-	35	-	-	-	-	-	-	468	-
4a.1.5.12	BM - Steam Generator Blowdown	-	143	2	12	139	-	-	59	355	355	-	-	1,157	-	-	-	-	46,993	2,137	-
4a.1.5.13	BM - Steam Generator Blowdown - RCA	-	491	8	43	494	-	-	204	1,240	1,240	-	-	4,109	-	-	-	-	166,857	7,066	-
4a.1.5.14	BN - Borated Refueling Water Storage	-	409	12	66	752	-	-	226	1,465	1,465	-	-	6,255	-	-	-	-	254,024	6,161	-
4a.1.5.15	CA - Steam Seal	-	29	-	-	-	-	-	4	33	-	-	33	-	-	-	-	-	455	-	
4a.1.5.16	CB - Main Turbine Lube Oil	-	82	-	-	-	-	-	12	95	-	-	95	-	-	-	-	-	1,207	-	
4a.1.5.17	CC - Generator Hydrogen Seal & CO2	-	13	-	-	-	-	-	2	15	-	-	15	-	-	-	-	-	198	-	
4a.1.5.18	CD - Generator Seal Oil	-	19	-	-	-	-	-	3	22	-	-	22	-	-	-	-	-	287	-	
4a.1.5.19	CE - Stator Cooling Water	-	16	-	-	-	-	-	2	19	-	-	19	-	-	-	-	-	241	-	
4a.1.5.20	CF - Lube Oil Storage Xfer & Prfication	-	53	-	-	-	-	-	8	61	-	-	61	-	-	-	-	-	812	-	
4a.1.5.21	CG - Condenser Air Removal	-	43	-	-	-	-	-	6	49	-	-	49	-	-	-	-	-	657	-	
4a.1.5.22	CH - Main Turbine Control Oil	-	85	-	-	-	-	-	13	97	-	-	97	-	-	-	-	-	1,219	-	
4a.1.5.23	DA - Circulating Water	-	473	-	-	-	-	-	71	544	-	-	544	-	-	-	-	-	7,502	-	
4a.1.5.24	DB - Cooling Tower Makeup & Blowdown	-	80	-	-	-	-	-	12	92	-	-	92	-	-	-	-	-	1,260	-	
4a.1.5.25	DD - Cooling Water Chemical Control Sys	-	71	-	-	-	-	-	11	81	-	-	81	-	-	-	-	-	1,084	-	
4a.1.5.26	DD - Cooling Wtr Chem Control RCA	-	361	7	37	427	-	-	161	993	993	-	-	3,555	-	-	-	-	144,376	4,951	-
4a.1.5.27	EJ - Residual Heat Removal	-	473	34	91	539	400	-	316	1,852	1,852	-	-	4,481	1,166	-	-	-	256,354	7,147	-
4a.1.5.28	EM - High Pressure Coolant Injection	-	398	4	23	266	-	-	143	835	835	-	-	2,214	-	-	-	-	89,903	5,913	-
4a.1.5.29	EN - Containment Spray	-	288	6	32	364	-	-	132	821	821	-	-	3,026	-	-	-	-	122,874	4,134	-
4a.1.5.30	EP - Accumulator Safety Injection	-	210	4	21	239	-	-	92	566	566	-	-	1,989	-	-	-	-	80,762	3,112	-
4a.1.5.31	FA - Auxiliary Steam Generator	-	32	-	-	-	-	-	5	37	-	-	37	-	-	-	-	-	-	521	-
4a.1.5.32	FB - Auxiliary Steam	-	133	-	-	-	-	-	20	152	-	-	152	-	-	-	-	-	-	2,106	-
4a.1.5.33	FB - Auxiliary Steam RCA	-	109	2	9	98	-	-	43	260	260	-	-	816	-	-	-	-	33,148	1,537	-
4a.1.5.34	FC - Auxiliary Turbines	-	87	-	-	-	-	-	13	100	-	-	100	-	-	-	-	-	-	1,320	-
4a.1.5.35	FE - Auxiliary Steam Chemical Addition	-	7	-	-	-	-	-	1	8	-	-	8	-	-	-	-	-	-	105	-
4a.1.5.36	GE - Turbine Building HVAC	-	240	-	-	-	-	-	36	276	-	-	276	-	-	-	-	-	-	3,957	-
4a.1.5.37	GS - Containment Hydrogen Control	-	91	2	8	96	-	-	39	236	236	-	-	801	-	-	-	-	32,539	1,395	-
4a.1.5.38	HE - Boron Recycle	-	607	27	66	416	275	-	295	1,686	1,686	-	-	3,460	794	-	-	-	191,531	8,970	-
4a.1.5.39	HF - Secondary Liquid Waste	-	1,194	54	148	1,014	548	-	615	3,572	3,572	-	-	8,431	1,588	-	-	-	444,251	17,832	-
4a.1.5.40	JA - Auxiliary Oil & Transfer	-	43	-	-	-	-	-	7	50	-	-	50	-	-	-	-	-	-	690	-
4a.1.5.41	KS - Bulk Chemical Storage	-	122	13	68	775	-	-	158	1,136	1,136	-	-	6,449	-	-	-	-	261,890	1,825	-
4a.1.5.42	LE - Oily Waste	-	246	-	-	-	-	-	37	282	-	-	282	-	-	-	-	-	-	3,865	-
4a.1.5.43	LE - Oily Waste RCA	-	313	4	24	271	-	-	123	735	735	-	-	2,256	-	-	-	-	91,628	4,296	-
4a.1.5.44	Turbine Bldg Non-System Specific	-	1,031	-	-	-	-	-	155	1,185	-	-	1,185	-	-	-	-	-	-	15,405	-
4a.1.5	Totals	-	11,097	200	759	7,165	1,233	-	3,818	24,273	18,833	-	5,440	59,608	3,579	-	-	-	2,649,944	166,890	-
4a.1.6	Scaffolding in support of decommissioning	-	1,897	27	18	164	37	-	514	2,658	2,658	-	-	1,233	109	-	-	-	62,391	33,634	-
4a.1	Subtotal Period 4a Activity Costs	166	37,875	21,441	10,592	17,126	57,059	612	41,447	186,318	180,879	-	5,440	156,643	81,418	501	406	2,217	13,312,480	336,251	8,359
Period 4a Additional Costs																					
4a.2.1	Remedial Action Surveys	-	-	-	-	-	-	1,465	440	1,905	1,905	-	-	-	-	-	-	-	-	28,815	-
4a.2	Subtotal Period 4a Additional Costs	-	-	-	-	-	-	1,465	440	1,905	1,905	-	-	-	-	-	-	-	-	28,815	-

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Period 4a Collateral Costs																					
4a.3.1	Process decommissioning water waste	5	-	9	23	-	39	-	17	93	93	-	-	-	76	-	-	-	4,560	15	-
4a.3.2	Process decommissioning chemical flush waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4a.3.3	Small tool allowance	-	375	-	-	-	-	-	56	431	388	-	43	-	-	-	-	-	-	-	-
4a.3.4	On-site survey and release of 60.87 tons clean metallic waste	-	-	-	-	-	-	111	11	122	122	-	-	-	-	-	-	-	-	-	-
4a.3	Subtotal Period 4a Collateral Costs	5	375	9	23	-	39	111	84	646	603	-	43	-	76	-	-	-	4,560	15	-
Period 4a Period-Dependent Costs																					
4a.4.1	Decon supplies	118	-	-	-	-	-	-	30	148	148	-	-	-	-	-	-	-	-	-	-
4a.4.2	Insurance	-	-	-	-	-	-	939	94	1,033	1,033	-	-	-	-	-	-	-	-	-	-
4a.4.3	Property taxes	-	-	-	-	-	-	166	17	183	183	-	-	-	-	-	-	-	-	-	-
4a.4.4	Health physics supplies	-	4,216	-	-	-	-	-	1,054	5,270	5,270	-	-	-	-	-	-	-	-	-	-
4a.4.5	Heavy equipment rental	-	3,081	-	-	-	-	-	462	3,543	3,543	-	-	-	-	-	-	-	-	-	-
4a.4.6	Disposal of DAW generated	-	-	106	60	-	310	-	97	573	573	-	-	-	5,233	-	-	-	104,653	171	-
4a.4.7	Plant energy budget	-	-	-	-	-	-	2,704	406	3,109	3,109	-	-	-	-	-	-	-	-	-	-
4a.4.8	NRC Fees	-	-	-	-	-	-	818	82	900	900	-	-	-	-	-	-	-	-	-	-
4a.4.9	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	691	104	795	795	-	-	-	-	-	-	-	-	-	-
4a.4.10	Corporate Allocations	-	-	-	-	-	-	1,386	139	1,525	1,525	-	-	-	-	-	-	-	-	-	-
4a.4.11	Security Staff Cost	-	-	-	-	-	-	6,168	925	7,094	7,094	-	-	-	-	-	-	-	-	-	90,110
4a.4.12	DOC Staff Cost	-	-	-	-	-	-	21,985	3,298	25,283	25,283	-	-	-	-	-	-	-	-	-	198,962
4a.4.13	Utility Staff Cost	-	-	-	-	-	-	32,471	4,871	37,341	37,341	-	-	-	-	-	-	-	-	-	360,438
4a.4	Subtotal Period 4a Period-Dependent Costs	118	7,296	106	60	-	310	67,329	11,577	86,797	86,797	-	-	-	5,233	-	-	-	104,653	171	649,510
4a.0	TOTAL PERIOD 4a COST	289	45,546	21,557	10,675	17,126	57,408	69,517	53,547	275,666	270,183	-	5,483	156,643	86,727	501	406	2,217	13,421,690	365,252	657,869
PERIOD 4b - Site Decontamination																					
Period 4b Direct Decommissioning Activities																					
4b.1.1	Remove spent fuel racks	959	112	294	261	-	2,389	-	1,173	5,187	5,187	-	-	-	6,988	-	-	-	443,960	1,925	-
Disposal of Plant Systems																					
4b.1.2.1	200 Reactor Bldg Non-System Specific	-	109	1	6	60	6	-	39	222	222	-	-	502	19	-	-	-	21,590	1,569	-
4b.1.2.2	200 Reactor Bldg Non-System Specific RCA	-	752	9	50	573	-	-	282	1,667	1,667	-	-	4,768	-	-	-	-	193,612	10,425	-
4b.1.2.3	300 Control Bldg Non-System Specific	-	236	4	22	257	-	-	101	621	621	-	-	2,139	-	-	-	-	86,849	3,413	-
4b.1.2.4	300 Control Bldg Non-System Specific Cln	-	1,836	-	-	-	-	-	275	2,111	-	-	2,111	-	-	-	-	-	-	29,076	-
4b.1.2.5	600 Fuel Bldg Non-Specific Systems RCA	-	411	6	34	385	-	-	166	1,002	1,002	-	-	3,200	-	-	-	-	129,974	5,859	-
4b.1.2.6	600 Fuel Bldg Non-System Specific	-	58	1	4	39	4	-	22	127	127	-	-	322	12	-	-	-	13,829	850	-
4b.1.2.7	700 Radwaste Bldg Non-Sys Specific RCA	-	1,514	25	133	1,525	-	-	630	3,826	3,826	-	-	12,684	-	-	-	-	515,103	21,919	-
4b.1.2.8	700 Radwaste Bldg Non-System Specific	-	219	4	16	160	17	-	86	501	501	-	-	1,329	50	-	-	-	57,145	3,253	-
4b.1.2.9	AN - Demineralized Wtr Storage & Xfer	-	208	-	-	-	-	-	31	239	-	-	239	-	-	-	-	-	-	3,283	-
4b.1.2.10	AN - Demineralized Wtr Strg & Xfer RCA	-	53	1	3	38	-	-	19	114	114	-	-	314	-	-	-	-	12,759	740	-
4b.1.2.11	AP-HCST/Condensate Stor.& Transfr	-	275	-	-	-	-	-	41	316	-	-	316	-	-	-	-	-	-	4,018	-
4b.1.2.12	BB - Reactor Coolant System	-	408	28	69	311	387	-	259	1,462	1,462	-	-	2,586	1,130	-	-	-	176,949	6,323	-
4b.1.2.13	BG - Chemical & Volume Control	-	1,157	76	183	985	891	-	695	3,987	3,987	-	-	8,192	2,586	-	-	-	498,359	17,275	-
4b.1.2.14	BL - Reactor Makeup Water	-	370	16	42	304	145	-	182	1,059	1,059	-	-	2,529	418	-	-	-	129,620	5,494	-
4b.1.2.15	DE - Intake & Water Treatment	-	166	-	-	-	-	-	25	191	-	-	191	-	-	-	-	-	-	2,517	-
4b.1.2.16	DE - Intake & Water Treatment RCA	-	331	24	125	1,433	-	-	319	2,232	2,232	-	-	11,923	-	-	-	-	484,206	5,014	-
4b.1.2.17	EA - Service Water	-	197	-	-	-	-	-	30	227	-	-	227	-	-	-	-	-	-	3,145	-
4b.1.2.18	EA - Service Water RCA	-	59	2	13	150	-	-	39	264	264	-	-	1,248	-	-	-	-	50,693	839	-
4b.1.2.19	EB - Closed Cooling Water	-	80	-	-	-	-	-	12	92	-	-	92	-	-	-	-	-	-	1,267	-
4b.1.2.20	EC - Fuel Pool Cooling & Cleanup	-	484	8	43	495	-	-	203	1,233	1,233	-	-	4,119	-	-	-	-	167,293	7,163	-
4b.1.2.21	EF - Essential Service Water	-	458	-	-	-	-	-	69	527	-	-	527	-	-	-	-	-	-	7,244	-
4b.1.2.22	EF - Essential Service Water RCA	-	263	11	56	640	-	-	171	1,141	1,141	-	-	5,326	-	-	-	-	216,287	3,862	-
4b.1.2.23	EG - Component Cooling Water RCA	-	336	-	-	-	-	-	50	386	-	-	386	-	-	-	-	-	-	5,335	-
4b.1.2.24	GA - Plant Heating	-	120	-	-	-	-	-	18	138	-	-	138	-	-	-	-	-	-	1,912	-
4b.1.2.25	GA - Plant Heating RCA	-	126	1	7	77	-	-	44	255	255	-	-	638	-	-	-	-	25,924	1,765	-
4b.1.2.26	GA- Plant Heating Fuel Building	-	27	0	1	13	-	-	9	50	50	-	-	107	-	-	-	-	4,351	400	-
4b.1.2.27	GB - Central Chilled Water	-	113	-	-	-	-	-	17	130	-	-	130	-	-	-	-	-	-	1,803	-
4b.1.2.28	GB - Central Chilled Water RCA	-	34	0	2	22	-	-	12	71	71	-	-	187	-	-	-	-	7,591	482	-
4b.1.2.29	GD - Essential Serv Wtr Pumphouse HVAC	-	25	-	-	-	-	-	4	29	-	-	29	-	-	-	-	-	-	427	-
4b.1.2.30	GF - Miscellaneous Building HVAC	-	155	4	21	245	-	-	79	504	504	-	-	2,034	-	-	-	-	82,602	2,026	-
4b.1.2.31	GG - Fuel Building HVAC	-	295	8	41	474	-	-	152	970	970	-	-	3,945	-	-	-	-	160,195	4,052	-
4b.1.2.32	GH - Radwaste Building HVAC	-	217	5	27	308	-	-	105	661	661	-	-	2,561	-	-	-	-	104,012	3,004	-
4b.1.2.33	GK - Control Building HVAC	-	231	-	-	-	-	-	35	266	-	-	266	-	-	-	-	-	-	3,959	-
4b.1.2.34	GL - Auxiliary Building HVAC	-	535	10	56	647	-	-	240	1,489	1,489	-	-	5,381	-	-	-	-	218,514	7,364	-
4b.1.2.35	GM - Diesel Generator Building HVAC	-	40	-	-	-	-	-	6	46	-	-	46	-	-	-	-	-	-	695	-
4b.1.2.36	GN - Containment Cooling	-	599	16	87	993	-	-	313	2,008	2,008	-	-	8,264	-	-	-	-	335,602	8,405	-
4b.1.2.37	GP - Containment Intgratd Leak Rate Test	-	52	1	6	70	-	-	24	153	153	-	-	580	-	-	-	-	23,570	750	-
4b.1.2.38	GR - Containment Atmospheric Control	-	24	2	12	137	-	-	29	204	204	-	-	1,143	-	-	-	-	46,407	350	-

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
4b.1.2.39	GT - Containment Purge HVAC	-	140	4	23	263	-	-	78	508	508	-	-	2,185	-	-	-	-	88,746	1,973	-
4b.1.2.40	HA - Gaseous Radwaste	-	434	7	39	445	-	-	182	1,106	1,106	-	-	3,699	-	-	-	-	150,219	6,296	-
4b.1.2.41	HB - Liquid Radwaste	-	1,054	53	132	885	504	-	547	3,176	3,176	-	-	7,362	1,450	-	-	-	392,564	15,506	-
4b.1.2.42	HC - Solid Radwaste	-	450	25	64	359	297	-	252	1,446	1,446	-	-	2,985	862	-	-	-	176,332	6,652	-
4b.1.2.43	HD - Decontamination	-	125	6	17	118	59	-	67	392	392	-	-	983	171	-	-	-	50,973	1,835	-
4b.1.2.44	JE - Emergency Fuel Oil	-	86	-	-	-	-	-	13	99	-	-	99	-	-	-	-	-	-	1,260	-
4b.1.2.45	KA - Compressed Air	-	262	-	-	-	-	-	39	301	-	-	301	-	-	-	-	-	-	4,187	-
4b.1.2.46	KA - Compressed Air RCA	-	169	2	8	96	-	-	58	334	334	-	-	801	-	-	-	-	32,538	2,339	-
4b.1.2.47	KB - Breathing Air	-	33	-	-	-	-	-	5	38	-	-	38	-	-	-	-	-	-	516	-
4b.1.2.48	KB - Breathing Air RCA	-	26	0	1	9	-	-	8	43	43	-	-	71	-	-	-	-	2,874	402	-
4b.1.2.49	KC - Fire Protection	-	514	-	-	-	-	-	77	591	-	-	591	-	-	-	-	-	-	8,376	-
4b.1.2.50	KC - Fire Protection RCA	-	530	9	46	530	-	-	220	1,335	1,335	-	-	4,411	-	-	-	-	179,151	7,064	-
4b.1.2.51	KC- Fire Protection Fuel Building	-	157	2	13	149	-	-	64	385	385	-	-	1,239	-	-	-	-	50,329	2,115	-
4b.1.2.52	KD - Domestic Water	-	239	-	-	-	-	-	36	275	-	-	275	-	-	-	-	-	-	3,837	-
4b.1.2.53	KD - Domestic Water RCA	-	34	0	3	30	-	-	13	80	80	-	-	247	-	-	-	-	10,039	459	-
4b.1.2.54	KE - Fuel Handling & Storage Rctor vssl	-	23	2	9	106	-	-	23	163	163	-	-	882	-	-	-	-	35,813	332	-
4b.1.2.55	KH - Service Gas (CO2 N2 H2 & O2)	-	76	-	-	-	-	-	11	87	-	-	87	-	-	-	-	-	-	1,226	-
4b.1.2.56	KH - Service Gas (CO2 N2 H2 & O2) RCA	-	333	5	25	292	-	-	131	787	787	-	-	2,433	-	-	-	-	98,813	4,481	-
4b.1.2.57	KJ - Standby Diesel Engine	-	454	-	-	-	-	-	68	523	-	-	523	-	-	-	-	-	-	6,749	-
4b.1.2.58	LA - Sanitary Drains	-	61	-	-	-	-	-	9	70	-	-	70	-	-	-	-	-	-	972	-
4b.1.2.59	LA - Sanitary Drains RCA	-	140	3	13	153	-	-	60	369	369	-	-	1,273	-	-	-	-	51,684	1,811	-
4b.1.2.60	LB - Roof Drains	-	81	-	-	-	-	-	12	93	-	-	93	-	-	-	-	-	-	1,276	-
4b.1.2.61	LB - Roof Drains RCA	-	190	4	22	257	-	-	90	563	563	-	-	2,139	-	-	-	-	86,858	2,694	-
4b.1.2.62	LD - Chemical & Detergent Waste	-	144	2	8	96	-	-	52	302	302	-	-	797	-	-	-	-	32,369	2,139	-
4b.1.2.63	LF - Floor & Equipment Drains	-	1,788	86	205	801	1,242	-	917	5,039	5,039	-	-	6,660	3,627	-	-	-	501,387	26,164	-
4b.1.2.64	RM - Process Sampling & Analysis	-	162	2	10	119	-	-	60	354	354	-	-	990	-	-	-	-	40,200	2,450	-
4b.1.2.65	SJ - Nuclear Sampling	-	94	1	7	81	-	-	37	221	221	-	-	677	-	-	-	-	27,501	1,430	-
4b.1.2.66	UB - Servces Stores Site Security Bldg	-	245	-	-	-	-	-	37	282	-	-	282	-	-	-	-	-	3,815	-	-
4b.1.2.67	Yard Non-System Specific	-	41	-	-	-	-	-	6	47	-	-	47	-	-	-	-	-	-	603	-
4b.1.2	Totals	-	20,658	479	1,706	15,129	3,553	-	8,008	49,533	42,429	-	7,104	125,856	10,326	-	-	-	5,771,424	306,237	-
4b.1.3	Scaffolding in support of decommissioning	-	2,846	41	28	246	56	-	771	3,987	3,987	-	-	1,849	163	-	-	-	93,587	50,451	-
Decontamination of Site Buildings																					
4b.1.4.1	Reactor	1,458	2,094	161	1,596	721	2,910	-	2,344	11,283	11,283	-	-	5,995	45,300	-	-	-	2,386,838	48,576	-
4b.1.4.2	Auxiliary	739	294	17	138	247	242	-	563	2,240	2,240	-	-	2,058	3,514	-	-	-	250,317	15,255	-
4b.1.4.3	Communication Corridor - Contaminated	16	4	0	3	2	5	-	11	42	42	-	-	17	76	-	-	-	4,296	306	-
4b.1.4.4	Fuel Building	955	969	11	58	325	92	-	801	3,211	3,211	-	-	2,705	984	-	-	-	158,200	27,457	-
4b.1.4.5	Hot Machine Shop	20	8	0	3	-	6	-	14	52	52	-	-	-	94	-	-	-	4,446	421	-
4b.1.4.6	RAM Storage Building	51	10	1	7	2	12	-	32	115	115	-	-	19	195	-	-	-	9,974	920	-
4b.1.4.7	Radioactive and Personnel Tunnel	6	7	0	2	-	3	-	6	25	25	-	-	-	54	-	-	-	2,532	195	-
4b.1.4.8	Radwaste	394	134	8	71	102	125	-	288	1,122	1,122	-	-	844	1,857	-	-	-	122,469	7,815	-
4b.1.4.9	Radwaste Drum Storage	44	13	1	8	8	14	-	31	119	119	-	-	66	208	-	-	-	12,565	850	-
4b.1.4.10	Reactor Head Assembly Building	40	-	-	-	-	-	-	20	59	59	-	-	-	-	-	-	-	-	614	-
4b.1.4.11	Steam Generator Replacement Bldgs	295	-	-	-	-	-	-	147	442	442	-	-	-	-	-	-	-	-	3,885	-
4b.1.4	Totals	4,019	3,532	200	1,886	1,407	3,409	-	4,258	18,711	18,711	-	-	11,704	52,283	-	-	-	2,951,637	106,295	-
4b.1.5	Prepare/submit License Termination Plan	-	-	-	-	-	-	650	98	748	748	-	-	-	-	-	-	-	-	-	4,096
4b.1.6	Receive NRC approval of termination plan									a											
4b.1	Subtotal Period 4b Activity Costs	4,977	27,148	1,013	3,881	16,782	9,406	650	14,308	78,165	71,062	-	7,104	139,409	69,760	-	-	-	9,260,607	464,907	4,096
Period 4b Additional Costs																					
4b.2.1	License Termination Survey Planning	-	-	-	-	-	-	1,778	533	2,311	2,311	-	-	-	-	-	-	-	-	-	12,480
4b.2.2	Operational Tools & Equipment	-	-	22	103	866	-	-	148	1,139	1,139	-	-	11,700	-	-	-	-	292,500	32	-
4b.2.3	Excavation of Underground Services	-	1,879	-	-	-	-	551	552	2,982	2,982	-	-	-	-	-	-	-	-	12,396	-
4b.2.4	License Termination ISFSI	-	684	154	166	-	3,547	3,894	2,111	10,556	10,556	-	-	-	14,077	-	-	-	1,053,456	17,572	10,920
4b.2.5	Remedial Action Surveys	-	-	-	-	-	-	2,438	731	3,170	3,170	-	-	-	-	-	-	-	-	47,950	-
4b.2.6	Sanitary Treatment Lagoon	-	7	92	235	-	540	-	181	1,054	1,054	-	-	-	4,608	-	-	-	392,140	423	-
4b.2.7	Cooling Tower Asbestos Panel Removal	-	6,512	-	305	-	-	641	1,119	8,576	-	-	8,576	-	-	-	-	-	-	71,419	-
4b.2.8	Retired Reactor Closure Head	-	151	847	1,330	-	1,110	-	599	4,037	4,037	-	-	-	2,764	-	-	-	338,540	3,157	2,000
4b.2.9	Spent Fuel Pool Legacy Waste	-	108	163	67	-	2,617	14	710	3,680	3,680	-	-	-	-	250	-	-	14,900	1,333	53
4b.2	Subtotal Period 4b Additional Costs	-	9,340	1,278	2,206	866	7,814	9,316	6,685	37,504	28,928	-	8,576	11,700	21,449	250	-	-	2,091,536	154,282	25,453
Period 4b Collateral Costs																					
4b.3.1	Process decommissioning water waste	14	-	26	66	-	109	-	47	261	261	-	-	-	214	-	-	-	12,834	42	-
4b.3.2	Process decommissioning chemical flush waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4b.3.3	Small tool allowance	-	625	-	-	-	-	-	94	719	719	-	-	-	-	-	-	-	-	-	-
4b.3.4	Decommissioning Equipment Disposition	-	-	133	101	799	181	-	194	1,408	1,408	-	-	6,000	529	-	-	-	303,608	147	-

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
4b.3.5	On-site survey and release of 309.6 tons clean metallic waste	-	-	-	-	-	-	564	56	620	620	-	-	-	-	-	-	-	-	-	-
4b.3	Subtotal Period 4b Collateral Costs	14	625	160	166	799	290	564	390	3,007	3,007	-	-	6,000	743	-	-	-	316,441	189	-
Period 4b Period-Dependent Costs																					
4b.4.1	Decon supplies	1,947	-	-	-	-	-	-	487	2,434	2,434	-	-	-	-	-	-	-	-	-	-
4b.4.2	Insurance	-	-	-	-	-	-	1,563	156	1,719	1,719	-	-	-	-	-	-	-	-	-	-
4b.4.3	Property taxes	-	-	-	-	-	-	277	28	304	304	-	-	-	-	-	-	-	-	-	-
4b.4.4	Health physics supplies	-	7,041	-	-	-	-	-	1,760	8,801	8,801	-	-	-	-	-	-	-	-	-	-
4b.4.5	Heavy equipment rental	-	5,257	-	-	-	-	-	789	6,045	6,045	-	-	-	-	-	-	-	-	-	-
4b.4.6	Disposal of DAW generated	-	-	135	76	-	392	-	123	725	725	-	-	-	6,615	-	-	-	132,302	216	-
4b.4.7	Plant energy budget	-	-	-	-	-	-	3,552	533	4,085	4,085	-	-	-	-	-	-	-	-	-	-
4b.4.8	NRC Fees	-	-	-	-	-	-	1,362	136	1,498	1,498	-	-	-	-	-	-	-	-	-	-
4b.4.9	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	1,150	172	1,322	1,322	-	-	-	-	-	-	-	-	-	-
4b.4.10	Corporate Allocations	-	-	-	-	-	-	2,307	231	2,538	2,538	-	-	-	-	-	-	-	-	-	-
4b.4.11	Security Staff Cost	-	-	-	-	-	-	10,264	1,540	11,804	11,804	-	-	-	-	-	-	-	-	-	149,945
4b.4.12	DOC Staff Cost	-	-	-	-	-	-	35,739	5,361	41,100	41,100	-	-	-	-	-	-	-	-	-	321,483
4b.4.13	Utility Staff Cost	-	-	-	-	-	-	51,214	7,682	58,896	58,896	-	-	-	-	-	-	-	-	-	566,193
4b.4	Subtotal Period 4b Period-Dependent Costs	1,947	12,297	135	76	-	392	107,428	18,997	141,272	141,272	-	-	-	6,615	-	-	-	132,302	216	1,037,621
4b.0	TOTAL PERIOD 4b COST	6,939	49,411	2,586	6,328	18,447	17,901	117,958	40,380	259,949	244,269	-	15,680	157,109	98,567	250	-	-	11,800,890	619,593	1,067,170
PERIOD 4f - License Termination																					
Period 4f Direct Decommissioning Activities																					
4f.1.1	ORISE confirmatory survey	-	-	-	-	-	-	168	50	218	218	-	-	-	-	-	-	-	-	-	-
4f.1.2	Terminate license									a											
4f.1	Subtotal Period 4f Activity Costs	-	-	-	-	-	-	168	50	218	218	-	-	-	-	-	-	-	-	-	-
Period 4f Additional Costs																					
4f.2.1	License Termination Survey	-	-	-	-	-	-	10,211	3,063	13,274	13,274	-	-	-	-	-	-	-	153,878		6,240
4f.2	Subtotal Period 4f Additional Costs	-	-	-	-	-	-	10,211	3,063	13,274	13,274	-	-	-	-	-	-	-	153,878		6,240
Period 4f Collateral Costs																					
4f.3.1	DOC staff relocation expenses	-	-	-	-	-	-	1,641	246	1,887	1,887	-	-	-	-	-	-	-	-	-	-
4f.3	Subtotal Period 4f Collateral Costs	-	-	-	-	-	-	1,641	246	1,887	1,887	-	-	-	-	-	-	-	-	-	-
Period 4f Period-Dependent Costs																					
4f.4.1	Insurance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4f.4.2	Property taxes	-	-	-	-	-	-	91	9	100	100	-	-	-	-	-	-	-	-	-	-
4f.4.3	Health physics supplies	-	1,316	-	-	-	-	-	329	1,645	1,645	-	-	-	-	-	-	-	-	-	-
4f.4.4	Disposal of DAW generated	-	-	7	4	-	21	-	7	39	39	-	-	-	353	-	-	-	7,050	11	-
4f.4.5	Plant energy budget	-	-	-	-	-	-	310	47	357	357	-	-	-	-	-	-	-	-	-	-
4f.4.6	NRC Fees	-	-	-	-	-	-	546	55	601	601	-	-	-	-	-	-	-	-	-	-
4f.4.7	Corporate Allocations	-	-	-	-	-	-	756	76	832	832	-	-	-	-	-	-	-	-	-	-
4f.4.8	Security Staff Cost	-	-	-	-	-	-	1,715	257	1,973	1,973	-	-	-	-	-	-	-	-	-	18,874
4f.4.9	DOC Staff Cost	-	-	-	-	-	-	6,532	980	7,511	7,511	-	-	-	-	-	-	-	-	-	57,408
4f.4.10	Utility Staff Cost	-	-	-	-	-	-	7,153	1,073	8,226	8,226	-	-	-	-	-	-	-	-	-	74,709
4f.4	Subtotal Period 4f Period-Dependent Costs	-	1,316	7	4	-	21	17,104	2,831	21,283	21,283	-	-	-	353	-	-	-	7,050	11	150,991
4f.0	TOTAL PERIOD 4f COST	-	1,316	7	4	-	21	29,123	6,191	36,662	36,662	-	-	-	353	-	-	-	7,050	153,889	157,231
PERIOD 4 TOTALS		7,228	96,274	24,150	17,007	35,573	75,330	216,598	100,118	572,277	551,114	-	21,162	313,752	185,646	751	406	2,217	25,229,630	1,138,735	1,882,270
PERIOD 5b - Site Restoration																					
Period 5b Direct Decommissioning Activities																					
Demolition of Remaining Site Buildings																					
5b.1.1.1	Reactor	-	3,482	-	-	-	-	-	522	4,004	-	-	4,004	-	-	-	-	-	27,502	-	-
5b.1.1.2	Auxiliary	-	2,865	-	-	-	-	-	430	3,295	-	-	3,295	-	-	-	-	-	19,024	-	-
5b.1.1.3	Auxiliary Boiler	-	26	-	-	-	-	-	4	30	-	-	30	-	-	-	-	-	248	-	-
5b.1.1.4	Barge Facility	-	957	-	-	-	-	-	144	1,101	-	-	1,101	-	-	-	-	-	4,290	-	-
5b.1.1.5	Circulating & Service Water Pumphouse	-	233	-	-	-	-	-	35	268	-	-	268	-	-	-	-	-	1,996	-	-
5b.1.1.6	Communication Corridor - Clean	-	1,079	-	-	-	-	-	162	1,241	-	-	1,241	-	-	-	-	-	8,280	-	-
5b.1.1.7	Communication Corridor - Contaminated	-	35	-	-	-	-	-	5	40	-	-	40	-	-	-	-	-	184	-	-
5b.1.1.8	Cooling Tower Concrete	-	451	-	-	-	-	-	68	519	-	-	519	-	-	-	-	-	2,332	-	-
5b.1.1.9	Diesel Generator	-	329	-	-	-	-	-	49	378	-	-	378	-	-	-	-	-	2,185	-	-
5b.1.1.10	Essential Service Water Pumphouse	-	176	-	-	-	-	-	26	203	-	-	203	-	-	-	-	-	955	-	-

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
5b.1.1.11	Fire Water Pumphouse	-	23	-	-	-	-	-	3	26	-	-	26	-	-	-	-	-	-	151	-
5b.1.1.12	Flex Building Storage	-	337	-	-	-	-	-	51	388	-	-	388	-	-	-	-	-	-	1,972	-
5b.1.1.13	Fuel Building	-	1,209	-	-	-	-	-	181	1,390	-	-	1,390	-	-	-	-	-	-	7,874	-
5b.1.1.14	Hardened Condensate Storage Tank - HCST	-	243	-	-	-	-	-	36	279	-	-	279	-	-	-	-	-	-	1,870	-
5b.1.1.15	Hot Machine Shop	-	21	-	-	-	-	-	3	24	-	-	24	-	-	-	-	-	-	243	-
5b.1.1.16	Intake	-	219	-	-	-	-	-	33	252	-	-	252	-	-	-	-	-	-	1,411	-
5b.1.1.17	Misc. Structures	-	2,722	-	-	-	-	-	408	3,130	-	-	3,130	-	-	-	-	-	-	18,774	-
5b.1.1.18	Miscellaneous Site Foundations	-	194	-	-	-	-	-	29	223	-	-	223	-	-	-	-	-	-	1,011	-
5b.1.1.19	Outage Maintenance	-	140	-	-	-	-	-	21	161	-	-	161	-	-	-	-	-	-	1,570	-
5b.1.1.20	RAM Storage Building	-	59	-	-	-	-	-	9	68	-	-	68	-	-	-	-	-	-	624	-
5b.1.1.21	Radioactive and Personnel Tunnel	-	34	-	-	-	-	-	5	39	-	-	39	-	-	-	-	-	-	386	-
5b.1.1.22	Radwaste	-	1,196	-	-	-	-	-	179	1,375	-	-	1,375	-	-	-	-	-	-	8,111	-
5b.1.1.23	Radwaste Drum Storage	-	171	-	-	-	-	-	26	197	-	-	197	-	-	-	-	-	-	1,449	-
5b.1.1.24	Reactor Head Assembly Building	-	98	-	-	-	-	-	15	113	-	-	113	-	-	-	-	-	-	1,108	-
5b.1.1.25	Security Additions	-	1,655	-	-	-	-	-	248	1,903	-	-	1,903	-	-	-	-	-	-	6,051	-
5b.1.1.26	Service	-	522	-	-	-	-	-	78	600	-	-	600	-	-	-	-	-	-	3,485	-
5b.1.1.27	Sludge Pump Station & Lagoon	-	1,678	-	-	-	-	-	252	1,930	-	-	1,930	-	-	-	-	-	-	10,601	-
5b.1.1.28	Steam Generator Replacement Bldgs	-	976	-	-	-	-	-	146	1,122	-	-	1,122	-	-	-	-	-	-	6,874	-
5b.1.1.29	Turbine Building	-	4,906	-	-	-	-	-	736	5,642	-	-	5,642	-	-	-	-	-	-	47,075	-
5b.1.1.30	Turbine Pedestal	-	561	-	-	-	-	-	84	646	-	-	646	-	-	-	-	-	-	2,934	-
5b.1.1.31	U.H.S. Cooling Tower	-	343	-	-	-	-	-	51	395	-	-	395	-	-	-	-	-	-	1,814	-
5b.1.1.32	Water Treatment Plant	-	1	-	-	-	-	-	0	1	-	-	1	-	-	-	-	-	-	9	-
5b.1.1	Totals	-	26,942	-	-	-	-	-	4,041	30,983	-	-	30,983	-	-	-	-	-	-	192,393	-
Site Closeout Activities																					
5b.1.2	Remove Rubble	-	1,558	-	-	-	-	-	234	1,792	-	-	1,792	-	-	-	-	-	-	7,233	-
5b.1.3	Grade & landscape site	-	129	-	-	-	-	-	19	148	-	-	148	-	-	-	-	-	-	592	-
5b.1.4	Final report to NRC	-	-	-	-	-	-	-	248	37	285	285	-	-	-	-	-	-	-	-	1,560
5b.1	Subtotal Period 5b Activity Costs	-	28,629	-	-	-	-	-	248	4,331	33,208	285	-	32,923	-	-	-	-	-	-	200,218	1,560
Period 5b Additional Costs																					
5b.2.1	Concrete Crushing	-	1,546	-	-	-	-	-	19	235	1,800	-	-	1,800	-	-	-	-	-	-	6,035	-
5b.2.2	Mine Area Backfill	-	6,441	-	-	-	-	-	-	966	7,407	-	-	7,407	-	-	-	-	-	-	15,960	-
5b.2.3	Construction Debris	-	-	-	-	-	-	-	2,950	443	3,393	-	-	3,393	-	-	-	-	-	-	-	-
5b.2.4	Site Restoration ISFSI	-	1,416	-	-	-	-	-	97	227	1,740	-	-	1,740	-	-	-	-	-	-	10,514	160
5b.2.5	Cooling Tower Discharge & Intake Pipe Flow Fill	-	5,020	-	-	-	-	-	-	753	5,772	-	-	5,772	-	-	-	-	-	-	9,588	-
5b.2.6	Cooling Tower Demolition	-	5,495	-	-	-	-	-	-	824	6,320	-	-	6,320	-	-	-	-	-	-	21,619	-
5b.2	Subtotal Period 5b Additional Costs	-	19,918	-	-	-	-	-	3,067	3,448	26,432	-	-	26,432	-	-	-	-	-	-	63,716	160
Period 5b Collateral Costs																					
5b.3.1	Small tool allowance	-	329	-	-	-	-	-	-	49	379	-	-	379	-	-	-	-	-	-	-	-
5b.3	Subtotal Period 5b Collateral Costs	-	329	-	-	-	-	-	-	49	379	-	-	379	-	-	-	-	-	-	-	-
Period 5b Period-Dependent Costs																					
5b.4.1	Insurance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5b.4.2	Property taxes	-	-	-	-	-	-	-	180	18	198	-	-	198	-	-	-	-	-	-	-	-
5b.4.3	Heavy equipment rental	-	4,790	-	-	-	-	-	-	718	5,508	-	-	5,508	-	-	-	-	-	-	-	-
5b.4.4	Plant energy budget	-	-	-	-	-	-	-	309	46	355	-	-	355	-	-	-	-	-	-	-	-
5b.4.5	Corporate Allocations	-	-	-	-	-	-	-	1,504	150	1,655	-	-	1,655	-	-	-	-	-	-	-	-
5b.4.6	Security Staff Cost	-	-	-	-	-	-	-	3,412	512	3,924	-	-	3,924	-	-	-	-	-	-	-	37,543
5b.4.7	DOC Staff Cost	-	-	-	-	-	-	-	12,661	1,899	14,560	-	-	14,560	-	-	-	-	-	-	-	106,371
5b.4.8	Utility Staff Cost	-	-	-	-	-	-	-	5,808	871	6,679	-	-	6,679	-	-	-	-	-	-	-	61,007
5b.4	Subtotal Period 5b Period-Dependent Costs	-	4,790	-	-	-	-	-	23,874	4,215	32,879	-	-	32,879	-	-	-	-	-	-	-	204,920
5b.0	TOTAL PERIOD 5b COST	-	53,666	-	-	-	-	-	27,188	12,044	92,898	285	-	92,613	-	-	-	-	-	-	263,934	206,640
PERIOD 5 TOTALS		-	53,666	-	-	-	-	-	27,188	12,044	92,898	285	-	92,613	-	-	-	-	-	-	263,934	206,640
TOTAL COST TO DECOMMISSION		15,891	166,532	24,592	17,796	35,573	76,968	884,376	213,688	1,435,417	1,223,308	96,323	115,786	313,752	196,099	751	406	2,217	25,529,410	1,500,444	7,425,559

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			

TOTAL COST TO DECOMMISSION WITH 17.49% CONTINGENCY:	**$1,435,417**	**thousands of 2023 dollars**
TOTAL NRC LICENSE TERMINATION COST IS 85.22% OR:	**$1,223,308**	**thousands of 2023 dollars**
SPENT FUEL MANAGEMENT COST IS 6.71% OR:	**$96,323**	**thousands of 2023 dollars**
NON-NUCLEAR DEMOLITION COST IS 8.07% OR:	**$115,786**	**thousands of 2023 dollars**
TOTAL LOW-LEVEL RADIOACTIVE WASTE VOLUME BURIED (EXCLUDING GTCC):	**197,255**	**Cubic Feet**
TOTAL GREATER THAN CLASS C RADWASTE VOLUME GENERATED:	**2,217**	**Cubic Feet**
TOTAL SCRAP METAL REMOVED:	**71,143**	**Tons**
TOTAL CRAFT LABOR REQUIREMENTS:	**1,500,444**	**Man-hours**

End Notes:
n/a - indicates that this activity not charged as decommissioning expense
a - indicates that this activity performed by decommissioning staff
0 - indicates that this value is less than 0.5 but is non-zero
A cell containing " - " indicates a zero value

APPENDIX E
DETAILED COST ANALYSIS

DECON

with

DIRECT DISPOSAL OF LOW-LEVEL RADIOACTIVE WASTE

Table E
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
PERIOD 1a - Shutdown through Transition																					
Period 1a Direct Decommissioning Activities																					
1a.1.1	Prepare preliminary decommissioning cost	-	-	-	-	-	-	206	31	237	237	-	-	-	-	-	-	-	-	-	1,300
1a.1.2	Notification of Cessation of Operations									a											
1a.1.3	Remove fuel & source material									n/a											
1a.1.4	Notification of Permanent Defueling									a											
1a.1.5	Deactivate plant systems & process waste									a											
1a.1.6	Prepare and submit PSDAR	-	-	-	-	-	-	317	48	365	365	-	-	-	-	-	-	-	-	-	2,000
1a.1.7	Review plant dwgs & specs.	-	-	-	-	-	-	730	110	840	840	-	-	-	-	-	-	-	-	-	4,600
1a.1.8	Perform detailed rad survey									a											
1a.1.9	Estimate by-product inventory	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
1a.1.10	End product description	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
1a.1.11	Detailed by-product inventory	-	-	-	-	-	-	206	31	237	237	-	-	-	-	-	-	-	-	-	1,300
1a.1.12	Define major work sequence	-	-	-	-	-	-	1,190	179	1,369	1,369	-	-	-	-	-	-	-	-	-	7,500
1a.1.13	Perform SER and EA	-	-	-	-	-	-	492	74	566	566	-	-	-	-	-	-	-	-	-	3,100
1a.1.14	Prepare/submit Defueled Technical Specifications	-	-	-	-	-	-	1,190	179	1,369	1,369	-	-	-	-	-	-	-	-	-	7,500
1a.1.15	Perform Site-Specific Cost Study	-	-	-	-	-	-	794	119	913	913	-	-	-	-	-	-	-	-	-	5,000
1a.1.16	Prepare/submit Irradiated Fuel Management Plan	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
Activity Specifications																					
1a.1.17.1	Plant & temporary facilities	-	-	-	-	-	-	781	117	898	808	-	90	-	-	-	-	-	-	-	4,920
1a.1.17.2	Plant systems	-	-	-	-	-	-	661	99	761	684	-	76	-	-	-	-	-	-	-	4,167
1a.1.17.3	NSSS Decontamination Flush	-	-	-	-	-	-	79	12	91	91	-	-	-	-	-	-	-	-	-	500
1a.1.17.4	Reactor internals	-	-	-	-	-	-	1,127	169	1,296	1,296	-	-	-	-	-	-	-	-	-	7,100
1a.1.17.5	Reactor vessel	-	-	-	-	-	-	1,032	155	1,186	1,186	-	-	-	-	-	-	-	-	-	6,500
1a.1.17.6	Biological shield	-	-	-	-	-	-	79	12	91	91	-	-	-	-	-	-	-	-	-	500
1a.1.17.7	Steam generators	-	-	-	-	-	-	495	74	569	569	-	-	-	-	-	-	-	-	-	3,120
1a.1.17.8	Reinforced concrete	-	-	-	-	-	-	254	38	292	146	-	146	-	-	-	-	-	-	-	1,600
1a.1.17.9	Main Turbine	-	-	-	-	-	-	63	10	73	-	-	73	-	-	-	-	-	-	-	400
1a.1.17.10	Main Condensers	-	-	-	-	-	-	63	10	73	-	-	73	-	-	-	-	-	-	-	400
1a.1.17.11	Plant structures & buildings	-	-	-	-	-	-	495	74	569	285	-	285	-	-	-	-	-	-	-	3,120
1a.1.17.12	Waste management	-	-	-	-	-	-	730	110	840	840	-	-	-	-	-	-	-	-	-	4,600
1a.1.17.13	Facility & site closeout	-	-	-	-	-	-	143	21	164	82	-	82	-	-	-	-	-	-	-	900
1a.1.17	Total	-	-	-	-	-	-	6,004	901	6,904	6,080	-	825	-	-	-	-	-	-	-	37,827
Planning & Site Preparations																					
1a.1.18	Prepare dismantling sequence	-	-	-	-	-	-	381	57	438	438	-	-	-	-	-	-	-	-	-	2,400
1a.1.19	Plant prep. & temp. svces	-	-	-	-	-	-	4,000	600	4,600	4,600	-	-	-	-	-	-	-	-	-	-
1a.1.20	Design water clean-up system	-	-	-	-	-	-	222	33	256	256	-	-	-	-	-	-	-	-	-	1,400
1a.1.21	Rigging/Cont. Cntrl Envlps/tooling/etc.	-	-	-	-	-	-	2,800	420	3,220	3,220	-	-	-	-	-	-	-	-	-	-
1a.1.22	Procure casks/liners & containers	-	-	-	-	-	-	195	29	225	225	-	-	-	-	-	-	-	-	-	1,230
1a.1	Subtotal Period 1a Activity Costs	-	-	-	-	-	-	19,205	2,881	22,086	21,261	-	825	-	-	-	-	-	-	-	78,157
Period 1a Collateral Costs																					
1a.3.1	Spent Fuel Capital and Transfer	-	-	-	-	-	-	10,080	1,512	11,592	-	11,592	-	-	-	-	-	-	-	-	-
1a.3	Subtotal Period 1a Collateral Costs	-	-	-	-	-	-	10,080	1,512	11,592	-	11,592	-	-	-	-	-	-	-	-	-
Period 1a Period-Dependent Costs																					
1a.4.1	Insurance	-	-	-	-	-	-	3,972	397	4,370	4,370	-	-	-	-	-	-	-	-	-	-
1a.4.2	Property taxes	-	-	-	-	-	-	120	12	132	132	-	-	-	-	-	-	-	-	-	-
1a.4.3	Health physics supplies	-	888	-	-	-	-	-	222	1,110	1,110	-	-	-	-	-	-	-	-	-	-
1a.4.4	Heavy equipment rental	-	657	-	-	-	-	-	99	755	755	-	-	-	-	-	-	-	-	-	-
1a.4.5	Disposal of DAW generated	-	-	12	7	-	36	-	11	67	67	-	-	-	610	-	-	-	12,190	20	-
1a.4.6	Plant energy budget	-	-	-	-	-	-	2,053	308	2,361	2,361	-	-	-	-	-	-	-	-	-	-
1a.4.7	NRC Fees	-	-	-	-	-	-	1,321	132	1,453	1,453	-	-	-	-	-	-	-	-	-	-
1a.4.8	Emergency Planning Fees	-	-	-	-	-	-	1,620	162	1,782	-	1,782	-	-	-	-	-	-	-	-	-
1a.4.9	INPO Fees	-	-	-	-	-	-	358	54	411	411	-	-	-	-	-	-	-	-	-	-
1a.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	988	148	1,136	-	1,136	-	-	-	-	-	-	-	-	-
1a.4.11	ISFSI Operating Costs	-	-	-	-	-	-	127	19	146	-	146	-	-	-	-	-	-	-	-	-
1a.4.12	Corporate Allocations	-	-	-	-	-	-	1,000	100	1,100	1,100	-	-	-	-	-	-	-	-	-	-
1a.4.13	Security Staff Cost	-	-	-	-	-	-	15,699	2,355	18,054	18,054	-	-	-	-	-	-	-	-	-	251,680
1a.4.14	Utility Staff Cost	-	-	-	-	-	-	37,678	5,652	43,329	43,329	-	-	-	-	-	-	-	-	-	422,240
1a.4	Subtotal Period 1a Period-Dependent Costs	-	1,545	12	7	-	36	64,936	9,670	76,207	73,142	3,064	-	-	610	-	-	-	12,190	20	673,920
1a.0	TOTAL PERIOD 1a COST	-	1,545	12	7	-	36	94,221	14,063	109,884	94,403	14,656	825	-	610	-	-	-	12,190	20	752,077

Table E
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
PERIOD 1b - Decommissioning Preparations																					
Period 1b Direct Decommissioning Activities																					
Detailed Work Procedures																					
1b.1.1.1	Plant systems	-	-	-	-	-	-	751	113	864	778	-	86	-	-	-	-	-	-	-	4,733
1b.1.1.2	NSSS Decontamination Flush	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.3	Reactor internals	-	-	-	-	-	-	397	60	456	456	-	-	-	-	-	-	-	-	-	2,500
1b.1.1.4	Remaining buildings	-	-	-	-	-	-	214	32	246	62	-	185	-	-	-	-	-	-	-	1,350
1b.1.1.5	CRD cooling assembly	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.6	CRD housings & ICI tubes	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.7	Incore instrumentation	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.8	Reactor vessel	-	-	-	-	-	-	576	86	663	663	-	-	-	-	-	-	-	-	-	3,630
1b.1.1.9	Facility closeout	-	-	-	-	-	-	190	29	219	110	-	110	-	-	-	-	-	-	-	1,200
1b.1.1.10	Missile shields	-	-	-	-	-	-	71	11	82	82	-	-	-	-	-	-	-	-	-	450
1b.1.1.11	Biological shield	-	-	-	-	-	-	190	29	219	219	-	-	-	-	-	-	-	-	-	1,200
1b.1.1.12	Steam generators	-	-	-	-	-	-	730	110	840	840	-	-	-	-	-	-	-	-	-	4,600
1b.1.1.13	Reinforced concrete	-	-	-	-	-	-	159	24	183	91	-	91	-	-	-	-	-	-	-	1,000
1b.1.1.14	Main Turbine	-	-	-	-	-	-	248	37	285	-	-	285	-	-	-	-	-	-	-	1,560
1b.1.1.15	Main Condensers	-	-	-	-	-	-	248	37	285	-	-	285	-	-	-	-	-	-	-	1,560
1b.1.1.16	Auxiliary building	-	-	-	-	-	-	433	65	498	448	-	50	-	-	-	-	-	-	-	2,730
1b.1.1.17	Reactor building	-	-	-	-	-	-	433	65	498	448	-	50	-	-	-	-	-	-	-	2,730
1b.1.1	Total	-	-	-	-	-	-	5,276	791	6,068	4,927	-	1,141	-	-	-	-	-	-	-	33,243
1b.1.2	Decon primary loop	973	-	-	-	-	-	-	486	1,459	1,459	-	-	-	-	-	-	-	-	1,067	-
1b.1	Subtotal Period 1b Activity Costs	973	-	-	-	-	-	5,276	1,278	7,527	6,386	-	1,141	-	-	-	-	-	-	1,067	33,243
Period 1b Additional Costs																					
1b.2.1	Spent Fuel Pool Isolation	-	-	-	-	-	-	14,330	2,150	16,480	16,480	-	-	-	-	-	-	-	-	-	-
1b.2.2	Site Characterization	-	-	-	-	-	-	3,198	959	4,158	4,158	-	-	-	-	-	-	-	-	19,100	7,852
1b.2	Subtotal Period 1b Additional Costs	-	-	-	-	-	-	17,529	3,109	20,638	20,638	-	-	-	-	-	-	-	-	19,100	7,852
Period 1b Collateral Costs																					
1b.3.1	Decon equipment	1,193	-	-	-	-	-	-	179	1,371	1,371	-	-	-	-	-	-	-	-	-	-
1b.3.2	DOC staff relocation expenses	-	-	-	-	-	-	1,641	246	1,887	1,887	-	-	-	-	-	-	-	-	-	-
1b.3.3	Process decommissioning water waste	49	-	35	87	-	144	-	77	392	392	-	-	-	283	-	-	-	16,989	55	-
1b.3.4	Process decommissioning chemical flush waste	2	-	92	369	-	2,012	-	569	3,044	3,044	-	-	-	-	788	-	-	83,917	147	-
1b.3.5	Small tool allowance	-	2	-	-	-	-	-	0	3	3	-	-	-	-	-	-	-	-	-	-
1b.3.6	Pipe cutting equipment	-	1,400	-	-	-	-	-	210	1,610	1,610	-	-	-	-	-	-	-	-	-	-
1b.3.7	Decon rig	2,451	-	-	-	-	-	-	368	2,819	2,819	-	-	-	-	-	-	-	-	-	-
1b.3.8	Spent Fuel Capital and Transfer	-	-	-	-	-	-	5,040	756	5,796	-	5,796	-	-	-	-	-	-	-	-	-
1b.3	Subtotal Period 1b Collateral Costs	3,696	1,402	127	456	-	2,156	6,681	2,405	16,922	11,126	5,796	-	-	283	788	-	-	100,906	203	-
Period 1b Period-Dependent Costs																					
1b.4.1	Decon supplies	43	-	-	-	-	-	-	11	54	54	-	-	-	-	-	-	-	-	-	-
1b.4.2	Insurance	-	-	-	-	-	-	2,002	200	2,203	2,203	-	-	-	-	-	-	-	-	-	-
1b.4.3	Property taxes	-	-	-	-	-	-	60	6	66	66	-	-	-	-	-	-	-	-	-	-
1b.4.4	Health physics supplies	-	502	-	-	-	-	-	126	628	628	-	-	-	-	-	-	-	-	-	-
1b.4.5	Heavy equipment rental	-	331	-	-	-	-	-	50	381	381	-	-	-	-	-	-	-	-	-	-
1b.4.6	Disposal of DAW generated	-	-	7	4	-	21	-	7	39	39	-	-	-	360	-	-	-	7,197	12	-
1b.4.7	Plant energy budget	-	-	-	-	-	-	2,070	310	2,380	2,380	-	-	-	-	-	-	-	-	-	-
1b.4.8	NRC Fees	-	-	-	-	-	-	400	40	440	440	-	-	-	-	-	-	-	-	-	-
1b.4.9	Emergency Planning Fees	-	-	-	-	-	-	817	82	899	-	899	-	-	-	-	-	-	-	-	-
1b.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	498	75	573	-	573	-	-	-	-	-	-	-	-	-
1b.4.11	ISFSI Operating Costs	-	-	-	-	-	-	64	10	73	-	73	-	-	-	-	-	-	-	-	-
1b.4.12	Corporate Allocations	-	-	-	-	-	-	504	50	555	555	-	-	-	-	-	-	-	-	-	-
1b.4.13	Security Staff Cost	-	-	-	-	-	-	7,914	1,187	9,101	9,101	-	-	-	-	-	-	-	-	-	126,874
1b.4.14	DOC Staff Cost	-	-	-	-	-	-	7,234	1,085	8,319	8,319	-	-	-	-	-	-	-	-	-	63,961
1b.4.15	Utility Staff Cost	-	-	-	-	-	-	19,087	2,863	21,950	21,950	-	-	-	-	-	-	-	-	-	213,904
1b.4	Subtotal Period 1b Period-Dependent Costs	43	833	7	4	-	21	40,652	6,101	47,662	46,117	1,545	-	-	360	-	-	-	7,197	12	404,740
1b.0	TOTAL PERIOD 1b COST	4,711	2,236	134	460	-	2,178	70,137	12,893	92,748	84,266	7,341	1,141	-	643	788	-	-	108,103	20,381	445,835
PERIOD 1 TOTALS		4,711	3,780	146	467	-	2,214	164,358	26,956	202,633	178,670	21,997	1,966	-	1,253	788	-	-	120,293	20,401	1,197,911
PERIOD 2a - Large Component Removal																					

Table E
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Period 2a Direct Decommissioning Activities																					
Nuclear Steam Supply System Removal																					
2a.1.1.1	Reactor Coolant Piping	244	244	39	136	-	768	-	399	1,830	1,830	-	-	-	2,046	-	-	-	142,726	6,863	-
2a.1.1.2	Pressurizer Relief Tank	41	34	11	38	-	217	-	90	432	432	-	-	-	578	-	-	-	40,338	1,077	-
2a.1.1.3	Reactor Coolant Pumps & Motors	124	125	185	267	-	1,483	-	523	2,708	2,708	-	-	-	3,386	-	-	-	816,140	4,188	100
2a.1.1.4	Pressurizer	-	80	839	208	-	1,638	-	545	3,310	3,310	-	-	-	3,739	-	-	-	293,734	1,666	1,875
2a.1.1.5	Steam Generators	-	8,305	4,689	3,380	-	16,197	-	7,102	39,674	39,674	-	-	-	63,478	-	-	-	3,570,150	23,279	3,500
2a.1.1.6	Retired Steam Generator Units	-	-	3,353	3,319	-	16,000	-	4,833	27,505	27,505	-	-	-	62,808	-	-	-	3,349,305	10,852	2,250
2a.1.1.7	CRDMs/ICIs/Service Structure Removal	207	353	230	141	-	783	-	432	2,145	2,145	-	-	-	3,881	-	-	-	145,494	7,976	-
2a.1.1.8	Reactor Vessel Internals	112	6,004	12,696	1,844	-	18,156	393	17,331	56,535	56,535	-	-	-	2,764	1,230	393	-	336,142	32,573	1,461
2a.1.1.9	Vessel & Internals GTCC Disposal	-	-	-	-	-	13,035	-	1,955	14,990	14,990	-	-	-	-	-	-	2,217	433,180	-	-
2a.1.1.10	Reactor Vessel	141	7,737	3,180	1,898	-	5,983	393	10,193	29,525	29,525	-	-	-	13,715	-	-	-	973,586	32,573	1,461
2a.1.1	Totals	870	22,883	25,222	11,231	-	74,261	785	43,403	178,655	178,655	-	-	-	156,395	1,230	393	2,217	10,100,790	121,047	10,648
Removal of Major Equipment																					
2a.1.2	Main Turbine/Generator	-	686	2,848	491	-	17,692	-	4,953	26,671	26,671	-	-	-	54,809	-	-	-	3,481,857	9,888	-
2a.1.3	Main Condensers	-	1,923	1,386	2,399	-	21,985	-	6,475	34,167	34,167	-	-	-	64,324	-	-	-	4,086,353	27,762	-
Cascading Costs from Clean Building Demolition																					
2a.1.4.1	Reactor	-	612	-	-	-	-	-	92	704	704	-	-	-	-	-	-	-	-	4,832	-
2a.1.4.2	Auxiliary	-	318	-	-	-	-	-	48	366	366	-	-	-	-	-	-	-	-	2,113	-
2a.1.4.3	Hot Machine Shop	-	1	-	-	-	-	-	0	1	1	-	-	-	-	-	-	-	-	7	-
2a.1.4.4	Radwaste	-	61	-	-	-	-	-	9	70	70	-	-	-	-	-	-	-	-	387	-
2a.1.4.5	Fuel Building	-	129	-	-	-	-	-	19	149	149	-	-	-	-	-	-	-	-	795	-
2a.1.4	Totals	-	1,121	-	-	-	-	-	168	1,290	1,290	-	-	-	-	-	-	-	-	8,134	-
Disposal of Plant Systems																					
2a.1.5.1	100 Aux.Bldg Non-System Specific RCA	-	920	108	204	-	1,867	-	738	3,838	3,838	-	-	-	5,463	-	-	-	347,071	13,677	-
2a.1.5.2	100 Auxiliary Bldg Non-System Specific	-	151	12	23	-	212	-	95	494	494	-	-	-	621	-	-	-	39,480	2,291	-
2a.1.5.3	AB - Main Steam	-	366	-	-	-	-	-	55	420	-	-	420	-	-	-	-	-	-	5,833	-
2a.1.5.4	AB - Main Steam RCA	-	103	33	58	-	531	-	171	896	896	-	-	-	1,547	-	-	-	98,672	1,580	-
2a.1.5.5	AC - Main Turbine	-	361	-	-	-	-	-	54	415	-	-	415	-	-	-	-	-	-	5,641	-
2a.1.5.6	AD - Condensate	-	401	-	-	-	-	-	60	461	-	-	461	-	-	-	-	-	-	6,144	-
2a.1.5.7	AE - Feedwater	-	275	-	-	-	-	-	41	316	-	-	316	-	-	-	-	-	-	4,271	-
2a.1.5.8	AF - Feedwater Heater Extraction	-	337	-	-	-	-	-	51	388	-	-	388	-	-	-	-	-	-	5,352	-
2a.1.5.9	AK - Condensate Demineralizer	-	125	-	-	-	-	-	19	143	-	-	143	-	-	-	-	-	-	1,944	-
2a.1.5.10	AL - Auxiliary Feedwater	-	54	-	-	-	-	-	8	63	-	-	63	-	-	-	-	-	-	852	-
2a.1.5.11	AQ - Condensate & Feedwater Chem Addtn	-	30	-	-	-	-	-	5	35	-	-	35	-	-	-	-	-	-	468	-
2a.1.5.12	BM - Steam Generator Blowdown	-	158	19	31	-	287	-	118	613	613	-	-	-	832	-	-	-	53,260	2,415	-
2a.1.5.13	BM - Steam Generator Blowdown - RCA	-	491	75	112	-	1,024	-	403	2,105	2,105	-	-	-	2,963	-	-	-	190,396	7,221	-
2a.1.5.14	BN - Borated Refueling Water Storage	-	457	95	167	-	1,535	-	533	2,787	2,787	-	-	-	4,482	-	-	-	285,246	7,044	-
2a.1.5.15	CA - Steam Seal	-	29	-	-	-	-	-	4	33	-	-	33	-	-	-	-	-	-	455	-
2a.1.5.16	CB - Main Turbine Lube Oil	-	82	-	-	-	-	-	12	95	-	-	95	-	-	-	-	-	-	1,207	-
2a.1.5.17	CC - Generator Hydrogen Seal & CO2	-	13	-	-	-	-	-	2	15	-	-	15	-	-	-	-	-	-	198	-
2a.1.5.18	CD - Generator Seal Oil	-	19	-	-	-	-	-	3	22	-	-	22	-	-	-	-	-	-	287	-
2a.1.5.19	CE - Stator Cooling Water	-	16	-	-	-	-	-	2	19	-	-	19	-	-	-	-	-	-	241	-
2a.1.5.20	CF - Lube Oil Storage Xfer & Prfication	-	53	-	-	-	-	-	8	61	-	-	61	-	-	-	-	-	-	812	-
2a.1.5.21	CG - Condenser Air Removal	-	43	-	-	-	-	-	6	49	-	-	49	-	-	-	-	-	-	657	-
2a.1.5.22	CH - Main Turbine Control Oil	-	85	-	-	-	-	-	13	97	-	-	97	-	-	-	-	-	-	1,219	-
2a.1.5.23	DA - Circulating Water	-	473	-	-	-	-	-	71	544	-	-	544	-	-	-	-	-	-	7,502	-
2a.1.5.24	DB - Cooling Tower Makeup & Blowdown	-	80	-	-	-	-	-	12	92	-	-	92	-	-	-	-	-	-	1,260	-
2a.1.5.25	DD - Cooling Water Chemical Control Sys	-	71	-	-	-	-	-	11	81	-	-	81	-	-	-	-	-	-	1,084	-
2a.1.5.26	DD - Cooling Wtr Chem Control RCA	-	361	69	97	-	891	-	335	1,753	1,753	-	-	-	2,569	-	-	-	165,613	5,095	-
2a.1.5.27	EJ - Residual Heat Removal	-	524	95	164	-	1,506	-	542	2,831	2,831	-	-	-	4,385	-	-	-	280,003	8,105	-
2a.1.5.28	EM - High Pressure Coolant Injection	-	438	41	60	-	554	-	261	1,356	1,356	-	-	-	1,599	-	-	-	103,047	6,672	-
2a.1.5.29	EN - Containment Spray	-	288	53	82	-	752	-	277	1,452	1,452	-	-	-	2,179	-	-	-	139,742	4,242	-
2a.1.5.30	EP - Accumulator Safety Injection	-	231	35	54	-	495	-	193	1,008	1,008	-	-	-	1,433	-	-	-	91,944	3,516	-
2a.1.5.31	FA - Auxiliary Steam Generator	-	32	-	-	-	-	-	5	37	-	-	37	-	-	-	-	-	-	521	-
2a.1.5.32	FB - Auxiliary Steam	-	133	-	-	-	-	-	20	152	-	-	152	-	-	-	-	-	-	2,106	-
2a.1.5.33	FB - Auxiliary Steam RCA	-	109	15	22	-	204	-	83	433	433	-	-	-	589	-	-	-	37,925	1,569	-
2a.1.5.34	FC - Auxiliary Turbines	-	87	-	-	-	-	-	13	100	-	-	100	-	-	-	-	-	-	1,320	-
2a.1.5.35	FE - Auxiliary Steam Chemical Addition	-	7	-	-	-	-	-	1	8	-	-	8	-	-	-	-	-	-	105	-
2a.1.5.36	GE - Turbine Building HVAC	-	240	-	-	-	-	-	36	276	-	-	276	-	-	-	-	-	-	3,957	-
2a.1.5.37	GS - Containment Hydrogen Control	-	101	13	22	-	199	-	80	414	414	-	-	-	577	-	-	-	36,925	1,574	-
2a.1.5.38	HE - Boron Recycle	529	668	77	123	-	1,129	-	740	3,267	3,267	-	-	-	3,280	-	-	-	209,922	16,718	-
2a.1.5.39	HF - Secondary Liquid Waste	975	1,319	175	287	-	2,629	-	1,535	6,920	6,920	-	-	-	7,644	-	-	-	488,595	32,027	-

Table E
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Disposal of Plant Systems (continued)																					
2a.1.5.40	JA - Auxiliary Oil & Transfer	-	43	-	-	-	-	-	7	50	-	-	50	-	-	-	-	-	-	690	-
2a.1.5.41	KS - Bulk Chemical Storage	-	122	94	172	-	1,580	-	461	2,429	2,429	-	-	-	4,620	-	-	-	293,686	2,002	-
2a.1.5.42	LE - Oily Waste	-	246	-	-	-	-	-	37	282	-	-	282	-	-	-	-	-	-	3,865	-
2a.1.5.43	LE - Oily Waste RCA	-	313	38	61	-	559	-	231	1,201	1,201	-	-	-	1,623	-	-	-	103,828	4,372	-
2a.1.5.44	Turbine Bldg Non-System Specific	-	1,031	-	-	-	-	-	155	1,185	-	-	1,185	-	-	-	-	-	-	15,405	-
2a.1.5	Totals	1,504	11,484	1,049	1,741	-	15,954	-	7,505	39,236	33,797	-	5,440	-	46,409	-	-	-	2,965,355	193,518	-
2a.1.6	Scaffolding in support of decommissioning	-	2,067	23	41	-	372	-	618	3,121	3,121	-	-	-	1,087	-	-	-	69,064	36,741	-
2a.1	Subtotal Period 2a Activity Costs	2,374	40,164	30,528	15,902	-	130,263	785	63,122	283,140	277,700	-	5,440	-	323,024	1,230	393	2,217	20,703,420	397,090	10,648
Period 2a Additional Costs																					
2a.2.1	Remedial Action Surveys	-	-	-	-	-	-	1,824	547	2,372	2,372	-	-	-	-	-	-	-	-	35,877	-
2a.2	Subtotal Period 2a Additional Costs	-	-	-	-	-	-	1,824	547	2,372	2,372	-	-	-	-	-	-	-	-	35,877	-
Period 2a Collateral Costs																					
2a.3.1	Process decommissioning water waste	214	-	152	382	-	634	-	338	1,720	1,720	-	-	-	1,246	-	-	-	74,768	243	-
2a.3.2	Process decommissioning chemical flush waste	1	-	48	192	-	371	-	127	739	739	-	-	-	410	-	-	-	43,711	77	-
2a.3.3	Small tool allowance	-	449	-	-	-	-	-	67	516	465	-	52	-	-	-	-	-	-	-	-
2a.3.4	Spent Fuel Capital and Transfer	-	-	-	-	-	-	18,270	2,741	21,011	-	21,011	-	-	-	-	-	-	-	-	-
2a.3	Subtotal Period 2a Collateral Costs	215	449	200	574	-	1,005	18,270	3,273	23,986	2,923	21,011	52	-	1,656	-	-	-	118,478	320	-
Period 2a Period-Dependent Costs																					
2a.4.1	Decon supplies	147	-	-	-	-	-	-	37	184	184	-	-	-	-	-	-	-	-	-	-
2a.4.2	Insurance	-	-	-	-	-	-	1,169	117	1,286	1,286	-	-	-	-	-	-	-	-	-	-
2a.4.3	Property taxes	-	-	-	-	-	-	207	21	228	228	-	-	-	-	-	-	-	-	-	-
2a.4.4	Health physics supplies	-	5,131	-	-	-	-	-	1,283	6,414	6,414	-	-	-	-	-	-	-	-	-	-
2a.4.5	Heavy equipment rental	-	3,836	-	-	-	-	-	575	4,411	4,411	-	-	-	-	-	-	-	-	-	-
2a.4.6	Disposal of DAW generated	-	-	132	74	-	385	-	121	712	712	-	-	-	6,501	-	-	-	130,017	212	-
2a.4.7	Plant energy budget	-	-	-	-	-	-	3,366	505	3,871	3,871	-	-	-	-	-	-	-	-	-	-
2a.4.8	NRC Fees	-	-	-	-	-	-	1,246	125	1,370	1,370	-	-	-	-	-	-	-	-	-	-
2a.4.9	Emergency Planning Fees	-	-	-	-	-	-	1,728	173	1,900	-	1,900	-	-	-	-	-	-	-	-	-
2a.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	1,706	256	1,962	-	1,962	-	-	-	-	-	-	-	-	-
2a.4.11	ISFSI Operating Costs	-	-	-	-	-	-	218	33	251	-	251	-	-	-	-	-	-	-	-	-
2a.4.12	Corporate Allocations	-	-	-	-	-	-	1,726	173	1,899	1,899	-	-	-	-	-	-	-	-	-	-
2a.4.13	Security Staff Cost	-	-	-	-	-	-	25,225	3,784	29,008	29,008	-	-	-	-	-	-	-	-	-	387,735
2a.4.14	DOC Staff Cost	-	-	-	-	-	-	30,559	4,584	35,143	35,143	-	-	-	-	-	-	-	-	-	272,850
2a.4.15	Utility Staff Cost	-	-	-	-	-	-	46,358	6,954	53,311	53,311	-	-	-	-	-	-	-	-	-	508,004
2a.4	Subtotal Period 2a Period-Dependent Costs	147	8,967	132	74	-	385	113,507	18,738	141,951	137,838	4,113	-	-	6,501	-	-	-	130,017	212	1,168,590
2a.0	TOTAL PERIOD 2a COST	2,737	49,580	30,860	16,551	-	131,653	134,387	85,680	451,447	420,833	25,124	5,491	-	331,181	1,230	393	2,217	20,951,920	433,498	1,179,237
PERIOD 2b - Site Decontamination																					
Period 2b Direct Decommissioning Activities																					
Disposal of Plant Systems																					
2b.1.1.1	200 Reactor Bldg Non-System Specific	-	120	7	14	-	129	-	65	337	337	-	-	-	378	-	-	-	24,042	1,765	-
2b.1.1.2	200 Reactor Bldg Non-System Specific RCA	-	752	68	127	-	1,167	-	506	2,620	2,620	-	-	-	3,414	-	-	-	216,897	10,554	-
2b.1.1.3	300 Control Bldg Non-System Specific	-	236	30	57	-	523	-	202	1,049	1,049	-	-	-	1,532	-	-	-	97,294	3,471	-
2b.1.1.4	300 Control Bldg Non-System Specific Cln	-	1,836	-	-	-	-	-	275	2,111	-	-	2,111	-	-	-	-	-	-	29,076	-
2b.1.1.5	700 Radwaste Bldg Non-Sys Specific RCA	-	1,514	180	339	-	3,105	-	1,223	6,361	6,361	-	-	-	9,083	-	-	-	577,051	22,261	-
2b.1.1.6	700 Radwaste Bldg Non-System Specific	-	243	19	37	-	342	-	154	796	796	-	-	-	1,002	-	-	-	63,635	3,667	-
2b.1.1.7	AN - Demineralized Wtr Storage & Xfer	-	208	-	-	-	-	-	31	239	-	-	239	-	-	-	-	-	-	3,283	-
2b.1.1.8	AN - Demineralized Wtr Strg & Xfer RCA	-	53	6	9	-	79	-	35	182	182	-	-	-	227	-	-	-	14,650	753	-
2b.1.1.9	AP -HCST/Condensate Stor.& Transfr	-	275	-	-	-	-	-	41	316	-	-	316	-	-	-	-	-	-	4,018	-
2b.1.1.10	BB - Reactor Coolant System	-	453	65	112	-	1,025	-	393	2,047	2,047	-	-	-	2,987	-	-	-	190,474	7,115	-
2b.1.1.11	BG - Chemical & Volume Control	1,143	1,276	193	318	-	2,918	-	1,687	7,535	7,535	-	-	-	8,476	-	-	-	542,341	28,266	-
2b.1.1.12	BL - Reactor Makeup Water	-	408	52	84	-	768	-	312	1,624	1,624	-	-	-	2,234	-	-	-	142,818	6,176	-
2b.1.1.13	DE - Intake & Water Treatment	-	166	-	-	-	-	-	25	191	-	-	191	-	-	-	-	-	-	2,517	-
2b.1.1.14	DE - Intake & Water Treatment RCA	-	331	175	319	-	2,925	-	879	4,630	4,630	-	-	-	8,546	-	-	-	543,623	5,351	-
2b.1.1.15	EA - Service Water	-	197	-	-	-	-	-	30	227	-	-	227	-	-	-	-	-	-	3,145	-
2b.1.1.16	EA - Service Water RCA	-	59	19	33	-	307	-	98	516	516	-	-	-	895	-	-	-	57,005	876	-
2b.1.1.17	EB - Closed Cooling Water	-	80	-	-	-	-	-	12	92	-	-	92	-	-	-	-	-	-	1,267	-
2b.1.1.18	EF - Essential Service Water	-	458	-	-	-	-	-	69	527	-	-	527	-	-	-	-	-	-	7,244	-
2b.1.1.19	EF - Essential Service Water RCA	-	263	81	143	-	1,309	-	422	2,218	2,218	-	-	-	3,820	-	-	-	243,301	4,018	-

Table E
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Disposal of Plant Systems (continued)																					
2b.1.1.20	EG - Component Cooling Water RCA	-	336	-	-	-	-	-	50	386	-	-	386	-	-	-	-	-	-	5,335	-
2b.1.1.21	GA - Plant Heating	-	120	-	-	-	-	-	18	138	-	-	138	-	-	-	-	-	-	1,912	-
2b.1.1.22	GA - Plant Heating RCA	-	126	14	18	-	162	-	76	395	395	-	-	-	463	-	-	-	30,040	1,795	-
2b.1.1.23	GB - Central Chilled Water	-	113	-	-	-	-	-	17	130	-	-	130	-	-	-	-	-	-	1,803	-
2b.1.1.24	GB - Central Chilled Water RCA	-	34	4	5	-	47	-	22	112	112	-	-	-	136	-	-	-	8,778	490	-
2b.1.1.25	GD - Essential Serv Wtr Pumphouse HVAC	-	25	-	-	-	-	-	4	29	-	-	29	-	-	-	-	-	-	427	-
2b.1.1.26	GF - Miscellaneous Building HVAC	-	155	29	54	-	498	-	174	911	911	-	-	-	1,457	-	-	-	92,563	2,081	-
2b.1.1.27	GH - Radwaste Building HVAC	-	240	35	68	-	627	-	230	1,201	1,201	-	-	-	1,834	-	-	-	116,569	3,502	-
2b.1.1.28	GK - Control Building HVAC	-	231	-	-	-	-	-	35	266	-	-	266	-	-	-	-	-	-	3,959	-
2b.1.1.29	GL - Auxiliary Building HVAC	-	592	75	144	-	1,318	-	507	2,636	2,636	-	-	-	3,855	-	-	-	245,020	8,590	-
2b.1.1.30	GM - Diesel Generator Building HVAC	-	40	-	-	-	-	-	6	46	-	-	46	-	-	-	-	-	-	695	-
2b.1.1.31	GN - Containment Cooling	-	661	118	221	-	2,027	-	717	3,744	3,744	-	-	-	5,923	-	-	-	376,780	9,749	-
2b.1.1.32	GP - Containment Intgratd Leak Rate Test	-	52	9	16	-	143	-	52	272	272	-	-	-	417	-	-	-	26,623	768	-
2b.1.1.33	GR - Containment Atmospheric Control	-	26	16	31	-	280	-	83	435	435	-	-	-	818	-	-	-	51,989	413	-
2b.1.1.34	GT - Containment Purge HVAC	-	155	31	58	-	535	-	184	963	963	-	-	-	1,566	-	-	-	99,513	2,297	-
2b.1.1.35	HA - Gaseous Radwaste	-	476	65	100	-	919	-	370	1,929	1,929	-	-	-	2,664	-	-	-	170,799	7,097	-
2b.1.1.36	HB - Liquid Radwaste	1,055	1,161	159	253	-	2,319	-	1,451	6,397	6,397	-	-	-	6,735	-	-	-	430,985	31,019	-
2b.1.1.37	HC - Solid Radwaste	-	495	67	113	-	1,033	-	406	2,114	2,114	-	-	-	3,006	-	-	-	192,060	7,493	-
2b.1.1.38	HD - Decontamination	-	138	20	33	-	302	-	117	609	609	-	-	-	877	-	-	-	56,053	2,072	-
2b.1.1.39	JE - Emergency Fuel Oil	-	86	-	-	-	-	-	13	99	-	-	99	-	-	-	-	-	-	1,260	-
2b.1.1.40	KA - Compressed Air	-	262	-	-	-	-	-	39	301	-	-	301	-	-	-	-	-	-	4,187	-
2b.1.1.41	KA - Compressed Air RCA	-	169	19	22	-	204	-	99	513	513	-	-	-	583	-	-	-	37,947	2,380	-
2b.1.1.42	KB - Breathing Air	-	33	-	-	-	-	-	5	38	-	-	38	-	-	-	-	-	-	516	-
2b.1.1.43	KB - Breathing Air RCA	-	26	2	2	-	18	-	12	60	60	-	-	-	52	-	-	-	3,401	406	-
2b.1.1.44	KC - Fire Protection	-	514	-	-	-	-	-	77	591	-	-	591	-	-	-	-	-	-	8,376	-
2b.1.1.45	KC - Fire Protection RCA	-	530	86	121	-	1,106	-	436	2,279	2,279	-	-	-	3,189	-	-	-	205,625	7,245	-
2b.1.1.46	KD - Domestic Water	-	239	-	-	-	-	-	36	275	-	-	275	-	-	-	-	-	-	3,837	-
2b.1.1.47	KD - Domestic Water RCA	-	34	5	7	-	62	-	25	132	132	-	-	-	178	-	-	-	11,465	468	-
2b.1.1.48	KE - Fuel Handling & Storage Rctor vssl	-	25	12	24	-	216	-	65	342	342	-	-	-	632	-	-	-	40,119	388	-
2b.1.1.49	KH - Service Gas (CO2 N2 H2 & O2)	-	76	-	-	-	-	-	11	87	-	-	87	-	-	-	-	-	-	1,226	-
2b.1.1.50	KH - Service Gas (CO2 N2 H2 & O2) RCA	-	333	45	66	-	608	-	250	1,302	1,302	-	-	-	1,756	-	-	-	112,949	4,575	-
2b.1.1.51	KJ - Standby Diesel Engine	-	454	-	-	-	-	-	68	523	-	-	523	-	-	-	-	-	-	6,749	-
2b.1.1.52	LA - Sanitary Drains	-	61	-	-	-	-	-	9	70	-	-	70	-	-	-	-	-	-	972	-
2b.1.1.53	LA - Sanitary Drains RCA	-	140	21	34	-	315	-	121	632	632	-	-	-	916	-	-	-	58,593	1,854	-
2b.1.1.54	LB - Roof Drains	-	81	-	-	-	-	-	12	93	-	-	93	-	-	-	-	-	-	1,276	-
2b.1.1.55	LB - Roof Drains RCA	-	190	32	57	-	526	-	191	996	996	-	-	-	1,534	-	-	-	97,740	2,757	-
2b.1.1.56	LD - Chemical & Detergent Waste	92	159	14	22	-	198	-	140	625	625	-	-	-	574	-	-	-	36,840	3,503	-
2b.1.1.57	LF - Floor & Equipment Drains	-	1,970	183	316	-	2,893	-	1,281	6,643	6,643	-	-	-	8,419	-	-	-	537,647	29,417	-
2b.1.1.58	RM - Process Sampling & Analysis	-	182	20	27	-	249	-	114	592	592	-	-	-	717	-	-	-	46,349	2,792	-
2b.1.1.59	SJ - Nuclear Sampling	-	106	14	19	-	171	-	73	382	382	-	-	-	491	-	-	-	31,744	1,632	-
2b.1.1.60	UB - Serves Stores Site Security Bldg	-	245	-	-	-	-	-	37	282	-	-	282	-	-	-	-	-	-	3,815	-
2b.1.1.61	Yard Non-System Specific	-	41	-	-	-	-	-	6	47	-	-	47	-	-	-	-	-	-	603	-
2b.1.1	Totals	2,290	20,061	1,989	3,424	-	31,373	-	14,098	73,233	66,129	-	7,104	-	91,385	-	-	-	5,831,320	326,556	-
2b.1.2	Scaffolding in support of decommissioning	-	2,584	29	51	-	464	-	773	3,901	3,901	-	-	-	1,359	-	-	-	86,330	45,926	-
Decontamination of Site Buildings																					
2b.1.3.1	Reactor	1,628	2,446	258	1,747	-	9,929	-	4,196	20,204	20,204	-	-	-	61,873	-	-	-	2,713,720	56,041	-
2b.1.3.2	Auxiliary	842	489	58	291	-	963	-	834	3,478	3,478	-	-	-	8,629	-	-	-	422,631	19,470	-
2b.1.3.3	Communication Corridor - Contaminated	19	8	1	6	-	14	-	16	63	63	-	-	-	164	-	-	-	7,935	395	-
2b.1.3.4	Hot Machine Shop	23	17	1	6	-	12	-	20	79	79	-	-	-	188	-	-	-	8,892	597	-
2b.1.3.5	RAM Storage Building	58	20	2	14	-	29	-	43	166	166	-	-	-	415	-	-	-	19,255	1,162	-
2b.1.3.6	Radioactive and Personnel Tunnel	8	16	0	4	-	7	-	10	44	44	-	-	-	106	-	-	-	5,022	335	-
2b.1.3.7	Radwaste	448	236	26	148	-	447	-	420	1,724	1,724	-	-	-	4,322	-	-	-	212,823	10,019	-
2b.1.3.8	Radwaste Drum Storage	50	24	2	16	-	43	-	45	180	180	-	-	-	460	-	-	-	22,567	1,094	-
2b.1.3.9	Reactor Head Assembly Building	44	-	-	-	-	-	-	22	66	66	-	-	-	-	-	-	-	-	691	-
2b.1.3.10	Steam Generator Replacement Bldgs	331	-	-	-	-	-	-	165	496	496	-	-	-	-	-	-	-	-	4,358	-
2b.1.3	Totals	3,450	3,257	348	2,231	-	11,444	-	5,770	26,500	26,500	-	-	-	76,157	-	-	-	3,412,845	94,163	-
2b.1.4	Prepare/submit License Termination Plan	-	-	-	-	-	-	650	98	748	748	-	-	-	-	-	-	-	-	-	4,096
2b.1.5	Receive NRC approval of termination plan									a											
2b.1	Subtotal Period 2b Activity Costs	5,740	25,902	2,366	5,705	-	43,281	650	20,738	104,382	97,278	-	7,104	-	168,901	-	-	-	9,330,495	466,645	4,096

Table E
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Period 2b Additional Costs																					
2b.2.1	Remedial Action Surveys	-	-	-	-	-	-	2,401	720	3,121	3,121	-	-	-	-	-	-	-	-	47,209	-
2b.2.2	Sanitary Treatment Lagoon	-	7	92	235	-	540	-	181	1,054	1,054	-	-	-	4,608	-	-	-	392,140	423	-
2b.2.3	Cooling Tower Asbestos Panel Removal	-	6,512	-	305	-	-	641	1,119	8,576	-	-	8,576	-	-	-	-	-	-	71,419	-
2b.2.4	Operational Equipment	-	-	22	235	-	1,574	-	431	2,261	2,261	-	-	-	11,700	-	-	-	292,500	32	-
2b.2.5	Retired Reactor Closure Head	-	151	847	1,330	-	1,110	-	599	4,037	4,037	-	-	-	2,764	-	-	-	338,540	3,157	2,000
2b.2.6	Spent Fuel Pool Legacy Waste	-	108	163	67	-	2,617	14	710	3,680	3,680	-	-	-	-	250	-	-	14,900	1,333	53
2b.2	Subtotal Period 2b Additional Costs	-	6,778	1,124	2,171	-	5,841	3,056	3,760	22,729	14,153	-	8,576	-	19,072	250	-	-	1,038,080	123,574	2,053
Period 2b Collateral Costs																					
2b.3.1	Process decommissioning water waste	187	-	136	342	-	568	-	300	1,534	1,534	-	-	-	1,117	-	-	-	66,992	218	-
2b.3.2	Process decommissioning chemical flush waste	4	-	157	626	-	1,209	-	414	2,409	2,409	-	-	-	1,338	-	-	-	142,540	250	-
2b.3.3	Small tool allowance	-	583	-	-	-	-	-	87	670	670	-	-	-	-	-	-	-	-	-	-
2b.3.4	Spent Fuel Capital and Transfer	-	-	-	-	-	-	22,680	3,402	26,082	-	26,082	-	-	-	-	-	-	-	-	-
2b.3	Subtotal Period 2b Collateral Costs	191	583	293	969	-	1,777	22,680	4,204	30,695	4,613	26,082	-	-	2,454	-	-	-	209,532	468	-
Period 2b Period-Dependent Costs																					
2b.4.1	Decon supplies	1,889	-	-	-	-	-	-	472	2,362	2,362	-	-	-	-	-	-	-	-	-	-
2b.4.2	Insurance	-	-	-	-	-	-	1,539	154	1,693	1,693	-	-	-	-	-	-	-	-	-	-
2b.4.3	Property taxes	-	-	-	-	-	-	272	27	300	300	-	-	-	-	-	-	-	-	-	-
2b.4.4	Health physics supplies	-	6,892	-	-	-	-	-	1,723	8,615	8,615	-	-	-	-	-	-	-	-	-	-
2b.4.5	Heavy equipment rental	-	5,176	-	-	-	-	-	776	5,952	5,952	-	-	-	-	-	-	-	-	-	-
2b.4.6	Disposal of DAW generated	-	-	135	76	-	392	-	123	725	725	-	-	-	6,613	-	-	-	132,265	216	-
2b.4.7	Plant energy budget	-	-	-	-	-	-	3,497	525	4,022	4,022	-	-	-	-	-	-	-	-	-	-
2b.4.8	NRC Fees	-	-	-	-	-	-	1,639	164	1,803	1,803	-	-	-	-	-	-	-	-	-	-
2b.4.9	Emergency Planning Fees	-	-	-	-	-	-	2,273	227	2,501	-	2,501	-	-	-	-	-	-	-	-	-
2b.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	2,244	337	2,581	-	2,581	-	-	-	-	-	-	-	-	-
2b.4.11	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	566	85	651	651	-	-	-	-	-	-	-	-	-	-
2b.4.12	ISFSI Operating Costs	-	-	-	-	-	-	287	43	331	-	331	-	-	-	-	-	-	-	-	-
2b.4.13	Corporate Allocations	-	-	-	-	-	-	2,271	227	2,498	2,498	-	-	-	-	-	-	-	-	-	-
2b.4.14	Security Staff Cost	-	-	-	-	-	-	30,845	4,627	35,472	35,472	-	-	-	-	-	-	-	-	-	510,210
2b.4.15	DOC Staff Cost	-	-	-	-	-	-	38,792	5,819	44,611	44,611	-	-	-	-	-	-	-	-	-	344,864
2b.4.16	Utility Staff Cost	-	-	-	-	-	-	58,488	8,773	67,261	67,261	-	-	-	-	-	-	-	-	-	640,124
2b.4	Subtotal Period 2b Period-Dependent Costs	1,889	12,068	135	76	-	392	142,715	24,102	181,376	175,964	5,412	-	-	6,613	-	-	-	132,265	216	1,495,198
2b.0	TOTAL PERIOD 2b COST	7,820	45,331	3,917	8,921	-	51,290	169,101	52,803	339,183	292,009	31,494	15,680	-	197,041	250	-	-	10,710,370	590,902	1,501,347
PERIOD 2d - Decontamination Following Wet Fuel Storage																					
Period 2d Direct Decommissioning Activities																					
2d.1.1	Remove spent fuel racks	1,060	112	294	261	-	2,389	-	1,223	5,338	5,338	-	-	-	6,988	-	-	-	443,960	1,925	-
Disposal of Plant Systems																					
2d.1.2.1	600 Fuel Bldg Non-Specific Systems RCA	-	411	46	85	-	783	-	316	1,641	1,641	-	-	-	2,292	-	-	-	145,605	5,946	-
2d.1.2.2	600 Fuel Bldg Non-System Specific	-	64	5	9	-	83	-	39	199	199	-	-	-	242	-	-	-	15,399	957	-
2d.1.2.3	EC - Fuel Pool Cooling & Cleanup	-	535	68	111	-	1,021	-	413	2,148	2,148	-	-	-	2,965	-	-	-	189,813	8,118	-
2d.1.2.4	GA- Plant Heating Fuel Building	-	30	2	3	-	27	-	15	77	77	-	-	-	78	-	-	-	5,037	451	-
2d.1.2.5	GG - Fuel Building HVAC	-	326	55	105	-	966	-	344	1,796	1,796	-	-	-	2,825	-	-	-	179,529	4,745	-
2d.1.2.6	KC- Fire Protection Fuel Building	-	157	24	34	-	311	-	124	650	650	-	-	-	896	-	-	-	57,758	2,166	-
2d.1.2	Totals	-	1,523	199	348	-	3,191	-	1,251	6,512	6,512	-	-	-	9,298	-	-	-	593,141	22,383	-
Decontamination of Site Buildings																					
2d.1.3.1	Fuel Building	1,070	1,141	74	140	-	841	-	1,059	4,324	4,324	-	-	-	3,849	-	-	-	218,838	31,668	-
2d.1.3	Totals	1,070	1,141	74	140	-	841	-	1,059	4,324	4,324	-	-	-	3,849	-	-	-	218,838	31,668	-
2d.1.4	Scaffolding in support of decommissioning	-	517	6	10	-	93	-	155	780	780	-	-	-	272	-	-	-	17,266	9,185	-
2d.1	Subtotal Period 2d Activity Costs	2,130	3,292	573	759	-	6,513	-	3,687	16,954	16,954	-	-	-	20,407	-	-	-	1,273,206	65,161	-
Period 2d Additional Costs																					
2d.2.1	License Termination Survey Planning	-	-	-	-	-	-	1,778	533	2,311	2,311	-	-	-	-	-	-	-	-	-	12,480
2d.2.2	License Termination ISFSI	-	684	154	166	-	3,547	3,894	2,111	10,556	10,556	-	-	-	14,077	-	-	-	1,053,456	17,572	10,920
2d.2.3	Excavation of Underground Services	-	1,879	-	-	-	-	551	552	2,982	2,982	-	-	-	-	-	-	-	-	12,396	-
2d.2.4	Remedial Action Surveys	-	-	-	-	-	-	704	211	915	915	-	-	-	-	-	-	-	-	13,838	-
2d.2	Subtotal Period 2d Additional Costs	-	2,562	154	166	-	3,547	6,927	3,408	16,764	16,764	-	-	-	14,077	-	-	-	1,053,456	43,806	23,400

Table E
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Period 2d Collateral Costs																					
2d.3.1	Process decommissioning water waste	100	-	73	184	-	306	-	161	824	824	-	-	-	601	-	-	-	36,070	117	-
2d.3.2	Process decommissioning chemical flush waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2d.3.3	Small tool allowance	-	114	-	-	-	-	-	17	131	131	-	-	-	-	-	-	-	-	-	-
2d.3.4	Decommissioning Equipment Disposition	-	-	114	197	-	1,808	-	493	2,612	2,612	-	-	-	5,290	-	-	-	336,079	147	-
2d.3	Subtotal Period 2d Collateral Costs	100	114	187	382	-	2,114	-	671	3,567	3,567	-	-	-	5,891	-	-	-	372,149	264	-
Period 2d Period-Dependent Costs																					
2d.4.1	Decon supplies	276	-	-	-	-	-	-	69	345	345	-	-	-	-	-	-	-	-	-	-
2d.4.2	Insurance	-	-	-	-	-	-	451	45	496	496	-	-	-	-	-	-	-	-	-	-
2d.4.3	Property taxes	-	-	-	-	-	-	80	8	88	88	-	-	-	-	-	-	-	-	-	-
2d.4.4	Health physics supplies	-	1,392	-	-	-	-	-	348	1,739	1,739	-	-	-	-	-	-	-	-	-	-
2d.4.5	Heavy equipment rental	-	1,517	-	-	-	-	-	228	1,745	1,745	-	-	-	-	-	-	-	-	-	-
2d.4.6	Disposal of DAW generated	-	-	42	24	-	123	-	39	228	228	-	-	-	2,081	-	-	-	41,624	68	-
2d.4.7	Plant energy budget	-	-	-	-	-	-	547	82	629	629	-	-	-	-	-	-	-	-	-	-
2d.4.8	NRC Fees	-	-	-	-	-	-	454	45	499	499	-	-	-	-	-	-	-	-	-	-
2d.4.9	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	332	50	382	382	-	-	-	-	-	-	-	-	-	-
2d.4.10	Corporate Allocations	-	-	-	-	-	-	666	67	732	732	-	-	-	-	-	-	-	-	-	-
2d.4.11	Security Staff Cost	-	-	-	-	-	-	1,850	277	2,127	2,127	-	-	-	-	-	-	-	-	-	20,772
2d.4.12	DOC Staff Cost	-	-	-	-	-	-	7,766	1,165	8,931	8,931	-	-	-	-	-	-	-	-	-	69,238
2d.4.13	Utility Staff Cost	-	-	-	-	-	-	12,053	1,808	13,861	13,861	-	-	-	-	-	-	-	-	-	130,861
2d.4	Subtotal Period 2d Period-Dependent Costs	276	2,909	42	24	-	123	24,198	4,230	31,802	31,802	-	-	-	2,081	-	-	-	41,624	68	220,870
2d.0	TOTAL PERIOD 2d COST	2,505	8,877	956	1,330	-	12,297	31,124	11,997	69,087	69,087	-	-	-	42,457	-	-	-	2,740,434	109,300	244,270
PERIOD 2f - License Termination																					
Period 2f Direct Decommissioning Activities																					
2f.1.1	ORISE confirmatory survey	-	-	-	-	-	-	168	50	218	218	-	-	-	-	-	-	-	-	-	-
2f.1.2	Terminate license									a											
2f.1	Subtotal Period 2f Activity Costs	-	-	-	-	-	-	168	50	218	218	-	-	-	-	-	-	-	-	-	-
Period 2f Additional Costs																					
2f.2.1	License Termination Survey	-	-	-	-	-	-	10,211	3,063	13,274	13,274	-	-	-	-	-	-	-	-	153,878	6,240
2f.2	Subtotal Period 2f Additional Costs	-	-	-	-	-	-	10,211	3,063	13,274	13,274	-	-	-	-	-	-	-	-	153,878	6,240
Period 2f Collateral Costs																					
2f.3.1	DOC staff relocation expenses	-	-	-	-	-	-	1,641	246	1,887	1,887	-	-	-	-	-	-	-	-	-	-
2f.3	Subtotal Period 2f Collateral Costs	-	-	-	-	-	-	1,641	246	1,887	1,887	-	-	-	-	-	-	-	-	-	-
Period 2f Period-Dependent Costs																					
2f.4.1	Insurance	-	-	-	-	-	-	512	51	564	564	-	-	-	-	-	-	-	-	-	-
2f.4.2	Property taxes	-	-	-	-	-	-	91	9	100	100	-	-	-	-	-	-	-	-	-	-
2f.4.3	Health physics supplies	-	1,316	-	-	-	-	-	329	1,645	1,645	-	-	-	-	-	-	-	-	-	-
2f.4.4	Disposal of DAW generated	-	-	7	4	-	21	-	7	39	39	-	-	-	353	-	-	-	7,050	11	-
2f.4.5	Plant energy budget	-	-	-	-	-	-	310	47	357	357	-	-	-	-	-	-	-	-	-	-
2f.4.6	NRC Fees	-	-	-	-	-	-	546	55	601	601	-	-	-	-	-	-	-	-	-	-
2f.4.7	Corporate Allocations	-	-	-	-	-	-	756	76	832	832	-	-	-	-	-	-	-	-	-	-
2f.4.8	Security Staff Cost	-	-	-	-	-	-	2,101	315	2,416	2,416	-	-	-	-	-	-	-	-	-	23,592
2f.4.9	DOC Staff Cost	-	-	-	-	-	-	6,532	980	7,511	7,511	-	-	-	-	-	-	-	-	-	57,408
2f.4.10	Utility Staff Cost	-	-	-	-	-	-	7,153	1,073	8,226	8,226	-	-	-	-	-	-	-	-	-	74,709
2f.4	Subtotal Period 2f Period-Dependent Costs	-	1,316	7	4	-	21	18,001	2,941	22,290	22,290	-	-	-	353	-	-	-	7,050	11	155,709
2f.0	TOTAL PERIOD 2f COST	-	1,316	7	4	-	21	30,021	6,300	37,669	37,669	-	-	-	353	-	-	-	7,050	153,889	161,949
PERIOD 2 TOTALS		13,062	105,104	35,741	26,806	-	195,260	364,632	156,780	897,386	819,597	56,618	21,171	-	571,031	1,481	393	2,217	34,409,770	1,287,589	3,086,805
PERIOD 3b - Site Restoration																					
Period 3b Direct Decommissioning Activities																					
Demolition of Remaining Site Buildings																					
3b.1.1.1	Reactor	-	3,482	-	-	-	-	-	522	4,004	-	-	4,004	-	-	-	-	-	-	27,502	-
3b.1.1.2	Auxiliary	-	2,865	-	-	-	-	-	430	3,295	-	-	3,295	-	-	-	-	-	-	19,024	-
3b.1.1.3	Auxiliary Boiler	-	26	-	-	-	-	-	4	30	-	-	30	-	-	-	-	-	-	248	-
3b.1.1.4	Barge Facility	-	957	-	-	-	-	-	144	1,101	-	-	1,101	-	-	-	-	-	-	4,290	-

Table E
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Demolition of Remaining Site Buildings (continued)																					
3b.1.1.5	Circulating & Service Water Pumphouse	-	233	-	-	-	-	-	35	268	-	-	268	-	-	-	-	-	-	1,996	-
3b.1.1.6	Communication Corridor - Clean	-	1,079	-	-	-	-	-	162	1,241	-	-	1,241	-	-	-	-	-	-	8,280	-
3b.1.1.7	Communication Corridor - Contaminated	-	35	-	-	-	-	-	5	40	-	-	40	-	-	-	-	-	-	184	-
3b.1.1.8	Cooling Tower Concrete	-	451	-	-	-	-	-	68	519	-	-	519	-	-	-	-	-	-	2,332	-
3b.1.1.9	Diesel Generator	-	329	-	-	-	-	-	49	378	-	-	378	-	-	-	-	-	-	2,185	-
3b.1.1.10	Essential Service Water Pumphouse	-	176	-	-	-	-	-	26	203	-	-	203	-	-	-	-	-	-	955	-
3b.1.1.11	Fire Water Pumphouse	-	23	-	-	-	-	-	3	26	-	-	26	-	-	-	-	-	-	151	-
3b.1.1.12	Flex Building Storage	-	337	-	-	-	-	-	51	388	-	-	388	-	-	-	-	-	-	1,972	-
3b.1.1.13	Hardened Condensate Storage Tank - HCST	-	243	-	-	-	-	-	36	279	-	-	279	-	-	-	-	-	-	1,870	-
3b.1.1.14	Hot Machine Shop	-	21	-	-	-	-	-	3	24	-	-	24	-	-	-	-	-	-	243	-
3b.1.1.15	Intake	-	219	-	-	-	-	-	33	252	-	-	252	-	-	-	-	-	-	1,411	-
3b.1.1.16	Misc. Structures	-	2,722	-	-	-	-	-	408	3,130	-	-	3,130	-	-	-	-	-	-	18,774	-
3b.1.1.17	Miscellaneous Site Foundations	-	194	-	-	-	-	-	29	223	-	-	223	-	-	-	-	-	-	1,011	-
3b.1.1.18	Outage Maintenance	-	140	-	-	-	-	-	21	161	-	-	161	-	-	-	-	-	-	1,570	-
3b.1.1.19	RAM Storage Building	-	59	-	-	-	-	-	9	68	-	-	68	-	-	-	-	-	-	624	-
3b.1.1.20	Radioactive and Personnel Tunnel	-	34	-	-	-	-	-	5	39	-	-	39	-	-	-	-	-	-	386	-
3b.1.1.21	Radwaste	-	1,196	-	-	-	-	-	179	1,375	-	-	1,375	-	-	-	-	-	-	8,111	-
3b.1.1.22	Radwaste Drum Storage	-	171	-	-	-	-	-	26	197	-	-	197	-	-	-	-	-	-	1,449	-
3b.1.1.23	Reactor Head Assembly Building	-	98	-	-	-	-	-	15	113	-	-	113	-	-	-	-	-	-	1,108	-
3b.1.1.24	Security Additions	-	1,655	-	-	-	-	-	248	1,903	-	-	1,903	-	-	-	-	-	-	6,051	-
3b.1.1.25	Service	-	522	-	-	-	-	-	78	600	-	-	600	-	-	-	-	-	-	3,485	-
3b.1.1.26	Sludge Pump Station & Lagoon	-	1,678	-	-	-	-	-	252	1,930	-	-	1,930	-	-	-	-	-	-	10,601	-
3b.1.1.27	Steam Generator Replacement Bldgs	-	976	-	-	-	-	-	146	1,122	-	-	1,122	-	-	-	-	-	-	6,874	-
3b.1.1.28	Turbine Building	-	4,906	-	-	-	-	-	736	5,642	-	-	5,642	-	-	-	-	-	-	47,075	-
3b.1.1.29	Turbine Pedestal	-	561	-	-	-	-	-	84	646	-	-	646	-	-	-	-	-	-	2,934	-
3b.1.1.30	U.H.S. Cooling Tower	-	343	-	-	-	-	-	51	395	-	-	395	-	-	-	-	-	-	1,814	-
3b.1.1.31	Water Treatment Plant	-	1	-	-	-	-	-	0	1	-	-	1	-	-	-	-	-	-	9	-
3b.1.1.32	Fuel Building	-	1,229	-	-	-	-	-	184	1,414	-	-	1,414	-	-	-	-	-	-	8,068	-
3b.1.1	Totals	-	26,963	-	-	-	-	-	4,044	31,007	-	-	31,007	-	-	-	-	-	-	192,587	-
Site Closeout Activities																					
3b.1.2	Remove Rubble	-	1,558	-	-	-	-	-	234	1,792	-	-	1,792	-	-	-	-	-	-	7,233	-
3b.1.3	Grade & landscape site	-	129	-	-	-	-	-	19	148	-	-	148	-	-	-	-	-	-	592	-
3b.1.4	Final report to NRC	-	-	-	-	-	-	248	37	285	285	-	-	-	-	-	-	-	-	-	1,560
3b.1	Subtotal Period 3b Activity Costs	-	28,650	-	-	-	-	248	4,335	33,232	285	-	32,947	-	-	-	-	-	-	200,413	1,560
Period 3b Additional Costs																					
3b.2.1	Concrete Crushing	-	1,546	-	-	-	-	19	235	1,800	-	-	1,800	-	-	-	-	-	-	6,035	-
3b.2.2	Mine Area Backfill	-	6,441	-	-	-	-	-	966	7,407	-	-	7,407	-	-	-	-	-	-	15,960	-
3b.2.3	Construction Debris	-	-	-	-	-	-	2,950	443	3,393	-	-	3,393	-	-	-	-	-	-	-	-
3b.2.4	Cooling Tower Discharge & Intake Pipe Flow Fill	-	5,020	-	-	-	-	-	753	5,772	-	-	5,772	-	-	-	-	-	-	9,588	-
3b.2.5	Cooling Tower Demolition	-	5,495	-	-	-	-	-	824	6,320	-	-	6,320	-	-	-	-	-	-	21,619	-
3b.2.6	Site Restoration ISFSI	-	1,416	-	-	-	-	97	227	1,740	-	-	1,740	-	-	-	-	-	-	10,514	160
3b.2	Subtotal Period 3b Additional Costs	-	19,918	-	-	-	-	3,067	3,448	26,432	-	-	26,432	-	-	-	-	-	-	63,716	160
Period 3b Collateral Costs																					
3b.3.1	Small tool allowance	-	329	-	-	-	-	-	49	379	-	-	379	-	-	-	-	-	-	-	-
3b.3	Subtotal Period 3b Collateral Costs	-	329	-	-	-	-	-	49	379	-	-	379	-	-	-	-	-	-	-	-
Period 3b Period-Dependent Costs																					
3b.4.1	Insurance	-	-	-	-	-	-	1,019	102	1,121	-	-	1,121	-	-	-	-	-	-	-	-
3b.4.2	Property taxes	-	-	-	-	-	-	180	18	198	-	-	198	-	-	-	-	-	-	-	-
3b.4.3	Heavy equipment rental	-	4,790	-	-	-	-	-	718	5,508	-	-	5,508	-	-	-	-	-	-	-	-
3b.4.4	Plant energy budget	-	-	-	-	-	-	309	46	355	-	-	355	-	-	-	-	-	-	-	-
3b.4.5	Corporate Allocations	-	-	-	-	-	-	1,504	150	1,655	-	-	1,655	-	-	-	-	-	-	-	-
3b.4.6	Security Staff Cost	-	-	-	-	-	-	3,412	512	3,924	-	-	3,924	-	-	-	-	-	-	-	37,543
3b.4.7	DOC Staff Cost	-	-	-	-	-	-	12,661	1,899	14,560	-	-	14,560	-	-	-	-	-	-	-	106,371
3b.4.8	Utility Staff Cost	-	-	-	-	-	-	5,808	871	6,679	-	-	6,679	-	-	-	-	-	-	-	61,007
3b.4	Subtotal Period 3b Period-Dependent Costs	-	4,790	-	-	-	-	24,893	4,317	34,000	-	-	34,000	-	-	-	-	-	-	-	204,920
3b.0	TOTAL PERIOD 3b COST	-	53,687	-	-	-	-	28,207	12,149	94,043	285	-	93,758	-	-	-	-	-	-	264,129	206,640
PERIOD 3 TOTALS		-	53,687	-	-	-	-	28,207	12,149	94,043	285	-	93,758	-	-	-	-	-	-	264,129	206,640
TOTAL COST TO DECOMMISSION		17,773	162,571	35,887	27,273	-	197,474	557,198	195,885	1,194,061	998,551	78,615	116,895	-	572,283	2,268	393	2,217	34,530,070	1,572,119	4,491,356

Table E
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			

TOTAL COST TO DECOMMISSION WITH 19.62% CONTINGENCY:	**$1,194,061**	**thousands of 2023 dollars**
TOTAL NRC LICENSE TERMINATION COST IS 83.63% OR:	**$998,551**	**thousands of 2023 dollars**
SPENT FUEL MANAGEMENT COST IS 6.58% OR:	**$78,615**	**thousands of 2023 dollars**
NON-NUCLEAR DEMOLITION COST IS 9.79% OR:	**$116,895**	**thousands of 2023 dollars**
TOTAL LOW-LEVEL RADIOACTIVE WASTE VOLUME BURIED (EXCLUDING GTCC):	**574,944**	**Cubic Feet**
TOTAL GREATER THAN CLASS C RADWASTE VOLUME GENERATED:	**2,217**	**Cubic Feet**
TOTAL SCRAP METAL REMOVED:	**69,040**	**Tons**
TOTAL CRAFT LABOR REQUIREMENTS:	**1,572,119**	**Man-hours**

End Notes:
n/a - indicates that this activity not charged as decommissioning expense
a - indicates that this activity performed by decommissioning staff
0 - indicates that this value is less than 0.5 but is non-zero
A cell containing " - " indicates a zero value

APPENDIX F
DETAILED COST ANALYSIS

SAFSTOR

with

DIRECT DISPOSAL OF LOW-LEVEL RADIOACTIVE WASTE

Table F
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
PERIOD 1a - Shutdown through Transition																					
Period 1a Direct Decommissioning Activities																					
1a.1.1	SAFSTOR site characterization survey	-	-	-	-	-	-	394	118	512	512	-	-	-	-	-	-	-	-	-	-
1a.1.2	Prepare preliminary decommissioning cost	-	-	-	-	-	-	206	31	237	237	-	-	-	-	-	-	-	-	-	1,300
1a.1.3	Notification of Cessation of Operations									a											
1a.1.4	Remove fuel & source material									n/a											
1a.1.5	Notification of Permanent Defueling									a											
1a.1.6	Deactivate plant systems & process waste									a											
1a.1.7	Prepare and submit PSDAR	-	-	-	-	-	-	317	48	365	365	-	-	-	-	-	-	-	-	-	2,000
1a.1.8	Review plant dwgs & specs.	-	-	-	-	-	-	206	31	237	237	-	-	-	-	-	-	-	-	-	1,300
1a.1.9	Perform detailed rad survey									a											
1a.1.10	Estimate by-product inventory	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
1a.1.11	End product description	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
1a.1.12	Detailed by-product inventory	-	-	-	-	-	-	238	36	274	274	-	-	-	-	-	-	-	-	-	1,500
1a.1.13	Define major work sequence	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
1a.1.14	Perform SER and EA	-	-	-	-	-	-	492	74	566	566	-	-	-	-	-	-	-	-	-	3,100
1a.1.15	Perform Site-Specific Cost Study	-	-	-	-	-	-	794	119	913	913	-	-	-	-	-	-	-	-	-	5,000
Activity Specifications																					
1a.1.16.1	Prepare plant and facilities for SAFSTOR	-	-	-	-	-	-	781	117	898	898	-	-	-	-	-	-	-	-	-	4,920
1a.1.16.2	Plant systems	-	-	-	-	-	-	661	99	761	761	-	-	-	-	-	-	-	-	-	4,167
1a.1.16.3	Plant structures and buildings	-	-	-	-	-	-	495	74	569	569	-	-	-	-	-	-	-	-	-	3,120
1a.1.16.4	Waste management	-	-	-	-	-	-	317	48	365	365	-	-	-	-	-	-	-	-	-	2,000
1a.1.16.5	Facility and site dormancy	-	-	-	-	-	-	317	48	365	365	-	-	-	-	-	-	-	-	-	2,000
1a.1.16	Total	-	-	-	-	-	-	2,572	386	2,958	2,958	-	-	-	-	-	-	-	-	-	16,207
Detailed Work Procedures																					
1a.1.17.1	Plant systems	-	-	-	-	-	-	188	28	216	216	-	-	-	-	-	-	-	-	-	1,183
1a.1.17.2	Facility closeout & dormancy	-	-	-	-	-	-	190	29	219	219	-	-	-	-	-	-	-	-	-	1,200
1a.1.17	Total	-	-	-	-	-	-	378	57	435	435	-	-	-	-	-	-	-	-	-	2,383
1a.1.18	Procure vacuum drying system	-	-	-	-	-	-	16	2	18	18	-	-	-	-	-	-	-	-	-	100
1a.1.19	Drain/de-energize non-cont. systems									a											
1a.1.20	Drain & dry NSSS									a											
1a.1.21	Drain/de-energize contaminated systems									a											
1a.1.22	Decon/secure contaminated systems									a											
1a.1	Subtotal Period 1a Activity Costs	-	-	-	-	-	-	6,090	973	7,063	7,063	-	-	-	-	-	-	-	-	-	35,890
Period 1a Collateral Costs																					
1a.3.1	Spent Fuel Capital and Transfer	-	-	-	-	-	-	10,080	1,512	11,592	-	11,592	-	-	-	-	-	-	-	-	-
1a.3	Subtotal Period 1a Collateral Costs	-	-	-	-	-	-	10,080	1,512	11,592	-	11,592	-	-	-	-	-	-	-	-	-
Period 1a Period-Dependent Costs																					
1a.4.1	Insurance	-	-	-	-	-	-	3,972	397	4,370	4,370	-	-	-	-	-	-	-	-	-	-
1a.4.2	Property taxes	-	-	-	-	-	-	120	12	132	132	-	-	-	-	-	-	-	-	-	-
1a.4.3	Health physics supplies	-	888	-	-	-	-	-	222	1,110	1,110	-	-	-	-	-	-	-	-	-	-
1a.4.4	Heavy equipment rental	-	657	-	-	-	-	-	99	755	755	-	-	-	-	-	-	-	-	-	-
1a.4.5	Disposal of DAW generated	-	-	12	7	-	36	-	11	67	67	-	-	-	610	-	-	-	12,190	20	-
1a.4.6	Plant energy budget	-	-	-	-	-	-	2,053	308	2,361	2,361	-	-	-	-	-	-	-	-	-	-
1a.4.7	NRC Fees	-	-	-	-	-	-	1,057	106	1,163	1,163	-	-	-	-	-	-	-	-	-	-
1a.4.8	Emergency Planning Fees	-	-	-	-	-	-	1,620	162	1,782	-	1,782	-	-	-	-	-	-	-	-	-
1a.4.9	INPO Fees	-	-	-	-	-	-	358	54	411	411	-	-	-	-	-	-	-	-	-	-
1a.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	988	148	1,136	-	1,136	-	-	-	-	-	-	-	-	-
1a.4.11	ISFSI Operating Costs	-	-	-	-	-	-	127	19	146	-	146	-	-	-	-	-	-	-	-	-
1a.4.12	Corporate Allocations	-	-	-	-	-	-	1,000	100	1,100	1,100	-	-	-	-	-	-	-	-	-	-
1a.4.13	Security Staff Cost	-	-	-	-	-	-	15,699	2,355	18,054	18,054	-	-	-	-	-	-	-	-	-	251,680
1a.4.14	Utility Staff Cost	-	-	-	-	-	-	37,678	5,652	43,329	43,329	-	-	-	-	-	-	-	-	-	422,240
1a.4	Subtotal Period 1a Period-Dependent Costs	-	1,545	12	7	-	36	64,672	9,644	75,916	72,852	3,064	-	-	610	-	-	-	12,190	20	673,920
1a.0	TOTAL PERIOD 1a COST	-	1,545	12	7	-	36	80,842	12,129	94,571	79,915	14,656	-	-	610	-	-	-	12,190	20	709,810

Table F
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
PERIOD 1b - SAFSTOR Limited DECON Activities																					
Period 1b Direct Decommissioning Activities																					
Decontamination of Site Buildings																					
1b.1.1.1	Reactor	1,604	-	-	-	-	-	-	802	2,407	2,407	-	-	-	-	-	-	-	24,102	-	
1b.1.1.2	Auxiliary	792	-	-	-	-	-	-	396	1,188	1,188	-	-	-	-	-	-	-	12,527	-	
1b.1.1.3	Communication Corridor - Contaminated	17	-	-	-	-	-	-	9	26	26	-	-	-	-	-	-	-	276	-	
1b.1.1.4	Fuel Building	1,056	-	-	-	-	-	-	528	1,584	1,584	-	-	-	-	-	-	-	14,371	-	
1b.1.1.5	Hot Machine Shop	22	-	-	-	-	-	-	11	33	33	-	-	-	-	-	-	-	344	-	
1b.1.1.6	RAM Storage Building	55	-	-	-	-	-	-	27	82	82	-	-	-	-	-	-	-	865	-	
1b.1.1.7	Radioactive and Personnel Tunnel	6	-	-	-	-	-	-	3	10	10	-	-	-	-	-	-	-	102	-	
1b.1.1.8	Radwaste	422	-	-	-	-	-	-	211	633	633	-	-	-	-	-	-	-	6,671	-	
1b.1.1.9	Radwaste Drum Storage	47	-	-	-	-	-	-	24	71	71	-	-	-	-	-	-	-	750	-	
1b.1.1.10	Reactor Head Assembly Building	44	-	-	-	-	-	-	22	66	66	-	-	-	-	-	-	-	691	-	
1b.1.1	Totals	4,067	-	-	-	-	-	-	2,033	6,100	6,100	-	-	-	-	-	-	-	60,700	-	
1b.1	Subtotal Period 1b Activity Costs	4,067	-	-	-	-	-	-	2,033	6,100	6,100	-	-	-	-	-	-	-	60,700	-	
Period 1b Additional Costs																					
1b.2.1	Spent Fuel Pool Isolation	-	-	-	-	-	-	14,330	2,150	16,480	16,480	-	-	-	-	-	-	-	-	-	
1b.2	Subtotal Period 1b Additional Costs	-	-	-	-	-	-	14,330	2,150	16,480	16,480	-	-	-	-	-	-	-	-	-	
Period 1b Collateral Costs																					
1b.3.1	Decon equipment	1,193	-	-	-	-	-	-	179	1,371	1,371	-	-	-	-	-	-	-	-	-	
1b.3.2	Process decommissioning water waste	190	-	132	333	-	552	-	296	1,504	1,504	-	-	-	1,085	-	-	-	65,127	212	
1b.3.3	Process decommissioning chemical flush waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1b.3.4	Small tool allowance	-	67	-	-	-	-	-	10	77	77	-	-	-	-	-	-	-	-	-	
1b.3.5	Spent Fuel Capital and Transfer	-	-	-	-	-	-	2,520	378	2,898	-	2,898	-	-	-	-	-	-	-	-	
1b.3	Subtotal Period 1b Collateral Costs	1,382	67	132	333	-	552	2,520	863	5,850	2,952	2,898	-	-	1,085	-	-	-	65,127	212	-
Period 1b Period-Dependent Costs																					
1b.4.1	Decon supplies	1,772	-	-	-	-	-	-	443	2,215	2,215	-	-	-	-	-	-	-	-	-	
1b.4.2	Insurance	-	-	-	-	-	-	1,001	100	1,101	1,101	-	-	-	-	-	-	-	-	-	
1b.4.3	Property taxes	-	-	-	-	-	-	30	3	33	33	-	-	-	-	-	-	-	-	-	
1b.4.4	Health physics supplies	-	725	-	-	-	-	-	181	906	906	-	-	-	-	-	-	-	-	-	
1b.4.5	Heavy equipment rental	-	166	-	-	-	-	-	25	190	190	-	-	-	-	-	-	-	-	-	
1b.4.6	Disposal of DAW generated	-	-	15	9	-	45	-	14	82	82	-	-	-	752	-	-	-	15,043	25	
1b.4.7	Plant energy budget	-	-	-	-	-	-	517	78	595	595	-	-	-	-	-	-	-	-	-	
1b.4.8	NRC Fees	-	-	-	-	-	-	200	20	220	220	-	-	-	-	-	-	-	-	-	
1b.4.9	Emergency Planning Fees	-	-	-	-	-	-	408	41	449	-	449	-	-	-	-	-	-	-	-	
1b.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	249	37	286	-	286	-	-	-	-	-	-	-	-	
1b.4.11	ISFSI Operating Costs	-	-	-	-	-	-	32	5	37	-	37	-	-	-	-	-	-	-	-	
1b.4.12	Corporate Allocations	-	-	-	-	-	-	252	25	277	277	-	-	-	-	-	-	-	-	-	
1b.4.13	Security Staff Cost	-	-	-	-	-	-	3,957	594	4,551	4,551	-	-	-	-	-	-	-	-	-	63,437
1b.4.14	Utility Staff Cost	-	-	-	-	-	-	9,497	1,425	10,921	10,921	-	-	-	-	-	-	-	-	-	106,428
1b.4	Subtotal Period 1b Period-Dependent Costs	1,772	890	15	9	-	45	16,144	2,990	21,866	21,093	772	-	-	752	-	-	-	15,043	25	169,865
1b.0	TOTAL PERIOD 1b COST	7,221	958	148	342	-	597	32,995	8,036	50,296	46,625	3,670	-	-	1,838	-	-	-	80,170	60,936	169,865
PERIOD 1c - Preparations for SAFSTOR Dormancy																					
Period 1c Direct Decommissioning Activities																					
1c.1.1	Prepare support equipment for storage	-	588	-	-	-	-	-	88	676	676	-	-	-	-	-	-	-	-	3,000	-
1c.1.2	Install containment pressure equal. lines	-	56	-	-	-	-	-	8	64	64	-	-	-	-	-	-	-	-	700	-
1c.1.3	Interim survey prior to dormancy	-	-	-	-	-	-	733	220	953	953	-	-	-	-	-	-	-	-	13,566	-
1c.1.4	Secure building accesses									a											
1c.1.5	Prepare & submit interim report	-	-	-	-	-	-	93	14	106	106	-	-	-	-	-	-	-	-	-	583
1c.1	Subtotal Period 1c Activity Costs	-	644	-	-	-	-	825	330	1,800	1,800	-	-	-	-	-	-	-	-	17,266	583
Period 1c Collateral Costs																					
1c.3.1	Process decommissioning water waste	206	-	144	363	-	602	-	322	1,637	1,637	-	-	-	1,183	-	-	-	70,953	231	-
1c.3.2	Process decommissioning chemical flush waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1c.3.3	Small tool allowance	-	5	-	-	-	-	-	1	6	6	-	-	-	-	-	-	-	-	-	-
1c.3.4	Spent Fuel Capital and Transfer	-	-	-	-	-	-	2,520	378	2,898	-	2,898	-	-	-	-	-	-	-	-	-

Table F
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
1c.3	Subtotal Period 1c Collateral Costs	206	5	144	363	-	602	2,520	701	4,541	1,643	2,898	-	-	1,183	-	-	-	70,953	231	-
Period 1c Period-Dependent Costs																					
1c.4.1	Insurance	-	-	-	-	-	-	1,001	100	1,101	1,101	-	-	-	-	-	-	-	-	-	-
1c.4.2	Property taxes	-	-	-	-	-	-	30	3	33	33	-	-	-	-	-	-	-	-	-	-
1c.4.3	Health physics supplies	-	368	-	-	-	-	-	92	460	460	-	-	-	-	-	-	-	-	-	-
1c.4.4	Heavy equipment rental	-	166	-	-	-	-	-	25	190	190	-	-	-	-	-	-	-	-	-	-
1c.4.5	Disposal of DAW generated	-	-	3	2	-	9	-	3	17	17	-	-	-	154	-	-	-	3,073	5	-
1c.4.6	Plant energy budget	-	-	-	-	-	-	517	78	595	595	-	-	-	-	-	-	-	-	-	-
1c.4.7	NRC Fees	-	-	-	-	-	-	200	20	220	220	-	-	-	-	-	-	-	-	-	-
1c.4.8	Emergency Planning Fees	-	-	-	-	-	-	408	41	449	-	449	-	-	-	-	-	-	-	-	-
1c.4.9	Spent Fuel Pool O&M	-	-	-	-	-	-	249	37	286	-	286	-	-	-	-	-	-	-	-	-
1c.4.10	ISFSI Operating Costs	-	-	-	-	-	-	32	5	37	-	37	-	-	-	-	-	-	-	-	-
1c.4.11	Corporate Allocations	-	-	-	-	-	-	252	25	277	277	-	-	-	-	-	-	-	-	-	-
1c.4.12	Security Staff Cost	-	-	-	-	-	-	3,957	594	4,551	4,551	-	-	-	-	-	-	-	-	-	63,437
1c.4.13	Utility Staff Cost	-	-	-	-	-	-	9,497	1,425	10,921	10,921	-	-	-	-	-	-	-	-	-	106,428
1c.4	Subtotal Period 1c Period-Dependent Costs	-	533	3	2	-	9	16,144	2,447	19,138	18,366	772	-	-	154	-	-	-	3,073	5	169,865
1c.0	TOTAL PERIOD 1c COST	206	1,183	147	364	-	611	19,490	3,478	25,480	21,809	3,670	-	-	1,336	-	-	-	74,026	17,502	170,448
PERIOD 1 TOTALS		7,428	3,685	307	713	-	1,244	133,327	23,643	170,346	148,349	21,997	-	-	3,783	-	-	-	166,386	78,458	1,050,123
PERIOD 2a - SAFSTOR Dormancy with Wet Spent Fuel Storage																					
Period 2a Direct Decommissioning Activities																					
2a.1.1	Quarterly Inspection									a											
2a.1.2	Semi-annual environmental survey									a											
2a.1.3	Prepare reports									a											
2a.1.4	Bituminous roof replacement	-	-	-	-	-	-	326	49	374	374	-	-	-	-	-	-	-	-	-	-
2a.1.5	Maintenance supplies	-	-	-	-	-	-	615	154	769	769	-	-	-	-	-	-	-	-	-	-
2a.1	Subtotal Period 2a Activity Costs	-	-	-	-	-	-	941	203	1,143	1,143	-	-	-	-	-	-	-	-	-	-
Period 2a Collateral Costs																					
2a.3.1	Spent Fuel Capital and Transfer	-	-	-	-	-	-	40,950	6,143	47,093	-	47,093	-	-	-	-	-	-	-	-	-
2a.3	Subtotal Period 2a Collateral Costs	-	-	-	-	-	-	40,950	6,143	47,093	-	47,093	-	-	-	-	-	-	-	-	-
Period 2a Period-Dependent Costs																					
2a.4.1	Insurance	-	-	-	-	-	-	2,708	271	2,979	2,979	-	-	-	-	-	-	-	-	-	-
2a.4.2	Property taxes	-	-	-	-	-	-	479	48	527	527	-	-	-	-	-	-	-	-	-	-
2a.4.3	Health physics supplies	-	1,423	-	-	-	-	-	356	1,779	1,779	-	-	-	-	-	-	-	-	-	-
2a.4.4	Disposal of DAW generated	-	-	19	11	-	54	-	17	101	101	-	-	-	920	-	-	-	18,394	30	-
2a.4.5	Plant energy budget	-	-	-	-	-	-	1,641	246	1,887	944	944	-	-	-	-	-	-	-	-	-
2a.4.6	NRC Fees	-	-	-	-	-	-	1,304	130	1,434	1,434	-	-	-	-	-	-	-	-	-	-
2a.4.7	Emergency Planning Fees	-	-	-	-	-	-	4,001	400	4,401	-	4,401	-	-	-	-	-	-	-	-	-
2a.4.8	Spent Fuel Pool O&M	-	-	-	-	-	-	3,950	593	4,543	-	4,543	-	-	-	-	-	-	-	-	-
2a.4.9	ISFSI Operating Costs	-	-	-	-	-	-	506	76	582	-	582	-	-	-	-	-	-	-	-	-
2a.4.10	Corporate Allocations	-	-	-	-	-	-	3,997	400	4,397	4,397	-	-	-	-	-	-	-	-	-	-
2a.4.11	Security Staff Cost	-	-	-	-	-	-	56,070	8,410	64,480	54,035	10,446	-	-	-	-	-	-	-	-	897,945
2a.4.12	Utility Staff Cost	-	-	-	-	-	-	31,218	4,683	35,900	29,582	6,318	-	-	-	-	-	-	-	-	328,415
2a.4	Subtotal Period 2a Period-Dependent Costs	-	1,423	19	11	-	54	105,874	15,630	123,011	95,778	27,233	-	-	920	-	-	-	18,394	30	1,226,360
2a.0	TOTAL PERIOD 2a COST	-	1,423	19	11	-	54	147,765	21,975	171,247	96,921	74,326	-	-	920	-	-	-	18,394	30	1,226,360
PERIOD 2c - SAFSTOR Dormancy without Spent Fuel Storage																					
Period 2c Direct Decommissioning Activities																					
2c.1.1	Quarterly Inspection									a											
2c.1.2	Semi-annual environmental survey									a											
2c.1.3	Prepare reports									a											
2c.1.4	Bituminous roof replacement	-	-	-	-	-	-	3,955	593	4,548	4,548	-	-	-	-	-	-	-	-	-	-
2c.1.5	Maintenance supplies	-	-	-	-	-	-	7,471	1,868	9,338	9,338	-	-	-	-	-	-	-	-	-	-
2c.1	Subtotal Period 2c Activity Costs	-	-	-	-	-	-	11,425	2,461	13,886	13,886	-	-	-	-	-	-	-	-	-	-
Period 2c Period-Dependent Costs																					
2c.4.1	Insurance	-	-	-	-	-	-	20,383	2,038	22,422	22,422	-	-	-	-	-	-	-	-	-	-
2c.4.2	Property taxes	-	-	-	-	-	-	5,822	582	6,405	6,405	-	-	-	-	-	-	-	-	-	-
2c.4.3	Health physics supplies	-	7,889	-	-	-	-	-	1,972	9,862	9,862	-	-	-	-	-	-	-	-	-	-

Table F
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Period 2c Period-Dependent Costs (continued)																					
2c.4.4	Disposal of DAW generated	-	-	101	57	-	293	-	92	541	541	-	-	-	4,942	-	-	-	98,844	161	-
2c.4.5	Plant energy budget	-	-	-	-	-	-	9,968	1,495	11,463	11,463	-	-	-	-	-	-	-	-	-	-
2c.4.6	NRC Fees	-	-	-	-	-	-	14,105	1,410	15,515	15,515	-	-	-	-	-	-	-	-	-	-
2c.4.7	Security Staff Cost	-	-	-	-	-	-	134,884	20,233	155,117	155,117	-	-	-	-	-	-	-	-	-	1,514,867
2c.4.8	Utility Staff Cost	-	-	-	-	-	-	79,438	11,916	91,353	91,353	-	-	-	-	-	-	-	-	-	883,672
2c.4	Subtotal Period 2c Period-Dependent Costs	-	7,889	101	57	-	293	264,601	39,739	312,679	312,679	-	-	-	4,942	-	-	-	98,844	161	2,398,539
2c.0	TOTAL PERIOD 2c COST	-	7,889	101	57	-	293	276,026	42,199	326,565	326,565	-	-	-	4,942	-	-	-	98,844	161	2,398,539
PERIOD 2 TOTALS		-	9,313	119	67	-	347	423,791	64,174	497,811	423,486	74,326	-	-	5,862	-	-	-	117,238	191	3,624,899
PERIOD 3a - Reactivate Site Following SAFSTOR Dormancy																					
Period 3a Direct Decommissioning Activities																					
3a.1.1	Prepare preliminary decommissioning cost	-	-	-	-	-	-	206	31	237	237	-	-	-	-	-	-	-	-	-	1,300
3a.1.2	Review plant dwgs & specs.	-	-	-	-	-	-	730	110	840	840	-	-	-	-	-	-	-	-	-	4,600
3a.1.3	Perform detailed rad survey									a											
3a.1.4	End product description	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
3a.1.5	Detailed by-product inventory	-	-	-	-	-	-	206	31	237	237	-	-	-	-	-	-	-	-	-	1,300
3a.1.6	Define major work sequence	-	-	-	-	-	-	1,190	179	1,369	1,369	-	-	-	-	-	-	-	-	-	7,500
3a.1.7	Perform SER and EA	-	-	-	-	-	-	492	74	566	566	-	-	-	-	-	-	-	-	-	3,100
3a.1.8	Prepare/submit Defueled Technical Specifications	-	-	-	-	-	-	1,190	179	1,369	1,369	-	-	-	-	-	-	-	-	-	7,500
3a.1.9	Perform Site-Specific Cost Study	-	-	-	-	-	-	794	119	913	913	-	-	-	-	-	-	-	-	-	5,000
3a.1.10	Prepare/submit Irradiated Fuel Management Plan	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
Activity Specifications																					
3a.1.11.1	Re-activate plant & temporary facilities	-	-	-	-	-	-	1,170	175	1,345	1,211	-	135	-	-	-	-	-	-	-	7,370
3a.1.11.2	Plant systems	-	-	-	-	-	-	661	99	761	684	-	76	-	-	-	-	-	-	-	4,167
3a.1.11.3	Reactor internals	-	-	-	-	-	-	1,127	169	1,296	1,296	-	-	-	-	-	-	-	-	-	7,100
3a.1.11.4	Reactor vessel	-	-	-	-	-	-	1,032	155	1,186	1,186	-	-	-	-	-	-	-	-	-	6,500
3a.1.11.5	Biological shield	-	-	-	-	-	-	79	12	91	91	-	-	-	-	-	-	-	-	-	500
3a.1.11.6	Steam generators	-	-	-	-	-	-	495	74	569	569	-	-	-	-	-	-	-	-	-	3,120
3a.1.11.7	Reinforced concrete	-	-	-	-	-	-	254	38	292	146	-	146	-	-	-	-	-	-	-	1,600
3a.1.11.8	Main Turbine	-	-	-	-	-	-	63	10	73	-	-	73	-	-	-	-	-	-	-	400
3a.1.11.9	Main Condensers	-	-	-	-	-	-	63	10	73	-	-	73	-	-	-	-	-	-	-	400
3a.1.11.10	Plant structures & buildings	-	-	-	-	-	-	495	74	569	285	-	285	-	-	-	-	-	-	-	3,120
3a.1.11.11	Waste management	-	-	-	-	-	-	730	110	840	840	-	-	-	-	-	-	-	-	-	4,600
3a.1.11.12	Facility & site closeout	-	-	-	-	-	-	143	21	164	82	-	82	-	-	-	-	-	-	-	900
3a.1.11	Total	-	-	-	-	-	-	6,313	947	7,260	6,391	-	870	-	-	-	-	-	-	-	39,777
Planning & Site Preparations																					
3a.1.12	Prepare dismantling sequence	-	-	-	-	-	-	381	57	438	438	-	-	-	-	-	-	-	-	-	2,400
3a.1.13	Plant prep. & temp. svces	-	-	-	-	-	-	4,000	600	4,600	4,600	-	-	-	-	-	-	-	-	-	-
3a.1.14	Design water clean-up system	-	-	-	-	-	-	222	33	256	256	-	-	-	-	-	-	-	-	-	1,400
3a.1.15	Rigging/Cont. Cntrl Envlps/tooling/etc.	-	-	-	-	-	-	2,800	420	3,220	3,220	-	-	-	-	-	-	-	-	-	-
3a.1.16	Procure casks/liners & containers	-	-	-	-	-	-	195	29	225	225	-	-	-	-	-	-	-	-	-	1,230
3a.1	Subtotal Period 3a Activity Costs	-	-	-	-	-	-	19,038	2,856	21,894	21,025	-	870	-	-	-	-	-	-	-	77,107
Period 3a Additional Costs																					
3a.2.1	Site Characterization	-	-	-	-	-	-	3,198	959	4,158	4,158	-	-	-	-	-	-	-	-	19,100	7,852
3a.2	Subtotal Period 3a Additional Costs	-	-	-	-	-	-	3,198	959	4,158	4,158	-	-	-	-	-	-	-	-	19,100	7,852
Period 3a Period-Dependent Costs																					
3a.4.1	Insurance	-	-	-	-	-	-	420	42	462	462	-	-	-	-	-	-	-	-	-	-
3a.4.2	Property taxes	-	-	-	-	-	-	120	12	132	132	-	-	-	-	-	-	-	-	-	-
3a.4.3	Health physics supplies	-	776	-	-	-	-	-	194	970	970	-	-	-	-	-	-	-	-	-	-
3a.4.4	Heavy equipment rental	-	657	-	-	-	-	-	99	755	755	-	-	-	-	-	-	-	-	-	-
3a.4.5	Disposal of DAW generated	-	-	10	6	-	30	-	10	56	56	-	-	-	514	-	-	-	10,287	17	-
3a.4.6	Plant energy budget	-	-	-	-	-	-	2,053	308	2,361	2,361	-	-	-	-	-	-	-	-	-	-
3a.4.7	NRC Fees	-	-	-	-	-	-	458	46	504	504	-	-	-	-	-	-	-	-	-	-
3a.4.8	Corporate Allocations	-	-	-	-	-	-	1,000	100	1,100	1,100	-	-	-	-	-	-	-	-	-	-
3a.4.9	Security Staff Cost	-	-	-	-	-	-	4,449	667	5,117	5,117	-	-	-	-	-	-	-	-	-	65,000
3a.4.10	Utility Staff Cost	-	-	-	-	-	-	23,216	3,482	26,699	26,699	-	-	-	-	-	-	-	-	-	257,920
3a.4	Subtotal Period 3a Period-Dependent Costs	-	1,433	10	6	-	30	31,716	4,960	38,156	38,156	-	-	-	514	-	-	-	10,287	17	322,920
3a.0	TOTAL PERIOD 3a COST	-	1,433	10	6	-	30	53,953	8,775	64,207	63,338	-	870	-	514	-	-	-	10,287	19,117	407,879

Table F
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
PERIOD 3b - Decommissioning Preparations																					
Period 3b Direct Decommissioning Activities																					
Detailed Work Procedures																					
3b.1.1.1	Plant systems	-	-	-	-	-	-	751	113	864	778	-	86	-	-	-	-	-	-	-	4,733
3b.1.1.2	Reactor internals	-	-	-	-	-	-	397	60	456	456	-	-	-	-	-	-	-	-	-	2,500
3b.1.1.3	Remaining buildings	-	-	-	-	-	-	214	32	246	62	-	185	-	-	-	-	-	-	-	1,350
3b.1.1.4	CRD cooling assembly	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
3b.1.1.5	CRD housings & ICI tubes	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
3b.1.1.6	Incore instrumentation	-	-	-	-	-	-	159	24	183	183	-	-	-	-	-	-	-	-	-	1,000
3b.1.1.7	Reactor vessel	-	-	-	-	-	-	576	86	663	663	-	-	-	-	-	-	-	-	-	3,630
3b.1.1.8	Facility closeout	-	-	-	-	-	-	190	29	219	110	-	110	-	-	-	-	-	-	-	1,200
3b.1.1.9	Missile shields	-	-	-	-	-	-	71	11	82	82	-	-	-	-	-	-	-	-	-	450
3b.1.1.10	Biological shield	-	-	-	-	-	-	190	29	219	219	-	-	-	-	-	-	-	-	-	1,200
3b.1.1.11	Steam generators	-	-	-	-	-	-	730	110	840	840	-	-	-	-	-	-	-	-	-	4,600
3b.1.1.12	Reinforced concrete	-	-	-	-	-	-	159	24	183	91	-	91	-	-	-	-	-	-	-	1,000
3b.1.1.13	Main Turbine	-	-	-	-	-	-	248	37	285	-	-	285	-	-	-	-	-	-	-	1,560
3b.1.1.14	Main Condensers	-	-	-	-	-	-	248	37	285	-	-	285	-	-	-	-	-	-	-	1,560
3b.1.1.15	Auxiliary building	-	-	-	-	-	-	433	65	498	448	-	50	-	-	-	-	-	-	-	2,730
3b.1.1.16	Reactor building	-	-	-	-	-	-	433	65	498	448	-	50	-	-	-	-	-	-	-	2,730
3b.1.1	Total	-	-	-	-	-	-	5,118	768	5,885	4,744	-	1,141	-	-	-	-	-	-	-	32,243
3b.1	Subtotal Period 3b Activity Costs	-	-	-	-	-	-	5,118	768	5,885	4,744	-	1,141	-	-	-	-	-	-	-	32,243
Period 3b Collateral Costs																					
3b.3.1	Decon equipment	1,193	-	-	-	-	-	-	179	1,371	1,371	-	-	-	-	-	-	-	-	-	-
3b.3.2	DOC staff relocation expenses	-	-	-	-	-	-	1,641	246	1,887	1,887	-	-	-	-	-	-	-	-	-	-
3b.3.3	Pipe cutting equipment	-	1,400	-	-	-	-	-	210	1,610	1,610	-	-	-	-	-	-	-	-	-	-
3b.3	Subtotal Period 3b Collateral Costs	1,193	1,400	-	-	-	-	1,641	635	4,868	4,868	-	-	-	-	-	-	-	-	-	-
Period 3b Period-Dependent Costs																					
3b.4.1	Decon supplies	43	-	-	-	-	-	-	11	54	54	-	-	-	-	-	-	-	-	-	-
3b.4.2	Insurance	-	-	-	-	-	-	342	34	376	376	-	-	-	-	-	-	-	-	-	-
3b.4.3	Property taxes	-	-	-	-	-	-	60	6	66	66	-	-	-	-	-	-	-	-	-	-
3b.4.4	Health physics supplies	-	431	-	-	-	-	-	108	539	539	-	-	-	-	-	-	-	-	-	-
3b.4.5	Heavy equipment rental	-	331	-	-	-	-	-	50	381	381	-	-	-	-	-	-	-	-	-	-
3b.4.6	Disposal of DAW generated	-	-	6	3	-	17	-	5	32	32	-	-	-	293	-	-	-	5,866	10	-
3b.4.7	Plant energy budget	-	-	-	-	-	-	1,035	155	1,190	1,190	-	-	-	-	-	-	-	-	-	-
3b.4.8	NRC Fees	-	-	-	-	-	-	231	23	254	254	-	-	-	-	-	-	-	-	-	-
3b.4.9	Corporate Allocations	-	-	-	-	-	-	504	50	555	555	-	-	-	-	-	-	-	-	-	-
3b.4.10	Security Staff Cost	-	-	-	-	-	-	2,243	336	2,579	2,579	-	-	-	-	-	-	-	-	-	32,767
3b.4.11	DOC Staff Cost	-	-	-	-	-	-	6,642	996	7,639	7,639	-	-	-	-	-	-	-	-	-	58,719
3b.4.12	Utility Staff Cost	-	-	-	-	-	-	11,704	1,756	13,459	13,459	-	-	-	-	-	-	-	-	-	130,020
3b.4	Subtotal Period 3b Period-Dependent Costs	43	762	6	3	-	17	22,761	3,531	27,124	27,124	-	-	-	293	-	-	-	5,866	10	221,506
3b.0	TOTAL PERIOD 3b COST	1,235	2,162	6	3	-	17	29,519	4,934	37,877	36,736	-	1,141	-	293	-	-	-	5,866	10	253,749
PERIOD 3 TOTALS		1,235	3,595	16	9	-	48	83,472	13,708	102,084	100,074	-	2,011	-	808	-	-	-	16,153	19,126	661,628
PERIOD 4a - Large Component Removal																					
Period 4a Direct Decommissioning Activities																					
Nuclear Steam Supply System Removal																					
4a.1.1.1	Reactor Coolant Piping	46	222	39	101	-	768	-	289	1,464	1,464	-	-	-	2,046	-	-	-	142,726	3,982	-
4a.1.1.2	Pressurizer Relief Tank	8	31	11	28	-	217	-	71	366	366	-	-	-	578	-	-	-	40,338	603	-
4a.1.1.3	Reactor Coolant Pumps & Motors	26	111	95	249	-	1,483	-	458	2,423	2,423	-	-	-	3,386	-	-	-	816,140	2,474	80
4a.1.1.4	Pressurizer	-	80	548	193	-	1,638	-	513	2,973	2,973	-	-	-	3,739	-	-	-	241,053	1,346	1,500
4a.1.1.5	Steam Generators	-	8,305	3,254	3,319	-	16,197	-	6,949	38,024	38,024	-	-	-	62,808	-	-	-	3,349,305	20,559	2,250
4a.1.1.6	Retired Steam Generator Units	-	-	3,254	3,319	-	16,000	-	4,823	27,395	27,395	-	-	-	62,808	-	-	-	3,349,305	10,852	2,250
4a.1.1.7	CRDMs/ICIs/Service Structure Removal	39	311	230	107	-	783	-	332	1,801	1,801	-	-	-	3,881	-	-	-	145,494	5,232	-
4a.1.1.8	Reactor Vessel Internals	48	5,349	11,276	1,031	-	11,929	306	13,123	43,063	43,063	-	-	-	5,623	501	406	-	342,863	24,523	1,139
4a.1.1.9	Vessel & Internals GTCC Disposal	-	-	-	-	-	13,035	-	1,955	14,990	14,990	-	-	-	-	-	-	2,217	433,180	-	-
4a.1.1.10	Reactor Vessel	-	7,025	2,076	1,382	-	6,848	306	9,603	27,239	27,239	-	-	-	15,631	-	-	-	979,036	24,523	1,139
4a.1.1	Totals	166	21,433	20,784	9,730	-	68,898	612	38,117	159,740	159,740	-	-	-	160,499	501	406	2,217	9,839,439	94,094	8,359

Table F
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Removal of Major Equipment																					
4a.1.2	Main Turbine/Generator	-	606	2,848	491	-	17,692	-	4,933	26,570	26,570	-	-	-	54,809	-	-	-	3,481,857	8,721	-
4a.1.3	Main Condensers	-	1,723	1,386	2,399	-	21,985	-	6,425	33,917	33,917	-	-	-	64,324	-	-	-	4,086,353	24,802	-
Cascading Costs from Clean Building Demolition																					
4a.1.4.1	Reactor	-	612	-	-	-	-	-	92	704	704	-	-	-	-	-	-	-	-	4,832	-
4a.1.4.2	Auxiliary	-	318	-	-	-	-	-	48	366	366	-	-	-	-	-	-	-	-	2,113	-
4a.1.4.3	Fuel Building	-	127	-	-	-	-	-	19	146	146	-	-	-	-	-	-	-	-	773	-
4a.1.4.4	Hot Machine Shop	-	1	-	-	-	-	-	0	1	1	-	-	-	-	-	-	-	-	7	-
4a.1.4.5	Radwaste	-	61	-	-	-	-	-	9	70	70	-	-	-	-	-	-	-	-	387	-
4a.1.4	Totals	-	1,119	-	-	-	-	-	168	1,287	1,287	-	-	-	-	-	-	-	-	8,113	-
Disposal of Plant Systems																					
4a.1.5.1	100 Aux.Bldg Non-System Specific RCA	-	920	108	204	-	1,867	-	738	3,838	3,838	-	-	-	5,463	-	-	-	347,071	13,677	-
4a.1.5.2	100 Auxiliary Bldg Non-System Specific	-	136	12	23	-	212	-	92	475	475	-	-	-	621	-	-	-	39,480	2,047	-
4a.1.5.3	AB - Main Steam	-	366	-	-	-	-	-	55	420	-	-	420	-	-	-	-	-	-	5,833	-
4a.1.5.4	AB - Main Steam RCA	-	103	33	58	-	531	-	171	896	896	-	-	-	1,547	-	-	-	98,672	1,580	-
4a.1.5.5	AC - Main Turbine	-	361	-	-	-	-	-	54	415	-	-	415	-	-	-	-	-	-	5,641	-
4a.1.5.6	AD - Condensate	-	401	-	-	-	-	-	60	461	-	-	461	-	-	-	-	-	-	6,144	-
4a.1.5.7	AE - Feedwater	-	275	-	-	-	-	-	41	316	-	-	316	-	-	-	-	-	-	4,271	-
4a.1.5.8	AF - Feedwater Heater Extraction	-	337	-	-	-	-	-	51	388	-	-	388	-	-	-	-	-	-	5,352	-
4a.1.5.9	AK - Condensate Demineralizer	-	125	-	-	-	-	-	19	143	-	-	143	-	-	-	-	-	-	1,944	-
4a.1.5.10	AL - Auxiliary Feedwater	-	54	-	-	-	-	-	8	63	-	-	63	-	-	-	-	-	-	852	-
4a.1.5.11	AQ - Condensate & Feedwater Chem Addtn	-	30	-	-	-	-	-	5	35	-	-	35	-	-	-	-	-	-	468	-
4a.1.5.12	BM - Steam Generator Blowdown	-	143	19	31	-	287	-	114	594	594	-	-	-	832	-	-	-	53,260	2,164	-
4a.1.5.13	BM - Steam Generator Blowdown - RCA	-	491	75	112	-	1,024	-	403	2,105	2,105	-	-	-	2,963	-	-	-	190,396	7,221	-
4a.1.5.14	BN - Borated Refueling Water Storage	-	409	95	167	-	1,535	-	520	2,726	2,726	-	-	-	4,482	-	-	-	285,246	6,282	-
4a.1.5.15	CA - Steam Seal	-	29	-	-	-	-	-	4	33	-	-	33	-	-	-	-	-	-	455	-
4a.1.5.16	CB - Main Turbine Lube Oil	-	82	-	-	-	-	-	12	95	-	-	95	-	-	-	-	-	-	1,207	-
4a.1.5.17	CC - Generator Hydrogen Seal & CO2	-	13	-	-	-	-	-	2	15	-	-	15	-	-	-	-	-	-	198	-
4a.1.5.18	CD - Generator Seal Oil	-	19	-	-	-	-	-	3	22	-	-	22	-	-	-	-	-	-	287	-
4a.1.5.19	CE - Stator Cooling Water	-	16	-	-	-	-	-	2	19	-	-	19	-	-	-	-	-	-	241	-
4a.1.5.20	CF - Lube Oil Storage Xfer & Prfication	-	53	-	-	-	-	-	8	61	-	-	61	-	-	-	-	-	-	812	-
4a.1.5.21	CG - Condenser Air Removal	-	43	-	-	-	-	-	6	49	-	-	49	-	-	-	-	-	-	657	-
4a.1.5.22	CH - Main Turbine Control Oil	-	85	-	-	-	-	-	13	97	-	-	97	-	-	-	-	-	-	1,219	-
4a.1.5.23	DA - Circulating Water	-	473	-	-	-	-	-	71	544	-	-	544	-	-	-	-	-	-	7,502	-
4a.1.5.24	DB - Cooling Tower Makeup & Blowdown	-	80	-	-	-	-	-	12	92	-	-	92	-	-	-	-	-	-	1,260	-
4a.1.5.25	DD - Cooling Water Chemical Control Sys	-	71	-	-	-	-	-	11	81	-	-	81	-	-	-	-	-	-	1,084	-
4a.1.5.26	DD - Cooling Wtr Chem Control RCA	-	361	69	97	-	891	-	335	1,753	1,753	-	-	-	2,569	-	-	-	165,613	5,095	-
4a.1.5.27	EJ - Residual Heat Removal	-	473	95	164	-	1,506	-	529	2,767	2,767	-	-	-	4,385	-	-	-	280,003	7,249	-
4a.1.5.28	EM - High Pressure Coolant Injection	-	398	41	60	-	554	-	251	1,305	1,305	-	-	-	1,599	-	-	-	103,047	5,976	-
4a.1.5.29	EN - Containment Spray	-	288	53	82	-	752	-	277	1,452	1,452	-	-	-	2,179	-	-	-	139,742	4,242	-
4a.1.5.30	EP - Accumulator Safety Injection	-	210	35	54	-	495	-	188	982	982	-	-	-	1,433	-	-	-	91,944	3,163	-
4a.1.5.31	FA - Auxiliary Steam Generator	-	32	-	-	-	-	-	5	37	-	-	37	-	-	-	-	-	-	521	-
4a.1.5.32	FB - Auxiliary Steam	-	133	-	-	-	-	-	20	152	-	-	152	-	-	-	-	-	-	2,106	-
4a.1.5.33	FB - Auxiliary Steam RCA	-	109	15	22	-	204	-	83	433	433	-	-	-	589	-	-	-	37,925	1,569	-
4a.1.5.34	FC - Auxiliary Turbines	-	87	-	-	-	-	-	13	100	-	-	100	-	-	-	-	-	-	1,320	-
4a.1.5.35	FE - Auxiliary Steam Chemical Addition	-	7	-	-	-	-	-	1	8	-	-	8	-	-	-	-	-	-	105	-
4a.1.5.36	GE - Turbine Building HVAC	-	240	-	-	-	-	-	36	276	-	-	276	-	-	-	-	-	-	3,957	-
4a.1.5.37	GS - Containment Hydrogen Control	-	91	13	22	-	199	-	77	402	402	-	-	-	577	-	-	-	36,925	1,415	-
4a.1.5.38	HE - Boron Recycle	-	607	77	123	-	1,129	-	460	2,397	2,397	-	-	-	3,280	-	-	-	209,922	9,046	-
4a.1.5.39	HF - Secondary Liquid Waste	-	1,194	175	287	-	2,629	-	1,016	5,300	5,300	-	-	-	7,644	-	-	-	488,595	18,015	-
4a.1.5.40	JA - Auxiliary Oil & Transfer	-	43	-	-	-	-	-	7	50	-	-	50	-	-	-	-	-	-	690	-
4a.1.5.41	KS - Bulk Chemical Storage	-	122	94	172	-	1,580	-	461	2,429	2,429	-	-	-	4,620	-	-	-	293,686	2,002	-
4a.1.5.42	LE - Oily Waste	-	246	-	-	-	-	-	37	282	-	-	282	-	-	-	-	-	-	3,865	-
4a.1.5.43	LE - Oily Waste RCA	-	313	38	61	-	559	-	231	1,201	1,201	-	-	-	1,623	-	-	-	103,828	4,372	-
4a.1.5.44	Turbine Bldg Non-System Specific	-	1,031	-	-	-	-	-	155	1,185	-	-	1,185	-	-	-	-	-	-	15,405	-
4a.1.5	Totals	-	11,097	1,049	1,741	-	15,954	-	6,656	36,496	31,056	-	5,440	-	46,409	-	-	-	2,965,355	168,513	-
4a.1.6	Scaffolding in support of decommissioning	-	1,897	23	41	-	372	-	576	2,908	2,908	-	-	-	1,087	-	-	-	69,064	33,634	-
4a.1	Subtotal Period 4a Activity Costs	166	37,875	26,090	14,401	-	124,900	612	56,875	260,919	255,479	-	5,440	-	327,128	501	406	2,217	20,442,070	337,876	8,359
Period 4a Additional Costs																					
4a.2.1	Remedial Action Surveys	-	-	-	-	-	-	1,465	440	1,905	1,905	-	-	-	-	-	-	-	-	28,815	-
4a.2	Subtotal Period 4a Additional Costs	-	-	-	-	-	-	1,465	440	1,905	1,905	-	-	-	-	-	-	-	-	28,815	-

Table F
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Period 4a Collateral Costs																					
4a.3.1	Process decommissioning water waste	5	-	9	23	-	39	-	17	93	93	-	-	-	76	-	-	-	4,564	15	-
4a.3.2	Process decommissioning chemical flush waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4a.3.3	Small tool allowance	-	375	-	-	-	-	-	56	431	388	-	43	-	-	-	-	-	-	-	-
4a.3	Subtotal Period 4a Collateral Costs	5	375	9	23	-	39	-	73	524	481	-	43	-	76	-	-	-	4,564	15	-
Period 4a Period-Dependent Costs																					
4a.4.1	Decon supplies	118	-	-	-	-	-	-	30	148	148	-	-	-	-	-	-	-	-	-	-
4a.4.2	Insurance	-	-	-	-	-	-	939	94	1,033	1,033	-	-	-	-	-	-	-	-	-	-
4a.4.3	Property taxes	-	-	-	-	-	-	166	17	183	183	-	-	-	-	-	-	-	-	-	-
4a.4.4	Health physics supplies	-	4,229	-	-	-	-	-	1,057	5,286	5,286	-	-	-	-	-	-	-	-	-	-
4a.4.5	Heavy equipment rental	-	3,081	-	-	-	-	-	462	3,543	3,543	-	-	-	-	-	-	-	-	-	-
4a.4.6	Disposal of DAW generated	-	-	106	60	-	310	-	97	573	573	-	-	-	5,233	-	-	-	104,652	171	-
4a.4.7	Plant energy budget	-	-	-	-	-	-	2,704	406	3,109	3,109	-	-	-	-	-	-	-	-	-	-
4a.4.8	NRC Fees	-	-	-	-	-	-	818	82	900	900	-	-	-	-	-	-	-	-	-	-
4a.4.9	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	691	104	795	795	-	-	-	-	-	-	-	-	-	-
4a.4.10	Corporate Allocations	-	-	-	-	-	-	1,386	139	1,525	1,525	-	-	-	-	-	-	-	-	-	-
4a.4.11	Security Staff Cost	-	-	-	-	-	-	6,168	925	7,094	7,094	-	-	-	-	-	-	-	-	-	90,110
4a.4.12	DOC Staff Cost	-	-	-	-	-	-	21,985	3,298	25,283	25,283	-	-	-	-	-	-	-	-	-	198,962
4a.4.13	Utility Staff Cost	-	-	-	-	-	-	32,471	4,871	37,341	37,341	-	-	-	-	-	-	-	-	-	360,438
4a.4	Subtotal Period 4a Period-Dependent Costs	118	7,310	106	60	-	310	67,329	11,580	86,813	86,813	-	-	-	5,233	-	-	-	104,652	171	649,510
4a.0	TOTAL PERIOD 4a COST	289	45,560	26,206	14,484	-	125,249	69,407	68,967	350,161	344,678	-	5,483	-	332,437	501	406	2,217	20,551,280	366,877	657,869
PERIOD 4b - Site Decontamination																					
Period 4b Direct Decommissioning Activities																					
4b.1.1	Remove spent fuel racks	959	112	294	261	-	2,389	-	1,173	5,187	5,187	-	-	-	6,988	-	-	-	443,960	1,925	-
Disposal of Plant Systems																					
4b.1.2.1	200 Reactor Bldg Non-System Specific	-	109	7	14	-	129	-	62	322	322	-	-	-	378	-	-	-	24,042	1,579	-
4b.1.2.2	200 Reactor Bldg Non-System Specific RCA	-	752	68	127	-	1,167	-	506	2,620	2,620	-	-	-	3,414	-	-	-	216,897	10,554	-
4b.1.2.3	300 Control Bldg Non-System Specific	-	236	30	57	-	523	-	202	1,049	1,049	-	-	-	1,532	-	-	-	97,294	3,471	-
4b.1.2.4	300 Control Bldg Non-System Specific Cln	-	1,836	-	-	-	-	-	275	2,111	-	-	2,111	-	-	-	-	-	-	29,076	-
4b.1.2.5	600 Fuel Bldg Non-Specific Systems RCA	-	411	46	85	-	783	-	316	1,641	1,641	-	-	-	2,292	-	-	-	145,605	5,946	-
4b.1.2.6	600 Fuel Bldg Non-System Specific	-	58	5	9	-	83	-	37	191	191	-	-	-	242	-	-	-	15,399	856	-
4b.1.2.7	700 Radwaste Bldg Non-Sys Specific RCA	-	1,514	180	339	-	3,105	-	1,223	6,361	6,361	-	-	-	9,083	-	-	-	577,051	22,261	-
4b.1.2.8	700 Radwaste Bldg Non-System Specific	-	219	19	37	-	342	-	148	766	766	-	-	-	1,002	-	-	-	63,635	3,278	-
4b.1.2.9	AN - Demineralized Wtr Storage & Xfer	-	208	-	-	-	-	-	31	239	-	-	239	-	-	-	-	-	-	3,283	-
4b.1.2.10	AN - Demineralized Wtr Strg & Xfer RCA	-	53	6	9	-	79	-	35	182	182	-	-	-	227	-	-	-	14,650	753	-
4b.1.2.11	AP-HCST/Condensate Stor.& Transfr	-	275	-	-	-	-	-	41	316	-	-	316	-	-	-	-	-	-	4,018	-
4b.1.2.12	BB - Reactor Coolant System	-	408	65	112	-	1,025	-	382	1,991	1,991	-	-	-	2,987	-	-	-	190,474	6,379	-
4b.1.2.13	BG - Chemical & Volume Control	-	1,157	193	318	-	2,918	-	1,086	5,672	5,672	-	-	-	8,476	-	-	-	542,341	17,466	-
4b.1.2.14	BL - Reactor Makeup Water	-	370	52	84	-	768	-	302	1,576	1,576	-	-	-	2,234	-	-	-	142,818	5,547	-
4b.1.2.15	DE - Intake & Water Treatment	-	166	-	-	-	-	-	25	191	-	-	191	-	-	-	-	-	-	2,517	-
4b.1.2.16	DE - Intake & Water Treatment RCA	-	331	175	319	-	2,925	-	879	4,630	4,630	-	-	-	8,546	-	-	-	543,623	5,351	-
4b.1.2.17	EA - Service Water	-	197	-	-	-	-	-	30	227	-	-	227	-	-	-	-	-	-	3,145	-
4b.1.2.18	EA - Service Water RCA	-	59	19	33	-	307	-	98	516	516	-	-	-	895	-	-	-	57,005	876	-
4b.1.2.19	EB - Closed Cooling Water	-	80	-	-	-	-	-	12	92	-	-	92	-	-	-	-	-	-	1,267	-
4b.1.2.20	EC - Fuel Pool Cooling & Cleanup	-	484	68	111	-	1,021	-	400	2,085	2,085	-	-	-	2,965	-	-	-	189,813	7,264	-
4b.1.2.21	EF - Essential Service Water	-	458	-	-	-	-	-	69	527	-	-	527	-	-	-	-	-	-	7,244	-
4b.1.2.22	EF - Essential Service Water RCA	-	263	81	143	-	1,309	-	422	2,218	2,218	-	-	-	3,820	-	-	-	243,301	4,018	-
4b.1.2.23	EG - Component Cooling Water RCA	-	336	-	-	-	-	-	50	386	-	-	386	-	-	-	-	-	-	5,335	-
4b.1.2.24	GA - Plant Heating	-	120	-	-	-	-	-	18	138	-	-	138	-	-	-	-	-	-	1,912	-
4b.1.2.25	GA - Plant Heating RCA	-	126	14	18	-	162	-	76	395	395	-	-	-	463	-	-	-	30,040	1,795	-
4b.1.2.26	GA- Plant Heating Fuel Building	-	27	2	3	-	27	-	14	74	74	-	-	-	78	-	-	-	5,037	404	-
4b.1.2.27	GB - Central Chilled Water	-	113	-	-	-	-	-	17	130	-	-	130	-	-	-	-	-	-	1,803	-
4b.1.2.28	GB - Central Chilled Water RCA	-	34	4	5	-	47	-	22	112	112	-	-	-	136	-	-	-	8,778	490	-
4b.1.2.29	GD - Essential Serv Wtr Pumphouse HVAC	-	25	-	-	-	-	-	4	29	-	-	29	-	-	-	-	-	-	427	-
4b.1.2.30	GF - Miscellaneous Building HVAC	-	155	29	54	-	498	-	174	911	911	-	-	-	1,457	-	-	-	92,563	2,081	-
4b.1.2.31	GG - Fuel Building HVAC	-	295	55	105	-	966	-	336	1,757	1,757	-	-	-	2,825	-	-	-	179,529	4,129	-
4b.1.2.32	GH - Radwaste Building HVAC	-	217	35	68	-	627	-	225	1,172	1,172	-	-	-	1,834	-	-	-	116,569	3,054	-
4b.1.2.33	GK - Control Building HVAC	-	231	-	-	-	-	-	35	266	-	-	266	-	-	-	-	-	-	3,959	-
4b.1.2.34	GL - Auxiliary Building HVAC	-	535	75	144	-	1,318	-	493	2,565	2,565	-	-	-	3,855	-	-	-	245,020	7,470	-
4b.1.2.35	GM - Diesel Generator Building HVAC	-	40	-	-	-	-	-	6	46	-	-	46	-	-	-	-	-	-	695	-
4b.1.2.36	GN - Containment Cooling	-	599	118	221	-	2,027	-	701	3,666	3,666	-	-	-	5,923	-	-	-	376,780	8,572	-
4b.1.2.37	GP - Containment Intgratd Leak Rate Test	-	52	9	16	-	143	-	52	272	272	-	-	-	417	-	-	-	26,623	768	-

Table F
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Disposal of Plant Systems (continued)																					
4b.1.2.38	GR - Containment Atmospheric Control	-	24	16	31	-	280	-	82	432	432	-	-	-	818	-	-	-	51,989	372	-
4b.1.2.39	GT - Containment Purge HVAC	-	140	31	58	-	535	-	181	945	945	-	-	-	1,566	-	-	-	99,513	2,016	-
4b.1.2.40	HA - Gaseous Radwaste	-	434	65	100	-	919	-	360	1,877	1,877	-	-	-	2,664	-	-	-	170,799	6,388	-
4b.1.2.41	HB - Liquid Radwaste	-	1,054	159	253	-	2,319	-	897	4,682	4,682	-	-	-	6,735	-	-	-	430,985	15,662	-
4b.1.2.42	HC - Solid Radwaste	-	450	67	113	-	1,033	-	394	2,057	2,057	-	-	-	3,006	-	-	-	192,060	6,719	-
4b.1.2.43	HD - Decontamination	-	125	20	33	-	302	-	113	592	592	-	-	-	877	-	-	-	56,053	1,855	-
4b.1.2.44	JE - Emergency Fuel Oil	-	86	-	-	-	-	-	13	99	-	-	99	-	-	-	-	-	-	1,260	-
4b.1.2.45	KA - Compressed Air	-	262	-	-	-	-	-	39	301	-	-	301	-	-	-	-	-	-	4,187	-
4b.1.2.46	KA - Compressed Air RCA	-	169	19	22	-	204	-	99	513	513	-	-	-	583	-	-	-	37,947	2,380	-
4b.1.2.47	KB - Breathing Air	-	33	-	-	-	-	-	5	38	-	-	38	-	-	-	-	-	-	516	-
4b.1.2.48	KB - Breathing Air RCA	-	26	2	2	-	18	-	12	60	60	-	-	-	52	-	-	-	3,401	406	-
4b.1.2.49	KC - Fire Protection	-	514	-	-	-	-	-	77	591	-	-	591	-	-	-	-	-	-	8,376	-
4b.1.2.50	KC - Fire Protection RCA	-	530	86	121	-	1,106	-	436	2,279	2,279	-	-	-	3,189	-	-	-	205,625	7,245	-
4b.1.2.51	KC- Fire Protection Fuel Building	-	157	24	34	-	311	-	124	650	650	-	-	-	896	-	-	-	57,758	2,166	-
4b.1.2.52	KD - Domestic Water	-	239	-	-	-	-	-	36	275	-	-	275	-	-	-	-	-	-	3,837	-
4b.1.2.53	KD - Domestic Water RCA	-	34	5	7	-	62	-	25	132	132	-	-	-	178	-	-	-	11,465	468	-
4b.1.2.54	KE - Fuel Handling & Storage Rctor vssl	-	23	12	24	-	216	-	64	339	339	-	-	-	632	-	-	-	40,119	349	-
4b.1.2.55	KH - Service Gas (CO2 N2 H2 & O2)	-	76	-	-	-	-	-	11	87	-	-	87	-	-	-	-	-	-	1,226	-
4b.1.2.56	KH - Service Gas (CO2 N2 H2 & O2) RCA	-	333	45	66	-	608	-	250	1,302	1,302	-	-	-	1,756	-	-	-	112,949	4,575	-
4b.1.2.57	KJ - Standby Diesel Engine	-	454	-	-	-	-	-	68	523	-	-	523	-	-	-	-	-	-	6,749	-
4b.1.2.58	LA - Sanitary Drains	-	61	-	-	-	-	-	9	70	-	-	70	-	-	-	-	-	-	972	-
4b.1.2.59	LA - Sanitary Drains RCA	-	140	21	34	-	315	-	121	632	632	-	-	-	916	-	-	-	58,593	1,854	-
4b.1.2.60	LB - Roof Drains	-	81	-	-	-	-	-	12	93	-	-	93	-	-	-	-	-	-	1,276	-
4b.1.2.61	LB - Roof Drains RCA	-	190	32	57	-	526	-	191	996	996	-	-	-	1,534	-	-	-	97,740	2,757	-
4b.1.2.62	LD - Chemical & Detergent Waste	-	144	14	22	-	198	-	90	468	468	-	-	-	574	-	-	-	36,840	2,159	-
4b.1.2.63	LF - Floor & Equipment Drains	-	1,788	183	316	-	2,893	-	1,236	6,415	6,415	-	-	-	8,419	-	-	-	537,647	26,325	-
4b.1.2.64	RM - Process Sampling & Analysis	-	162	20	27	-	249	-	109	567	567	-	-	-	717	-	-	-	46,349	2,481	-
4b.1.2.65	SJ - Nuclear Sampling	-	94	14	19	-	171	-	70	368	368	-	-	-	491	-	-	-	31,744	1,451	-
4b.1.2.66	UB - Servces Stores Site Security Bldg	-	245	-	-	-	-	-	37	282	-	-	282	-	-	-	-	-	-	3,815	-
4b.1.2.67	Yard Non-System Specific	-	41	-	-	-	-	-	6	47	-	-	47	-	-	-	-	-	-	603	-
4b.1.2	Totals	-	20,658	2,188	3,772	-	34,564	-	13,972	75,154	68,050	-	7,104	-	100,683	-	-	-	6,424,461	309,491	-
4b.1.3	Scaffolding in support of decommissioning	-	2,846	35	61	-	557	-	863	4,363	4,363	-	-	-	1,631	-	-	-	103,596	50,451	-
Decontamination of Site Buildings																					
4b.1.4.1	Reactor	1,458	2,094	254	1,704	-	4,395	-	2,633	12,538	12,538	-	-	-	49,719	-	-	-	2,419,534	48,711	-
4b.1.4.2	Auxiliary	739	294	47	175	-	748	-	661	2,664	2,664	-	-	-	5,204	-	-	-	260,859	15,287	-
4b.1.4.3	Communication Corridor - Contaminated	16	4	1	3	-	9	-	12	45	45	-	-	-	88	-	-	-	4,377	307	-
4b.1.4.4	Fuel Building	955	969	71	110	-	785	-	939	3,829	3,829	-	-	-	2,969	-	-	-	177,276	27,561	-
4b.1.4.5	Hot Machine Shop	20	8	0	3	-	6	-	14	52	52	-	-	-	94	-	-	-	4,446	421	-
4b.1.4.6	RAM Storage Building	51	10	1	7	-	17	-	33	120	120	-	-	-	221	-	-	-	10,093	920	-
4b.1.4.7	Radioactive and Personnel Tunnel	6	7	0	2	-	3	-	6	25	25	-	-	-	54	-	-	-	2,532	195	-
4b.1.4.8	Radwaste	394	134	20	86	-	333	-	328	1,295	1,295	-	-	-	2,498	-	-	-	126,675	7,830	-
4b.1.4.9	Radwaste Drum Storage	44	13	2	9	-	30	-	34	132	132	-	-	-	256	-	-	-	12,889	851	-
4b.1.4.10	Reactor Head Assembly Building	40	-	-	-	-	-	-	20	59	59	-	-	-	-	-	-	-	-	614	-
4b.1.4.11	Steam Generator Replacement Bldgs	295	-	-	-	-	-	-	147	442	442	-	-	-	-	-	-	-	-	3,885	-
4b.1.4	Totals	4,019	3,532	397	2,098	-	6,327	-	4,828	21,201	21,201	-	-	-	61,102	-	-	-	3,018,682	106,582	-
4b.1.5	Prepare/submit License Termination Plan	-	-	-	-	-	-	650	98	748	748	-	-	-	-	-	-	-	-	-	4,096
4b.1.6	Receive NRC approval of termination plan									a											
4b.1	Subtotal Period 4b Activity Costs	4,977	27,148	2,913	6,192	-	43,836	650	20,935	106,652	99,548	-	7,104	-	170,405	-	-	-	9,990,698	468,448	4,096
Period 4b Additional Costs																					
4b.2.1	License Termination Survey Planning	-	-	-	-	-	-	1,778	533	2,311	2,311	-	-	-	-	-	-	-	-	-	12,480
4b.2.2	Operational Tools & Equipment	-	-	22	235	-	1,574	-	431	2,261	2,261	-	-	-	11,700	-	-	-	292,500	32	-
4b.2.3	Excavation of Underground Services	-	1,879	-	-	-	-	551	552	2,982	2,982	-	-	-	-	-	-	-	-	12,396	-
4b.2.4	License Termination ISFSI	-	684	154	166	-	3,547	3,894	2,111	10,556	10,556	-	-	-	14,077	-	-	-	1,053,456	17,572	10,920
4b.2.5	Remedial Action Surveys	-	-	-	-	-	-	2,438	731	3,170	3,170	-	-	-	-	-	-	-	-	47,950	-
4b.2.6	Sanitary Treatment Lagoon	-	7	92	235	-	540	-	181	1,054	1,054	-	-	-	4,608	-	-	-	392,140	423	-
4b.2.7	Cooling Tower Asbestos Panel Removal	-	6,512	-	305	-	-	641	1,119	8,576	-	-	8,576	-	-	-	-	-	-	71,419	-
4b.2.8	Retired Reactor Closure Head	-	151	847	1,330	-	1,110	-	599	4,037	4,037	-	-	-	2,764	-	-	-	338,540	3,157	2,000
4b.2.9	Spent Fuel Pool Legacy Waste	-	108	163	67	-	2,617	14	710	3,680	3,680	-	-	-	-	250	-	-	14,900	1,333	53
4b.2	Subtotal Period 4b Additional Costs	-	9,340	1,278	2,337	-	9,387	9,316	6,968	38,627	30,051	-	8,576	-	33,149	250	-	-	2,091,536	154,282	25,453

Table F
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Period 4b Collateral Costs																					
4b.3.1	Process decommissioning water waste	14	-	26	66	-	109	-	47	261	261	-	-	-	214	-	-	-	12,843	42	-
4b.3.2	Process decommissioning chemical flush waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4b.3.3	Small tool allowance	-	625	-	-	-	-	-	94	719	719	-	-	-	-	-	-	-	-	-	-
4b.3.4	Decommissioning Equipment Disposition	-	-	114	197	-	1,808	-	493	2,612	2,612	-	-	-	5,290	-	-	-	336,079	147	-
4b.3	Subtotal Period 4b Collateral Costs	14	625	140	263	-	1,917	-	633	3,593	3,593	-	-	-	5,504	-	-	-	348,922	189	-
Period 4b Period-Dependent Costs																					
4b.4.1	Decon supplies	1,947	-	-	-	-	-	-	487	2,434	2,434	-	-	-	-	-	-	-	-	-	-
4b.4.2	Insurance	-	-	-	-	-	-	1,563	156	1,719	1,719	-	-	-	-	-	-	-	-	-	-
4b.4.3	Property taxes	-	-	-	-	-	-	277	28	304	304	-	-	-	-	-	-	-	-	-	-
4b.4.4	Health physics supplies	-	7,070	-	-	-	-	-	1,767	8,837	8,837	-	-	-	-	-	-	-	-	-	-
4b.4.5	Heavy equipment rental	-	5,257	-	-	-	-	-	789	6,045	6,045	-	-	-	-	-	-	-	-	-	-
4b.4.6	Disposal of DAW generated	-	-	135	76	-	392	-	123	725	725	-	-	-	6,615	-	-	-	132,302	216	-
4b.4.7	Plant energy budget	-	-	-	-	-	-	3,552	533	4,085	4,085	-	-	-	-	-	-	-	-	-	-
4b.4.8	NRC Fees	-	-	-	-	-	-	1,362	136	1,498	1,498	-	-	-	-	-	-	-	-	-	-
4b.4.9	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	1,150	172	1,322	1,322	-	-	-	-	-	-	-	-	-	-
4b.4.10	Corporate Allocations	-	-	-	-	-	-	2,307	231	2,538	2,538	-	-	-	-	-	-	-	-	-	-
4b.4.11	Security Staff Cost	-	-	-	-	-	-	10,264	1,540	11,804	11,804	-	-	-	-	-	-	-	-	-	149,945
4b.4.12	DOC Staff Cost	-	-	-	-	-	-	35,739	5,361	41,100	41,100	-	-	-	-	-	-	-	-	-	321,483
4b.4.13	Utility Staff Cost	-	-	-	-	-	-	51,214	7,682	58,896	58,896	-	-	-	-	-	-	-	-	-	566,193
4b.4	Subtotal Period 4b Period-Dependent Costs	1,947	12,327	135	76	-	392	107,428	19,004	141,308	141,308	-	-	-	6,615	-	-	-	132,302	216	1,037,621
4b.0	TOTAL PERIOD 4b COST	6,939	49,441	4,466	8,868	-	55,532	117,394	47,541	290,179	274,500	-	15,680	-	215,673	250	-	-	12,563,460	623,134	1,067,170
PERIOD 4f - License Termination																					
Period 4f Direct Decommissioning Activities																					
4f.1.1	ORISE confirmatory survey	-	-	-	-	-	-	168	50	218	218	-	-	-	-	-	-	-	-	-	-
4f.1.2	Terminate license									a											
4f.1	Subtotal Period 4f Activity Costs	-	-	-	-	-	-	168	50	218	218	-	-	-	-	-	-	-	-	-	-
Period 4f Additional Costs																					
4f.2.1	License Termination Survey	-	-	-	-	-	-	10,211	3,063	13,274	13,274	-	-	-	-	-	-	-	-	153,878	6,240
4f.2	Subtotal Period 4f Additional Costs	-	-	-	-	-	-	10,211	3,063	13,274	13,274	-	-	-	-	-	-	-	-	153,878	6,240
Period 4f Collateral Costs																					
4f.3.1	DOC staff relocation expenses	-	-	-	-	-	-	1,641	246	1,887	1,887	-	-	-	-	-	-	-	-	-	-
4f.3	Subtotal Period 4f Collateral Costs	-	-	-	-	-	-	1,641	246	1,887	1,887	-	-	-	-	-	-	-	-	-	-
Period 4f Period-Dependent Costs																					
4f.4.1	Insurance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4f.4.2	Property taxes	-	-	-	-	-	-	91	9	100	100	-	-	-	-	-	-	-	-	-	-
4f.4.3	Health physics supplies	-	1,316	-	-	-	-	-	329	1,645	1,645	-	-	-	-	-	-	-	-	-	-
4f.4.4	Disposal of DAW generated	-	-	7	4	-	21	-	7	39	39	-	-	-	353	-	-	-	7,050	11	-
4f.4.5	Plant energy budget	-	-	-	-	-	-	310	47	357	357	-	-	-	-	-	-	-	-	-	-
4f.4.6	NRC Fees	-	-	-	-	-	-	546	55	601	601	-	-	-	-	-	-	-	-	-	-
4f.4.7	Corporate Allocations	-	-	-	-	-	-	756	76	832	832	-	-	-	-	-	-	-	-	-	-
4f.4.8	Security Staff Cost	-	-	-	-	-	-	1,715	257	1,973	1,973	-	-	-	-	-	-	-	-	-	18,874
4f.4.9	DOC Staff Cost	-	-	-	-	-	-	6,532	980	7,511	7,511	-	-	-	-	-	-	-	-	-	57,408
4f.4.10	Utility Staff Cost	-	-	-	-	-	-	7,153	1,073	8,226	8,226	-	-	-	-	-	-	-	-	-	74,709
4f.4	Subtotal Period 4f Period-Dependent Costs	-	1,316	7	4	-	21	17,104	2,831	21,283	21,283	-	-	-	353	-	-	-	7,050	11	150,991
4f.0	TOTAL PERIOD 4f COST	-	1,316	7	4	-	21	29,123	6,191	36,662	36,662	-	-	-	353	-	-	-	7,050	153,889	157,231
PERIOD 4 TOTALS		7,228	96,316	30,679	23,356	-	180,802	215,924	122,699	677,003	655,840	-	21,162	-	548,462	751	406	2,217	33,121,790	1,143,901	1,882,270
PERIOD 5b - Site Restoration																					
Period 5b Direct Decommissioning Activities																					
Demolition of Remaining Site Buildings																					
5b.1.1.1	Reactor	-	3,482	-	-	-	-	-	522	4,004	-	-	4,004	-	-	-	-	-	-	27,502	-
5b.1.1.2	Auxiliary	-	2,865	-	-	-	-	-	430	3,295	-	-	3,295	-	-	-	-	-	-	19,024	-
5b.1.1.3	Auxiliary Boiler	-	26	-	-	-	-	-	4	30	-	-	30	-	-	-	-	-	-	248	-
5b.1.1.4	Barge Facility	-	957	-	-	-	-	-	144	1,101	-	-	1,101	-	-	-	-	-	-	4,290	-
5b.1.1.5	Circulating & Service Water Pumphouse	-	233	-	-	-	-	-	35	268	-	-	268	-	-	-	-	-	-	1,996	-

Table F
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Demolition of Remaining Site Buildings (continued)																					
5b.1.1.6	Communication Corridor - Clean	-	1,079	-	-	-	-	-	162	1,241	-	-	1,241	-	-	-	-	-	-	8,280	-
5b.1.1.7	Communication Corridor - Contaminated	-	35	-	-	-	-	-	5	40	-	-	40	-	-	-	-	-	-	184	-
5b.1.1.8	Cooling Tower Concrete	-	451	-	-	-	-	-	68	519	-	-	519	-	-	-	-	-	-	2,332	-
5b.1.1.9	Diesel Generator	-	329	-	-	-	-	-	49	378	-	-	378	-	-	-	-	-	-	2,185	-
5b.1.1.10	Essential Service Water Pumphouse	-	176	-	-	-	-	-	26	203	-	-	203	-	-	-	-	-	-	955	-
5b.1.1.11	Fire Water Pumphouse	-	23	-	-	-	-	-	3	26	-	-	26	-	-	-	-	-	-	151	-
5b.1.1.12	Flex Building Storage	-	337	-	-	-	-	-	51	388	-	-	388	-	-	-	-	-	-	1,972	-
5b.1.1.13	Fuel Building	-	1,209	-	-	-	-	-	181	1,390	-	-	1,390	-	-	-	-	-	-	7,874	-
5b.1.1.14	Hardened Condensate Storage Tank - HCST	-	243	-	-	-	-	-	36	279	-	-	279	-	-	-	-	-	-	1,870	-
5b.1.1.15	Hot Machine Shop	-	21	-	-	-	-	-	3	24	-	-	24	-	-	-	-	-	-	243	-
5b.1.1.16	Intake	-	219	-	-	-	-	-	33	252	-	-	252	-	-	-	-	-	-	1,411	-
5b.1.1.17	Misc. Structures	-	2,722	-	-	-	-	-	408	3,130	-	-	3,130	-	-	-	-	-	-	18,774	-
5b.1.1.18	Miscellaneous Site Foundations	-	194	-	-	-	-	-	29	223	-	-	223	-	-	-	-	-	-	1,011	-
5b.1.1.19	Outage Maintenance	-	140	-	-	-	-	-	21	161	-	-	161	-	-	-	-	-	-	1,570	-
5b.1.1.20	RAM Storage Building	-	59	-	-	-	-	-	9	68	-	-	68	-	-	-	-	-	-	624	-
5b.1.1.21	Radioactive and Personnel Tunnel	-	34	-	-	-	-	-	5	39	-	-	39	-	-	-	-	-	-	386	-
5b.1.1.22	Radwaste	-	1,196	-	-	-	-	-	179	1,375	-	-	1,375	-	-	-	-	-	-	8,111	-
5b.1.1.23	Radwaste Drum Storage	-	171	-	-	-	-	-	26	197	-	-	197	-	-	-	-	-	-	1,449	-
5b.1.1.24	Reactor Head Assembly Building	-	98	-	-	-	-	-	15	113	-	-	113	-	-	-	-	-	-	1,108	-
5b.1.1.25	Security Additions	-	1,655	-	-	-	-	-	248	1,903	-	-	1,903	-	-	-	-	-	-	6,051	-
5b.1.1.26	Service	-	522	-	-	-	-	-	78	600	-	-	600	-	-	-	-	-	-	3,485	-
5b.1.1.27	Sludge Pump Station & Lagoon	-	1,678	-	-	-	-	-	252	1,930	-	-	1,930	-	-	-	-	-	-	10,601	-
5b.1.1.28	Steam Generator Replacement Bldgs	-	976	-	-	-	-	-	146	1,122	-	-	1,122	-	-	-	-	-	-	6,874	-
5b.1.1.29	Turbine Building	-	4,906	-	-	-	-	-	736	5,642	-	-	5,642	-	-	-	-	-	-	47,075	-
5b.1.1.30	Turbine Pedestal	-	561	-	-	-	-	-	84	646	-	-	646	-	-	-	-	-	-	2,934	-
5b.1.1.31	U.H.S. Cooling Tower	-	343	-	-	-	-	-	51	395	-	-	395	-	-	-	-	-	-	1,814	-
5b.1.1.32	Water Treatment Plant	-	1	-	-	-	-	-	0	1	-	-	1	-	-	-	-	-	-	9	-
5b.1.1	Totals	-	26,942	-	-	-	-	-	4,041	30,983	-	-	30,983	-	-	-	-	-	-	192,393	-
Site Closeout Activities																					
5b.1.2	Remove Rubble	-	1,558	-	-	-	-	-	234	1,792	-	-	1,792	-	-	-	-	-	-	7,233	-
5b.1.3	Grade & landscape site	-	129	-	-	-	-	-	19	148	-	-	148	-	-	-	-	-	-	592	-
5b.1.4	Final report to NRC	-	-	-	-	-	-	248	37	285	285	-	-	-	-	-	-	-	-	-	1,560
5b.1	Subtotal Period 5b Activity Costs	-	28,629	-	-	-	-	248	4,331	33,208	285	-	32,923	-	-	-	-	-	-	200,218	1,560
Period 5b Additional Costs																					
5b.2.1	Concrete Crushing	-	1,546	-	-	-	-	19	235	1,800	-	-	1,800	-	-	-	-	-	-	6,035	-
5b.2.2	Mine Area Backfill	-	6,441	-	-	-	-	-	966	7,407	-	-	7,407	-	-	-	-	-	-	15,960	-
5b.2.3	Construction Debris	-	-	-	-	-	-	2,950	443	3,393	-	-	3,393	-	-	-	-	-	-	-	-
5b.2.4	Site Restoration ISFSI	-	1,416	-	-	-	-	97	227	1,740	-	-	1,740	-	-	-	-	-	-	10,514	160
5b.2.5	Cooling Tower Discharge & Intake Pipe Flow Fill	-	5,020	-	-	-	-	-	753	5,772	-	-	5,772	-	-	-	-	-	-	9,588	-
5b.2.6	Cooling Tower Demolition	-	5,495	-	-	-	-	-	824	6,320	-	-	6,320	-	-	-	-	-	-	21,619	-
5b.2	Subtotal Period 5b Additional Costs	-	19,918	-	-	-	-	3,067	3,448	26,432	-	-	26,432	-	-	-	-	-	-	63,716	160
Period 5b Collateral Costs																					
5b.3.1	Small tool allowance	-	329	-	-	-	-	-	49	379	-	-	379	-	-	-	-	-	-	-	-
5b.3	Subtotal Period 5b Collateral Costs	-	329	-	-	-	-	-	49	379	-	-	379	-	-	-	-	-	-	-	-
Period 5b Period-Dependent Costs																					
5b.4.1	Insurance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5b.4.2	Property taxes	-	-	-	-	-	-	180	18	198	-	-	198	-	-	-	-	-	-	-	-
5b.4.3	Heavy equipment rental	-	4,790	-	-	-	-	-	718	5,508	-	-	5,508	-	-	-	-	-	-	-	-
5b.4.4	Plant energy budget	-	-	-	-	-	-	309	46	355	-	-	355	-	-	-	-	-	-	-	-
5b.4.5	Corporate Allocations	-	-	-	-	-	-	1,504	150	1,655	-	-	1,655	-	-	-	-	-	-	-	-
5b.4.6	Security Staff Cost	-	-	-	-	-	-	3,412	512	3,924	-	-	3,924	-	-	-	-	-	-	-	37,543
5b.4.7	DOC Staff Cost	-	-	-	-	-	-	12,661	1,899	14,560	-	-	14,560	-	-	-	-	-	-	-	106,371
5b.4.8	Utility Staff Cost	-	-	-	-	-	-	5,808	871	6,679	-	-	6,679	-	-	-	-	-	-	-	61,007
5b.4	Subtotal Period 5b Period-Dependent Costs	-	4,790	-	-	-	-	23,874	4,215	32,879	-	-	32,879	-	-	-	-	-	-	-	204,920
5b.0	TOTAL PERIOD 5b COST	-	53,666	-	-	-	-	27,188	12,044	92,898	285	-	92,613	-	-	-	-	-	-	263,934	206,640
PERIOD 5 TOTALS		-	53,666	-	-	-	-	27,188	12,044	92,898	285	-	92,613	-	-	-	-	-	-	263,934	206,640
TOTAL COST TO DECOMMISSION		15,891	166,575	31,122	24,145	-	182,441	883,701	236,268	1,540,143	1,328,034	96,323	115,786	-	558,915	751	406	2,217	33,421,570	1,505,610	7,425,559

Table F
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2023 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			

TOTAL COST TO DECOMMISSION WITH 18.12% CONTINGENCY:	**$1,540,143**	**thousands of 2023 dollars**
TOTAL NRC LICENSE TERMINATION COST IS 86.23% OR:	**$1,328,034**	**thousands of 2023 dollars**
SPENT FUEL MANAGEMENT COST IS 6.25% OR:	**$96,323**	**thousands of 2023 dollars**
NON-NUCLEAR DEMOLITION COST IS 7.52% OR:	**$115,786**	**thousands of 2023 dollars**
TOTAL LOW-LEVEL RADIOACTIVE WASTE VOLUME BURIED (EXCLUDING GTCC):	**560,071**	**Cubic Feet**
TOTAL GREATER THAN CLASS C RADWASTE VOLUME GENERATED:	**2,217**	**Cubic Feet**
TOTAL SCRAP METAL REMOVED:	**69,004**	**Tons**
TOTAL CRAFT LABOR REQUIREMENTS:	**1,505,610**	**Man-hours**

End Notes:
n/a - indicates that this activity not charged as decommissioning expense
a - indicates that this activity performed by decommissioning staff
0 - indicates that this value is less than 0.5 but is non-zero
A cell containing " - " indicates a zero value

APPENDIX G
DETAILED COST ANALYSIS

ISFSI DECOMMISSIONING AND DEMOLITION

TABLE G-1
SIGNIFICANT QUANTITIES AND PHYSICAL DIMENSIONS

ISFSI Pad

Item	Length (feet)	Width (feet)	Depth (feet)	Residual Radioactivity
ISFSI Pad	157.5	143.5	2.5	No

ISFSI HI-STORM UMAX

Item	Value	Notes (all dimensions are nominal)
Cavity Enclosure Container Inside Height	181	inches
Cavity Enclosure Container Inside Diameter	86	inches
Quantity (total)	53	Spent Fuel (48) + GTCC (5)
Quantity (with residual radioactivity)	6	Equivalent to the number of VVMs used to store last complete core offload)
Potentially Activated Steel and Concrete	847,767	pounds
Misc. Low-Level Radioactive Waste	3,289	pounds
Low-Level Radioactive Waste	13,299	cubic feet (excluding transfer cask)
Low-Level Radioactive Waste (packaged density)	75	pounds per cubic foot average weight density

Other Potentially Impacted Items

Item	Value	Notes
Number of VVMs used for GTCC storage	5	No residual radioactivity

TABLE G-2
ISFSI DECOMMISSIONING COST
(thousands, 2023 dollars)

	Costs						Waste Volume	Person-Hours	
	Removal	**Packaging**	**Transport**	**Disposal**	**Other**	**Total**	**Cubic Feet**	**Craft**	**Oversight and Contractor**
Decommissioning Contractor									
Planning (characterization, specifications and procedures)					280	280			1,048
Remediation (activated metal removal)	684	154	166	3,547		4,551	14,077	7,706	
License Termination (radiological surveys)					1,588	1,588		9,866	
Subtotal	**684**	**154**	**166**	**3,547**	**1,868**	**6,418**	**14,077**	**17,572**	**1,048**
Supporting Costs									
NRC and NRC Contractor Fees					572	572			1,153
Insurance					144	144			
Property Taxes					39	39			
Plant Energy Budget					13	13			
Corporate A&G					329	329			
Security (industrial)					557	557			4,958
Ameren Services Oversight					372	372			3,761
Subtotal	-	-	-	-	**2,026**	**2,026**	-	-	**9,872**
Total (w/o contingency)	**684**	**154**	**166**	**3,547**	**3,894**	**8,444**	**14,077**	**17,572**	**10,920**
Total (w/25% contingency)	**854**	**193**	**208**	**4,433**	**4,867**	**10,556**			

The application of contingency (25%) is consistent with the evaluation criteria referenced by the NRC in NUREG-1757 (""Consolidated Decommissioning Guidance, Financial Assurance, Recordkeeping, and Timeliness,"" U.S. NRC's Office of Nuclear Material Safety and Safeguards, NUREG-1757, Vol. 3, Rev. 1, February 2012)"

TABLE G-3
ISFSI DEMOLITION COSTS [1]

	Costs (thousands, 2023 dollars)						**Person-Hours**	
	Removal	Packaging	Transport	Disposal	Other	Total	Craft	Oversight and Contractor
Decommissioning Contractor								
Excavation and Demolition	178					178	965	
Steel Removal	724					724	8,419	
Concrete Processing	156				29	185	512	
Backfill	357					357	618	
Tooling	-				42	42		
Final Report	-				26	26		160
Subtotal	**1,416**	**-**	**-**	**-**	**97**	**1,513**	**10,514**	**160**
Supporting Costs								
Property Taxes					20	20		
Heavy Equipment	131					131		
Plant Energy Budget					7	7		
Corporate A&G					164	164		
Security (industrial)					278	278		2,479
Ameren Services Oversight					153	153		1,539
Subtotal	131				622	753	-	4,018
Total (w/o contingency)	**1,547**				**720**	**2,266**	**10,514**	**4,178**
Total (w/15% contingency)	**1,779**	**-**	**-**	**-**	**828**	**2,606**		

Note 1: For funding planning purposes demolition costs are incurred in the time period 2051-53 (for the DECON alternative)

Ameren Nuclear Decommissioning Trust

Results of Asset/Liability Study and Funding Adequacy Analysis

Willis Towers Watson

Fall 2023 Final

wtw

Modeling Assumptions – Cost Projections

Costs in 2023 dollars (000s)

Year	Plant	IFSI	Total	Break Even Case: Cumulative Annualized Escalation Factor	Break Even Case: Total Escalated Cost ($000)
2023	0	0	0	4.53%	0
2024	0	0	0	4.71%	0
2025	0	0	0	4.79%	0
2026	0	0	0	4.84%	0
2027	0	0	0	4.83%	0
2028	0	0	0	4.85%	0
2029	0	0	0	4.86%	0
2030	0	0	0	4.86%	0
2031	0	0	0	4.87%	0
2032	0	0	0	4.88%	0
2033	0	0	0	4.85%	0
2034	0	0	0	4.83%	0
2035	0	0	0	4.83%	0
2036	0	0	0	4.83%	0
2037	0	0	0	4.84%	0
2038	0	0	0	4.83%	0
2039	0	0	0	4.81%	0
2040	0	0	0	4.79%	0
2041	0	0	0	4.79%	0
2042	0	0	0	4.78%	0
2043	0	0	0	4.78%	0
2044	22,579	0	22,579	4.78%	63,054
2045	125,110	0	125,110	4.77%	365,434
2046	210,225	0	210,225	4.76%	641,270
2047	221,397	0	221,397	4.73%	703,378
2048	141,758	0	141,758	4.72%	470,183
2049	139,353	0	139,353	4.72%	483,625
2050	97,305	10,556	107,861	4.71%	391,827
2051	53,107	330	53,437	4.71%	202,788
2052	61,535	1,160	62,695	4.70%	248,699
2053	13,282	250	13,532	4.70%	56,171

Modeling Assumptions – Asset Projections

- Cumulative annual return: 5.20%

	Break Even Case	
Year	Total Escalated Cost ($000)	Market Value ($000)
2023	0	1,075,240
2024	0	1,117,974
2025	0	1,174,500
2026	0	1,234,702
2027	0	1,282,264
2028	0	1,341,291
2029	0	1,390,333
2030	0	1,455,507
2031	0	1,522,215
2032	0	1,596,195
2033	0	1,669,821
2034	0	1,746,076
2035	0	1,828,177
2036	0	1,920,179
2037	0	2,017,363
2038	0	2,129,106
2039	0	2,240,870
2040	0	2,351,915
2041	0	2,488,477
2042	0	2,616,334
2043	0	2,745,530
2044	63,054	2,843,291
2045	365,434	2,903,954
2046	641,270	2,662,940
2047	703,378	2,149,667
2048	470,183	1,568,726
2049	483,625	1,180,953
2050	391,827	766,752
2051	202,788	450,749
2052	248,699	281,508
2053	56,171	77,211

Capital Market Assumptions

Summary assumptions for July 1, 2023 Towers Watson Investment Services							
	1st Year Returns	**10th Year Returns**	**10 Year Returns**	**31st Year Returns**	**31 Year Returns**	**31 Year Returns**	**Annual Risk**
	Arithmetic Mean	Arithmetic Mean	Geometric Mean	Arithmetic Mean	Geometric Mean	Break-Even Case	Standard Deviation
US Large Cap Equity	9.6%	8.8%	7.2%	8.8%	7.0%	5.6%	17.9%
Government/Credit	5.5%	3.5%	3.8%	4.9%	4.3%	3.9%	4.0%
Cash	4.6%	3.8%	3.8%	4.2%	3.9%	2.7%	3.1%
Inflation	3.0%	2.5%	2.5%	2.5%	2.5%	3.0%	2.4%

- Our asset model switches among different states of normal and stressed market conditions
- “Regime switching” creates more frequent and severe downside events (“fat tails”) than would have occurred under a normal (or lognormal) distribution and allows for converging correlations

Asset Projections - Assumptions

	Market Value ($M)	Book Value ($M)	Target Allocation
US Government/Credit Bonds	346	385	35%
Large Cap US Equity	729	185	65%
Total	1,075	570	100%

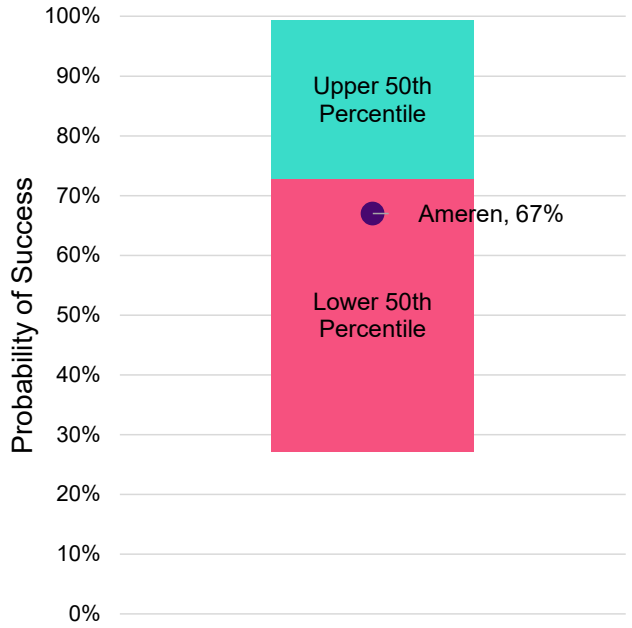
- Simulated asset returns
- Simulated costs

- 5 years of future cumulative decommissioning costs as a % of assets, at that time, are invested in 50% fixed income and 50% cash

- Assumed Tax Rate: 20%
- Pay out of capital gains taxes annually (calculated using simulated market value in excess of simulated book)
- Assets sold as a result of routine annual turnover
- Assets are assumed to rebalance back to the target allocation annually
- Assets sold in order to pay decommissioning costs
  - Costs paid by asset class in proportion to the amount in excess of target allocation prior to annual rebalance in the interest of minimizing taxes paid
- Pay out income taxes annually
  - Income assumed: ~2% dividend for equity; simulated yield for fixed income

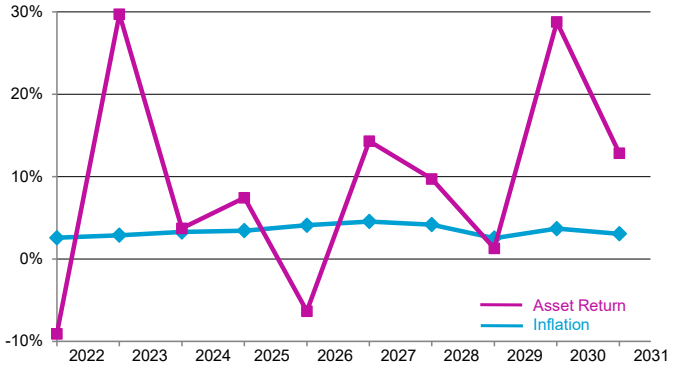
NDT Funding Analysis – Summary

Compared to 31 Nuclear Power units

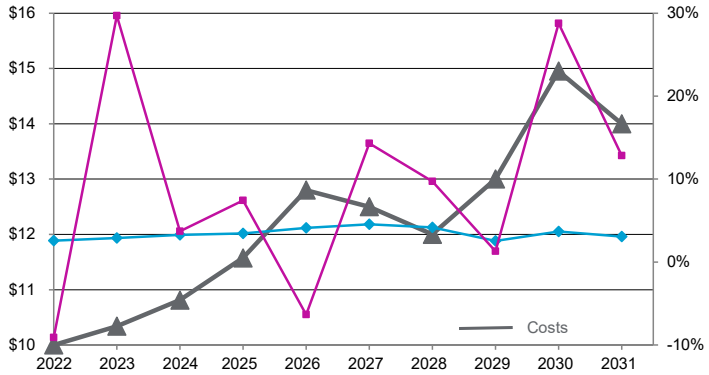


How Does Willis Towers Watson Model Work?

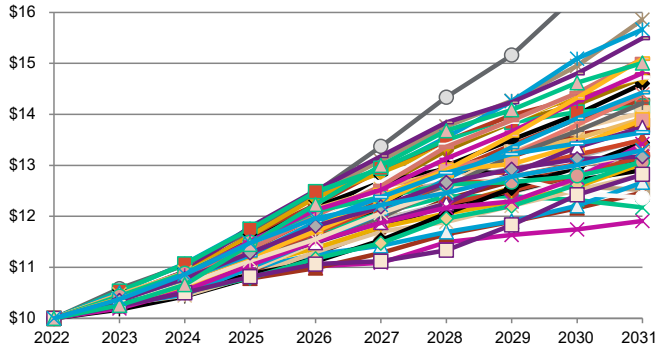
1. Project Future Economic Environments



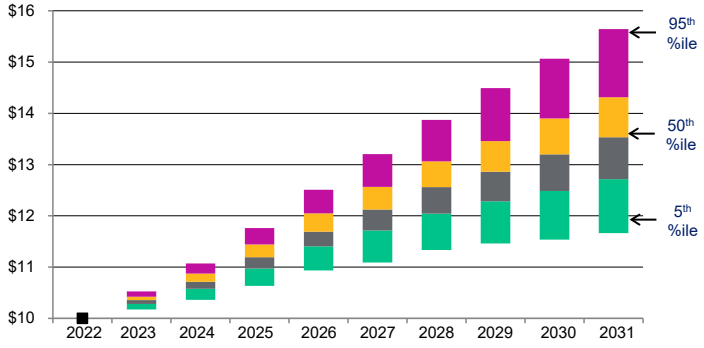
2. Project Costs at Each Future Year

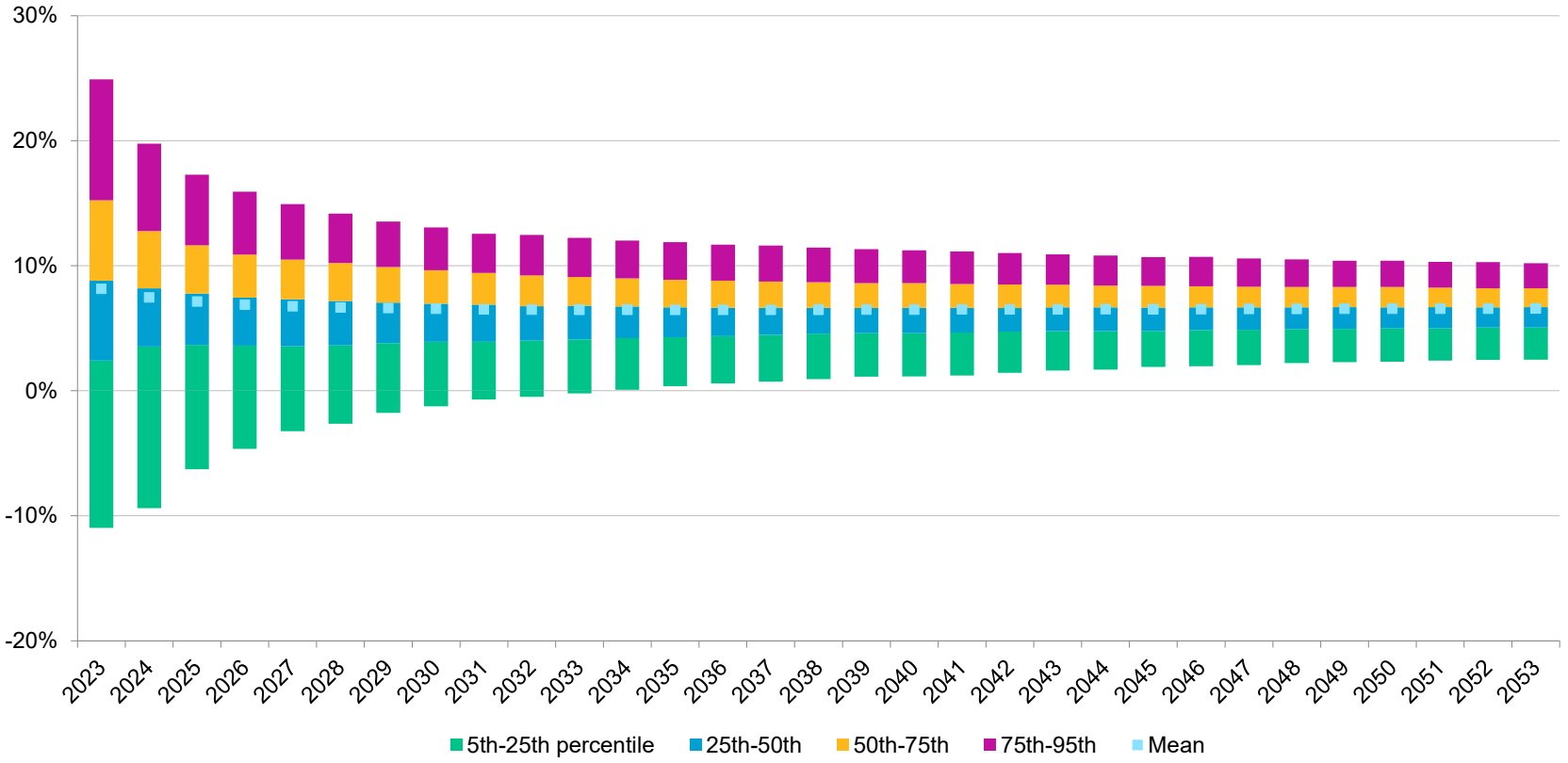


3. Repeat 5,000 Times

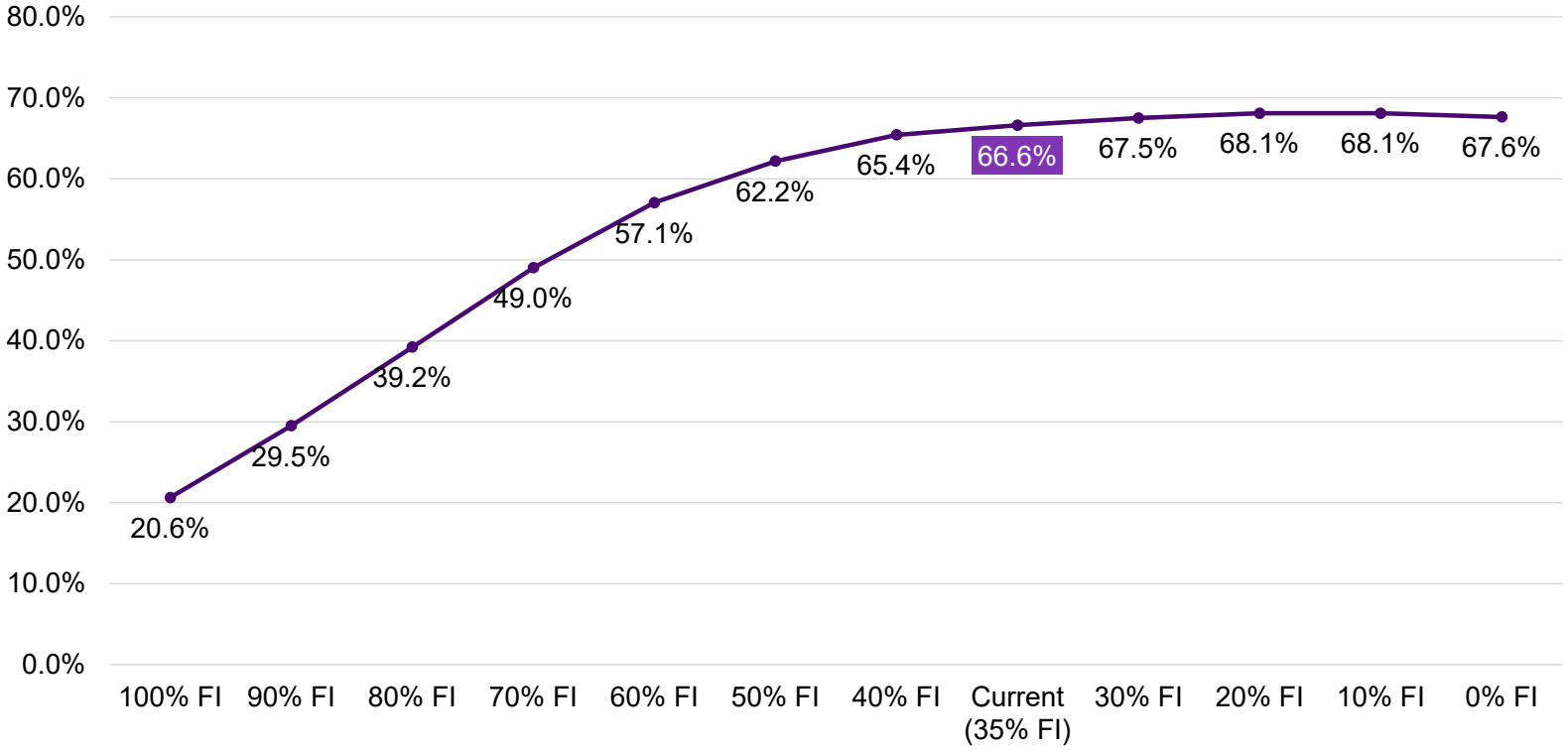


4. Rank Results





Probability of Success – Asset Allocation



Attachment 4