DECOMMISSIONING COST ANALYSIS

for the

CALLAWAY ENERGY CENTER

prepared for

Ameren Missouri

prepared by

TLG Services, Inc.
Bridgewater, Connecticut

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TABLE OF CONTENTS

SECTION **PAGE**

EXECUTIVE SUMMARY ..... vii-xvii

1. INTRODUCTION 1-1
   - 1.1 Objectives of Study 1-1
   - 1.2 Site Description 1-1
   - 1.3 Regulatory Guidance 1-2
     - 1.3.1 High-Level Radioactive Waste Management 1-4
     - 1.3.2 Low-Level Radioactive Waste Disposal 1-5
     - 1.3.3 Radiological Criteria for License Termination 1-7

2. DECOMMISSIONING ALTERNATIVES 2-1
   - 2.1 DECON 2-2
     - 2.1.1 Period 1 - Preparations 2-2
     - 2.1.2 Period 2 - Decommissioning Operations 2-4
     - 2.1.3 Period 3 - Site Restoration 2-7
   - 2.2 SAFSTOR 2-8
     - 2.2.1 Period 1 - Preparations 2-9
     - 2.2.2 Period 2 - Dormancy 2-10
     - 2.2.3 Periods 3 and 4 - Delayed Decommissioning 2-11
     - 2.2.4 Period 5 - Site Restoration 2-12

3. COST ESTIMATE 3-1
   - 3.1 Basis of Estimate 3-1
   - 3.2 Methodology 3-1
   - 3.3 Financial Components of the Cost Model 3-3
     - 3.3.1 Contingency 3-3
     - 3.3.2 Financial Risk 3-5
   - 3.4 Site-Specific Considerations 3-6
     - 3.4.1 Spent Fuel Management 3-6
     - 3.4.2 Reactor Vessel and Internal Components 3-7
     - 3.4.3 Primary System Components 3-8
     - 3.4.4 Retired Components 3-10
     - 3.4.5 Main Turbine and Condenser 3-10
     - 3.4.6 Transportation Methods 3-10
     - 3.4.7 Low-Level Radioactive Waste Disposal 3-11
     - 3.4.8 Site Conditions Following Decommissioning 3-12

TABLE OF CONTENTS
(continued)

SECTION **PAGE**

3.5 Assumptions 3-13
3.5.1 Estimating Basis 3-13
3.5.2 Labor Costs 3-13
3.5.3 Design Conditions 3-14
3.5.4 General 3-15
3.6 Cost Estimate Summary 3-17

4. SCHEDULE ESTIMATE 4-1
4.1 Schedule Estimate Assumptions 4-1
4.2 Project Schedule 4-2

5. RADIOACTIVE WASTES 5-1

6. RESULTS 6-1

7. REFERENCES 7-1

TABLES

DECON Cost Summary, Decommissioning Cost Elements xvi
SAFSTOR Cost Summary, Decommissioning Cost Elements xvii
3.1 DECON Alternative, Total Annual Expenditures 3-19
3.1a DECON Alternative, License Termination Expenditures 3-20
3.1b DECON Alternative, Spent Fuel Management Expenditures 3-21
3.1c DECON Alternative, Site Restoration Expenditures 3-22
3.2 SAFSTOR Alternative, Total Annual Expenditures 3-23
3.2a SAFSTOR Alternative, License Termination Expenditures 3-26
3.2b SAFSTOR Alternative, Spent Fuel Management Expenditures 3-29
3.2c SAFSTOR Alternative, Site Restoration Expenditures 3-30
5.1 DECON Alternative, Decommissioning Waste Summary 5-5
5.2 SAFSTOR Alternative, Decommissioning Waste Summary 5-6
6.1 DECON Alternative, Decommissioning Cost Elements 6-4
6.2 SAFSTOR Alternative, Decommissioning Cost Elements 6-5

TABLE OF CONTENTS
(continued)

SECTION **PAGE**

G-1 DECON Alternative, Total Annual Expenditures G-2
G-1a DECON Alternative, License Termination Expenditures G-3
G-1b DECON Alternative, Spent Fuel Management Expenditures G-4
G-1c DECON Alternative, Site Restoration Expenditures G-5
H-1 SAFSTOR Alternative, Total Annual Expenditures H-2
H-1a SAFSTOR Alternative, License Termination Expenditures H-5
H-1b SAFSTOR Alternative, Spent Fuel Management Expenditures H-8
H-1c SAFSTOR Alternative, Site Restoration Expenditures H-9

FIGURES

4.1 Activity Schedule 4-3
4.2 Decommissioning Timeline, DECON 4-4
4.3. Decommissioning Timeline, SAFSTOR 4-5
5.1 Radioactive Waste Disposition 5-3
5.2 Decommissioning Waste Destinations, Radiological 5-4

APPENDICES

A. Unit Cost Factor Development A-1
B. Unit Cost Factor Listing B-1
C. DECON Alternative Decommissioning Cost Estimate, 40-Year Operating Life with Low-Level Radioactive Waste Processing C-2
D. SAFSTOR Alternative Decommissioning Cost Estimate, 40-Year Operating Life with Low-Level Radioactive Waste Processing D-2
E. DECON Alternative Decommissioning Cost Estimate, 40-Year Operating Life with Direct Disposal of Low-Level Radioactive Waste E-2
F. SAFSTOR Alternative Decommissioning Cost Estimate, 40-Year Operating Life with Direct Disposal of Low-Level Radioactive Waste F-2
G. DECON Alternative Decommissioning Cost Estimate, 60-Year Operating Life with Low-Level Radioactive Waste Processing G-6
H. SAFSTOR Alternative Decommissioning Cost Estimate, 60-Year Operating Life with Low-Level Radioactive Waste Processing H-10

REVISION LOG

No.	Date	Item Revised	Reason for Revision
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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 Missouri 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 2011,[1] updated to reflect current assumptions pertaining to the disposition of the nuclear unit and relevant industry experience in undertaking such projects. The analysis is not a comprehensive engineering evaluation, but estimates prepared in advance of the detailed planning required to execute 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 costs to decommission Callaway for the base scenarios (current license expiration date) are presented at the end of this section. Costs are reported in 2014 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 within this document are provided in the appendices along with the costs for the additional scenarios.

Consistent with the 2011 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 handling building as an interim wet fuel storage facility for approximately five and one-half years after operations cease. During this time period, it is assumed that the spent fuel residing in the pool will be transferred to an independent spent fuel storage installation (ISFSI) located on the site. The ISFSI will remain operational until the Department of Energy (DOE) is able to

1 "Decommissioning Cost Analysis for the Callaway Energy Center," Document No. A22-1644-001, Rev. 0, TLG Services, Inc., August 2011

complete the transfer of the fuel to a federal facility (e.g., a monitored retrievable storage facility).

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 time 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

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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.

5 Ibid. Page FR24023, Column 2

> 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 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,[7] issued in July 2000, further described the methods and procedures acceptable to the NRC staff for implementing the requirements of the 1996 revised rule relating to the initial activities and major phases of the decommissioning process. The costs and schedules presented in this analysis follow the general guidance and processes described in the amended regulations. The format and content of the estimates is also consistent with the recommendations of Regulatory Guide 1.202,[8] issued in February 2005.

Decommissioning Scenarios

Multiple decommissioning scenarios were evaluated for the Callaway nuclear unit. The scenarios selected are representative of alternatives currently available to the owner. The DECON and SAFSTOR alternatives were evaluated for both a 40-year and 60-year operating license since the application for license renewal is still in review. Two disposal options were also evaluated: recycling and direct disposal. Recycling is presented as the base option and considers the off-site processing of plant

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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

7 "Decommissioning of Nuclear Power Reactors," Regulatory Guide 1.184, Nuclear Regulatory Commission, July 2000

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

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	Plant Operating Life (years)	Low-Level Radioactive Waste Options	Cost Summaries and/or Detailed Estimates
DECON	40	Recycling	Sections 3, 6, Appendix C
		Direct Disposal	Appendix E
SAFSTOR	40	Recycling	Sections 3, 6, Appendix D
		Direct Disposal	Appendix F
DECON	60	Recycling	Appendix G
SAFSTOR	60	Recycling	Appendix H

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.

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

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

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

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.

With the exception of Texas, no new compact facilities have been successfully sited, licensed, and constructed. The Texas Compact disposal facility is now operational and waste is being accepted from generators within the Compact by the operator, Waste Control Specialists (WCS). The facility is also 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 Missouri. 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 Missouri's Utilities Service Alliance 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 Missouri's current agreement with WCS.

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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

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

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. However, to date, the federal government has not identified a 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 either stored on site or shipped directly to a DOE 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 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 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.

<u>High-Level Radioactive Waste Management</u>

Congress passed the "Nuclear Waste Policy Act"[14] (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, even with the License Application for a geologic repository submitted by the DOE to the NRC in

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

2008. As a result, generators have initiated legal action against the DOE in an attempt to obtain compensation for DOE's breach of contract.

In June 2011, Ameren Missouri and the DOE reached an agreement on a settlement. The terms include payment to Ameren Missouri for spent fuel storage and related costs through 2010, and thereafter, annual payment of such costs after they are incurred.

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 the assemblies are packaged into multipurpose canisters for transfer to the ISFSI. It is assumed that this period provides the necessary cooling for the final core to meet the dry storage system's requirements for decay heat.

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 Secretary of Energy, pursuant to 10 CFR Part 50.54(bb).[15] 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.

Costs are included within the decommissioning estimates for offloading the pool. These costs include the acquisition of the dry storage system modules (multipurpose canisters and shielded overpacks. ISFSI operations, once the fuel has been off-loaded from the pool and until such time that the transfer of fuel to the DOE can be completed, are expected to be fully reimbursable and therefore not addressed in this study. The eventual decommissioning of the ISFSI is also not included.

Relocation of the spent fuel from the pool to the ISFSI will allow Ameren Missouri to proceed with decommissioning (or safe-storage preparations) in the shortest time possible.

Site Restoration

Immediate dismantling of site structures (once the facilities are decontaminated) is clearly the most appropriate and cost-effective option. 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 on site is more efficient than if the process is deferred.

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

Site facilities quickly degrade without maintenance, adding additional expense and creating potential hazards to the public and the demolition work force.

Consequently, this study assumes that site structures are removed to a nominal depth of three feet below the local grade level wherever possible. The site is then to be graded and stabilized.

Summary

The costs 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 to a controlled disposal facility.

Decommissioning is accomplished within the 60-year period 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 scenario. The major cost contributors are identified in Section 6, with detailed activity costs, waste volumes, and associated manpower 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 are assigned to one of three subcategories: NRC License Termination, 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 "Spent Fuel Management" subcategory contains costs associated with the transfer of the spent fuel to the ISFSI as well as the operation of the spent fuel pool until such time that the transfer is complete.

"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 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 2014 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 plant decommissioning at the expiration of its current license (2024) and the use of off-site low-level radioactive waste processing to minimize the volume designated for controlled disposal. Costs for the other identified scenarios (including those for a 60-year operating life) are presented in the appendices (E through H).

DECON COST SUMMARY
40-YEAR PLANT OPERATING LIFE
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
DECOMMISSIONING COST ELEMENTS
(thousands of 2014 dollars)

Cost Element	Cost
Decontamination	18,461
Removal	173,424
Packaging	27,586
Transportation	15,934
Waste Disposal	92,986
Off-site Waste Processing	25,790
Program Management [1]	302,704
Security	69,772
Corporate Allocations	9,273
Spent Fuel Pool Isolation	12,434
Spent Fuel Management - Direct Costs [2]	29,564
Insurance and Regulatory Fees	13,592
Energy	11,386
Characterization and Licensing Surveys	24,124
Property Taxes	2,595
Miscellaneous Equipment	6,956
Total [3]	836,582

Cost Element	Cost
License Termination	692,622
Spent Fuel Management	29,564
Site Restoration	114,396
Total [3]	836,582

[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

SAFSTOR COST SUMMARY
40-YEAR PLANT OPERATING LIFE
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
DECOMMISSIONING COST ELEMENTS
(thousands of 2014 dollars)

Cost Element	Cost
Decontamination	16,533
Removal	174,946
Packaging	23,969
Transportation	13,139
Waste Disposal	71,244
Off-site Waste Processing	28,471
Program Management [1]	394,922
Security	155,033
Corporate Allocations	9,891
Spent Fuel Pool Isolation	12,434
Spent Fuel Management [2]	29,564
Insurance and Regulatory Fees	73,348
Energy	23,204
Characterization and Licensing Surveys	24,327
Property Taxes	18,943
Miscellaneous Equipment	21,784
Total [3]	1,091,753

Cost Element	Cost
License Termination	887,947
Spent Fuel Management [4]	89,388
Site Restoration	114,417
Total [3]	1,091,753

[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.

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 Missouri 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 2011,[1] updated to reflect current assumptions pertaining to the disposition of the nuclear unit and relevant industry experience in undertaking such projects. The analysis is not a comprehensive engineering evaluation, but estimates prepared in advance of the detailed planning required to execute 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.

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. The current license expires at midnight on October 18, 2024. On December 19, 2011, Ameren Missouri submitted a request for renewal of the operating license for an additional period of 20 years. The application is current under review by the Nuclear Regulatory Commission (NRC).

For the purposes of this analysis, the base case reflects plant decommissioning at the expiration of its current license (2024) 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 an 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 1284 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 Commission concurred with the staff's recommendation.

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).

1.3.1 High-Level Radioactive Waste Management

Congress passed the "Nuclear Waste Policy Act"[7] (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. As a result, generators have initiated legal action against the DOE in an attempt to obtain compensation for DOE's breach of contract.

In June 2011, Ameren Missouri and the DOE reached an agreement on a settlement. The terms include payment to Ameren Missouri for spent fuel storage and related costs through 2010, and thereafter, annual payment of such costs after they are incurred.

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 the assemblies are packaged into multipurpose canisters for transfer to the ISFSI. It is assumed that this period provides the necessary cooling for the final core to meet the dry storage system's requirements for decay heat.

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 Secretary of Energy, pursuant to 10 CFR Part 50.54(bb).[8] 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.

Costs are included within the decommissioning estimates for offloading the pool. These costs include the acquisition of the dry storage system modules (multipurpose canisters and shielded overpacks. ISFSI operations once the fuel has been off-loaded from the pool and until such time that the transfer of fuel to the DOE can be completed, are expected to be fully reimbursable and therefore not addressed in this study. The eventual decommissioning of the ISFSI is also not included.

Relocation of the spent fuel from the pool to the ISFSI will allow Ameren Missouri to proceed with decommissioning (or safe-storage preparations) in the shortest time possible.

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,[9] and its Amendments of 1985,[10] 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 now operational and waste is being accepted from generators

within the Compact by the operator, Waste Control Specialists (WCS). The facility is also 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 Missouri. The majority of the low-level radioactive waste designated for controlled disposal (Class A[11]) can be sent to Energy*Solutions*' facility in Clive, Utah. Therefore, disposal costs for Class A waste were based upon Ameren Missouri's Utilities Service Alliance 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 Missouri's 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. However, to date, the federal government has not identified a 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 either stored on site or shipped directly to a DOE 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 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 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,"[12] 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).[13] An additional and separate limit of 4 millirem per year, as defined in 40 CFR §141.16, is applied to drinking water.[14]

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)[15] 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

Detailed cost estimates were developed to decommission Callaway for the approved decommissioning alternatives: DECON and SAFSTOR. 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 DECON and SAFSTOR alternatives were evaluated for both a 40-year and 60-year operating license since the application for license renewal is still in review. Two disposal options were also evaluated: 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	Plant Operating Life (years)	Low-Level Radioactive Waste Options	Cost Summaries and/or Detailed Estimates
DECON	40	Recycling	Sections 3, 6, Appendix C
		Direct Disposal	Appendix E
SAFSTOR	40	Recycling	Sections 3, 6, Appendix D
		Direct Disposal	Appendix F
DECON	60	Recycling	Appendix G
SAFSTOR	60	Recycling	Appendix H

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.

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 interim on-site storage of the fuel, pending shipment by the DOE to an off-site disposal facility, are fully reimbursable.

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 within two years of the notice to cease 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 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 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 (FSAR) 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)."[16] 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, exclusive of the ISFSI, 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 (exclusive of the ISFSI) 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, fuel handling, and radioactive waste 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.

Immediate dismantling of site structures is clearly the most appropriate and cost-effective option. 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 on site is more efficient than if the process were deferred. Site facilities quickly degrade without maintenance, adding additional expense and creating potential hazards to the public as well as to future workers. Abandonment creates a breeding ground for vermin infestation as well as other biological hazards.

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 time 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 the spent fuel from the storage pool to the ISFSI following 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 alternatives. 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 forty (or 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 estimates were developed using the site-specific, technical information from the 2011 analysis. 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 previously completed 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,"[17] and the DOE "Decommissioning Handbook."[18] 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 Data," published by R.S. Means.[19]

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.

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 Pathfinder, Shoreham, Rancho Seco, Trojan, Yankee Rowe, Big Rock Point, Maine Yankee, Humboldt Bay-3, Oyster Creek, Connecticut Yankee, and San Onofre-1 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 man-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"[20] 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%

- Non-Radioactive Component Removal 15%
- Heavy Equipment and Tooling 15%
- Supplies 25%
- Engineering 15%
- Energy 15%
- Insurance, Taxes and Fees 10%

- Staffing 15%
- Characterization and Termination Surveys 30%
- Construction 15%
- Spent Fuel Storage System Loading/Transfer Costs 15%
- Operations and Maintenance Expenses 15%

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 the appendices). For example, the composite contingency value reported for the DECON alternative in Appendix C is approximately 18.9%; the corresponding SAFSTOR alternative in Appendix D is approximately 17.2%.

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.

This cost study, however, 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 base 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. As such, the disposal cost is financed by a 1 mill/kWhr surcharge paid into the DOE's waste fund during operations. However, 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 Missouri has assumed that all spent fuel will be relocated to an ISFSI on the Callaway site within five and one-half years after shutdown. This will allow Ameren Missouri to proceed with decommissioning (or safe-storage) operations in the shortest time possible.

It is assumed that the five and one-half years provides the necessary cooling period for the final core to meet storage 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.

Canister Loading and Transfer

The estimates include the cost for the labor and equipment to load and transfer the spent fuel assemblies projected to reside in the pool at the cessation of plant operations. The capital cost associated with the dry storage system 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. It is assumed that the five and one-half years provides the necessary cooling period for the final core to meet the dry cask storage vendor's system.

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).

It is assumed that the DOE would not accept this waste prior to completing the transfer of spent fuel. Therefore, until such time the DOE is ready to accept GTCC waste, it is assumed that this material would remain in storage at the site (for the DECON alternative). In the SAFSTOR scenario, the GTCC material is shipped directly to a DOE facility as it is generated since the fuel has been removed from the site prior to the start of decommissioning.

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 the 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.[21] 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.[22]

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 (base case). 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 Missouri's 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 just below ground 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."

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 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 2014 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 2011 analysis.

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 Missouri, 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 Missouri. Overhead costs are included for site and corporate support, reduced commensurate with the staffing of the project.

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

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.

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.[23] 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 were derived from CR-0130[24] and CR-0672,[25] 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 Missouri and its subcontractors. The plant's 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 Missouri 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 required 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"[26] 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 (e.g., labor, materials, and waste disposal).

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 ISFSI. 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 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 2014 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 (2024) and the use of off-site low-level radioactive waste processing to minimize the volume designated for controlled disposal. Costs for the other identified scenarios (including those for a 60-year operating life) are presented in the appendices (E through H).

TABLE 3.1
DECON ALTERNATIVE
40-YEAR PLANT OPERATING LIFE
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
TOTAL ANNUAL EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other [1]	Total [2]
2024	13,581	889	396	8	1,612	16,487
2025	68,781	7,053	2,325	2,016	12,890	93,064
2026	77,965	25,246	2,437	33,861	24,285	163,793
2027	76,861	27,425	1,809	42,108	20,099	168,303
2028	67,852	10,602	1,450	10,079	8,664	98,647
2029	67,666	10,573	1,446	10,051	8,641	98,377
2030	49,267	7,323	956	8,271	6,289	72,106
2031	34,224	9,547	331	21	2,424	46,547
2032	32,080	29,448	193	0	3,320	65,042
2033	7,012	6,437	42	0	726	14,217
Total	495,290	134,543	11,386	106,415	88,948	836,582

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

TABLE 3.1a
DECON ALTERNATIVE
40-YEAR PLANT OPERATING LIFE
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
LICENSE TERMINATION EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2024	13,276	379	396	8	1,066	15,125
2025	67,064	4,573	2,325	2,016	10,232	86,209
2026	75,013	22,852	2,437	33,861	22,036	156,197
2027	73,677	25,015	1,809	42,108	18,007	160,616
2028	63,256	7,458	1,450	10,079	6,315	88,559
2029	63,084	7,438	1,446	10,051	6,298	88,317
2030	47,911	6,396	956	8,271	5,595	69,129
2031	25,239	1,259	277	21	1,489	28,286
2032	151	0	0	0	0	151
2033	33	0	0	0	0	33
Total	428,704	75,369	11,096	106,415	71,038	692,622

TABLE 3.1b
DECON ALTERNATIVE
40-YEAR PLANT OPERATING LIFE
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
SPENT FUEL MANAGEMENT EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2024	170	510	0	0	546	1,227
2025	827	2,480	0	0	2,658	5,964
2026	776	2,328	0	0	2,228	5,332
2027	759	2,276	0	0	2,045	5,080
2028	792	2,376	0	0	2,050	5,218
2029	790	2,369	0	0	2,045	5,204
2030	234	701	0	0	605	1,540
2031	0	0	0	0	0	0
2032	0	0	0	0	0	0
2033	0	0	0	0	0	0
Total	4,347	13,041	0	0	12,176	29,564

TABLE 3.1c
DECON ALTERNATIVE
40-YEAR PLANT OPERATING LIFE
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
SITE RESTORATION EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2024	135	0	0	0	0	135
2025	890	0	0	0	0	890
2026	2,176	66	0	0	22	2,264
2027	2,425	134	0	0	47	2,607
2028	3,803	768	0	0	299	4,870
2029	3,793	766	0	0	298	4,857
2030	1,122	227	0	0	88	1,437
2031	8,986	8,287	54	0	934	18,262
2032	31,929	29,448	193	0	3,320	64,891
2033	6,979	6,437	42	0	726	14,184
Total	62,239	46,133	290	0	5,734	114,396

TABLE 3.2
SAFSTOR ALTERNATIVE
40-YEAR PLANT OPERATING LIFE
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
TOTAL ANNUAL EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other [1]	Total [2]
2024	11,407	785	396	8	1,612	14,208
2025	57,355	6,687	1,928	560	7,919	74,449
2026	29,144	4,632	846	796	17,502	52,920
2027	18,493	2,776	386	15	3,697	25,367
2028	18,544	2,784	387	15	3,707	25,436
2029	18,493	2,776	386	15	3,697	25,367
2030	7,679	1,039	250	9	2,103	11,079
2031	3,134	309	193	6	1,432	5,075
2032	3,143	310	193	6	1,436	5,089
2033	3,134	309	193	6	1,432	5,075
2034	3,134	309	193	6	1,432	5,075
2035	3,134	309	193	6	1,432	5,075
2036	3,143	310	193	6	1,436	5,089
2037	3,134	309	193	6	1,432	5,075
2038	3,134	309	193	6	1,432	5,075
2039	3,134	309	193	6	1,432	5,075
2040	3,143	310	193	6	1,436	5,089
2041	3,134	309	193	6	1,432	5,075
2042	3,134	309	193	6	1,432	5,075
2043	3,134	309	193	6	1,432	5,075
2044	3,143	310	193	6	1,436	5,089
2045	3,134	309	193	6	1,432	5,075
2046	3,134	309	193	6	1,432	5,075
2047	3,134	309	193	6	1,432	5,075
2048	3,143	310	193	6	1,436	5,089
2049	3,134	309	193	6	1,432	5,075
2050	3,134	309	193	6	1,432	5,075
2051	3,134	309	193	6	1,432	5,075
2052	3,143	310	193	6	1,436	5,089
2053	3,134	309	193	6	1,432	5,075

TABLE 3.2 (continued)
SAFSTOR ALTERNATIVE
40-YEAR PLANT OPERATING LIFE
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
TOTAL ANNUAL EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other [1]	Total [2]
2054	3,134	309	193	6	1,432	5,075
2055	3,134	309	193	6	1,432	5,075
2056	3,143	310	193	6	1,436	5,089
2057	3,134	309	193	6	1,432	5,075
2058	3,134	309	193	6	1,432	5,075
2059	3,134	309	193	6	1,432	5,075
2060	3,143	310	193	6	1,436	5,089
2061	3,134	309	193	6	1,432	5,075
2062	3,134	309	193	6	1,432	5,075
2063	3,134	309	193	6	1,432	5,075
2064	3,143	310	193	6	1,436	5,089
2065	3,134	309	193	6	1,432	5,075
2066	3,134	309	193	6	1,432	5,075
2067	3,134	309	193	6	1,432	5,075
2068	3,143	310	193	6	1,436	5,089
2069	3,134	309	193	6	1,432	5,075
2070	3,134	309	193	6	1,432	5,075
2071	3,134	309	193	6	1,432	5,075
2072	3,143	310	193	6	1,436	5,089
2073	3,134	309	193	6	1,432	5,075
2074	3,134	309	193	6	1,432	5,075
2075	3,134	309	193	6	1,432	5,075
2076	3,143	310	193	6	1,436	5,089
2077	3,134	309	193	6	1,432	5,075
2078	12,946	687	511	11	1,658	15,813
2079	49,150	4,498	1,928	35	2,782	58,394
2080	56,932	21,216	1,868	30,307	14,982	125,305
2081	59,485	22,303	1,715	34,062	16,324	133,888
2082	53,708	8,092	1,446	10,385	6,479	80,111
2083	53,708	8,092	1,446	10,385	6,479	80,111

TABLE 3.2 (continued)
SAFSTOR ALTERNATIVE
40-YEAR PLANT OPERATING LIFE
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
TOTAL ANNUAL EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other [1]	Total [2]
2084	35,324	7,694	391	449	2,516	46,373
2085	31,992	29,368	193	0	3,311	64,864
2086	9,554	8,770	58	0	989	19,370
Total	671,319	146,747	23,204	87,354	163,128	1,091,752

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

TABLE 3.2a
SAFSTOR ALTERNATIVE
40-YEAR PLANT OPERATING LIFE
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
LICENSE TERMINATION EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2024	11,237	274	396	8	1,066	12,981
2025	56,528	4,207	1,928	560	5,261	68,484
2026	18,126	2,263	711	796	15,148	37,044
2027	3,134	447	193	15	1,472	5,261
2028	3,143	449	193	15	1,476	5,276
2029	3,134	447	193	15	1,472	5,261
2030	3,134	350	193	9	1,444	5,130
2031	3,134	309	193	6	1,432	5,075
2032	3,143	310	193	6	1,436	5,089
2033	3,134	309	193	6	1,432	5,075
2034	3,134	309	193	6	1,432	5,075
2035	3,134	309	193	6	1,432	5,075
2036	3,143	310	193	6	1,436	5,089
2037	3,134	309	193	6	1,432	5,075
2038	3,134	309	193	6	1,432	5,075
2039	3,134	309	193	6	1,432	5,075
2040	3,143	310	193	6	1,436	5,089
2041	3,134	309	193	6	1,432	5,075
2042	3,134	309	193	6	1,432	5,075
2043	3,134	309	193	6	1,432	5,075
2044	3,143	310	193	6	1,436	5,089
2045	3,134	309	193	6	1,432	5,075
2046	3,134	309	193	6	1,432	5,075
2047	3,134	309	193	6	1,432	5,075
2048	3,143	310	193	6	1,436	5,089
2049	3,134	309	193	6	1,432	5,075
2050	3,134	309	193	6	1,432	5,075
2051	3,134	309	193	6	1,432	5,075
2052	3,143	310	193	6	1,436	5,089
2053	3,134	309	193	6	1,432	5,075

TABLE 3.2a (continued)
SAFSTOR ALTERNATIVE
40-YEAR PLANT OPERATING LIFE
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
LICENSE TERMINATION EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2054	3,134	309	193	6	1,432	5,075
2055	3,134	309	193	6	1,432	5,075
2056	3,143	310	193	6	1,436	5,089
2057	3,134	309	193	6	1,432	5,075
2058	3,134	309	193	6	1,432	5,075
2059	3,134	309	193	6	1,432	5,075
2060	3,143	310	193	6	1,436	5,089
2061	3,134	309	193	6	1,432	5,075
2062	3,134	309	193	6	1,432	5,075
2063	3,134	309	193	6	1,432	5,075
2064	3,143	310	193	6	1,436	5,089
2065	3,134	309	193	6	1,432	5,075
2066	3,134	309	193	6	1,432	5,075
2067	3,134	309	193	6	1,432	5,075
2068	3,143	310	193	6	1,436	5,089
2069	3,134	309	193	6	1,432	5,075
2070	3,134	309	193	6	1,432	5,075
2071	3,134	309	193	6	1,432	5,075
2072	3,143	310	193	6	1,436	5,089
2073	3,134	309	193	6	1,432	5,075
2074	3,134	309	193	6	1,432	5,075
2075	3,134	309	193	6	1,432	5,075
2076	3,143	310	193	6	1,436	5,089
2077	3,134	309	193	6	1,432	5,075
2078	12,695	687	511	11	1,658	15,561
2079	48,095	4,498	1,928	35	2,782	57,339
2080	54,743	21,143	1,868	30,307	14,961	123,021
2081	56,387	21,994	1,715	34,062	16,212	130,369
2082	49,893	7,322	1,446	10,385	6,179	75,225
2083	49,893	7,322	1,446	10,385	6,179	75,225

TABLE 3.2a (continued)
SAFSTOR ALTERNATIVE
40-YEAR PLANT OPERATING LIFE
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
LICENSE TERMINATION EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2084	28,624	1,628	351	449	1,823	32,875
2085	150	0	0	0	0	150
2086	45	0	0	0	0	45
Total	546,366	87,580	22,143	87,354	144,505	887,947

TABLE 3.2b
SAFSTOR ALTERNATIVE
40-YEAR PLANT OPERATING LIFE
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
SPENT FUEL MANAGEMENT EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2024	170	510	0	0	546	1,227
2025	827	2,480	0	0	2,658	5,964
2026	11,018	2,369	135	0	2,354	15,876
2027	15,359	2,329	193	0	2,225	20,106
2028	15,401	2,335	193	0	2,231	20,161
2029	15,359	2,329	193	0	2,225	20,106
2030	4,545	689	57	0	658	5,949
Total	62,678	13,041	771	0	12,898	89,388

TABLE 3.2c
SAFSTOR ALTERNATIVE
40-YEAR PLANT OPERATING LIFE
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
SITE RESTORATION EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2024-77	0	0	0	0	0	0
2078	252	0	0	0	0	252
2079	1,055	0	0	0	0	1,055
2080	2,190	73	0	0	21	2,284
2081	3,097	309	0	0	113	3,519
2082	3,815	770	0	0	300	4,885
2083	3,815	770	0	0	300	4,885
2084	6,700	6,066	40	0	693	13,498
2085	31,842	29,368	193	0	3,311	64,714
2086	9,509	8,770	58	0	989	19,325
Total	62,275	46,127	290	0	5,726	114,417

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 2010" computer software.[27]

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 man-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.

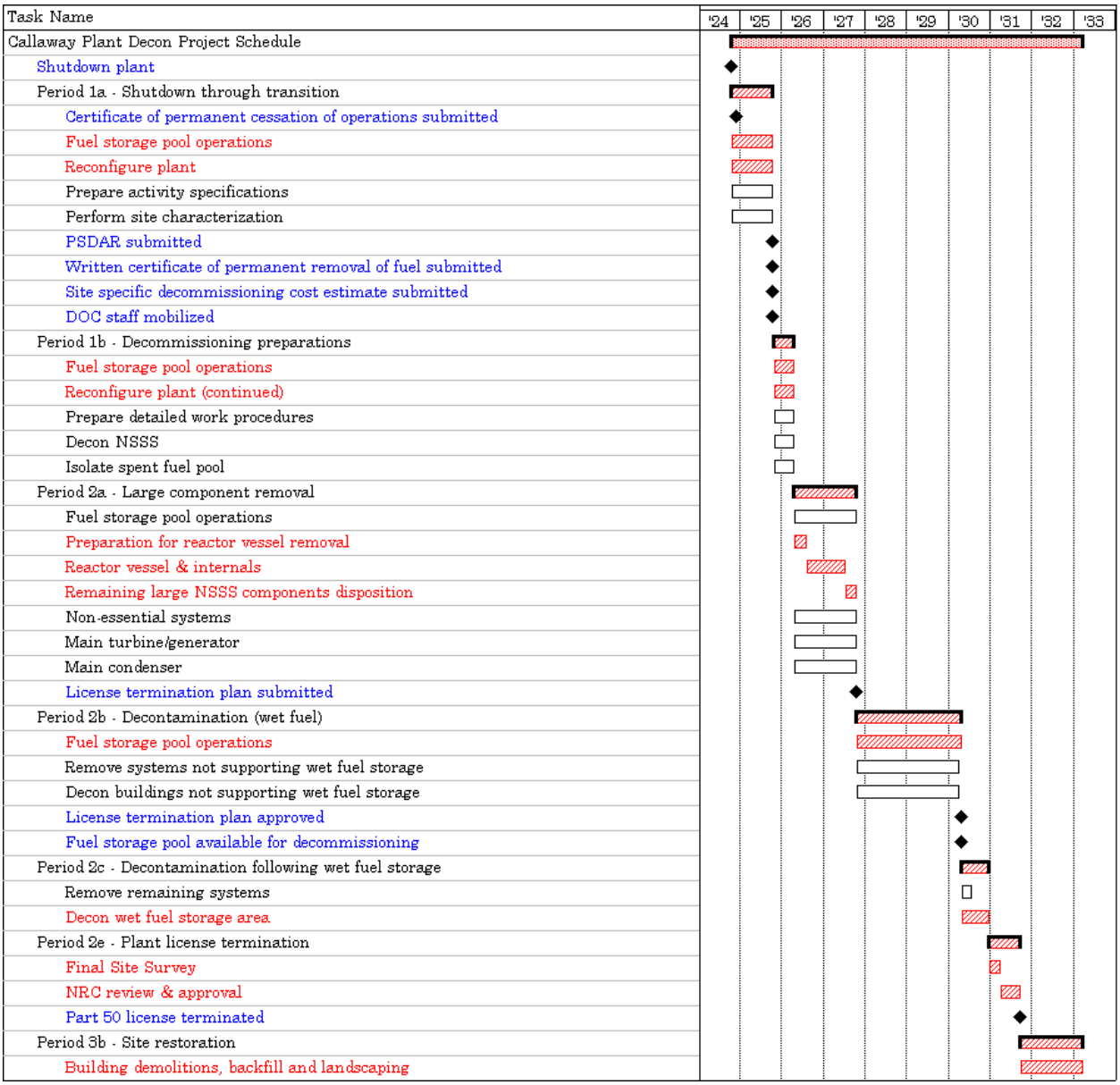
- For plant systems removal, the systems with the longest removal durations in areas on the critical path are considered to determine the duration of the activity.

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 2024 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



Legend:
1. Red text and/or shaded scheduling bars indicate critical path activities
2. Shaded scheduling bars associated with major decommissioning periods, e.g., Period 1a, indicate overall duration of that period
3. Blue text and/or diamond symbols indicate major milestones

FIGURE 4.2
DECOMMISSIONING TIMELINE
40-YEAR PLANT OPERATING LIFE
DECON
(not to scale)

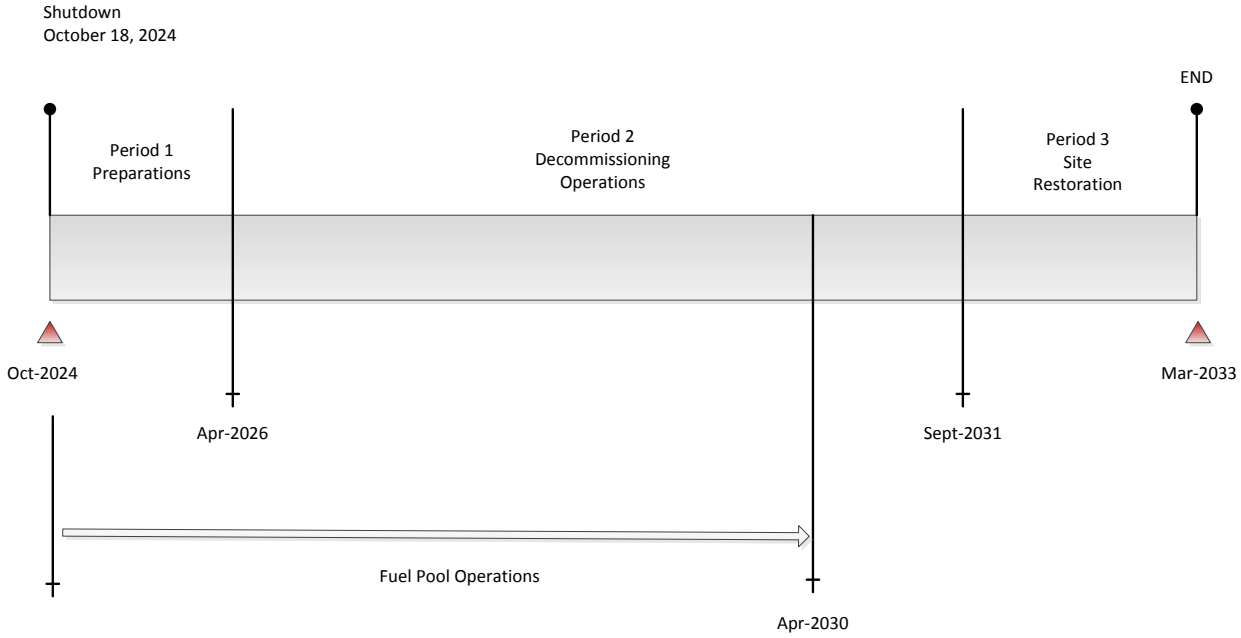
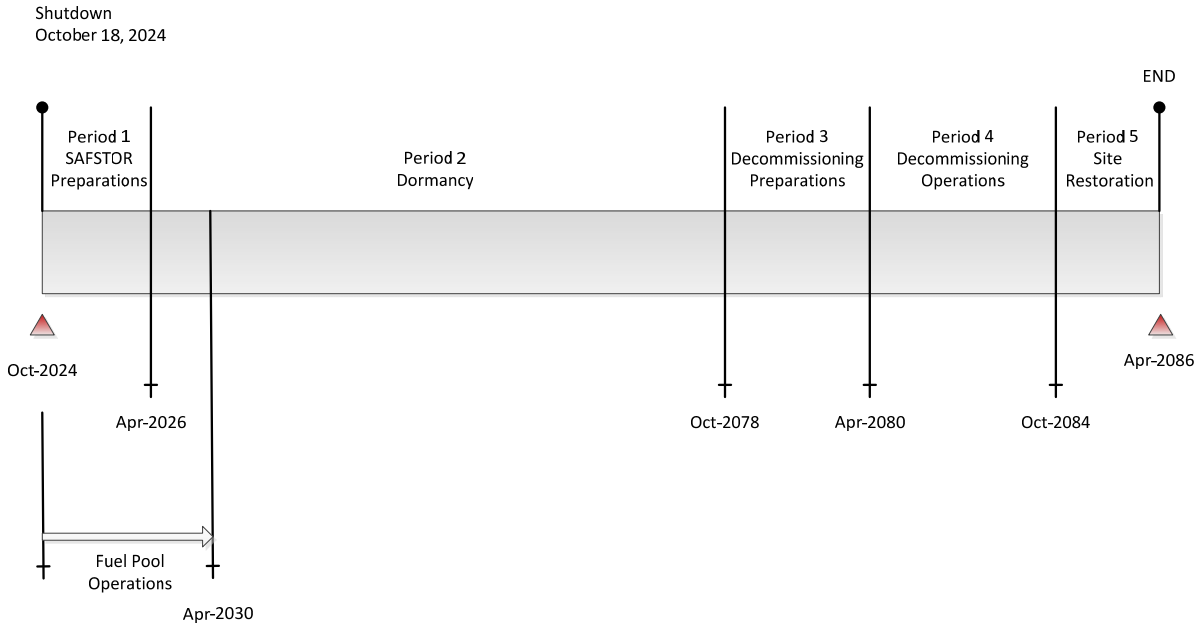


FIGURE 4.3
DECOMMISSIONING TIMELINE
40-YEAR PLANT OPERATING LIFE
SAFSTOR
(not to scale)



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,[28] 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 time 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 reprocessing 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 Missouri's 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. Such material, known as Greater-Than-Class-C or 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 spent fuel storage canisters.

FIGURE 5.1
RADIOACTIVE WASTE DISPOSITION

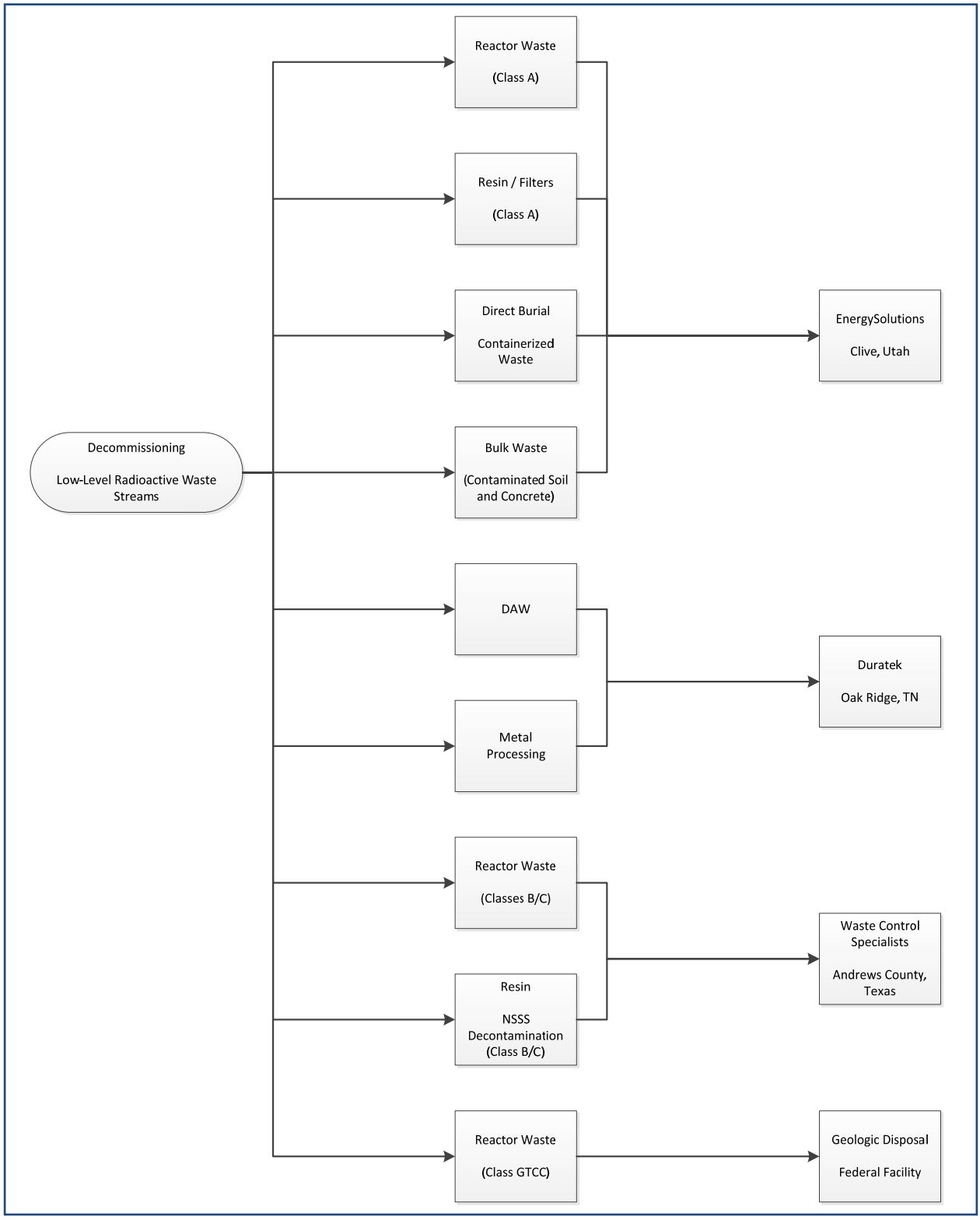


FIGURE 5.2
DECOMMISSIONING WASTE DESTINATIONS
RADIOLOGICAL

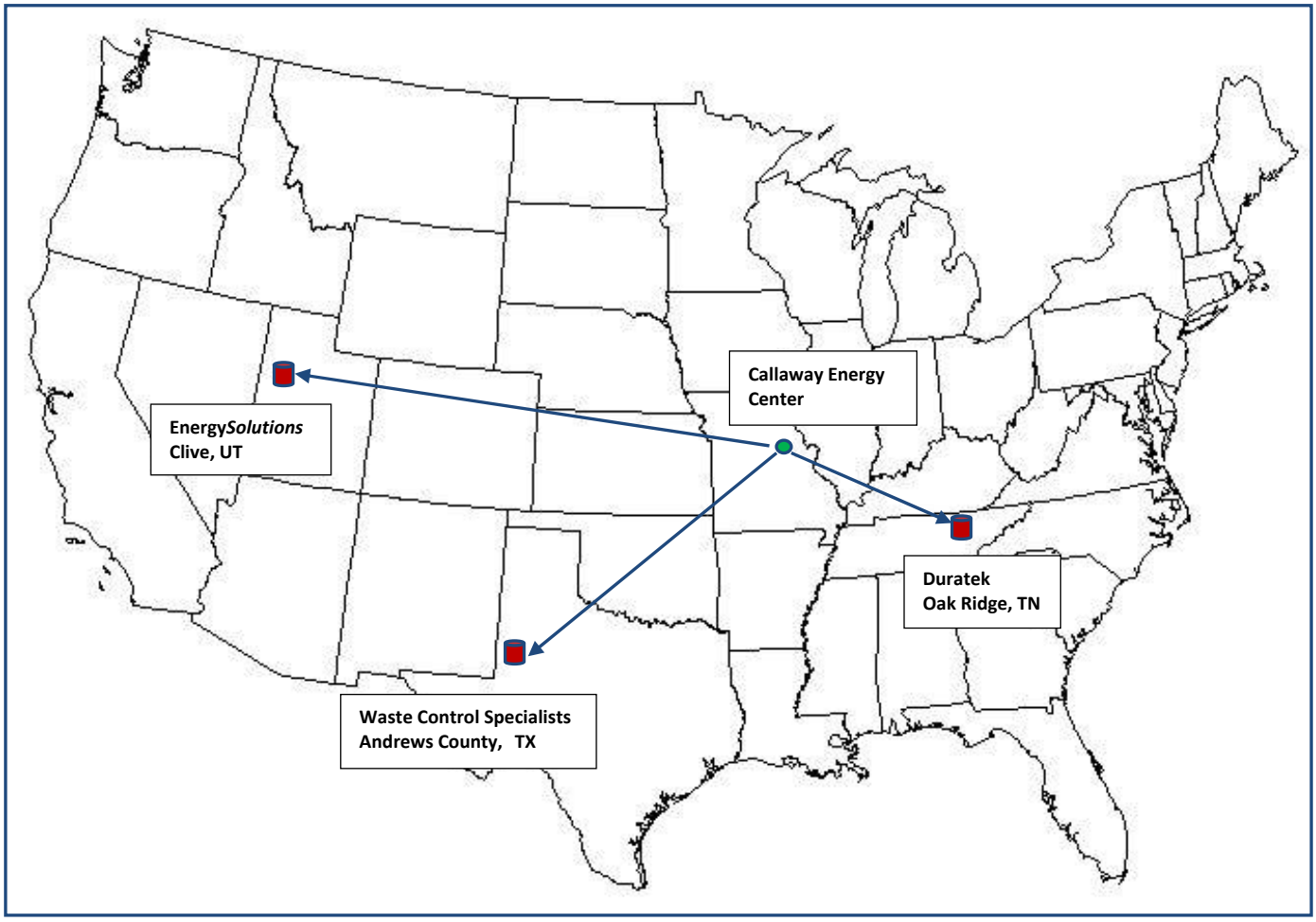


TABLE 5.1
DECON ALTERNATIVE
DECOMMISSIONING WASTE SUMMARY

Waste	Cost Basis	Class [1]	Waste Volume (cubic feet)	Mass (pounds)
Low-Level Radioactive Waste (near-surface disposal)	Energy*Solutions*	A	176,272	14,265,249
	WCS	B	1,750	191,469
	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	286,787	10,788,070
Totals [2]			467,419	25,725,380

[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.

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	148,204	11,859,238
	WCS	B	501	50,254
	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	313,266	11,919,870
Totals [2]			464,594	24,309,290

[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 2011. 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 on-half years following the cessation of operations for continued cooling of the assemblies. Once sufficiently cooled, the assemblies will be moved to the ISFSI for interim storage and to await transfer to a DOE facility (e.g., geologic repository).

The cost projected to promptly decommission (DECON) Callaway, assuming a 40-year operating life and the use of off-site low-level radioactive waste processing to reduce the volume requiring controlled disposal, is estimated to be $836.6 million. The majority of this cost (approximately 82.8%) is associated with the physical decontamination and dismantling of the nuclear unit so that the operating license can be terminated. Another 3.5% is associated with the management, interim storage, and eventual transfer of the spent fuel. The remaining 13.7% is for the demolition of the designated structures and limited restoration of the site.

The cost projected for deferred decommissioning (SAFSTOR), assuming a 40-year operating life and the use of off-site low-level radioactive waste processing to reduce the volume requiring controlled disposal, is estimated to be $1,091.8 million. The majority of this cost (approximately 81.3%) 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 8.2% is associated with the management, interim storage, and eventual transfer of the spent fuel. The remaining 10.5% 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 Missouri 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 multi-purpose canisters and transferred to the ISFSI. The ISFSI will continue to operate until such time that the transfer of spent fuel to a DOE facility is complete.

The cost for waste disposal includes only 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's 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
40-YEAR PLANT OPERATING LIFE
DECOMMISSIONING COST ELEMENTS
(thousands of 2014 dollars)

Cost Element	Total	Percentage
Decontamination	18,461	2.2
Removal	173,424	20.7
Packaging	27,586	3.3
Transportation	15,934	1.9
Waste Disposal	92,986	11.1
Off-site Waste Processing	25,790	3.1
Program Management [1]	302,704	36.2
Security	69,772	8.3
Corporate Allocations	9,273	1.1
Spent Fuel Pool Isolation	12,434	1.5
Spent Fuel Management [2]	29,564	3.5
Insurance and Regulatory Fees	13,592	1.6
Energy	11,386	1.4
Characterization and Licensing Surveys	24,124	2.9
Property Taxes	2,595	0.3
Miscellaneous Equipment	6,956	0.8
Total [3]	836,582	100

Cost Element	Total	Percentage
License Termination	692,622	82.8
Spent Fuel Management	29,564	3.5
Site Restoration	114,396	13.7
Total [3]	836,582	100

[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
40-YEAR PLANT OPERATING LIFE
DECOMMISSIONING COST ELEMENTS
(thousands of 2014 dollars)

Cost Element	Total	Percentage
Decontamination	16,533	1.5
Removal	174,946	16.0
Packaging	23,969	2.2
Transportation	13,139	1.2
Waste Disposal	71,244	6.5
Off-site Waste Processing	28,471	2.6
Program Management [1]	394,922	36.2
Security	155,033	14.2
Corporate Allocations	9,891	0.9
Spent Fuel Pool Isolation	12,434	1.1
Spent Fuel Management [2]	29,564	2.7
Insurance and Regulatory Fees	73,348	6.7
Energy	23,204	2.1
Characterization and Licensing Surveys	24,327	2.2
Property Taxes	18,943	1.7
Miscellaneous Equipment	21,784	2.0
Total [3]	1,091,753	100

Cost Element	Total	Percentage
License Termination	887,947	81.3
Spent Fuel Management [4]	89,388	8.2
Site Restoration	114,417	10.5
Total [3]	1,091,753	100

[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 No. A22-1644-001, Rev. 0, TLG Services, Inc., August 2014

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

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

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

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

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

7. "Nuclear Waste Policy Act of 1982 and Amendments," U.S. Department of Energy's Office of Civilian Radioactive Management, 1982

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

9. "Low Level Radioactive Waste Policy Act," Public Law 96-573, 1980

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

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

12. 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

7. REFERENCES
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13. "Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination," EPA Memorandum OSWER No. 9200.4-18, August 22, 1997

14. U.S. Code of Federal Regulations, Title 40, Part 141.16, "Maximum contaminant levels for beta particle and photon radioactivity from man-made radionuclides in community water systems"

15. "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

16. "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)," NUREG/CR-1575, Rev. 1, EPA 402-R-97-016, Rev. 1, August 2000

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

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

19. "Building Construction Cost Data 2014," Robert Snow Means Company, Inc., Kingston, Massachusetts

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

21. U.S. Department of Transportation, Title 49 of the Code of Federal Regulations, "Transportation," Parts 173 through 178

22. Tri-State Motor Transit Company, Radioactive Materials Tariff

23. 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

7. REFERENCES
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24. 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

25. 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

26. SECY-00-0145, "Integrated Rulemaking Plan for Nuclear Power Plant Decommissioning," June 2000

27. "Microsoft Project Professional 2010," Microsoft Corporation, Redmond, WA

28. "Atomic Energy Act of 1954," (68 Stat. 919)

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 hr *****

* alpha designators indicate activities that can be performed in parallel

APPENDIX A
(continued)

3. LABOR REQUIRED

Crew	Number	Duration (hours)	Rate ($/hr)	Cost
Laborers	3.00	11.217	$39.47	$1,328.21
Craftsmen	2.00	11.217	$54.57	$1,224.22
Foreman	1.00	11.217	$56.98	$639.14
General Foreman	0.25	11.217	$57.98	$162.59
Fire Watch	0.05	11.217	$39.47	$22.14
Health Physics Technician	1.00	11.217	$48.84	$547.84
Total Labor Cost				$3,924.14

4. EQUIPMENT & CONSUMABLES COSTS

Equipment Costs	none
Consumables/Materials Costs	
• Universal Polypropylene Sorbent 50 @ $0.60/sq ft [1]	$30.00
• Tarpaulin, oil resistant, fire retardant 50 @ $0.27/sq ft [2]	$13.50
• Gas torch consumables 1 @ $18.85 x 1 /hr [3]	$18.85
Subtotal cost of equipment and materials	$62.35
Overhead & profit on equipment and materials @ 14.23 %	$8.87
Total costs, equipment & material	$71.22

TOTAL COST:

Removal of contaminated **heat exchanger <3000 pounds:**	**$3,995.36**
Total labor cost:	$3,924.14
Total equipment/material costs:	$71.22
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 (2014) Division 01 56, Section 13.60-0600, page 23
    3. R.S. Means (2014) Division 01 54 33, Section 40-6360, page 698

- Material and consumable costs were adjusted using the regional indices for Columbia, Missouri.

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	0.44
Removal of clean pipe 0.25 to 2 inches diameter, $/linear foot	4.68
Removal of clean pipe >2 to 4 inches diameter, $/linear foot	6.72
Removal of clean pipe >4 to 8 inches diameter, $/linear foot	13.28
Removal of clean pipe >8 to 14 inches diameter, $/linear foot	25.46
Removal of clean pipe >14 to 20 inches diameter, $/linear foot	33.20
Removal of clean pipe >20 to 36 inches diameter, $/linear foot	48.82
Removal of clean pipe >36 inches diameter, $/linear foot	57.96
Removal of clean valve >2 to 4 inches	87.48
Removal of clean valve >4 to 8 inches	132.77
Removal of clean valve >8 to 14 inches	254.61
Removal of clean valve >14 to 20 inches	331.95
Removal of clean valve >20 to 36 inches	488.18
Removal of clean valve >36 inches	579.62
Removal of clean pipe hanger for small bore piping	31.06
Removal of clean pipe hanger for large bore piping	107.87
Removal of clean pump, <300 pound	225.92
Removal of clean pump, 300-1000 pound	627.83
Removal of clean pump, 1000-10,000 pound	2,464.05
Removal of clean pump, >10,000 pound	4,772.28
Removal of clean pump motor, 300-1000 pound	261.20
Removal of clean pump motor, 1000-10,000 pound	1,021.98
Removal of clean pump motor, >10,000 pound	2,299.43
Removal of clean heat exchanger <3000 pound	1,325.75
Removal of clean heat exchanger >3000 pound	3,346.84
Removal of clean feedwater heater/deaerator	9,416.15
Removal of clean moisture separator/reheater	19,332.45
Removal of clean tank, <300 gallons	290.37
Removal of clean tank, 300-3000 gallon	911.88
Removal of clean tank, >3000 gallons, $/square foot surface area	7.73

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of clean electrical equipment, <300 pound	121.36
Removal of clean electrical equipment, 300-1000 pound	425.26
Removal of clean electrical equipment, 1000-10,000 pound	850.50
Removal of clean electrical equipment, >10,000 pound	2,024.52
Removal of clean electrical transformer < 30 tons	1,406.01
Removal of clean electrical transformer > 30 tons	4,049.05
Removal of clean standby diesel generator, <100 kW	1,436.12
Removal of clean standby diesel generator, 100 kW to 1 MW	3,205.50
Removal of clean standby diesel generator, >1 MW	6,636.04
Removal of clean electrical cable tray, $/linear foot	11.49
Removal of clean electrical conduit, $/linear foot	5.02
Removal of clean mechanical equipment, <300 pound	121.36
Removal of clean mechanical equipment, 300-1000 pound	425.26
Removal of clean mechanical equipment, 1000-10,000 pound	850.50
Removal of clean mechanical equipment, >10,000 pound	2,024.52
Removal of clean HVAC equipment, <300 pound	146.73
Removal of clean HVAC equipment, 300-1000 pound	510.98
Removal of clean HVAC equipment, 1000-10,000 pound	1,018.38
Removal of clean HVAC equipment, >10,000 pound	2,024.52
Removal of clean HVAC ductwork, $/pound	0.46
Removal of contaminated instrument and sampling tubing, $/linear foot	1.40
Removal of contaminated pipe 0.25 to 2 inches diameter, $/linear foot	19.82
Removal of contaminated pipe >2 to 4 inches diameter, $/linear foot	33.76
Removal of contaminated pipe >4 to 8 inches diameter, $/linear foot	53.92
Removal of contaminated pipe >8 to 14 inches diameter, $/linear foot	105.29
Removal of contaminated pipe >14 to 20 inches diameter, $/linear foot	126.41
Removal of contaminated pipe >20 to 36 inches diameter, $/linear foot	174.60
Removal of contaminated pipe >36 inches diameter, $/linear foot	206.16
Removal of contaminated valve >2 to 4 inches	408.26
Removal of contaminated valve >4 to 8 inches	492.14

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of contaminated valve >8 to 14 inches	1,003.18
Removal of contaminated valve >14 to 20 inches	1,274.87
Removal of contaminated valve >20 to 36 inches	1,696.32
Removal of contaminated valve >36 inches	2,011.92
Removal of contaminated pipe hanger for small bore piping	133.15
Removal of contaminated pipe hanger for large bore piping	429.69
Removal of contaminated pump, <300 pound	880.15
Removal of contaminated pump, 300-1000 pound	2,040.83
Removal of contaminated pump, 1000-10,000 pound	6,586.89
Removal of contaminated pump, >10,000 pound	16,045.88
Removal of contaminated pump motor, 300-1000 pound	871.81
Removal of contaminated pump motor, 1000-10,000 pound	2,684.52
Removal of contaminated pump motor, >10,000 pound	6,027.15
Removal of contaminated heat exchanger <3000 pound	3,995.36
Removal of contaminated heat exchanger >3000 pound	11,602.53
Removal of contaminated tank, <300 gallons	1,463.53
Removal of contaminated tank, >300 gallons, $/square foot	28.55
Removal of contaminated electrical equipment, <300 pound	676.59
Removal of contaminated electrical equipment, 300-1000 pound	1,648.52
Removal of contaminated electrical equipment, 1000-10,000 pound	3,174.61
Removal of contaminated electrical equipment, >10,000 pound	6,219.42
Removal of contaminated electrical cable tray, $/linear foot	32.80
Removal of contaminated electrical conduit, $/linear foot	15.65
Removal of contaminated mechanical equipment, <300 pound	752.92
Removal of contaminated mechanical equipment, 300-1000 pound	1,821.37
Removal of contaminated mechanical equipment, 1000-10,000 pound	3,501.80
Removal of contaminated mechanical equipment, >10,000 pound	6,219.42
Removal of contaminated HVAC equipment, <300 pound	752.92
Removal of contaminated HVAC equipment, 300-1000 pound	1,821.37
Removal of contaminated HVAC equipment, 1000-10,000 pound	3,501.80

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of contaminated HVAC equipment, >10,000 pound	6,219.42
Removal of contaminated HVAC ductwork, $/pound	2.03
Removal/plasma arc cut of contaminated thin metal components, $/linear in.	3.60
Additional decontamination of surface by washing, $/square foot	7.49
Additional decontamination of surfaces by hydrolasing, $/square foot	33.00
Decontamination rig hook up and flush, $/ 250 foot length	6,364.45
Chemical flush of components/systems, $/gallon	18.79
Removal of clean standard reinforced concrete, $/cubic yard	137.19
Removal of grade slab concrete, $/cubic yard	179.99
Removal of clean concrete floors, $/cubic yard	363.14
Removal of sections of clean concrete floors, $/cubic yard	1,067.34
Removal of clean heavily rein concrete w/#9 rebar, $/cubic yard	236.89
Removal of contaminated heavily rein concrete w/#9 rebar, $/cubic yard	2,056.55
Removal of clean heavily rein concrete w/#18 rebar, $/cubic yard	299.52
Removal of contaminated heavily rein concrete w/#18 rebar, $/cubic yard	2,721.03
Removal heavily rein concrete w/#18 rebar & steel embedments, $/cubic yard	443.64
Removal of below-grade suspended floors, $/cubic yard	363.14
Removal of clean monolithic concrete structures, $/cubic yard	878.26
Removal of contaminated monolithic concrete structures, $/cubic yard	2,049.51
Removal of clean foundation concrete, $/cubic yard	692.34
Removal of contaminated foundation concrete, $/cubic yard	1,910.04
Explosive demolition of bulk concrete, $/cubic yard	30.64
Removal of clean hollow masonry block wall, $/cubic yard	96.38
Removal of contaminated hollow masonry block wall, $/cubic yard	319.77
Removal of clean solid masonry block wall, $/cubic yard	96.38
Removal of contaminated solid masonry block wall, $/cubic yard	319.77
Backfill of below-grade voids, $/cubic yard	32.65
Removal of subterranean tunnels/voids, $/linear foot	111.87
Placement of concrete for below-grade voids, $/cubic yard	123.61
Excavation of clean material, $/cubic yard	3.21

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Excavation of contaminated material, $/cubic yard	41.60
Removal of clean concrete rubble (tipping fee included), $/cubic yard	24.61
Removal of contaminated concrete rubble, $/cubic yard	26.65
Removal of building by volume, $/cubic foot	0.31
Removal of clean building metal siding, $/square foot	1.26
Removal of contaminated building metal siding, $/square foot	4.25
Removal of standard asphalt roofing, $/square foot	2.06
Removal of transite panels, $/square foot	2.04
Scarifying contaminated concrete surfaces (drill & spall), $/square foot	12.24
Scabbling contaminated concrete floors, $/square foot	7.42
Scabbling contaminated concrete walls, $/square foot	19.52
Scabbling contaminated ceilings, $/square foot	66.90
Scabbling structural steel, $/square foot	5.97
Removal of clean overhead crane/monorail < 10 ton capacity	599.12
Removal of contaminated overhead crane/monorail < 10 ton capacity	1,702.27
Removal of clean overhead crane/monorail >10-50 ton capacity	1,437.91
Removal of contaminated overhead crane/monorail >10-50 ton capacity	4,084.75
Removal of polar crane > 50 ton capacity	6,008.31
Removal of gantry crane > 50 ton capacity	25,306.61
Removal of structural steel, $/pound	0.19
Removal of clean steel floor grating, $/square foot	4.46
Removal of contaminated steel floor grating, $/square foot	12.92
Removal of clean free standing steel liner, $/square foot	11.59
Removal of contaminated free standing steel liner, $/square foot	33.35
Removal of clean concrete-anchored steel liner, $/square foot	5.80
Removal of contaminated concrete-anchored steel liner, $/square foot	38.89
Placement of scaffolding in clean areas, $/square foot	14.74
Placement of scaffolding in contaminated areas, $/square foot	24.14
Landscaping with topsoil, $/acre	24,007.77
Cost of CPC B-88 LSA box & preparation for use	1,999.95

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Cost of CPC B-25 LSA box & preparation for use	1,827.70
Cost of CPC B-12V 12 gauge LSA box & preparation for use	1,485.94
Cost of CPC B-144 LSA box & preparation for use	10,282.72
Cost of LSA drum & preparation for use	192.76
Cost of cask liner for CNSI 8 120A cask (resins)	11,931.47
Cost of cask liner for CNSI 8 120A cask (filters)	8,546.72
Decontamination of surfaces with vacuuming, $/square foot	0.77

APPENDIX C

DETAILED COST ANALYSIS

DECON ALTERNATIVE DECOMMISSIONING COST ESTIMATE
40-YEAR OPERATING LIFE with
LOW-LEVEL RADIOACTIVE WASTE PROCESSING

Table C
Callaway Energy Center
DECON Alternative Decommissioning Cost Estimate
40-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Processing Costs	Disposal Costs	Other Costs	Total Contingency	Total Costs	Lic. Term. Costs	Management Costs	Restoration Costs	Volume Cu. Feet	Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Processed Wt., Lbs.	Craft Manhours	S20 Contractor Manhours
PERIOD 1a - Shutdown through Transition																					
Period 1a Direct Decommissioning Activities																					
1a.1.1	Prepare preliminary decommissioning cost	-	-	-	-	-	-	164	25	189	189	-	-	-	-	-	-	-	-	-	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	-	-	-	-	-	-	252	38	290	290	-	-	-	-	-	-	-	-	-	2,000
1a.1.7	Review plant dwgs & specs.	-	-	-	-	-	-	580	87	667	667	-	-	-	-	-	-	-	-	-	4,600
1a.1.8	Perform detailed rad survey									a											
1a.1.9	Estimate by-product inventory	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1a.1.10	End product description	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1a.1.11	Detailed by-product inventory	-	-	-	-	-	-	164	25	189	189	-	-	-	-	-	-	-	-	-	1,300
1a.1.12	Define major work sequence	-	-	-	-	-	-	946	142	1,088	1,088	-	-	-	-	-	-	-	-	-	7,500
1a.1.13	Perform SER and EA	-	-	-	-	-	-	391	59	450	450	-	-	-	-	-	-	-	-	-	3,100
1a.1.14	Perform Site-Specific Cost Study	-	-	-	-	-	-	630	95	725	725	-	-	-	-	-	-	-	-	-	5,000
1a.1.15	Prepare/submit License Termination Plan	-	-	-	-	-	-	516	77	594	594	-	-	-	-	-	-	-	-	-	4,096
1a.1.16	Receive NRC approval of termination plan									a											
Activity Specifications																					
1a.1.17.1	Plant & temporary facilities	-	-	-	-	-	-	620	93	713	642	-	71	-	-	-	-	-	-	-	4,920
1a.1.17.2	Plant systems	-	-	-	-	-	-	525	79	604	544	-	60	-	-	-	-	-	-	-	4,167
1a.1.17.3	NSSS Decontamination Flush	-	-	-	-	-	-	63	9	73	73	-	-	-	-	-	-	-	-	-	500
1a.1.17.4	Reactor internals	-	-	-	-	-	-	895	134	1,030	1,030	-	-	-	-	-	-	-	-	-	7,100
1a.1.17.5	Reactor vessel	-	-	-	-	-	-	820	123	943	943	-	-	-	-	-	-	-	-	-	6,500
1a.1.17.6	Biological shield	-	-	-	-	-	-	63	9	73	73	-	-	-	-	-	-	-	-	-	500
1a.1.17.7	Steam generators	-	-	-	-	-	-	393	59	452	452	-	-	-	-	-	-	-	-	-	3,120
1a.1.17.8	Reinforced concrete	-	-	-	-	-	-	202	30	232	116	-	116	-	-	-	-	-	-	-	1,600
1a.1.17.9	Main Turbine	-	-	-	-	-	-	50	8	58	-	-	58	-	-	-	-	-	-	-	400
1a.1.17.10	Main Condensers	-	-	-	-	-	-	50	8	58	-	-	58	-	-	-	-	-	-	-	400
1a.1.17.11	Plant structures & buildings	-	-	-	-	-	-	393	59	452	226	-	226	-	-	-	-	-	-	-	3,120
1a.1.17.12	Waste management	-	-	-	-	-	-	580	87	667	667	-	-	-	-	-	-	-	-	-	4,600
1a.1.17.13	Facility & site closeout	-	-	-	-	-	-	113	17	131	65	-	65	-	-	-	-	-	-	-	900
1a.1.17	Total	-	-	-	-	-	-	4,770	715	5,485	4,830	-	655	-	-	-	-	-	-	-	37,827
Planning & Site Preparations																					
1a.1.18	Prepare dismantling sequence	-	-	-	-	-	-	303	45	348	348	-	-	-	-	-	-	-	-	-	2,400
1a.1.19	Plant prep. & temp. svces	-	-	-	-	-	-	3,000	450	3,450	3,450	-	-	-	-	-	-	-	-	-	-
1a.1.20	Design water clean-up system	-	-	-	-	-	-	177	26	203	203	-	-	-	-	-	-	-	-	-	1,400
1a.1.21	Rigging/Cont. Cntrl Envlps/tooling/etc.	-	-	-	-	-	-	2,300	345	2,645	2,645	-	-	-	-	-	-	-	-	-	-
1a.1.22	Procure casks/liners & containers	-	-	-	-	-	-	155	23	178	178	-	-	-	-	-	-	-	-	-	1,230
1a.1	Subtotal Period 1a Activity Costs	-	-	-	-	-	-	14,599	2,190	16,789	16,134	-	655	-	-	-	-	-	-	-	73,753
Period 1a Collateral Costs																					
1a.3.1	Spent Fuel Transfer	-	-	-	-	-	-	2,880	432	3,312	-	3,312	-	-	-	-	-	-	-	-	-
1a.3	Subtotal Period 1a Collateral Costs	-	-	-	-	-	-	2,880	432	3,312	-	3,312	-	-	-	-	-	-	-	-	-
Period 1a Period-Dependent Costs																					
1a.4.1	Insurance	-	-	-	-	-	-	1,902	190	2,092	2,092	-	-	-	-	-	-	-	-	-	-
1a.4.2	Property taxes	-	-	-	-	-	-	280	28	308	308	-	-	-	-	-	-	-	-	-	-
1a.4.3	Health physics supplies	-	497	-	-	-	-	-	124	621	621	-	-	-	-	-	-	-	-	-	-
1a.4.4	Heavy equipment rental	-	523	-	-	-	-	-	78	602	602	-	-	-	-	-	-	-	-	-	-
1a.4.5	Disposal of DAW generated	-	-	12	3	-	31	-	9	55	55	-	-	-	610	-	-	-	12,190	20	-
1a.4.6	Plant energy budget	-	-	-	-	-	-	1,677	252	1,928	1,928	-	-	-	-	-	-	-	-	-	-
1a.4.7	NRC Fees	-	-	-	-	-	-	1,181	118	1,299	1,299	-	-	-	-	-	-	-	-	-	-
1a.4.8	Emergency Planning Fees	-	-	-	-	-	-	1,490	149	1,638	-	1,638	-	-	-	-	-	-	-	-	-
1a.4.9	INPO Fees	-	-	-	-	-	-	336	50	386	386	-	-	-	-	-	-	-	-	-	-
1a.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	791	119	910	-	910	-	-	-	-	-	-	-	-	-
1a.4.11	ISFSI Operating Costs	-	-	-	-	-	-	95	14	110	-	110	-	-	-	-	-	-	-	-	-
1a.4.12	Corporate Allocations	-	-	-	-	-	-	1,000	100	1,100	1,100	-	-	-	-	-	-	-	-	-	-
1a.4.13	Security Staff Cost	-	-	-	-	-	-	11,224	1,684	12,908	12,908	-	-	-	-	-	-	-	-	-	275,314
1a.4.14	Utility Staff Cost	-	-	-	-	-	-	31,458	4,719	36,177	36,177	-	-	-	-	-	-	-	-	-	423,400
1a.4	Subtotal Period 1a Period-Dependent Costs	-	1,020	12	3	-	31	51,433	7,634	60,133	57,475	2,658	-	-	610	-	-	-	12,190	20	698,714
1a.0	TOTAL PERIOD 1a COST	-	1,020	12	3	-	31	68,913	10,256	80,235	73,610	5,970	655	-	610	-	-	-	12,190	20	772,467

Table C
Callaway Energy Center
DECON Alternative Decommissioning Cost Estimate
40-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Processing Costs	Disposal Costs	Other Costs	Total Contingency	Total Costs	Lic. Term. Costs	Management Costs	Restoration Costs	Volume Cu. Feet	Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Processed Wt., Lbs.	Craft Manhours	S20 Contractor Manhours
PERIOD 1b - Decommissioning Preparations																					
Period 1b Direct Decommissioning Activities																					
Detailed Work Procedures																					
1b.1.1.1	Plant systems	-	-	-	-	-	-	597	90	686	618	-	69	-	-	-	-	-	-	-	4,733
1b.1.1.2	NSSS Decontamination Flush	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.3	Reactor internals	-	-	-	-	-	-	315	47	363	363	-	-	-	-	-	-	-	-	-	2,500
1b.1.1.4	Remaining buildings	-	-	-	-	-	-	170	26	196	49	-	147	-	-	-	-	-	-	-	1,350
1b.1.1.5	CRD cooling assembly	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.6	CRD housings & ICI tubes	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.7	Incore instrumentation	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.8	Reactor vessel	-	-	-	-	-	-	458	69	526	526	-	-	-	-	-	-	-	-	-	3,630
1b.1.1.9	Facility closeout	-	-	-	-	-	-	151	23	174	87	-	87	-	-	-	-	-	-	-	1,200
1b.1.1.10	Missile shields	-	-	-	-	-	-	57	9	65	65	-	-	-	-	-	-	-	-	-	450
1b.1.1.11	Biological shield	-	-	-	-	-	-	151	23	174	174	-	-	-	-	-	-	-	-	-	1,200
1b.1.1.12	Steam generators	-	-	-	-	-	-	580	87	667	667	-	-	-	-	-	-	-	-	-	4,600
1b.1.1.13	Reinforced concrete	-	-	-	-	-	-	126	19	145	73	-	73	-	-	-	-	-	-	-	1,000
1b.1.1.14	Main Turbine	-	-	-	-	-	-	197	30	226	-	-	226	-	-	-	-	-	-	-	1,560
1b.1.1.15	Main Condensers	-	-	-	-	-	-	197	30	226	-	-	226	-	-	-	-	-	-	-	1,560
1b.1.1.16	Auxiliary building	-	-	-	-	-	-	344	52	396	356	-	40	-	-	-	-	-	-	-	2,730
1b.1.1.17	Reactor building	-	-	-	-	-	-	344	52	396	356	-	40	-	-	-	-	-	-	-	2,730
1b.1.1	Total	-	-	-	-	-	-	4,192	629	4,820	3,914	-	907	-	-	-	-	-	-	-	33,243
1b.1.2	Decon primary loop	648	-	-	-	-	-	-	324	971	971	-	-	-	-	-	-	-	-	1,067	-
1b.1	Subtotal Period 1b Activity Costs	648	-	-	-	-	-	4,192	953	5,792	4,885	-	907	-	-	-	-	-	-	1,067	33,243
Period 1b Additional Costs																					
1b.2.1	Spent fuel pool isolation	-	-	-	-	-	-	10,813	1,622	12,434	12,434	-	-	-	-	-	-	-	-	-	-
1b.2.2	Site Characterization	-	-	-	-	-	-	2,824	847	3,671	3,671	-	-	-	-	-	-	-	-	19,100	7,852
1b.2	Subtotal Period 1b Additional Costs	-	-	-	-	-	-	13,636	2,469	16,105	16,105	-	-	-	-	-	-	-	-	19,100	7,852
Period 1b Collateral Costs																					
1b.3.1	Decon equipment	893	-	-	-	-	-	-	134	1,026	1,026	-	-	-	-	-	-	-	-	-	-
1b.3.2	DOC staff relocation expenses	-	-	-	-	-	-	1,080	162	1,242	1,242	-	-	-	-	-	-	-	-	-	-
1b.3.3	Process decommissioning water waste	45	-	28	73	-	126	-	68	339	339	-	-	-	283	-	-	-	16,989	55	-
1b.3.4	Process decommissioning chemical flush waste	2	-	75	280	-	3,753	-	989	5,098	5,098	-	-	-	-	788	-	-	83,917	147	-
1b.3.5	Small tool allowance	-	2	-	-	-	-	-	0	2	2	-	-	-	-	-	-	-	-	-	-
1b.3.6	Pipe cutting equipment	-	1,100	-	-	-	-	-	165	1,265	1,265	-	-	-	-	-	-	-	-	-	-
1b.3.7	Decon rig	1,500	-	-	-	-	-	-	225	1,725	1,725	-	-	-	-	-	-	-	-	-	-
1b.3.8	Spent Fuel Transfer	-	-	-	-	-	-	1,440	216	1,656	-	1,656	-	-	-	-	-	-	-	-	-
1b.3	Subtotal Period 1b Collateral Costs	2,439	1,102	103	352	-	3,878	2,520	1,958	12,353	10,697	1,656	-	-	283	788	-	-	100,906	203	-
Period 1b Period-Dependent Costs																					
1b.4.1	Decon supplies	27	-	-	-	-	-	-	7	34	34	-	-	-	-	-	-	-	-	-	-
1b.4.2	Insurance	-	-	-	-	-	-	959	96	1,055	1,055	-	-	-	-	-	-	-	-	-	-
1b.4.3	Property taxes	-	-	-	-	-	-	141	14	155	155	-	-	-	-	-	-	-	-	-	-
1b.4.4	Health physics supplies	-	281	-	-	-	-	-	70	351	351	-	-	-	-	-	-	-	-	-	-
1b.4.5	Heavy equipment rental	-	264	-	-	-	-	-	40	303	303	-	-	-	-	-	-	-	-	-	-
1b.4.6	Disposal of DAW generated	-	-	7	1	-	18	-	6	33	33	-	-	-	360	-	-	-	7,197	12	-
1b.4.7	Plant energy budget	-	-	-	-	-	-	1,691	254	1,944	1,944	-	-	-	-	-	-	-	-	-	-
1b.4.8	NRC Fees	-	-	-	-	-	-	348	35	383	383	-	-	-	-	-	-	-	-	-	-
1b.4.9	Emergency Planning Fees	-	-	-	-	-	-	751	75	826	-	826	-	-	-	-	-	-	-	-	-
1b.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	399	60	459	-	459	-	-	-	-	-	-	-	-	-
1b.4.11	ISFSI Operating Costs	-	-	-	-	-	-	48	7	55	-	55	-	-	-	-	-	-	-	-	-
1b.4.12	Corporate Allocations	-	-	-	-	-	-	504	50	555	555	-	-	-	-	-	-	-	-	-	-
1b.4.13	Security Staff Cost	-	-	-	-	-	-	5,141	771	5,913	5,913	-	-	-	-	-	-	-	-	-	124,910
1b.4.14	DOC Staff Cost	-	-	-	-	-	-	6,322	948	7,271	7,271	-	-	-	-	-	-	-	-	-	64,137
1b.4.15	Utility Staff Cost	-	-	-	-	-	-	15,943	2,392	18,335	18,335	-	-	-	-	-	-	-	-	-	214,491
1b.4	Subtotal Period 1b Period-Dependent Costs	27	545	7	1	-	18	32,248	4,824	37,671	36,331	1,340	-	-	360	-	-	-	7,197	12	403,538
1b.0	TOTAL PERIOD 1b COST	3,114	1,647	111	354	-	3,897	52,595	10,204	71,921	68,019	2,996	907	-	643	788	-	-	108,103	20,381	444,633
PERIOD 1 TOTALS		3,114	2,666	123	356	-	3,928	121,508	20,460	152,156	141,628	8,966	1,562	-	1,253	788	-	-	120,293	20,401	1,217,100

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Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Processing Costs	Disposal Costs	Other Costs	Total Contingency	Total Costs	Lic. Term. Costs	Management Costs	Restoration Costs	Volume Cu. Feet	Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Processed Wt., Lbs.	Craft Manhours	S20 Contractor Manhours
PERIOD 2a - Large Component Removal																					
Period 2a Direct Decommissioning Activities																					
Nuclear Steam Supply System Removal																					
2a.1.1.1	Reactor Coolant Piping	174	186	24	32	-	519	-	270	1,205	1,205	-	-	-	1,227	-	-	-	140,300	6,838	-
2a.1.1.2	Pressurizer Relief Tank	29	25	7	9	-	135	-	57	262	262	-	-	-	328	-	-	-	36,395	1,068	-
2a.1.1.3	Reactor Coolant Pumps & Motors	89	93	134	220	-	1,031	-	372	1,938	1,938	-	-	-	3,386	-	-	-	816,140	4,188	100
2a.1.1.4	Pressurizer	47	55	621	168	-	1,138	-	409	2,437	2,437	-	-	-	3,739	-	-	-	293,734	2,534	1,875
2a.1.1.5	Steam Generators	369	5,359	3,228	2,742	2,599	7,066	-	4,415	25,780	25,780	-	-	40,262	23,217	-	-	-	3,570,150	23,233	3,500
2a.1.1.6	Retired Steam Generator Units	-	-	2,358	2,691	2,599	6,862	-	2,745	17,256	17,256	-	-	40,262	22,546	-	-	-	3,349,305	10,800	2,250
2a.1.1.7	CRDMs/ICIs/Service Structure Removal	148	83	226	55	-	318	-	205	1,035	1,035	-	-	-	3,881	-	-	-	86,025	4,285	-
2a.1.1.8	Reactor Vessel Internals	132	3,560	10,594	1,506	-	18,554	330	15,088	49,763	49,763	-	-	-	1,878	963	393	-	329,968	31,550	1,394
2a.1.1.9	Vessel & Internals GTCC Disposal	-	-	-	-	-	10,749	-	1,612	12,361	12,361	-	-	-	-	-	-	2,217	433,180	-	-
2a.1.1.10	Reactor Vessel	110	6,391	2,412	1,120	-	3,107	330	7,334	20,803	20,803	-	-	-	9,391	-	-	-	961,214	31,550	1,394
2a.1.1	Totals	1,098	15,753	19,603	8,543	5,199	49,479	660	32,507	132,841	132,841	-	-	80,523	69,593	963	393	2,217	10,016,410	116,046	10,513
Removal of Major Equipment																					
2a.1.2	Main Turbine/Generator	-	496	397	34	608	608	-	412	2,556	2,556	-	-	4,921	2,740	-	-	-	476,404	9,888	-
2a.1.3	Main Condensers	-	1,383	228	81	714	787	-	685	3,878	3,878	-	-	7,701	3,216	-	-	-	559,114	27,762	-
Cascading Costs from Clean Building Demolition																					
2a.1.4.1	Reactor	-	915	-	-	-	-	-	137	1,052	1,052	-	-	-	-	-	-	-	-	10,442	-
2a.1.4.2	Auxiliary	-	466	-	-	-	-	-	70	536	536	-	-	-	-	-	-	-	-	5,551	-
2a.1.4.3	Hot Machine Shop	-	1	-	-	-	-	-	0	1	1	-	-	-	-	-	-	-	-	16	-
2a.1.4.4	Radwaste	-	97	-	-	-	-	-	15	111	111	-	-	-	-	-	-	-	-	1,108	-
2a.1.4.5	Fuel Building	-	227	-	-	-	-	-	34	261	261	-	-	-	-	-	-	-	-	2,395	-
2a.1.4	Totals	-	1,705	-	-	-	-	-	256	1,961	1,961	-	-	-	-	-	-	-	-	19,512	-
Disposal of Plant Systems																					
2a.1.5.1	100 Aux.Bldg Non-System Specific RCA	-	688	12	29	638	-	-	273	1,640	1,640	-	-	7,629	-	-	-	-	309,812	13,471	-
2a.1.5.2	100 Auxiliary Bldg Non-System Specific	-	113	6	6	40	69	-	53	287	287	-	-	474	282	-	-	-	37,889	2,282	-
2a.1.5.3	AB - Main Steam	-	267	-	-	-	-	-	40	308	-	-	308	-	-	-	-	-	-	5,833	-
2a.1.5.4	AB - Main Steam RCA	-	78	3	8	180	-	-	48	318	318	-	-	2,156	-	-	-	-	87,550	1,515	-
2a.1.5.5	AC - Main Turbine	-	263	-	-	-	-	-	39	302	-	-	302	-	-	-	-	-	-	5,641	-
2a.1.5.6	AD - Condensate	-	290	-	-	-	-	-	43	333	-	-	333	-	-	-	-	-	-	6,144	-
2a.1.5.7	AE - Feedwater	-	200	-	-	-	-	-	30	229	-	-	229	-	-	-	-	-	-	4,271	-
2a.1.5.8	AF - Feedwater Heater Extraction	-	247	-	-	-	-	-	37	285	-	-	285	-	-	-	-	-	-	5,352	-
2a.1.5.9	AK - Condensate Demineralizer	-	91	-	-	-	-	-	14	105	-	-	105	-	-	-	-	-	-	1,944	-
2a.1.5.10	AL - Auxiliary Feedwater	-	40	-	-	-	-	-	6	46	-	-	46	-	-	-	-	-	-	852	-
2a.1.5.11	AQ - Condensate & Feedwater Chem Addtn	-	22	-	-	-	-	-	3	26	-	-	26	-	-	-	-	-	-	468	-
2a.1.5.12	BM - Steam Generator Blowdown	-	119	6	6	75	46	-	54	307	307	-	-	892	191	-	-	-	48,810	2,394	-
2a.1.5.13	BM - Steam Generator Blowdown - RCA	-	372	6	15	344	-	-	147	885	885	-	-	4,109	-	-	-	-	166,857	7,066	-
2a.1.5.14	BN - Borated Refueling Water Storage	-	343	19	29	461	129	-	193	1,174	1,174	-	-	5,512	533	-	-	-	258,692	6,939	-
2a.1.5.15	CA - Steam Seal	-	21	-	-	-	-	-	3	24	-	-	24	-	-	-	-	-	-	455	-
2a.1.5.16	CB - Main Turbine Lube Oil	-	59	-	-	-	-	-	9	68	-	-	68	-	-	-	-	-	-	1,207	-
2a.1.5.17	CC - Generator Hydrogen Seal & CO2	-	10	-	-	-	-	-	1	11	-	-	11	-	-	-	-	-	-	198	-
2a.1.5.18	CD - Generator Seal Oil	-	14	-	-	-	-	-	2	16	-	-	16	-	-	-	-	-	-	287	-
2a.1.5.19	CE - Stator Cooling Water	-	12	-	-	-	-	-	2	13	-	-	13	-	-	-	-	-	-	241	-
2a.1.5.20	CF - Lube Oil Storage Xfer & Prfication	-	39	-	-	-	-	-	6	44	-	-	44	-	-	-	-	-	-	812	-
2a.1.5.21	CG - Condenser Air Removal	-	31	-	-	-	-	-	5	36	-	-	36	-	-	-	-	-	-	657	-
2a.1.5.22	CH - Main Turbine Control Oil	-	60	-	-	-	-	-	9	69	-	-	69	-	-	-	-	-	-	1,219	-
2a.1.5.23	DA - Circulating Water	-	345	-	-	-	-	-	52	397	-	-	397	-	-	-	-	-	-	7,502	-
2a.1.5.24	DB - Cooling Tower Makeup & Blowdown	-	58	-	-	-	-	-	9	67	-	-	67	-	-	-	-	-	-	1,260	-
2a.1.5.25	DD - Cooling Water Chemical Control Sys	-	51	-	-	-	-	-	8	59	-	-	59	-	-	-	-	-	-	1,084	-
2a.1.5.26	DD - Cooling Wtr Chem Control RCA	-	274	5	13	297	-	-	116	706	706	-	-	3,555	-	-	-	-	144,376	4,951	-
2a.1.5.27	EJ - Residual Heat Removal	-	397	54	47	230	590	-	294	1,611	1,611	-	-	2,744	2,413	-	-	-	270,908	8,042	-
2a.1.5.28	EM - High Pressure Coolant Injection	-	335	17	15	110	159	-	144	780	780	-	-	1,315	648	-	-	-	96,322	6,633	-
2a.1.5.29	EN - Containment Spray	-	218	5	11	253	-	-	95	581	581	-	-	3,026	-	-	-	-	122,874	4,134	-
2a.1.5.30	EP - Accumulator Safety Injection	-	176	10	10	134	69	-	84	482	482	-	-	1,599	283	-	-	-	83,562	3,478	-
2a.1.5.31	FA - Auxiliary Steam Generator	-	24	-	-	-	-	-	4	27	-	-	27	-	-	-	-	-	-	521	-
2a.1.5.32	FB - Auxiliary Steam	-	98	-	-	-	-	-	15	112	-	-	112	-	-	-	-	-	-	2,106	-
2a.1.5.33	FB - Auxiliary Steam RCA	-	83	1	3	68	-	-	31	187	187	-	-	816	-	-	-	-	33,148	1,537	-
2a.1.5.34	FC - Auxiliary Turbines	-	63	-	-	-	-	-	9	72	-	-	72	-	-	-	-	-	-	1,320	-
2a.1.5.35	FE - Auxiliary Steam Chemical Addition	-	5	-	-	-	-	-	1	6	-	-	6	-	-	-	-	-	-	105	-
2a.1.5.36	GE - Turbine Building HVAC	-	175	-	-	-	-	-	26	201	-	-	201	-	-	-	-	-	-	3,957	-
2a.1.5.37	GS - Containment Hydrogen Control	-	77	4	4	55	26	-	35	201	201	-	-	658	104	-	-	-	33,630	1,559	-

Table C
Callaway Energy Center
DECON Alternative Decommissioning Cost Estimate
40-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Processing Costs	Disposal Costs	Other Costs	Total Contingency	Total Costs	Lic. Term. Costs	Management Costs	Restoration Costs	Volume Cu. Feet	Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Processed Wt., Lbs.	Craft Manhours	S20 Contractor Manhours
Disposal of Plant Systems (continued)																					
2a.1.5.38	HE - Boron Recycle	383	508	36	31	218	341	-	445	1,961	1,961	-	-	2,600	1,411	-	-	-	197,879	16,660	-
2a.1.5.39	HF - Secondary Liquid Waste	701	998	80	72	517	775	-	890	4,033	4,033	-	-	6,186	3,203	-	-	-	460,585	31,896	-
2a.1.5.40	JA - Auxiliary Oil & Transfer	-	32	-	-	-	-	-	5	36	-	-	36	-	-	-	-	-	-	690	-
2a.1.5.41	KS - Bulk Chemical Storage	-	91	10	24	539	-	-	108	773	773	-	-	6,449	-	-	-	-	261,890	1,825	-
2a.1.5.42	LE - Oily Waste	-	179	-	-	-	-	-	27	206	-	-	206	-	-	-	-	-	-	3,865	-
2a.1.5.43	LE - Oily Waste RCA	-	237	3	8	189	-	-	89	527	527	-	-	2,256	-	-	-	-	91,628	4,296	-
2a.1.5.44	Turbine Bldg Non-System Specific	-	742	-	-	-	-	-	111	853	-	-	853	-	-	-	-	-	-	15,405	-
2a.1.5	Totals	1,084	8,543	277	333	4,348	2,204	-	3,615	20,402	16,451	-	3,951	51,976	9,068	-	-	-	2,706,410	192,076	-
2a.1.6	Scaffolding in support of decommissioning	-	1,598	27	7	114	27	-	427	2,200	2,200	-	-	1,233	109	-	-	-	62,671	36,741	-
2a.1	Subtotal Period 2a Activity Costs	2,182	29,478	20,532	8,998	10,983	53,104	660	37,901	163,839	159,887	-	3,951	146,354	84,726	963	393	2,217	13,821,010	402,025	10,513
Period 2a Additional Costs																					
2a.2.1	Remedial Action Surveys	-	-	-	-	-	-	1,666	500	2,166	2,166	-	-	-	-	-	-	-	-	34,112	-
2a.2	Subtotal Period 2a Additional Costs	-	-	-	-	-	-	1,666	500	2,166	2,166	-	-	-	-	-	-	-	-	34,112	-
Period 2a Collateral Costs																					
2a.3.1	Process decommissioning water waste	197	-	126	324	-	562	-	300	1,509	1,509	-	-	-	1,265	-	-	-	75,906	247	-
2a.3.2	Process decommissioning chemical flush waste	1	-	39	146	-	323	-	107	616	616	-	-	-	410	-	-	-	43,711	77	-
2a.3.3	Small tool allowance	-	341	-	-	-	-	-	51	392	353	-	39	-	-	-	-	-	-	-	-
2a.3.4	Spent Fuel Transfer	-	-	-	-	-	-	4,320	648	4,968	-	4,968	-	-	-	-	-	-	-	-	-
2a.3.5	On-site survey and release of 60.87 tons clean metallic waste	-	-	-	-	-	-	84	8	92	92	-	-	-	-	-	-	-	-	-	-
2a.3	Subtotal Period 2a Collateral Costs	198	341	165	470	-	885	4,404	1,115	7,578	2,571	4,968	39	-	1,675	-	-	-	119,617	323	-
Period 2a Period-Dependent Costs																					
2a.4.1	Decon supplies	89	-	-	-	-	-	-	22	112	112	-	-	-	-	-	-	-	-	-	-
2a.4.2	Insurance	-	-	-	-	-	-	1,512	151	1,663	1,663	-	-	-	-	-	-	-	-	-	-
2a.4.3	Property taxes	-	-	-	-	-	-	459	46	505	455	-	51	-	-	-	-	-	-	-	-
2a.4.4	Health physics supplies	-	2,842	-	-	-	-	-	710	3,552	3,552	-	-	-	-	-	-	-	-	-	-
2a.4.5	Heavy equipment rental	-	3,300	-	-	-	-	-	495	3,795	3,795	-	-	-	-	-	-	-	-	-	-
2a.4.6	Disposal of DAW generated	-	-	122	25	-	305	-	92	543	543	-	-	-	6,016	-	-	-	120,328	196	-
2a.4.7	Plant energy budget	-	-	-	-	-	-	2,614	392	3,006	3,006	-	-	-	-	-	-	-	-	-	-
2a.4.8	NRC Fees	-	-	-	-	-	-	1,028	103	1,130	1,130	-	-	-	-	-	-	-	-	-	-
2a.4.9	Emergency Planning Fees	-	-	-	-	-	-	1,529	153	1,682	-	1,682	-	-	-	-	-	-	-	-	-
2a.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	1,298	195	1,493	-	1,493	-	-	-	-	-	-	-	-	-
2a.4.11	ISFSI Operating Costs	-	-	-	-	-	-	157	24	180	-	180	-	-	-	-	-	-	-	-	-
2a.4.12	Corporate Allocations	-	-	-	-	-	-	1,641	164	1,805	1,805	-	-	-	-	-	-	-	-	-	-
2a.4.13	Security Staff Cost	-	-	-	-	-	-	16,738	2,511	19,248	19,248	-	-	-	-	-	-	-	-	-	406,635
2a.4.14	DOC Staff Cost	-	-	-	-	-	-	25,196	3,779	28,975	28,975	-	-	-	-	-	-	-	-	-	260,137
2a.4.15	Utility Staff Cost	-	-	-	-	-	-	36,771	5,516	42,287	42,287	-	-	-	-	-	-	-	-	-	484,334
2a.4	Subtotal Period 2a Period-Dependent Costs	89	6,142	122	25	-	305	88,943	14,353	109,979	106,573	3,355	51	-	6,016	-	-	-	120,328	196	1,151,107
2a.0	TOTAL PERIOD 2a COST	2,469	35,961	20,819	9,492	10,983	54,294	95,673	53,868	283,561	271,197	8,323	4,041	146,354	92,418	963	393	2,217	14,060,950	436,657	1,161,620
PERIOD 2b - Site Decontamination																					
Period 2b Direct Decommissioning Activities																					
Disposal of Plant Systems																					
2b.1.1.1	200 Reactor Bldg Non-System Specific	-	90	4	4	23	45	-	38	204	204	-	-	269	186	-	-	-	23,204	1,760	-
2b.1.1.2	200 Reactor Bldg Non-System Specific RCA	-	557	7	18	399	-	-	203	1,184	1,184	-	-	4,768	-	-	-	-	193,612	10,425	-
2b.1.1.3	300 Control Bldg Non-System Specific	-	176	3	8	179	-	-	72	439	439	-	-	2,139	-	-	-	-	86,849	3,413	-
2b.1.1.4	300 Control Bldg Non-System Specific Cln	-	1,394	-	-	-	-	-	209	1,603	-	-	1,603	-	-	-	-	-	-	29,076	-
2b.1.1.5	700 Radwaste Bldg Non-Sys Specific RCA	-	1,131	19	48	1,061	-	-	451	2,710	2,710	-	-	12,684	-	-	-	-	515,103	21,919	-
2b.1.1.6	700 Radwaste Bldg Non-System Specific	-	182	11	10	59	121	-	87	471	471	-	-	705	497	-	-	-	61,467	3,653	-
2b.1.1.7	AN - Demineralized Wtr Storage & Xfer	-	153	-	-	-	-	-	23	176	-	-	176	-	-	-	-	-	-	3,283	-
2b.1.1.8	AN - Demineralized Wtr Strg & Xfer RCA	-	40	0	1	26	-	-	14	83	83	-	-	314	-	-	-	-	12,759	740	-
2b.1.1.9	AP - Condensate Storage & Transfer	-	89	-	-	-	-	-	13	102	-	-	102	-	-	-	-	-	-	1,794	-
2b.1.1.10	BB - Reactor Coolant System	-	343	36	32	152	405	-	218	1,185	1,185	-	-	1,812	1,685	-	-	-	182,942	7,074	-
2b.1.1.11	BG - Chemical & Volume Control	794	972	114	94	413	1,203	-	1,028	4,616	4,616	-	-	4,931	4,928	-	-	-	525,509	28,147	-
2b.1.1.12	BL - Reactor Makeup Water	-	309	22	20	161	204	-	158	874	874	-	-	1,928	850	-	-	-	133,562	6,136	-
2b.1.1.13	DE - Intake & Water Treatment	-	121	-	-	-	-	-	18	139	-	-	139	-	-	-	-	-	-	2,517	-
2b.1.1.14	DE - Intake & Water Treatment RCA	-	252	18	45	997	-	-	221	1,533	1,533	-	-	11,923	-	-	-	-	484,206	5,014	-
2b.1.1.15	EA - Service Water	-	144	-	-	-	-	-	22	166	-	-	166	-	-	-	-	-	-	3,145	-
2b.1.1.16	EA - Service Water RCA	-	45	2	5	104	-	-	28	184	184	-	-	1,248	-	-	-	-	50,693	839	-

Table C
Callaway Energy Center
DECON Alternative Decommissioning Cost Estimate
40-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Processing Costs	Disposal Costs	Other Costs	Total Contingency	Total Costs	Lic. Term. Costs	Management Costs	Restoration Costs	Volume Cu. Feet	Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Processed Wt., Lbs.	Craft Manhours	S20 Contractor Manhours
Disposal of Plant Systems (continued)																					
2b.1.1.17	EB - Closed Cooling Water	-	59	-	-	-	-	-	9	68	-	-	68	-	-	-	-	-	-	1,267	-
2b.1.1.18	EF - Essential Service Water	-	334	-	-	-	-	-	50	385	-	-	385	-	-	-	-	-	-	7,244	-
2b.1.1.19	EF - Essential Service Water RCA	-	200	8	20	446	-	-	121	794	794	-	-	5,326	-	-	-	-	216,287	3,862	-
2b.1.1.20	EG - Component Cooling Water RCA	-	247	-	-	-	-	-	37	284	-	-	284	-	-	-	-	-	-	5,335	-
2b.1.1.21	GA - Plant Heating	-	89	-	-	-	-	-	13	102	-	-	102	-	-	-	-	-	-	1,912	-
2b.1.1.22	GA - Plant Heating RCA	-	97	1	2	53	-	-	33	186	186	-	-	638	-	-	-	-	25,924	1,765	-
2b.1.1.23	GB - Central Chilled Water	-	84	-	-	-	-	-	13	96	-	-	96	-	-	-	-	-	-	1,803	-
2b.1.1.24	GB - Central Chilled Water RCA	-	26	0	1	16	-	-	9	52	52	-	-	187	-	-	-	-	7,591	482	-
2b.1.1.25	GD - Essential Serv Wtr Pumphouse HVAC	-	18	-	-	-	-	-	3	21	-	-	21	-	-	-	-	-	-	427	-
2b.1.1.26	GF - Miscellaneous Building HVAC	-	122	3	8	170	-	-	58	361	361	-	-	2,034	-	-	-	-	82,602	2,026	-
2b.1.1.27	GH - Radwaste Building HVAC	-	188	6	11	203	24	-	85	516	516	-	-	2,425	98	-	-	-	104,941	3,455	-
2b.1.1.28	GK - Control Building HVAC	-	168	-	-	-	-	-	25	193	-	-	193	-	-	-	-	-	-	3,959	-
2b.1.1.29	GL - Auxiliary Building HVAC	-	466	12	23	424	56	-	199	1,179	1,179	-	-	5,064	228	-	-	-	220,713	8,491	-
2b.1.1.30	GM - Diesel Generator Building HVAC	-	29	-	-	-	-	-	4	34	-	-	34	-	-	-	-	-	-	695	-
2b.1.1.31	GN - Containment Cooling	-	514	24	38	616	157	-	268	1,617	1,617	-	-	7,367	643	-	-	-	341,701	9,601	-
2b.1.1.32	GP - Containment Intgratd Leak Rate Test	-	39	1	2	49	-	-	17	108	108	-	-	580	-	-	-	-	23,570	750	-
2b.1.1.33	GR - Containment Atmospheric Control	-	19	2	5	91	10	-	22	149	149	-	-	1,086	41	-	-	-	46,792	392	-
2b.1.1.34	GT - Containment Purge HVAC	-	120	6	10	163	42	-	67	408	408	-	-	1,948	170	-	-	-	90,362	2,259	-
2b.1.1.35	HA - Gaseous Radwaste	-	363	22	21	233	163	-	172	973	973	-	-	2,782	666	-	-	-	156,977	7,037	-
2b.1.1.36	HB - Liquid Radwaste	764	880	73	62	465	663	-	854	3,760	3,760	-	-	5,560	2,745	-	-	-	404,879	30,903	-
2b.1.1.37	HC - Solid Radwaste	-	376	35	31	177	362	-	219	1,199	1,199	-	-	2,114	1,487	-	-	-	183,748	7,445	-
2b.1.1.38	HD - Decontamination	-	104	6	6	82	42	-	50	290	290	-	-	983	171	-	-	-	51,237	2,051	-
2b.1.1.39	JE - Emergency Fuel Oil	-	62	-	-	-	-	-	9	71	-	-	71	-	-	-	-	-	-	1,260	-
2b.1.1.40	KA - Compressed Air	-	195	-	-	-	-	-	29	224	-	-	224	-	-	-	-	-	-	4,187	-
2b.1.1.41	KA - Compressed Air RCA	-	130	1	3	67	-	-	43	244	244	-	-	801	-	-	-	-	32,538	2,339	-
2b.1.1.42	KB - Breathing Air	-	24	-	-	-	-	-	4	28	-	-	28	-	-	-	-	-	-	516	-
2b.1.1.43	KB - Breathing Air RCA	-	20	0	0	6	-	-	6	32	32	-	-	71	-	-	-	-	2,874	402	-
2b.1.1.44	KC - Fire Protection	-	378	-	-	-	-	-	57	435	-	-	435	-	-	-	-	-	-	8,376	-
2b.1.1.45	KC - Fire Protection RCA	-	403	7	17	369	-	-	159	954	954	-	-	4,411	-	-	-	-	179,151	7,064	-
2b.1.1.46	KD - Domestic Water	-	176	-	-	-	-	-	26	203	-	-	203	-	-	-	-	-	-	3,837	-
2b.1.1.47	KD - Domestic Water RCA	-	26	0	1	21	-	-	10	58	58	-	-	247	-	-	-	-	10,039	459	-
2b.1.1.48	KE - Fuel Handling & Storage Rctor vssl	-	19	4	5	55	39	-	24	145	145	-	-	661	158	-	-	-	37,295	375	-
2b.1.1.49	KH - Service Gas (CO2 N2 H2 & O2)	-	56	-	-	-	-	-	8	64	-	-	64	-	-	-	-	-	-	1,226	-
2b.1.1.50	KH - Service Gas (CO2 N2 H2 & O2) RCA	-	254	4	9	204	-	-	96	566	566	-	-	2,433	-	-	-	-	98,813	4,481	-
2b.1.1.51	KJ - Standby Diesel Engine	-	327	-	-	-	-	-	49	376	-	-	376	-	-	-	-	-	-	6,749	-
2b.1.1.52	LA - Sanitary Drains	-	44	-	-	-	-	-	7	51	-	-	51	-	-	-	-	-	-	972	-
2b.1.1.53	LA - Sanitary Drains RCA	-	106	2	5	106	-	-	43	263	263	-	-	1,273	-	-	-	-	51,684	1,811	-
2b.1.1.54	LB - Roof Drains	-	59	-	-	-	-	-	9	68	-	-	68	-	-	-	-	-	-	1,276	-
2b.1.1.55	LB - Roof Drains RCA	-	144	3	8	179	-	-	64	398	398	-	-	2,139	-	-	-	-	86,858	2,694	-
2b.1.1.56	LD - Chemical & Detergent Waste	67	121	5	5	42	52	-	84	376	376	-	-	504	211	-	-	-	34,402	3,490	-
2b.1.1.57	LF - Floor & Equipment Drains	-	1,493	121	101	313	1,399	-	797	4,224	4,224	-	-	3,739	5,724	-	-	-	529,989	29,320	-
2b.1.1.58	RM - Process Sampling & Analysis	-	138	8	6	55	59	-	59	325	325	-	-	661	240	-	-	-	42,764	2,774	-
2b.1.1.59	SJ - Nuclear Sampling	-	79	6	4	35	45	-	38	208	208	-	-	423	184	-	-	-	29,429	1,620	-
2b.1.1.60	UB - Servces Stores Site Security Bldg	-	177	-	-	-	-	-	27	204	-	-	204	-	-	-	-	-	-	3,815	-
2b.1.1.61	Yard Non-System Specific	-	29	-	-	-	-	-	4	33	-	-	33	-	-	-	-	-	-	603	-
2b.1.1	Totals	1,624	14,999	597	687	8,213	5,091	-	6,783	37,995	32,868	-	5,127	98,179	20,912	-	-	-	5,363,064	321,744	-
2b.1.2	Scaffolding in support of decommissioning	-	1,997	34	8	143	33	-	534	2,750	2,750	-	-	1,541	136	-	-	-	78,338	45,926	-
Decontamination of Site Buildings																					
2b.1.3.1	Reactor	1,243	1,884	75	590	502	1,564	-	1,655	7,512	7,512	-	-	5,995	25,485	-	-	-	2,446,171	55,809	-
2b.1.3.2	Auxiliary	660	381	14	92	172	242	-	527	2,087	2,087	-	-	2,058	3,823	-	-	-	412,089	19,424	-
2b.1.3.3	Communication Corridor - Contaminated	15	7	0	2	1	5	-	11	40	40	-	-	17	83	-	-	-	7,854	395	-
2b.1.3.4	Hot Machine Shop	18	14	0	2	-	6	-	14	55	55	-	-	-	103	-	-	-	8,892	597	-
2b.1.3.5	RAM Storage Building	45	16	1	5	2	13	-	31	112	112	-	-	19	213	-	-	-	19,136	1,162	-
2b.1.3.6	Radioactive and Personnel Tunnel	6	12	0	1	-	3	-	7	31	31	-	-	-	58	-	-	-	5,022	334	-
2b.1.3.7	Radwaste	352	185	7	48	71	126	-	272	1,060	1,060	-	-	844	2,022	-	-	-	208,617	9,997	-
2b.1.3.8	Radwaste Drum Storage	40	19	1	5	6	14	-	30	114	114	-	-	66	226	-	-	-	22,243	1,092	-
2b.1.3.9	Reactor Head Assembly Building	34	-	-	-	-	-	-	17	52	52	-	-	-	-	-	-	-	-	691	-
2b.1.3.10	Steam Generator Replacement Bldgs	236	-	-	-	-	-	-	118	354	354	-	-	-	-	-	-	-	-	4,358	-
2b.1.3	Totals	2,649	2,518	98	745	753	1,973	-	2,682	11,417	11,417	-	-	8,999	32,013	-	-	-	3,130,024	93,858	-
2b.1	Subtotal Period 2b Activity Costs	4,273	19,514	729	1,440	9,109	7,097	-	9,999	52,162	47,035	-	5,127	108,720	53,060	-	-	-	8,571,427	461,528	-

Table C
Callaway Energy Center
DECON Alternative Decommissioning Cost Estimate
40-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Processing Costs	Disposal Costs	Other Costs	Total Contingency	Total Costs	Lic. Term. Costs	Management Costs	Restoration Costs	Volume Cu. Feet	Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Processed Wt., Lbs.	Craft Manhours	S20 Contractor Manhours
Period 2b Additional Costs																					
2b.2.1	Remedial Action Surveys	-	-	-	-	-	-	2,395	718	3,113	3,113	-	-	-	-	-	-	-	-	49,026	-
2b.2.2	Sanitary Treatment Lagoon	-	6	93	92	-	280	-	95	567	567	-	-	-	4,608	-	-	-	392,140	423	-
2b.2.3	Cooling Tower Asbestos Panel Removal	-	4,893	-	122	-	-	490	826	6,330	-	-	6,330	-	-	-	-	-	-	71,419	-
2b.2.4	Operational Equipment	-	-	17	37	603	-	-	98	755	755	-	-	11,710	-	-	-	-	292,750	32	-
2b.2.5	Retired Reactor Closure Head	-	113	552	895	-	768	-	410	2,738	2,738	-	-	-	2,764	-	-	-	338,540	3,157	2,000
2b.2	Subtotal Period 2b Additional Costs	-	5,012	662	1,146	603	1,048	2,884	2,146	13,502	7,173	-	6,330	11,710	7,372	-	-	-	1,023,430	124,057	2,000
Period 2b Collateral Costs																					
2b.3.1	Process decommissioning water waste	169	-	111	286	-	495	-	262	1,323	1,323	-	-	-	1,115	-	-	-	66,898	217	-
2b.3.2	Process decommissioning chemical flush waste	3	-	128	475	-	1,055	-	349	2,010	2,010	-	-	-	1,338	-	-	-	142,540	250	-
2b.3.3	Small tool allowance	-	421	-	-	-	-	-	63	484	484	-	-	-	-	-	-	-	-	-	-
2b.3.4	Spent Fuel Transfer	-	-	-	-	-	-	6,480	972	7,452	-	7,452	-	-	-	-	-	-	-	-	-
2b.3.5	On-site survey and release of 297.3 tons clean metallic waste	-	-	-	-	-	-	410	41	451	451	-	-	-	-	-	-	-	-	-	-
2b.3	Subtotal Period 2b Collateral Costs	172	421	239	761	-	1,550	6,890	1,688	11,719	4,267	7,452	-	-	2,453	-	-	-	209,438	468	-
Period 2b Period-Dependent Costs																					
2b.4.1	Decon supplies	1,213	-	-	-	-	-	-	303	1,516	1,516	-	-	-	-	-	-	-	-	-	-
2b.4.2	Insurance	-	-	-	-	-	-	2,173	217	2,391	2,391	-	-	-	-	-	-	-	-	-	-
2b.4.3	Property taxes	-	-	-	-	-	-	660	66	726	726	-	-	-	-	-	-	-	-	-	-
2b.4.4	Health physics supplies	-	3,878	-	-	-	-	-	969	4,847	4,847	-	-	-	-	-	-	-	-	-	-
2b.4.5	Heavy equipment rental	-	4,696	-	-	-	-	-	704	5,401	5,401	-	-	-	-	-	-	-	-	-	-
2b.4.6	Disposal of DAW generated	-	-	135	27	-	337	-	102	602	602	-	-	-	6,667	-	-	-	133,346	217	-
2b.4.7	Plant energy budget	-	-	-	-	-	-	2,967	445	3,412	3,412	-	-	-	-	-	-	-	-	-	-
2b.4.8	NRC Fees	-	-	-	-	-	-	1,477	148	1,625	1,625	-	-	-	-	-	-	-	-	-	-
2b.4.9	Emergency Planning Fees	-	-	-	-	-	-	2,198	220	2,418	-	2,418	-	-	-	-	-	-	-	-	-
2b.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	1,866	280	2,146	-	2,146	-	-	-	-	-	-	-	-	-
2b.4.11	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	473	71	544	544	-	-	-	-	-	-	-	-	-	-
2b.4.12	ISFSI Operating Costs	-	-	-	-	-	-	225	34	259	-	259	-	-	-	-	-	-	-	-	-
2b.4.13	Corporate Allocations	-	-	-	-	-	-	2,359	236	2,595	2,595	-	-	-	-	-	-	-	-	-	-
2b.4.14	Security Staff Cost	-	-	-	-	-	-	24,059	3,609	27,667	27,667	-	-	-	-	-	-	-	-	-	584,496
2b.4.15	DOC Staff Cost	-	-	-	-	-	-	34,908	5,236	40,145	40,145	-	-	-	-	-	-	-	-	-	359,160
2b.4.16	Utility Staff Cost	-	-	-	-	-	-	50,771	7,616	58,386	58,386	-	-	-	-	-	-	-	-	-	666,660
2b.4	Subtotal Period 2b Period-Dependent Costs	1,213	8,574	135	27	-	337	124,136	20,256	154,679	149,856	4,823	-	-	6,667	-	-	-	133,346	217	1,610,316
2b.0	TOTAL PERIOD 2b COST	5,658	33,521	1,765	3,374	9,712	10,033	133,911	34,089	232,063	208,331	12,275	11,457	120,430	69,552	-	-	-	9,937,641	586,270	1,612,316
PERIOD 2d - Decontamination Following Wet Fuel Storage																					
Period 2d Direct Decommissioning Activities																					
2d.1.1	Remove spent fuel racks	831	82	293	107	-	1,709	-	909	3,930	3,930	-	-	-	6,988	-	-	-	461,925	1,925	-
Disposal of Plant Systems																					
2d.1.2.1	600 Fuel Bldg Non-Specific Systems RCA	-	306	5	12	268	-	-	119	710	710	-	-	3,200	-	-	-	-	129,974	5,859	-
2d.1.2.2	600 Fuel Bldg Non-System Specific	-	48	3	2	14	29	-	22	119	119	-	-	170	120	-	-	-	14,877	954	-
2d.1.2.3	EC - Fuel Pool Cooling & Cleanup	-	406	27	26	218	267	-	207	1,151	1,151	-	-	2,602	1,090	-	-	-	177,753	8,051	-
2d.1.2.4	GA- Plant Heating Fuel Building	-	23	1	1	4	10	-	9	48	48	-	-	50	41	-	-	-	4,770	449	-
2d.1.2.5	GG - Fuel Building HVAC	-	256	9	16	312	38	-	124	755	755	-	-	3,729	155	-	-	-	161,671	4,673	-
2d.1.2.6	KC- Fire Protection Fuel Building	-	119	2	5	104	-	-	46	276	276	-	-	1,239	-	-	-	-	50,329	2,115	-
2d.1.2	Totals	-	1,158	46	63	919	344	-	528	3,058	3,058	-	-	10,991	1,407	-	-	-	539,374	22,102	-
Decontamination of Site Buildings																					
2d.1.3.1	Fuel Building	777	854	9	32	226	83	-	663	2,644	2,644	-	-	2,705	1,064	-	-	-	199,826	31,561	-
2d.1.3	Totals	777	854	9	32	226	83	-	663	2,644	2,644	-	-	2,705	1,064	-	-	-	199,826	31,561	-
2d.1.4	Scaffolding in support of decommissioning	-	399	7	2	29	7	-	107	550	550	-	-	308	27	-	-	-	15,668	9,185	-
2d.1	Subtotal Period 2d Activity Costs	1,608	2,494	355	203	1,174	2,143	-	2,205	10,183	10,183	-	-	14,004	9,486	-	-	-	1,216,793	64,772	-
Period 2d Additional Costs																					
2d.2.1	License Termination Survey Planning	-	-	-	-	-	-	1,495	448	1,943	1,943	-	-	-	-	-	-	-	-	-	12,480
2d.2.2	Remedial Action Surveys	-	-	-	-	-	-	676	203	879	879	-	-	-	-	-	-	-	-	13,839	-
2d.2	Subtotal Period 2d Additional Costs	-	-	-	-	-	-	2,171	651	2,822	2,822	-	-	-	-	-	-	-	-	13,839	12,480

Table C
Callaway Energy Center
DECON Alternative Decommissioning Cost Estimate
40-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Processing Costs	Disposal Costs	Other Costs	Total Contingency	Total Costs	Lic. Term. Costs	Management Costs	Restoration Costs	Volume Cu. Feet	Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Processed Wt., Lbs.	Craft Manhours	S20 Contractor Manhours
Period 2d Collateral Costs																					
2d.3.1	Process decommissioning water waste	90	-	60	154	-	267	-	141	712	712	-	-	-	601	-	-	-	36,055	117	-
2d.3.3	Small tool allowance	-	65	-	-	-	-	-	10	75	75	-	-	-	-	-	-	-	-	-	-
2d.3.4	Decommissioning Equipment Disposition	-	-	134	39	556	129	-	135	993	993	-	-	6,000	529	-	-	-	304,968	88	-
2d.3	Subtotal Period 2d Collateral Costs	90	65	193	193	556	396	-	286	1,779	1,779	-	-	6,000	1,130	-	-	-	341,023	205	-
Period 2d Period-Dependent Costs																					
2d.4.1	Decon supplies	176	-	-	-	-	-	-	44	220	220	-	-	-	-	-	-	-	-	-	-
2d.4.2	Insurance	-	-	-	-	-	-	613	61	675	675	-	-	-	-	-	-	-	-	-	-
2d.4.3	Property taxes	-	-	-	-	-	-	186	19	205	205	-	-	-	-	-	-	-	-	-	-
2d.4.4	Health physics supplies	-	662	-	-	-	-	-	166	828	828	-	-	-	-	-	-	-	-	-	-
2d.4.5	Heavy equipment rental	-	1,325	-	-	-	-	-	199	1,524	1,524	-	-	-	-	-	-	-	-	-	-
2d.4.6	Disposal of DAW generated	-	-	42	9	-	105	-	32	188	188	-	-	-	2,081	-	-	-	41,624	68	-
2d.4.7	Plant energy budget	-	-	-	-	-	-	447	67	514	514	-	-	-	-	-	-	-	-	-	-
2d.4.8	NRC Fees	-	-	-	-	-	-	355	35	390	390	-	-	-	-	-	-	-	-	-	-
2d.4.9	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	267	40	307	307	-	-	-	-	-	-	-	-	-	-
2d.4.10	Corporate Allocations	-	-	-	-	-	-	666	67	732	732	-	-	-	-	-	-	-	-	-	-
2d.4.11	Security Staff Cost	-	-	-	-	-	-	1,337	201	1,537	1,537	-	-	-	-	-	-	-	-	-	43,393
2d.4.12	DOC Staff Cost	-	-	-	-	-	-	6,755	1,013	7,769	7,769	-	-	-	-	-	-	-	-	-	69,429
2d.4.13	Utility Staff Cost	-	-	-	-	-	-	10,274	1,541	11,815	11,815	-	-	-	-	-	-	-	-	-	131,220
2d.4	Subtotal Period 2d Period-Dependent Costs	176	1,988	42	9	-	105	20,899	3,484	26,704	26,704	-	-	-	2,081	-	-	-	41,624	68	244,041
2d.0	TOTAL PERIOD 2d COST	1,875	4,547	590	404	1,730	2,644	23,070	6,626	41,488	41,488	-	-	20,004	12,697	-	-	-	1,599,439	78,884	256,521
PERIOD 2f - License Termination																					
Period 2f Direct Decommissioning Activities																					
2f.1.1	ORISE confirmatory survey	-	-	-	-	-	-	163	49	212	212	-	-	-	-	-	-	-	-	-	-
2f.1.2	Terminate license									a											
2f.1	Subtotal Period 2f Activity Costs	-	-	-	-	-	-	163	49	212	212	-	-	-	-	-	-	-	-	-	-
Period 2f Additional Costs																					
2f.2.1	License Termination Survey	-	-	-	-	-	-	8,248	2,474	10,723	10,723	-	-	-	-	-	-	-	-	153,878	6,240
2f.2	Subtotal Period 2f Additional Costs	-	-	-	-	-	-	8,248	2,474	10,723	10,723	-	-	-	-	-	-	-	-	153,878	6,240
Period 2f Collateral Costs																					
2f.3.1	DOC staff relocation expenses	-	-	-	-	-	-	1,080	162	1,242	1,242	-	-	-	-	-	-	-	-	-	-
2f.3	Subtotal Period 2f Collateral Costs	-	-	-	-	-	-	1,080	162	1,242	1,242	-	-	-	-	-	-	-	-	-	-
Period 2f Period-Dependent Costs																					
2f.4.2	Property taxes	-	-	-	-	-	-	212	21	233	233	-	-	-	-	-	-	-	-	-	-
2f.4.3	Health physics supplies	-	736	-	-	-	-	-	184	920	920	-	-	-	-	-	-	-	-	-	-
2f.4.4	Disposal of DAW generated	-	-	7	1	-	18	-	5	32	32	-	-	-	353	-	-	-	7,050	11	-
2f.4.5	Plant energy budget	-	-	-	-	-	-	254	38	292	292	-	-	-	-	-	-	-	-	-	-
2f.4.6	NRC Fees	-	-	-	-	-	-	457	46	503	503	-	-	-	-	-	-	-	-	-	-
2f.4.7	Corporate Allocations	-	-	-	-	-	-	756	76	832	832	-	-	-	-	-	-	-	-	-	-
2f.4.8	Security Staff Cost	-	-	-	-	-	-	727	109	836	836	-	-	-	-	-	-	-	-	-	18,926
2f.4.9	DOC Staff Cost	-	-	-	-	-	-	5,685	853	6,538	6,538	-	-	-	-	-	-	-	-	-	57,566
2f.4.10	Utility Staff Cost	-	-	-	-	-	-	6,427	964	7,391	7,391	-	-	-	-	-	-	-	-	-	74,914
2f.4	Subtotal Period 2f Period-Dependent Costs	-	736	7	1	-	18	14,518	2,296	17,576	17,576	-	-	-	353	-	-	-	7,050	11	151,406
2f.0	TOTAL PERIOD 2f COST	-	736	7	1	-	18	24,009	4,981	29,752	29,752	-	-	-	353	-	-	-	7,050	153,889	157,646
PERIOD 2 TOTALS		10,002	74,765	23,182	13,272	22,426	66,989	276,662	99,565	586,864	550,768	20,598	15,498	286,787	175,020	963	393	2,217	25,605,080	1,255,701	3,188,103
PERIOD 3b - Site Restoration																					
Period 3b Direct Decommissioning Activities																					
Demolition of Remaining Site Buildings																					
3b.1.1.1	Reactor	-	5,191	-	-	-	-	-	779	5,969	-	-	5,969	-	-	-	-	-	-	59,292	-
3b.1.1.2	Auxiliary	-	4,194	-	-	-	-	-	629	4,823	-	-	4,823	-	-	-	-	-	-	49,968	-
3b.1.1.3	Auxiliary Boiler	-	39	-	-	-	-	-	6	45	-	-	45	-	-	-	-	-	-	619	-
3b.1.1.4	Barge Facility	-	1,595	-	-	-	-	-	239	1,834	-	-	1,834	-	-	-	-	-	-	18,771	-
3b.1.1.5	Circulating & Service Water Pumphouse	-	328	-	-	-	-	-	49	377	-	-	377	-	-	-	-	-	-	4,345	-
3b.1.1.6	Communication Corridor - Clean	-	1,346	-	-	-	-	-	202	1,548	-	-	1,548	-	-	-	-	-	-	17,215	-
3b.1.1.7	Communication Corridor - Contaminated	-	60	-	-	-	-	-	9	69	-	-	69	-	-	-	-	-	-	674	-

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Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Processing Costs	Disposal Costs	Other Costs	Total Contingency	Total Costs	Lic. Term. Costs	Management Costs	Restoration Costs	Volume Cu. Feet	Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Processed Wt., Lbs.	Craft Manhours	S20 Contractor Manhours
Demolition of Remaining Site Buildings (continued)																					
3b.1.1.8	Cooling Tower Concrete	-	918	-	-	-	-	-	138	1,056	-	-	1,056	-	-	-	-	-	-	13,472	-
3b.1.1.9	Diesel Generator	-	499	-	-	-	-	-	75	574	-	-	574	-	-	-	-	-	-	5,492	-
3b.1.1.10	Essential Service Water Pumphouse	-	306	-	-	-	-	-	46	352	-	-	352	-	-	-	-	-	-	3,938	-
3b.1.1.11	Fire Water Pumphouse	-	29	-	-	-	-	-	4	33	-	-	33	-	-	-	-	-	-	382	-
3b.1.1.12	Flex Building Storage	-	557	-	-	-	-	-	84	641	-	-	641	-	-	-	-	-	-	7,590	-
3b.1.1.13	Hot Machine Shop	-	25	-	-	-	-	-	4	29	-	-	29	-	-	-	-	-	-	417	-
3b.1.1.14	Intake	-	382	-	-	-	-	-	57	440	-	-	440	-	-	-	-	-	-	4,224	-
3b.1.1.15	Misc. Structures	-	2,487	-	-	-	-	-	373	2,861	-	-	2,861	-	-	-	-	-	-	27,921	-
3b.1.1.16	Miscellaneous Site Foundations	-	382	-	-	-	-	-	57	439	-	-	439	-	-	-	-	-	-	5,483	-
3b.1.1.17	Outage Maintenance	-	192	-	-	-	-	-	29	220	-	-	220	-	-	-	-	-	-	3,190	-
3b.1.1.18	RAM Storage Building	-	69	-	-	-	-	-	10	79	-	-	79	-	-	-	-	-	-	1,081	-
3b.1.1.19	Radioactive and Personnel Tunnel	-	29	-	-	-	-	-	4	34	-	-	34	-	-	-	-	-	-	386	-
3b.1.1.20	Radwaste	-	1,872	-	-	-	-	-	281	2,153	-	-	2,153	-	-	-	-	-	-	21,798	-
3b.1.1.21	Radwaste Drum Storage	-	279	-	-	-	-	-	42	321	-	-	321	-	-	-	-	-	-	3,840	-
3b.1.1.22	Reactor Head Assembly Building	-	81	-	-	-	-	-	12	94	-	-	94	-	-	-	-	-	-	1,357	-
3b.1.1.23	Security Additions	-	2,257	-	-	-	-	-	339	2,595	-	-	2,595	-	-	-	-	-	-	20,977	-
3b.1.1.24	Service	-	527	-	-	-	-	-	79	606	-	-	606	-	-	-	-	-	-	6,045	-
3b.1.1.25	Sludge Pump Station & Lagoon	-	26	-	-	-	-	-	4	30	-	-	30	-	-	-	-	-	-	313	-
3b.1.1.26	Steam Generator Replacement Bldgs	-	1,231	-	-	-	-	-	185	1,415	-	-	1,415	-	-	-	-	-	-	15,693	-
3b.1.1.27	Turbine Building	-	3,580	-	-	-	-	-	537	4,117	-	-	4,117	-	-	-	-	-	-	55,694	-
3b.1.1.28	Turbine Pedestal	-	1,092	-	-	-	-	-	164	1,256	-	-	1,256	-	-	-	-	-	-	10,928	-
3b.1.1.29	U.H.S. Cooling Tower	-	662	-	-	-	-	-	99	761	-	-	761	-	-	-	-	-	-	6,681	-
3b.1.1.30	Water Treatment Plant	-	1	-	-	-	-	-	0	1	-	-	1	-	-	-	-	-	-	9	-
3b.1.1.31	Fuel Building	-	2,092	-	-	-	-	-	314	2,405	-	-	2,405	-	-	-	-	-	-	22,580	-
3b.1.1	Totals	-	32,329	-	-	-	-	-	4,849	37,178	-	-	37,178	-	-	-	-	-	-	390,372	-
Site Closeout Activities																					
3b.1.2	BackFill Site	-	8,631	-	-	-	-	-	1,295	9,926	-	-	9,926	-	-	-	-	-	-	15,861	-
3b.1.3	Grade & landscape site	-	132	-	-	-	-	-	20	152	-	-	152	-	-	-	-	-	-	592	-
3b.1.4	Final report to NRC	-	-	-	-	-	-	197	30	226	226	-	-	-	-	-	-	-	-	-	1,560
3b.1	Subtotal Period 3b Activity Costs	-	41,092	-	-	-	-	197	6,193	47,482	226	-	47,256	-	-	-	-	-	-	406,825	1,560
Period 3b Additional Costs																					
3b.2.1	Concrete Crushing	-	1,194	-	-	-	-	9	180	1,384	-	-	1,384	-	-	-	-	-	-	5,976	-
3b.2.2	Mine Area Backfill	-	4,988	-	-	-	-	-	748	5,736	-	-	5,736	-	-	-	-	-	-	15,960	-
3b.2.3	Cooling Tower Discharge & Intake Pipe Flow Fill	-	3,778	-	-	-	-	-	567	4,345	-	-	4,345	-	-	-	-	-	-	9,588	-
3b.2.4	Cooling Tower Demolition	-	4,272	-	-	-	-	-	641	4,913	-	-	4,913	-	-	-	-	-	-	21,619	-
3b.2.5	Excavation of Underground Services	-	1,668	-	-	-	-	761	364	2,793	-	-	2,793	-	-	-	-	-	-	14,164	-
3b.2.6	Construction Debris	-	-	-	-	-	-	2,480	372	2,852	-	-	2,852	-	-	-	-	-	-	-	-
3b.2	Subtotal Period 3b Additional Costs	-	15,901	-	-	-	-	3,250	2,873	22,023	-	-	22,023	-	-	-	-	-	-	67,307	-
Period 3b Collateral Costs																					
3b.3.1	Small tool allowance	-	402	-	-	-	-	-	60	462	-	-	462	-	-	-	-	-	-	-	-
3b.3.2	Corporate Allocations	-	-	-	-	-	-	1,504	150	1,655	-	-	1,655	-	-	-	-	-	-	-	-
3b.3	Subtotal Period 3b Collateral Costs	-	402	-	-	-	-	1,504	211	2,117	-	-	2,117	-	-	-	-	-	-	-	-
Period 3b Period-Dependent Costs																					
3b.4.2	Property taxes	-	-	-	-	-	-	421	42	463	-	-	463	-	-	-	-	-	-	-	-
3b.4.3	Heavy equipment rental	-	4,254	-	-	-	-	-	638	4,892	-	-	4,892	-	-	-	-	-	-	-	-
3b.4.4	Plant energy budget	-	-	-	-	-	-	252	38	290	-	-	290	-	-	-	-	-	-	-	-
3b.4.5	Security Staff Cost	-	-	-	-	-	-	1,446	217	1,663	-	-	1,663	-	-	-	-	-	-	-	37,646
3b.4.6	DOC Staff Cost	-	-	-	-	-	-	11,002	1,650	12,652	-	-	12,652	-	-	-	-	-	-	-	106,663
3b.4.7	Utility Staff Cost	-	-	-	-	-	-	5,200	780	5,980	-	-	5,980	-	-	-	-	-	-	-	61,174
3b.4	Subtotal Period 3b Period-Dependent Costs	-	4,254	-	-	-	-	18,321	3,365	25,940	-	-	25,940	-	-	-	-	-	-	-	205,483
3b.0	TOTAL PERIOD 3b COST	-	61,649	-	-	-	-	23,272	12,642	97,563	226	-	97,336	-	-	-	-	-	-	474,132	207,043
PERIOD 3 TOTALS		-	61,649	-	-	-	-	23,272	12,642	97,563	226	-	97,336	-	-	-	-	-	-	474,132	207,043
TOTAL COST TO DECOMMISSION		**13,116**	**139,081**	**23,305**	**13,628**	**22,426**	**70,917**	**421,442**	**132,667**	**836,582**	**692,622**	**29,564**	**114,396**	**286,787**	**176,272**	**1,750**	**393**	**2,217**	**25,725,380**	**1,750,233**	**4,612,246**

Table C
Callaway Energy Center
DECON Alternative Decommissioning Cost Estimate
40-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Processing Costs	Disposal Costs	Other Costs	Total Contingency	Total Costs	Lic. Term. Costs	Management Costs	Restoration Costs	Volume Cu. Feet	Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Processed Wt., Lbs.	Craft Manhours	S20 Contractor Manhours

TOTAL COST TO DECOMMISSION WITH 18.85% CONTINGENCY:	**$836,582**	**thousands of 2014 dollars**
TOTAL NRC LICENSE TERMINATION COST IS 82.79% OR:	**$692,622**	**thousands of 2014 dollars**
SPENT FUEL MANAGEMENT COST IS 3.53% OR:	**$29,564**	**thousands of 2014 dollars**
NON-NUCLEAR DEMOLITION COST IS 13.67% OR:	**$114,396**	**thousands of 2014 dollars**
TOTAL LOW-LEVEL RADIOACTIVE WASTE VOLUME BURIED (EXCLUDING GTCC):	**178,415**	**cubic feet**
TOTAL GREATER THAN CLASS C RADWASTE VOLUME GENERATED:	**2,217**	**cubic feet**
TOTAL SCRAP METAL REMOVED:	**70,547**	**tons**
TOTAL CRAFT LABOR REQUIREMENTS:	**1,750,233**	**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 ALTERNATIVE DECOMMISSIONING COST ESTIMATE
40-YEAR OPERATING LIFE with
LOW-LEVEL RADIOACTIVE WASTE PROCESSING

Table D
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
40-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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	-	-	-	-	-	-	380	114	494	494	-	-	-	-	-	-	-	-	-	-
1a.1.2	Prepare preliminary decommissioning cost	-	-	-	-	-	-	164	25	189	189	-	-	-	-	-	-	-	-	-	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	-	-	-	-	-	-	252	38	290	290	-	-	-	-	-	-	-	-	-	2,000
1a.1.8	Review plant dwgs & specs.	-	-	-	-	-	-	164	25	189	189	-	-	-	-	-	-	-	-	-	1,300
1a.1.9	Perform detailed rad survey									a											
1a.1.10	Estimate by-product inventory	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1a.1.11	End product description	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1a.1.12	Detailed by-product inventory	-	-	-	-	-	-	189	28	218	218	-	-	-	-	-	-	-	-	-	1,500
1a.1.13	Define major work sequence	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1a.1.14	Perform SER and EA	-	-	-	-	-	-	391	59	450	450	-	-	-	-	-	-	-	-	-	3,100
1a.1.15	Perform Site-Specific Cost Study	-	-	-	-	-	-	630	95	725	725	-	-	-	-	-	-	-	-	-	5,000
Activity Specifications																					
1a.1.16.1	Prepare plant and facilities for SAFSTOR	-	-	-	-	-	-	620	93	713	713	-	-	-	-	-	-	-	-	-	4,920
1a.1.16.2	Plant systems	-	-	-	-	-	-	525	79	604	604	-	-	-	-	-	-	-	-	-	4,167
1a.1.16.3	Plant structures and buildings	-	-	-	-	-	-	393	59	452	452	-	-	-	-	-	-	-	-	-	3,120
1a.1.16.4	Waste management	-	-	-	-	-	-	252	38	290	290	-	-	-	-	-	-	-	-	-	2,000
1a.1.16.5	Facility and site dormancy	-	-	-	-	-	-	252	38	290	290	-	-	-	-	-	-	-	-	-	2,000
1a.1.16	Total	-	-	-	-	-	-	2,044	307	2,350	2,350	-	-	-	-	-	-	-	-	-	16,207
Detailed Work Procedures																					
1a.1.17.1	Plant systems	-	-	-	-	-	-	149	22	172	172	-	-	-	-	-	-	-	-	-	1,183
1a.1.17.2	Facility closeout & dormancy	-	-	-	-	-	-	151	23	174	174	-	-	-	-	-	-	-	-	-	1,200
1a.1.17	Total	-	-	-	-	-	-	301	45	346	346	-	-	-	-	-	-	-	-	-	2,383
1a.1.18	Procure vacuum drying system	-	-	-	-	-	-	13	2	15	15	-	-	-	-	-	-	-	-	-	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	-	-	-	-	-	-	4,905	793	5,698	5,698	-	-	-	-	-	-	-	-	-	35,890
Period 1a Collateral Costs																					
1a.3.1	Spent Fuel Transfer	-	-	-	-	-	-	2,880	432	3,312	-	3,312	-	-	-	-	-	-	-	-	-
1a.3	Subtotal Period 1a Collateral Costs	-	-	-	-	-	-	2,880	432	3,312	-	3,312	-	-	-	-	-	-	-	-	-
Period 1a Period-Dependent Costs																					
1a.4.1	Insurance	-	-	-	-	-	-	1,902	190	2,092	2,092	-	-	-	-	-	-	-	-	-	-
1a.4.2	Property taxes	-	-	-	-	-	-	280	28	308	308	-	-	-	-	-	-	-	-	-	-
1a.4.3	Health physics supplies	-	497	-	-	-	-	-	124	621	621	-	-	-	-	-	-	-	-	-	-
1a.4.4	Heavy equipment rental	-	523	-	-	-	-	-	78	602	602	-	-	-	-	-	-	-	-	-	-
1a.4.5	Disposal of DAW generated	-	-	12	3	-	31	-	9	55	55	-	-	-	610	-	-	-	12,190	20	-
1a.4.6	Plant energy budget	-	-	-	-	-	-	1,677	252	1,928	1,928	-	-	-	-	-	-	-	-	-	-
1a.4.7	NRC Fees	-	-	-	-	-	-	1,181	118	1,299	1,299	-	-	-	-	-	-	-	-	-	-
1a.4.8	Emergency Planning Fees	-	-	-	-	-	-	1,490	149	1,638	-	1,638	-	-	-	-	-	-	-	-	-
1a.4.9	INPO Fees	-	-	-	-	-	-	336	50	386	386	-	-	-	-	-	-	-	-	-	-
1a.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	791	119	910	-	910	-	-	-	-	-	-	-	-	-
1a.4.11	ISFSI Operating Costs	-	-	-	-	-	-	95	14	110	-	110	-	-	-	-	-	-	-	-	-
1a.4.12	Corporate Allocations	-	-	-	-	-	-	1,000	100	1,100	1,100	-	-	-	-	-	-	-	-	-	-
1a.4.13	Security Staff Cost	-	-	-	-	-	-	11,224	1,684	12,908	12,908	-	-	-	-	-	-	-	-	-	275,314
1a.4.14	Utility Staff Cost	-	-	-	-	-	-	31,458	4,719	36,177	36,177	-	-	-	-	-	-	-	-	-	423,400
1a.4	Subtotal Period 1a Period-Dependent Costs	-	1,020	12	3	-	31	51,433	7,634	60,133	57,475	2,658	-	-	610	-	-	-	12,190	20	698,714
1a.0	TOTAL PERIOD 1a COST	-	1,020	12	3	-	31	59,219	8,859	69,144	63,174	5,970	-	-	610	-	-	-	12,190	20	734,604

Table D
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
40-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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	1,225	-	-	-	-	-	-	612	1,837	1,837	-	-	-	-	-	-	-	24,102	-
1b.1.1.2	Auxiliary	621	-	-	-	-	-	-	311	932	932	-	-	-	-	-	-	-	12,527	-
1b.1.1.3	Communication Corridor - Contaminated	14	-	-	-	-	-	-	7	21	21	-	-	-	-	-	-	-	276	-
1b.1.1.4	Fuel Building	766	-	-	-	-	-	-	383	1,149	1,149	-	-	-	-	-	-	-	14,371	-
1b.1.1.5	Hot Machine Shop	17	-	-	-	-	-	-	9	26	26	-	-	-	-	-	-	-	344	-
1b.1.1.6	RAM Storage Building	43	-	-	-	-	-	-	21	64	64	-	-	-	-	-	-	-	865	-
1b.1.1.7	Radioactive and Personnel Tunnel	5	-	-	-	-	-	-	2	7	7	-	-	-	-	-	-	-	91	-
1b.1.1.8	Radwaste	300	-	-	-	-	-	-	150	450	450	-	-	-	-	-	-	-	5,964	-
1b.1.1.9	Radwaste Drum Storage	34	-	-	-	-	-	-	17	51	51	-	-	-	-	-	-	-	671	-
1b.1.1.10	Reactor Head Assembly Building	31	-	-	-	-	-	-	16	47	47	-	-	-	-	-	-	-	614	-
1b.1.1	Totals	3,055	-	-	-	-	-	-	1,528	4,583	4,583	-	-	-	-	-	-	-	59,826	-
1b.1	Subtotal Period 1b Activity Costs	3,055	-	-	-	-	-	-	1,528	4,583	4,583	-	-	-	-	-	-	-	59,826	-
Period 1b Collateral Costs																					
1b.3.1	Decon equipment	893	-	-	-	-	-	-	134	1,026	1,026	-	-	-	-	-	-	-	-	-	-
1b.3.2	Process decommissioning water waste	172	-	108	278	-	482	-	259	1,299	1,299	-	-	-	1,085	-	-	-	65,106	212	-
1b.3.4	Small tool allowance	-	48	-	-	-	-	-	7	55	55	-	-	-	-	-	-	-	-	-	-
1b.3.5	Spent Fuel Transfer	-	-	-	-	-	-	720	108	828	-	828	-	-	-	-	-	-	-	-	-
1b.3	Subtotal Period 1b Collateral Costs	1,064	48	108	278	-	482	720	508	3,209	2,381	828	-	-	1,085	-	-	-	65,106	212	-
Period 1b Period-Dependent Costs																					
1b.4.1	Decon supplies	1,133	-	-	-	-	-	-	283	1,417	1,417	-	-	-	-	-	-	-	-	-	-
1b.4.2	Insurance	-	-	-	-	-	-	479	48	527	527	-	-	-	-	-	-	-	-	-	-
1b.4.3	Property taxes	-	-	-	-	-	-	71	7	78	78	-	-	-	-	-	-	-	-	-	-
1b.4.4	Health physics supplies	-	401	-	-	-	-	-	100	502	502	-	-	-	-	-	-	-	-	-	-
1b.4.5	Heavy equipment rental	-	132	-	-	-	-	-	20	152	152	-	-	-	-	-	-	-	-	-	-
1b.4.6	Disposal of DAW generated	-	-	15	3	-	37	-	11	67	67	-	-	-	740	-	-	-	14,798	24	-
1b.4.7	Plant energy budget	-	-	-	-	-	-	423	63	486	486	-	-	-	-	-	-	-	-	-	-
1b.4.8	NRC Fees	-	-	-	-	-	-	174	17	191	191	-	-	-	-	-	-	-	-	-	-
1b.4.9	Emergency Planning Fees	-	-	-	-	-	-	375	38	413	-	413	-	-	-	-	-	-	-	-	-
1b.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	199	30	229	-	229	-	-	-	-	-	-	-	-	-
1b.4.11	ISFSI Operating Costs	-	-	-	-	-	-	24	4	28	-	28	-	-	-	-	-	-	-	-	-
1b.4.12	Corporate Allocations	-	-	-	-	-	-	252	25	277	277	-	-	-	-	-	-	-	-	-	-
1b.4.13	Security Staff Cost	-	-	-	-	-	-	2,312	347	2,659	2,659	-	-	-	-	-	-	-	-	-	55,515
1b.4.14	Utility Staff Cost	-	-	-	-	-	-	7,929	1,189	9,118	9,118	-	-	-	-	-	-	-	-	-	106,720
1b.4	Subtotal Period 1b Period-Dependent Costs	1,133	533	15	3	-	37	12,239	2,183	16,144	15,474	670	-	-	740	-	-	-	14,798	24	162,235
1b.0	TOTAL PERIOD 1b COST	5,253	581	123	281	-	519	12,959	4,219	23,936	22,438	1,498	-	-	1,825	-	-	-	79,905	60,061	162,235
PERIOD 1c - Preparations for SAFSTOR Dormancy																					
Period 1c Direct Decommissioning Activities																					
1c.1.1	Prepare support equipment for storage	-	444	-	-	-	-	-	67	510	510	-	-	-	-	-	-	-	3,000	-	
1c.1.2	Install containment pressure equal. lines	-	38	-	-	-	-	-	6	44	44	-	-	-	-	-	-	-	700	-	
1c.1.3	Interim survey prior to dormancy	-	-	-	-	-	-	733	220	953	953	-	-	-	-	-	-	-	14,124	-	
1c.1.4	Secure building accesses									a											
1c.1.5	Prepare & submit interim report	-	-	-	-	-	-	74	11	85	85	-	-	-	-	-	-	-	-	-	583
1c.1	Subtotal Period 1c Activity Costs	-	482	-	-	-	-	806	303	1,592	1,592	-	-	-	-	-	-	-	17,824	583	
Period 1c Additional Costs																					
1c.2.1	Spent fuel pool isolation	-	-	-	-	-	-	10,813	1,622	12,434	12,434	-	-	-	-	-	-	-	-	-	-
1c.2	Subtotal Period 1c Additional Costs	-	-	-	-	-	-	10,813	1,622	12,434	12,434	-	-	-	-	-	-	-	-	-	-
Period 1c Collateral Costs																					
1c.3.1	Process decommissioning water waste	187	-	118	303	-	525	-	282	1,415	1,415	-	-	-	1,183	-	-	-	70,966	231	-
1c.3.3	Small tool allowance	-	3	-	-	-	-	-	1	4	4	-	-	-	-	-	-	-	-	-	-
1c.3.4	Spent Fuel Transfer	-	-	-	-	-	-	720	108	828	-	828	-	-	-	-	-	-	-	-	-
1c.3	Subtotal Period 1c Collateral Costs	187	3	118	303	-	525	720	390	2,247	1,419	828	-	-	1,183	-	-	-	70,966	231	-

Table D
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
40-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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	-	-	-	-	-	-	479	48	527	527	-	-	-	-	-	-	-	-	-	-
1c.4.2	Property taxes	-	-	-	-	-	-	71	7	78	78	-	-	-	-	-	-	-	-	-	-
1c.4.3	Health physics supplies	-	208	-	-	-	-	-	52	260	260	-	-	-	-	-	-	-	-	-	-
1c.4.4	Heavy equipment rental	-	132	-	-	-	-	-	20	152	152	-	-	-	-	-	-	-	-	-	-
1c.4.5	Disposal of DAW generated	-	-	3	1	-	8	-	2	14	14	-	-	-	154	-	-	-	3,073	5	-
1c.4.6	Plant energy budget	-	-	-	-	-	-	423	63	486	486	-	-	-	-	-	-	-	-	-	-
1c.4.7	NRC Fees	-	-	-	-	-	-	174	17	191	191	-	-	-	-	-	-	-	-	-	-
1c.4.8	Emergency Planning Fees	-	-	-	-	-	-	375	38	413	-	413	-	-	-	-	-	-	-	-	-
1c.4.9	Spent Fuel Pool O&M	-	-	-	-	-	-	199	30	229	-	229	-	-	-	-	-	-	-	-	-
1c.4.10	ISFSI Operating Costs	-	-	-	-	-	-	24	4	28	-	28	-	-	-	-	-	-	-	-	-
1c.4.11	Corporate Allocations	-	-	-	-	-	-	252	25	277	277	-	-	-	-	-	-	-	-	-	-
1c.4.12	Security Staff Cost	-	-	-	-	-	-	2,312	347	2,659	2,659	-	-	-	-	-	-	-	-	-	55,515
1c.4.13	Utility Staff Cost	-	-	-	-	-	-	7,929	1,189	9,118	9,118	-	-	-	-	-	-	-	-	-	106,720
1c.4	Subtotal Period 1c Period-Dependent Costs	-	340	3	1	-	8	12,239	1,842	14,433	13,763	670	-	-	154	-	-	-	3,073	5	162,235
1c.0	TOTAL PERIOD 1c COST	187	825	121	304	-	533	24,578	4,158	30,706	29,208	1,498	-	-	1,336	-	-	-	74,038	18,060	162,819
PERIOD 1 TOTALS		5,440	2,427	256	588	-	1,083	96,756	17,236	123,785	114,819	8,966	-	-	3,771	-	-	-	166,133	78,141	1,059,658
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	-	-	-	-	-	-	320	48	368	368	-	-	-	-	-	-	-	-	-	-
2a.1.5	Maintenance supplies	-	-	-	-	-	-	556	139	695	695	-	-	-	-	-	-	-	-	-	-
2a.1	Subtotal Period 2a Activity Costs	-	-	-	-	-	-	876	187	1,063	1,063	-	-	-	-	-	-	-	-	-	-
Period 2a Collateral Costs																					
2a.3.1	Spent Fuel Transfer	-	-	-	-	-	-	10,800	1,620	12,420	-	12,420	-	-	-	-	-	-	-	-	-
2a.3	Subtotal Period 2a Collateral Costs	-	-	-	-	-	-	10,800	1,620	12,420	-	12,420	-	-	-	-	-	-	-	-	-
Period 2a Period-Dependent Costs																					
2a.4.1	Insurance	-	-	-	-	-	-	3,686	369	4,054	3,332	722	-	-	-	-	-	-	-	-	-
2a.4.2	Property taxes	-	-	-	-	-	-	1,119	112	1,231	1,231	-	-	-	-	-	-	-	-	-	-
2a.4.3	Health physics supplies	-	797	-	-	-	-	-	199	996	996	-	-	-	-	-	-	-	-	-	-
2a.4.4	Disposal of DAW generated	-	-	19	4	-	47	-	14	83	83	-	-	-	920	-	-	-	18,406	30	-
2a.4.5	Plant energy budget	-	-	-	-	-	-	1,341	201	1,543	771	771	-	-	-	-	-	-	-	-	-
2a.4.6	NRC Fees	-	-	-	-	-	-	1,157	116	1,273	1,273	-	-	-	-	-	-	-	-	-	-
2a.4.7	Emergency Planning Fees	-	-	-	-	-	-	3,727	373	4,100	-	4,100	-	-	-	-	-	-	-	-	-
2a.4.8	Spent Fuel Pool O&M	-	-	-	-	-	-	3,164	475	3,639	-	3,639	-	-	-	-	-	-	-	-	-
2a.4.9	ISFSI Operating Costs	-	-	-	-	-	-	382	57	439	-	439	-	-	-	-	-	-	-	-	-
2a.4.10	Security Staff Cost	-	-	-	-	-	-	36,697	5,504	42,201	6,594	35,607	-	-	-	-	-	-	-	-	881,006
2a.4.11	Utility Staff Cost	-	-	-	-	-	-	24,718	3,708	28,425	5,702	22,724	-	-	-	-	-	-	-	-	329,543
2a.4	Subtotal Period 2a Period-Dependent Costs	-	797	19	4	-	47	75,992	11,128	87,985	19,983	68,002	-	-	920	-	-	-	18,406	30	1,210,549
2a.0	TOTAL PERIOD 2a COST	-	797	19	4	-	47	87,667	12,934	101,468	21,045	80,422	-	-	920	-	-	-	18,406	30	1,210,549
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	-	-	-	-	-	-	3,886	583	4,469	4,469	-	-	-	-	-	-	-	-	-	-
2c.1.5	Maintenance supplies	-	-	-	-	-	-	6,744	1,686	8,430	8,430	-	-	-	-	-	-	-	-	-	-
2c.1	Subtotal Period 2c Activity Costs	-	-	-	-	-	-	10,630	2,269	12,899	12,899	-	-	-	-	-	-	-	-	-	-
Period 2c Period-Dependent Costs																					
2c.4.1	Insurance	-	-	-	-	-	-	36,772	3,677	40,450	40,450	-	-	-	-	-	-	-	-	-	-
2c.4.2	Property taxes	-	-	-	-	-	-	13,586	1,359	14,944	14,944	-	-	-	-	-	-	-	-	-	-
2c.4.3	Health physics supplies	-	4,413	-	-	-	-	-	1,103	5,516	5,516	-	-	-	-	-	-	-	-	-	-
2c.4.4	Disposal of DAW generated	-	-	100	20	-	250	-	76	446	446	-	-	-	4,942	-	-	-	98,844	161	-
2c.4.5	Plant energy budget	-	-	-	-	-	-	8,141	1,221	9,363	9,363	-	-	-	-	-	-	-	-	-	-
2c.4.6	NRC Fees	-	-	-	-	-	-	12,317	1,232	13,549	13,549	-	-	-	-	-	-	-	-	-	-
2c.4.7	Security Staff Cost	-	-	-	-	-	-	69,597	10,440	80,037	80,037	-	-	-	-	-	-	-	-	-	1,519,029
2c.4.8	Utility Staff Cost	-	-	-	-	-	-	60,184	9,028	69,212	69,212	-	-	-	-	-	-	-	-	-	886,100

Table D
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
40-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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	Subtotal Period 2c Period-Dependent Costs	-	4,413	100	20	-	250	200,598	28,135	233,516	233,516	-	-	-	4,942	-	-	-	98,844	161	2,405,129
2c.0	TOTAL PERIOD 2c COST	-	4,413	100	20	-	250	211,228	30,404	246,415	246,415	-	-	-	4,942	-	-	-	98,844	161	2,405,129
PERIOD 2 TOTALS		-	5,209	119	24	-	297	298,896	43,338	347,883	267,461	80,422	-	-	5,863	-	-	-	117,251	191	3,615,677
PERIOD 3a - Reactivate Site Following SAFSTOR Dormancy																					
Period 3a Direct Decommissioning Activities																					
3a.1.1	Prepare preliminary decommissioning cost	-	-	-	-	-	-	164	25	189	189	-	-	-	-	-	-	-	-	-	1,300
3a.1.2	Review plant dwgs & specs.	-	-	-	-	-	-	580	87	667	667	-	-	-	-	-	-	-	-	-	4,600
3a.1.3	Perform detailed rad survey									a											
3a.1.4	End product description	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
3a.1.5	Detailed by-product inventory	-	-	-	-	-	-	164	25	189	189	-	-	-	-	-	-	-	-	-	1,300
3a.1.6	Define major work sequence	-	-	-	-	-	-	946	142	1,088	1,088	-	-	-	-	-	-	-	-	-	7,500
3a.1.7	Perform SER and EA	-	-	-	-	-	-	391	59	450	450	-	-	-	-	-	-	-	-	-	3,100
3a.1.8	Perform Site-Specific Cost Study	-	-	-	-	-	-	630	95	725	725	-	-	-	-	-	-	-	-	-	5,000
3a.1.9	Prepare/submit License Termination Plan	-	-	-	-	-	-	516	77	594	594	-	-	-	-	-	-	-	-	-	4,096
3a.1.10	Receive NRC approval of termination plan									a											
Activity Specifications																					
3a.1.11.1	Re-activate plant & temporary facilities	-	-	-	-	-	-	929	139	1,069	962	-	107	-	-	-	-	-	-	-	7,370
3a.1.11.2	Plant systems	-	-	-	-	-	-	525	79	604	544	-	60	-	-	-	-	-	-	-	4,167
3a.1.11.3	Reactor internals	-	-	-	-	-	-	895	134	1,030	1,030	-	-	-	-	-	-	-	-	-	7,100
3a.1.11.4	Reactor vessel	-	-	-	-	-	-	820	123	943	943	-	-	-	-	-	-	-	-	-	6,500
3a.1.11.5	Biological shield	-	-	-	-	-	-	63	9	73	73	-	-	-	-	-	-	-	-	-	500
3a.1.11.6	Steam generators	-	-	-	-	-	-	393	59	452	452	-	-	-	-	-	-	-	-	-	3,120
3a.1.11.7	Reinforced concrete	-	-	-	-	-	-	202	30	232	116	-	116	-	-	-	-	-	-	-	1,600
3a.1.11.8	Main Turbine	-	-	-	-	-	-	50	8	58	-	-	58	-	-	-	-	-	-	-	400
3a.1.11.9	Main Condensers	-	-	-	-	-	-	50	8	58	-	-	58	-	-	-	-	-	-	-	400
3a.1.11.10	Plant structures & buildings	-	-	-	-	-	-	393	59	452	226	-	226	-	-	-	-	-	-	-	3,120
3a.1.11.11	Waste management	-	-	-	-	-	-	580	87	667	667	-	-	-	-	-	-	-	-	-	4,600
3a.1.11.12	Facility & site closeout	-	-	-	-	-	-	113	17	131	65	-	65	-	-	-	-	-	-	-	900
3a.1.11	Total	-	-	-	-	-	-	5,015	752	5,768	5,077	-	691	-	-	-	-	-	-	-	39,777
Planning & Site Preparations																					
3a.1.12	Prepare dismantling sequence	-	-	-	-	-	-	303	45	348	348	-	-	-	-	-	-	-	-	-	2,400
3a.1.13	Plant prep. & temp. svces	-	-	-	-	-	-	3,000	450	3,450	3,450	-	-	-	-	-	-	-	-	-	-
3a.1.14	Design water clean-up system	-	-	-	-	-	-	177	26	203	203	-	-	-	-	-	-	-	-	-	1,400
3a.1.15	Rigging/Cont. Cntrl Envlps/tooling/etc.	-	-	-	-	-	-	2,300	345	2,645	2,645	-	-	-	-	-	-	-	-	-	-
3a.1.16	Procure casks/liners & containers	-	-	-	-	-	-	155	23	178	178	-	-	-	-	-	-	-	-	-	1,230
3a.1	Subtotal Period 3a Activity Costs	-	-	-	-	-	-	14,467	2,170	16,637	15,946	-	691	-	-	-	-	-	-	-	72,703
Period 3a Period-Dependent Costs																					
3a.4.1	Insurance	-	-	-	-	-	-	382	38	420	420	-	-	-	-	-	-	-	-	-	-
3a.4.2	Property taxes	-	-	-	-	-	-	141	14	155	155	-	-	-	-	-	-	-	-	-	-
3a.4.3	Health physics supplies	-	219	-	-	-	-	-	55	273	273	-	-	-	-	-	-	-	-	-	-
3a.4.4	Heavy equipment rental	-	264	-	-	-	-	-	40	303	303	-	-	-	-	-	-	-	-	-	-
3a.4.5	Disposal of DAW generated	-	-	5	1	-	13	-	4	23	23	-	-	-	259	-	-	-	5,186	8	-
3a.4.6	Plant energy budget	-	-	-	-	-	-	845	127	972	972	-	-	-	-	-	-	-	-	-	-
3a.4.7	NRC Fees	-	-	-	-	-	-	191	19	210	210	-	-	-	-	-	-	-	-	-	-
3a.4.8	Corporate Allocations	-	-	-	-	-	-	504	50	555	555	-	-	-	-	-	-	-	-	-	-
3a.4.9	Security Staff Cost	-	-	-	-	-	-	1,012	152	1,164	1,164	-	-	-	-	-	-	-	-	-	32,857
3a.4.10	Utility Staff Cost	-	-	-	-	-	-	9,856	1,478	11,334	11,334	-	-	-	-	-	-	-	-	-	130,377
3a.4	Subtotal Period 3a Period-Dependent Costs	-	483	5	1	-	13	12,931	1,977	15,410	15,410	-	-	-	259	-	-	-	5,186	8	163,234
3a.0	TOTAL PERIOD 3a COST	-	483	5	1	-	13	27,398	4,147	32,047	31,356	-	691	-	259	-	-	-	5,186	8	235,937
PERIOD 3b - Decommissioning Preparations																					
Period 3b Direct Decommissioning Activities																					
Detailed Work Procedures																					
3b.1.1.1	Plant systems	-	-	-	-	-	-	597	90	686	618	-	69	-	-	-	-	-	-	-	4,733
3b.1.1.2	Reactor internals	-	-	-	-	-	-	315	47	363	363	-	-	-	-	-	-	-	-	-	2,500
3b.1.1.3	Remaining buildings	-	-	-	-	-	-	170	26	196	49	-	147	-	-	-	-	-	-	-	1,350
3b.1.1.4	CRD cooling assembly	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
3b.1.1.5	CRD housings & ICI tubes	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000

Table D
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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			
Detailed Work Procedures (continued)																					
3b.1.1.6	Incore instrumentation	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
3b.1.1.7	Reactor vessel	-	-	-	-	-	-	458	69	526	526	-	-	-	-	-	-	-	-	-	3,630
3b.1.1.8	Facility closeout	-	-	-	-	-	-	151	23	174	87	-	87	-	-	-	-	-	-	-	1,200
3b.1.1.9	Missile shields	-	-	-	-	-	-	57	9	65	65	-	-	-	-	-	-	-	-	-	450
3b.1.1.10	Biological shield	-	-	-	-	-	-	151	23	174	174	-	-	-	-	-	-	-	-	-	1,200
3b.1.1.11	Steam generators	-	-	-	-	-	-	580	87	667	667	-	-	-	-	-	-	-	-	-	4,600
3b.1.1.12	Reinforced concrete	-	-	-	-	-	-	126	19	145	73	-	73	-	-	-	-	-	-	-	1,000
3b.1.1.13	Main Turbine	-	-	-	-	-	-	197	30	226	-	-	226	-	-	-	-	-	-	-	1,560
3b.1.1.14	Main Condensers	-	-	-	-	-	-	197	30	226	-	-	226	-	-	-	-	-	-	-	1,560
3b.1.1.15	Auxiliary building	-	-	-	-	-	-	344	52	396	356	-	40	-	-	-	-	-	-	-	2,730
3b.1.1.16	Reactor building	-	-	-	-	-	-	344	52	396	356	-	40	-	-	-	-	-	-	-	2,730
3b.1.1	Total	-	-	-	-	-	-	4,066	610	4,675	3,769	-	907	-	-	-	-	-	-	-	32,243
3b.1	Subtotal Period 3b Activity Costs	-	-	-	-	-	-	4,066	610	4,675	3,769	-	907	-	-	-	-	-	-	-	32,243
Period 3b Additional Costs																					
3b.2.1	Site Characterization	-	-	-	-	-	-	2,824	847	3,671	3,671	-	-	-	-	-	-	-	-	19,100	7,852
3b.2	Subtotal Period 3b Additional Costs	-	-	-	-	-	-	2,824	847	3,671	3,671	-	-	-	-	-	-	-	-	19,100	7,852
Period 3b Collateral Costs																					
3b.3.1	Decon equipment	893	-	-	-	-	-	-	134	1,026	1,026	-	-	-	-	-	-	-	-	-	-
3b.3.2	DOC staff relocation expenses	-	-	-	-	-	-	1,080	162	1,242	1,242	-	-	-	-	-	-	-	-	-	-
3b.3.3	Pipe cutting equipment	-	1,100	-	-	-	-	-	165	1,265	1,265	-	-	-	-	-	-	-	-	-	-
3b.3	Subtotal Period 3b Collateral Costs	893	1,100	-	-	-	-	1,080	461	3,533	3,533	-	-	-	-	-	-	-	-	-	-
Period 3b Period-Dependent Costs																					
3b.4.1	Decon supplies	54	-	-	-	-	-	-	14	68	68	-	-	-	-	-	-	-	-	-	-
3b.4.2	Insurance	-	-	-	-	-	-	921	92	1,014	1,014	-	-	-	-	-	-	-	-	-	-
3b.4.3	Property taxes	-	-	-	-	-	-	280	28	308	308	-	-	-	-	-	-	-	-	-	-
3b.4.4	Health physics supplies	-	478	-	-	-	-	-	120	598	598	-	-	-	-	-	-	-	-	-	-
3b.4.5	Heavy equipment rental	-	523	-	-	-	-	-	78	602	602	-	-	-	-	-	-	-	-	-	-
3b.4.6	Disposal of DAW generated	-	-	12	2	-	29	-	9	53	53	-	-	-	582	-	-	-	11,636	19	-
3b.4.7	Plant energy budget	-	-	-	-	-	-	1,677	252	1,928	1,928	-	-	-	-	-	-	-	-	-	-
3b.4.8	NRC Fees	-	-	-	-	-	-	378	38	416	416	-	-	-	-	-	-	-	-	-	-
3b.4.9	Corporate Allocations	-	-	-	-	-	-	1,000	100	1,100	1,100	-	-	-	-	-	-	-	-	-	-
3b.4.10	Security Staff Cost	-	-	-	-	-	-	2,008	301	2,309	2,309	-	-	-	-	-	-	-	-	-	65,179
3b.4.11	DOC Staff Cost	-	-	-	-	-	-	11,473	1,721	13,194	13,194	-	-	-	-	-	-	-	-	-	116,800
3b.4.12	Utility Staff Cost	-	-	-	-	-	-	19,551	2,933	22,484	22,484	-	-	-	-	-	-	-	-	-	258,629
3b.4	Subtotal Period 3b Period-Dependent Costs	54	1,002	12	2	-	29	37,288	5,685	44,072	44,072	-	-	-	582	-	-	-	11,636	19	440,607
3b.0	TOTAL PERIOD 3b COST	947	2,102	12	2	-	29	45,257	7,603	55,952	55,045	-	907	-	582	-	-	-	11,636	19,119	480,702
PERIOD 3 TOTALS		947	2,584	17	3	-	43	72,655	11,750	87,999	86,401	-	1,597	-	841	-	-	-	16,822	19,127	716,639
PERIOD 4a - Large Component Removal																					
Period 4a Direct Decommissioning Activities																					
Nuclear Steam Supply System Removal																					
4a.1.1.1	Reactor Coolant Piping	36	169	24	17	133	260	-	150	787	787	-	-	580	614	-	-	-	134,538	3,957	-
4a.1.1.2	Pressurizer Relief Tank	6	23	7	5	37	67	-	33	178	178	-	-	164	164	-	-	-	36,395	594	-
4a.1.1.3	Reactor Coolant Pumps & Motors	20	82	70	206	-	1,031	-	326	1,735	1,735	-	-	-	3,386	-	-	-	816,140	2,700	80
4a.1.1.4	Pressurizer	10	55	433	156	-	1,138	-	370	2,161	2,161	-	-	-	3,739	-	-	-	241,053	1,538	1,500
4a.1.1.5	Steam Generators	76	5,359	2,279	2,691	2,599	6,862	-	4,115	23,982	23,982	-	-	40,262	22,546	-	-	-	3,349,305	20,508	2,250
4a.1.1.6	Retired Steam Generator Units	-	-	2,279	2,691	2,599	6,862	-	2,737	17,169	17,169	-	-	40,262	22,546	-	-	-	3,349,305	10,800	2,250
4a.1.1.7	CRDMs/ICIs/Service Structure Removal	30	81	222	39	57	199	-	122	751	751	-	-	753	2,947	-	-	-	81,666	2,134	-
4a.1.1.8	Reactor Vessel Internals	55	3,199	9,914	698	-	13,904	279	12,074	40,125	40,125	-	-	-	2,437	501	406	-	327,518	26,217	1,181
4a.1.1.9	Vessel & Internals GTCC Disposal	-	-	-	-	-	10,749	-	1,612	12,361	12,361	-	-	-	-	-	-	2,217	433,180	-	-
4a.1.1.10	Reactor Vessel	95	6,030	2,008	1,086	-	3,087	279	6,929	19,514	19,514	-	-	-	9,361	-	-	-	960,909	26,217	1,181
4a.1.1	Totals	328	14,999	17,235	7,589	5,426	44,159	559	28,468	118,763	118,763	-	-	82,020	67,739	501	406	2,217	9,730,008	94,664	8,441
Removal of Major Equipment																					
4a.1.2	Main Turbine/Generator	-	438	268	12	640	-	-	234	1,593	1,593	-	-	5,180	-	-	-	-	310,807	8,721	-
4a.1.3	Main Condensers	-	1,240	164	34	751	-	-	444	2,634	2,634	-	-	8,106	-	-	-	-	364,767	24,802	-
Cascading Costs from Clean Building Demolition																					
4a.1.4.1	Reactor	-	915	-	-	-	-	-	137	1,052	1,052	-	-	-	-	-	-	-	-	10,442	-
4a.1.4.2	Auxiliary	-	466	-	-	-	-	-	70	536	536	-	-	-	-	-	-	-	-	5,551	-
4a.1.4.3	Fuel Building	-	227	-	-	-	-	-	34	261	261	-	-	-	-	-	-	-	-	2,395	-

Table D
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
40-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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			
Cascading Costs from Clean Building Demolition (continued)																					
4a.1.4.4	Hot Machine Shop	-	1	-	-	-	-	-	0	1	1	-	-	-	-	-	-	-	-	16	-
4a.1.4.5	Radwaste	-	97	-	-	-	-	-	15	111	111	-	-	-	-	-	-	-	-	1,108	-
4a.1.4	Totals	-	1,705	-	-	-	-	-	256	1,961	1,961	-	-	-	-	-	-	-	-	19,512	-
Disposal of Plant Systems																					
4a.1.5.1	100 Aux.Bldg Non-System Specific RCA	-	688	12	29	638	-	-	273	1,640	1,640	-	-	7,629	-	-	-	-	309,812	13,471	-
4a.1.5.2	100 Auxiliary Bldg Non-System Specific	-	102	2	4	69	8	-	38	222	222	-	-	824	31	-	-	-	35,534	2,031	-
4a.1.5.3	AB - Main Steam	-	267	-	-	-	-	-	40	308	-	-	308	-	-	-	-	-	-	5,833	-
4a.1.5.4	AB - Main Steam RCA	-	78	3	8	180	-	-	48	318	318	-	-	2,156	-	-	-	-	87,550	1,515	-
4a.1.5.5	AC - Main Turbine	-	263	-	-	-	-	-	39	302	-	-	302	-	-	-	-	-	-	5,641	-
4a.1.5.6	AD - Condensate	-	290	-	-	-	-	-	43	333	-	-	333	-	-	-	-	-	-	6,144	-
4a.1.5.7	AE - Feedwater	-	200	-	-	-	-	-	30	229	-	-	229	-	-	-	-	-	-	4,271	-
4a.1.5.8	AF - Feedwater Heater Extraction	-	247	-	-	-	-	-	37	285	-	-	285	-	-	-	-	-	-	5,352	-
4a.1.5.9	AK - Condensate Demineralizer	-	91	-	-	-	-	-	14	105	-	-	105	-	-	-	-	-	-	1,944	-
4a.1.5.10	AL - Auxiliary Feedwater	-	40	-	-	-	-	-	6	46	-	-	46	-	-	-	-	-	-	852	-
4a.1.5.11	AQ - Condensate & Feedwater Chem Addtn	-	22	-	-	-	-	-	3	26	-	-	26	-	-	-	-	-	-	468	-
4a.1.5.12	BM - Steam Generator Blowdown	-	108	2	4	97	-	-	42	253	253	-	-	1,157	-	-	-	-	46,993	2,137	-
4a.1.5.13	BM - Steam Generator Blowdown - RCA	-	372	6	15	344	-	-	147	885	885	-	-	4,109	-	-	-	-	166,857	7,066	-
4a.1.5.14	BN - Borated Refueling Water Storage	-	306	9	24	523	-	-	160	1,022	1,022	-	-	6,255	-	-	-	-	254,024	6,161	-
4a.1.5.15	CA - Steam Seal	-	21	-	-	-	-	-	3	24	-	-	24	-	-	-	-	-	-	455	-
4a.1.5.16	CB - Main Turbine Lube Oil	-	59	-	-	-	-	-	9	68	-	-	68	-	-	-	-	-	-	1,207	-
4a.1.5.17	CC - Generator Hydrogen Seal & CO2	-	10	-	-	-	-	-	1	11	-	-	11	-	-	-	-	-	-	198	-
4a.1.5.18	CD - Generator Seal Oil	-	14	-	-	-	-	-	2	16	-	-	16	-	-	-	-	-	-	287	-
4a.1.5.19	CE - Stator Cooling Water	-	12	-	-	-	-	-	2	13	-	-	13	-	-	-	-	-	-	241	-
4a.1.5.20	CF - Lube Oil Storage Xfer & Prfication	-	39	-	-	-	-	-	6	44	-	-	44	-	-	-	-	-	-	812	-
4a.1.5.21	CG - Condenser Air Removal	-	31	-	-	-	-	-	5	36	-	-	36	-	-	-	-	-	-	657	-
4a.1.5.22	CH - Main Turbine Control Oil	-	60	-	-	-	-	-	9	69	-	-	69	-	-	-	-	-	-	1,219	-
4a.1.5.23	DA - Circulating Water	-	345	-	-	-	-	-	52	397	-	-	397	-	-	-	-	-	-	7,502	-
4a.1.5.24	DB - Cooling Tower Makeup & Blowdown	-	58	-	-	-	-	-	9	67	-	-	67	-	-	-	-	-	-	1,260	-
4a.1.5.25	DD - Cooling Water Chemical Control Sys	-	51	-	-	-	-	-	8	59	-	-	59	-	-	-	-	-	-	1,084	-
4a.1.5.26	DD - Cooling Wtr Chem Control RCA	-	274	5	13	297	-	-	116	706	706	-	-	3,555	-	-	-	-	144,376	4,951	-
4a.1.5.27	EJ - Residual Heat Removal	-	358	31	35	375	285	-	225	1,309	1,309	-	-	4,481	1,166	-	-	-	259,047	7,147	-
4a.1.5.28	EM - High Pressure Coolant Injection	-	304	3	8	185	-	-	105	606	606	-	-	2,214	-	-	-	-	89,903	5,913	-
4a.1.5.29	EN - Containment Spray	-	218	5	11	253	-	-	95	581	581	-	-	3,026	-	-	-	-	122,874	4,134	-
4a.1.5.30	EP - Accumulator Safety Injection	-	160	3	7	166	-	-	66	403	403	-	-	1,989	-	-	-	-	80,762	3,112	-
4a.1.5.31	FA - Auxiliary Steam Generator	-	24	-	-	-	-	-	4	27	-	-	27	-	-	-	-	-	-	521	-
4a.1.5.32	FB - Auxiliary Steam	-	98	-	-	-	-	-	15	112	-	-	112	-	-	-	-	-	-	2,106	-
4a.1.5.33	FB - Auxiliary Steam RCA	-	83	1	3	68	-	-	31	187	187	-	-	816	-	-	-	-	33,148	1,537	-
4a.1.5.34	FC - Auxiliary Turbines	-	63	-	-	-	-	-	9	72	-	-	72	-	-	-	-	-	-	1,320	-
4a.1.5.35	FE - Auxiliary Steam Chemical Addition	-	5	-	-	-	-	-	1	6	-	-	6	-	-	-	-	-	-	105	-
4a.1.5.36	GE - Turbine Building HVAC	-	175	-	-	-	-	-	26	201	-	-	201	-	-	-	-	-	-	3,957	-
4a.1.5.37	GS - Containment Hydrogen Control	-	70	1	3	67	-	-	28	169	169	-	-	801	-	-	-	-	32,539	1,395	-
4a.1.5.38	HE - Boron Recycle	-	461	24	25	289	194	-	213	1,206	1,206	-	-	3,460	794	-	-	-	192,819	8,970	-
4a.1.5.39	HF - Secondary Liquid Waste	-	903	48	56	705	387	-	441	2,541	2,541	-	-	8,431	1,588	-	-	-	447,007	17,832	-
4a.1.5.40	JA - Auxiliary Oil & Transfer	-	32	-	-	-	-	-	5	36	-	-	36	-	-	-	-	-	-	690	-
4a.1.5.41	KS - Bulk Chemical Storage	-	91	10	24	539	-	-	108	773	773	-	-	6,449	-	-	-	-	261,890	1,825	-
4a.1.5.42	LE - Oily Waste	-	179	-	-	-	-	-	27	206	-	-	206	-	-	-	-	-	-	3,865	-
4a.1.5.43	LE - Oily Waste RCA	-	237	3	8	189	-	-	89	527	527	-	-	2,256	-	-	-	-	91,628	4,296	-
4a.1.5.44	Turbine Bldg Non-System Specific	-	742	-	-	-	-	-	111	853	-	-	853	-	-	-	-	-	-	15,405	-
4a.1.5	Totals	-	8,248	168	279	4,987	873	-	2,743	17,298	13,347	-	3,951	59,608	3,579	-	-	-	2,656,763	166,890	-
4a.1.6	Scaffolding in support of decommissioning	-	1,464	27	7	114	27	-	394	2,033	2,033	-	-	1,233	109	-	-	-	62,671	33,634	-
4a.1	Subtotal Period 4a Activity Costs	328	28,094	17,864	7,920	11,919	45,060	559	32,539	144,282	140,331	-	3,951	156,147	71,427	501	406	2,217	13,125,020	348,223	8,441
Period 4a Additional Costs																					
4a.2.1	Remedial Action Surveys	-	-	-	-	-	-	1,399	420	1,819	1,819	-	-	-	-	-	-	-	-	28,645	-
4a.2	Subtotal Period 4a Additional Costs	-	-	-	-	-	-	1,399	420	1,819	1,819	-	-	-	-	-	-	-	-	28,645	-
Period 4a Collateral Costs																					
4a.3.1	Process decommissioning water waste	5	-	8	20	-	35	-	15	82	82	-	-	-	78	-	-	-	4,704	15	-
4a.3.3	Small tool allowance	-	288	-	-	-	-	-	43	331	298	-	33	-	-	-	-	-	-	-	-
4a.3.4	On-site survey and release of 60.87 tons clean metallic waste	-	-	-	-	-	-	84	8	92	92	-	-	-	-	-	-	-	-	-	-
4a.3	Subtotal Period 4a Collateral Costs	5	288	8	20	-	35	84	67	506	473	-	33	-	78	-	-	-	4,704	15	-

Table D
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
40-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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 Period-Dependent Costs																					
4a.4.1	Decon supplies	75	-	-	-	-	-	-	19	94	94	-	-	-	-	-	-	-	-	-	-
4a.4.2	Insurance	-	-	-	-	-	-	1,270	127	1,397	1,397	-	-	-	-	-	-	-	-	-	-
4a.4.3	Property taxes	-	-	-	-	-	-	386	39	424	382	-	42	-	-	-	-	-	-	-	-
4a.4.4	Health physics supplies	-	2,408	-	-	-	-	-	602	3,010	3,010	-	-	-	-	-	-	-	-	-	-
4a.4.5	Heavy equipment rental	-	2,771	-	-	-	-	-	416	3,187	3,187	-	-	-	-	-	-	-	-	-	-
4a.4.6	Disposal of DAW generated	-	-	100	20	-	250	-	75	445	445	-	-	-	4,929	-	-	-	98,590	161	-
4a.4.7	Plant energy budget	-	-	-	-	-	-	2,195	329	2,525	2,525	-	-	-	-	-	-	-	-	-	-
4a.4.8	NRC Fees	-	-	-	-	-	-	832	83	915	915	-	-	-	-	-	-	-	-	-	-
4a.4.9	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	552	83	635	635	-	-	-	-	-	-	-	-	-	-
4a.4.10	Corporate Allocations	-	-	-	-	-	-	1,378	138	1,516	1,516	-	-	-	-	-	-	-	-	-	-
4a.4.11	Security Staff Cost	-	-	-	-	-	-	2,767	415	3,182	3,182	-	-	-	-	-	-	-	-	-	89,821
4a.4.12	DOC Staff Cost	-	-	-	-	-	-	18,947	2,842	21,788	21,788	-	-	-	-	-	-	-	-	-	198,326
4a.4.13	Utility Staff Cost	-	-	-	-	-	-	27,104	4,066	31,170	31,170	-	-	-	-	-	-	-	-	-	359,286
4a.4	Subtotal Period 4a Period-Dependent Costs	75	5,180	100	20	-	250	55,430	9,233	70,288	70,246	-	42	-	4,929	-	-	-	98,590	161	647,433
4a.0	TOTAL PERIOD 4a COST	408	33,562	17,972	7,961	11,919	45,344	57,472	42,258	216,895	212,868	-	4,027	156,147	76,435	501	406	2,217	13,228,310	377,044	655,874
PERIOD 4b - Site Decontamination																					
Period 4b Direct Decommissioning Activities																					
4b.1.1	Remove spent fuel racks	753	82	293	107	-	1,709	-	870	3,814	3,814	-	-	-	6,988	-	-	-	461,925	1,925	-
Disposal of Plant Systems																					
4b.1.2.1	200 Reactor Bldg Non-System Specific	-	81	1	2	42	5	-	28	159	159	-	-	502	19	-	-	-	21,639	1,569	-
4b.1.2.2	200 Reactor Bldg Non-System Specific RCA	-	557	7	18	399	-	-	203	1,184	1,184	-	-	4,768	-	-	-	-	193,612	10,425	-
4b.1.2.3	300 Control Bldg Non-System Specific	-	176	3	8	179	-	-	72	439	439	-	-	2,139	-	-	-	-	86,849	3,413	-
4b.1.2.4	300 Control Bldg Non-System Specific Cln	-	1,394	-	-	-	-	-	209	1,603	-	-	1,603	-	-	-	-	-	-	29,076	-
4b.1.2.5	600 Fuel Bldg Non-Specific Systems RCA	-	306	5	12	268	-	-	119	710	710	-	-	3,200	-	-	-	-	129,974	5,859	-
4b.1.2.6	600 Fuel Bldg Non-System Specific	-	43	1	1	27	3	-	16	91	91	-	-	322	12	-	-	-	13,860	850	-
4b.1.2.7	700 Radwaste Bldg Non-Sys Specific RCA	-	1,131	19	48	1,061	-	-	451	2,710	2,710	-	-	12,684	-	-	-	-	515,103	21,919	-
4b.1.2.8	700 Radwaste Bldg Non-System Specific	-	164	3	6	111	12	-	62	358	358	-	-	1,329	50	-	-	-	57,274	3,253	-
4b.1.2.9	AN - Demineralized Wtr Storage & Xfer	-	153	-	-	-	-	-	23	176	-	-	176	-	-	-	-	-	-	3,283	-
4b.1.2.10	AN - Demineralized Wtr Strg & Xfer RCA	-	40	0	1	26	-	-	14	83	83	-	-	314	-	-	-	-	12,759	740	-
4b.1.2.11	AP - Condensate Storage & Transfer	-	89	-	-	-	-	-	13	102	-	-	102	-	-	-	-	-	-	1,794	-
4b.1.2.12	BB - Reactor Coolant System	-	309	26	27	216	273	-	184	1,035	1,035	-	-	2,586	1,130	-	-	-	178,727	6,323	-
4b.1.2.13	BG - Chemical & Volume Control	-	880	69	70	685	633	-	498	2,836	2,836	-	-	8,192	2,586	-	-	-	503,667	17,275	-
4b.1.2.14	BL - Reactor Makeup Water	-	280	14	16	212	102	-	131	754	754	-	-	2,529	418	-	-	-	130,204	5,494	-
4b.1.2.15	DE - Intake & Water Treatment	-	121	-	-	-	-	-	18	139	-	-	139	-	-	-	-	-	-	2,517	-
4b.1.2.16	DE - Intake & Water Treatment RCA	-	252	18	45	997	-	-	221	1,533	1,533	-	-	11,923	-	-	-	-	484,206	5,014	-
4b.1.2.17	EA - Service Water	-	144	-	-	-	-	-	22	166	-	-	166	-	-	-	-	-	-	3,145	-
4b.1.2.18	EA - Service Water RCA	-	45	2	5	104	-	-	28	184	184	-	-	1,248	-	-	-	-	50,693	839	-
4b.1.2.19	EB - Closed Cooling Water	-	59	-	-	-	-	-	9	68	-	-	68	-	-	-	-	-	-	1,267	-
4b.1.2.20	EC - Fuel Pool Cooling & Cleanup	-	367	6	15	345	-	-	146	880	880	-	-	4,119	-	-	-	-	167,293	7,163	-
4b.1.2.21	EF - Essential Service Water	-	334	-	-	-	-	-	50	385	-	-	385	-	-	-	-	-	-	7,244	-
4b.1.2.22	EF - Essential Service Water RCA	-	200	8	20	446	-	-	121	794	794	-	-	5,326	-	-	-	-	216,287	3,862	-
4b.1.2.23	EG - Component Cooling Water RCA	-	247	-	-	-	-	-	37	284	-	-	284	-	-	-	-	-	-	5,335	-
4b.1.2.24	GA - Plant Heating	-	89	-	-	-	-	-	13	102	-	-	102	-	-	-	-	-	-	1,912	-
4b.1.2.25	GA - Plant Heating RCA	-	97	1	2	53	-	-	33	186	186	-	-	638	-	-	-	-	25,924	1,765	-
4b.1.2.26	GA- Plant Heating Fuel Building	-	21	0	0	9	-	-	7	37	37	-	-	107	-	-	-	-	4,351	400	-
4b.1.2.27	GB - Central Chilled Water	-	84	-	-	-	-	-	13	96	-	-	96	-	-	-	-	-	-	1,803	-
4b.1.2.28	GB - Central Chilled Water RCA	-	26	0	1	16	-	-	9	52	52	-	-	187	-	-	-	-	7,591	482	-
4b.1.2.29	GD - Essential Serv Wtr Pumphouse HVAC	-	18	-	-	-	-	-	3	21	-	-	21	-	-	-	-	-	-	427	-
4b.1.2.30	GF - Miscellaneous Building HVAC	-	122	3	8	170	-	-	58	361	361	-	-	2,034	-	-	-	-	82,602	2,026	-
4b.1.2.31	GG - Fuel Building HVAC	-	232	6	15	330	-	-	110	693	693	-	-	3,945	-	-	-	-	160,195	4,052	-
4b.1.2.32	GH - Radwaste Building HVAC	-	170	4	10	214	-	-	76	474	474	-	-	2,561	-	-	-	-	104,012	3,004	-
4b.1.2.33	GK - Control Building HVAC	-	168	-	-	-	-	-	25	193	-	-	193	-	-	-	-	-	-	3,959	-
4b.1.2.34	GL - Auxiliary Building HVAC	-	422	8	20	450	-	-	177	1,077	1,077	-	-	5,381	-	-	-	-	218,514	7,364	-
4b.1.2.35	GM - Diesel Generator Building HVAC	-	29	-	-	-	-	-	4	34	-	-	34	-	-	-	-	-	-	695	-
4b.1.2.36	GN - Containment Cooling	-	465	12	31	691	-	-	226	1,425	1,425	-	-	8,264	-	-	-	-	335,602	8,405	-
4b.1.2.37	GP - Containment Intgratd Leak Rate Test	-	39	1	2	49	-	-	17	108	108	-	-	580	-	-	-	-	23,570	750	-
4b.1.2.38	GR - Containment Atmospheric Control	-	17	2	4	96	-	-	20	139	139	-	-	1,143	-	-	-	-	46,407	350	-
4b.1.2.39	GT - Containment Purge HVAC	-	109	3	8	183	-	-	56	359	359	-	-	2,185	-	-	-	-	88,746	1,973	-
4b.1.2.40	HA - Gaseous Radwaste	-	331	5	14	309	-	-	132	791	791	-	-	3,699	-	-	-	-	150,219	6,296	-
4b.1.2.41	HB - Liquid Radwaste	-	799	47	50	616	353	-	393	2,258	2,258	-	-	7,362	1,450	-	-	-	394,465	15,506	-
4b.1.2.42	HC - Solid Radwaste	-	341	23	24	250	211	-	181	1,030	1,030	-	-	2,985	862	-	-	-	178,137	6,652	-
4b.1.2.43	HD - Decontamination	-	94	6	6	82	42	-	48	278	278	-	-	983	171	-	-	-	51,237	1,835	-
4b.1.2.44	JE - Emergency Fuel Oil	-	62	-	-	-	-	-	9	71	-	-	71	-	-	-	-	-	-	1,260	-
4b.1.2.45	KA - Compressed Air	-	195	-	-	-	-	-	29	224	-	-	224	-	-	-	-	-	-	4,187	-

Table D
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
40-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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.1.2.46	KA - Compressed Air RCA	-	130	1	3	67	-	-	43	244	244	-	-	801	-	-	-	-	32,538	2,339	-
4b.1.2.47	KB - Breathing Air	-	24	-	-	-	-	-	4	28	-	-	28	-	-	-	-	-	-	516	-
4b.1.2.48	KB - Breathing Air RCA	-	20	0	0	6	-	-	6	32	32	-	-	71	-	-	-	-	2,874	402	-
4b.1.2.49	KC - Fire Protection	-	378	-	-	-	-	-	57	435	-	-	435	-	-	-	-	-	-	8,376	-
4b.1.2.50	KC - Fire Protection RCA	-	403	7	17	369	-	-	159	954	954	-	-	4,411	-	-	-	-	179,151	7,064	-
4b.1.2.51	KC- Fire Protection Fuel Building	-	119	2	5	104	-	-	46	276	276	-	-	1,239	-	-	-	-	50,329	2,115	-
4b.1.2.52	KD - Domestic Water	-	176	-	-	-	-	-	26	203	-	-	203	-	-	-	-	-	-	3,837	-
4b.1.2.53	KD - Domestic Water RCA	-	26	0	1	21	-	-	10	58	58	-	-	247	-	-	-	-	10,039	459	-
4b.1.2.54	KE - Fuel Handling & Storage Rctor vssl	-	17	1	3	74	-	-	16	111	111	-	-	882	-	-	-	-	35,813	332	-
4b.1.2.55	KH - Service Gas (CO2 N2 H2 & O2)	-	56	-	-	-	-	-	8	64	-	-	64	-	-	-	-	-	-	1,226	-
4b.1.2.56	KH - Service Gas (CO2 N2 H2 & O2) RCA	-	254	4	9	204	-	-	96	566	566	-	-	2,433	-	-	-	-	98,813	4,481	-
4b.1.2.57	KJ - Standby Diesel Engine	-	327	-	-	-	-	-	49	376	-	-	376	-	-	-	-	-	-	6,749	-
4b.1.2.58	LA - Sanitary Drains	-	44	-	-	-	-	-	7	51	-	-	51	-	-	-	-	-	-	972	-
4b.1.2.59	LA - Sanitary Drains RCA	-	106	2	5	106	-	-	43	263	263	-	-	1,273	-	-	-	-	51,684	1,811	-
4b.1.2.60	LB - Roof Drains	-	59	-	-	-	-	-	9	68	-	-	68	-	-	-	-	-	-	1,276	-
4b.1.2.61	LB - Roof Drains RCA	-	144	3	8	179	-	-	64	398	398	-	-	2,139	-	-	-	-	86,858	2,694	-
4b.1.2.62	LD - Chemical & Detergent Waste	-	110	1	3	67	-	-	38	218	218	-	-	797	-	-	-	-	32,369	2,139	-
4b.1.2.63	LF - Floor & Equipment Drains	-	1,353	82	80	557	887	-	664	3,624	3,624	-	-	6,660	3,627	-	-	-	510,199	26,164	-
4b.1.2.64	RM - Process Sampling & Analysis	-	123	1	4	83	-	-	44	255	255	-	-	990	-	-	-	-	40,200	2,450	-
4b.1.2.65	SJ - Nuclear Sampling	-	71	1	3	57	-	-	27	158	158	-	-	677	-	-	-	-	27,501	1,430	-
4b.1.2.66	UB - Servces Stores Site Security Bldg	-	177	-	-	-	-	-	27	204	-	-	204	-	-	-	-	-	-	3,815	-
4b.1.2.67	Yard Non-System Specific	-	29	-	-	-	-	-	4	33	-	-	33	-	-	-	-	-	-	603	-
4b.1.2	Totals	-	15,449	411	630	10,529	2,520	-	5,761	35,300	30,173	-	5,127	125,856	10,326	-	-	-	5,792,086	304,013	-
4b.1.3	Scaffolding in support of decommissioning	-	2,196	41	10	171	40	-	590	3,049	3,049	-	-	1,849	163	-	-	-	94,006	50,451	-
Decontamination of Site Buildings																					
4b.1.4.1	Reactor	1,115	1,610	74	574	502	1,523	-	1,510	6,907	6,907	-	-	5,995	24,801	-	-	-	2,386,873	48,482	-
4b.1.4.2	Auxiliary	581	225	9	50	172	130	-	413	1,581	1,581	-	-	2,058	1,956	-	-	-	250,317	15,248	-
4b.1.4.3	Communication Corridor - Contaminated	13	3	0	1	1	3	-	8	30	30	-	-	17	42	-	-	-	4,296	306	-
4b.1.4.4	Fuel Building	693	723	8	21	226	54	-	579	2,305	2,305	-	-	2,705	584	-	-	-	158,264	27,455	-
4b.1.4.5	Hot Machine Shop	16	6	0	1	-	3	-	10	37	37	-	-	-	51	-	-	-	4,446	421	-
4b.1.4.6	RAM Storage Building	40	8	0	2	2	6	-	24	83	83	-	-	19	107	-	-	-	9,974	919	-
4b.1.4.7	Radioactive and Personnel Tunnel	5	6	0	1	-	2	-	4	18	18	-	-	-	29	-	-	-	2,532	195	-
4b.1.4.8	Radwaste	309	104	4	26	71	67	-	212	793	793	-	-	844	1,028	-	-	-	122,469	7,811	-
4b.1.4.9	Radwaste Drum Storage	35	10	0	3	6	7	-	23	84	84	-	-	66	115	-	-	-	12,565	850	-
4b.1.4.10	Reactor Head Assembly Building	31	-	-	-	-	-	-	16	47	47	-	-	-	-	-	-	-	-	614	-
4b.1.4.11	Steam Generator Replacement Bldgs	211	-	-	-	-	-	-	105	316	316	-	-	-	-	-	-	-	-	3,885	-
4b.1.4	Totals	3,049	2,696	96	679	979	1,795	-	2,905	12,199	12,199	-	-	11,704	28,713	-	-	-	2,951,736	106,187	-
4b.1	Subtotal Period 4b Activity Costs	3,802	20,422	841	1,426	11,679	6,064	-	10,127	54,362	49,235	-	5,127	139,409	46,190	-	-	-	9,299,752	462,575	-
Period 4b Additional Costs																					
4b.2.1	License Termination Survey Planning	-	-	-	-	-	-	1,495	448	1,943	1,943	-	-	-	-	-	-	-	-	-	12,480
4b.2.2	Remedial Action Surveys	-	-	-	-	-	-	2,381	714	3,095	3,095	-	-	-	-	-	-	-	-	48,748	-
4b.2.3	Sanitary Treatment Lagoon	-	6	93	92	-	280	-	95	567	567	-	-	-	4,608	-	-	-	392,140	423	-
4b.2.4	Cooling Tower Asbestos Panel Removal	-	4,893	-	122	-	-	490	826	6,330	-	-	6,330	-	-	-	-	-	-	71,419	-
4b.2.5	Operational Equipment	-	-	17	37	603	-	-	98	755	755	-	-	11,710	-	-	-	-	292,750	32	-
4b.2.6	Retired Reactor Closure Head	-	113	552	895	-	768	-	410	2,738	2,738	-	-	-	2,764	-	-	-	338,540	3,157	2,000
4b.2	Subtotal Period 4b Additional Costs	-	5,012	662	1,146	603	1,048	4,366	2,591	15,428	9,098	-	6,330	11,710	7,372	-	-	-	1,023,430	123,780	14,480
Period 4b Collateral Costs																					
4b.3.1	Process decommissioning water waste	13	-	21	55	-	95	-	40	224	224	-	-	-	214	-	-	-	12,825	42	-
4b.3.3	Small tool allowance	-	434	-	-	-	-	-	65	499	499	-	-	-	-	-	-	-	-	-	-
4b.3.4	Decommissioning Equipment Disposition	-	-	134	39	556	129	-	135	993	993	-	-	6,000	529	-	-	-	304,968	88	-
4b.3.5	On-site survey and release of 297.3 tons clean metallic waste	-	-	-	-	-	-	410	41	451	451	-	-	-	-	-	-	-	-	-	-
4b.3	Subtotal Period 4b Collateral Costs	13	434	155	93	556	224	410	281	2,167	2,167	-	-	6,000	743	-	-	-	317,793	130	-
Period 4b Period-Dependent Costs																					
4b.4.1	Decon supplies	1,247	-	-	-	-	-	-	312	1,559	1,559	-	-	-	-	-	-	-	-	-	-
4b.4.2	Insurance	-	-	-	-	-	-	2,161	216	2,377	2,377	-	-	-	-	-	-	-	-	-	-
4b.4.3	Property taxes	-	-	-	-	-	-	656	66	722	722	-	-	-	-	-	-	-	-	-	-
4b.4.4	Health physics supplies	-	3,829	-	-	-	-	-	957	4,786	4,786	-	-	-	-	-	-	-	-	-	-
4b.4.5	Heavy equipment rental	-	4,669	-	-	-	-	-	700	5,369	5,369	-	-	-	-	-	-	-	-	-	-
4b.4.6	Disposal of DAW generated	-	-	135	27	-	336	-	102	600	600	-	-	-	6,638	-	-	-	132,753	216	-
4b.4.7	Plant energy budget	-	-	-	-	-	-	2,949	442	3,392	3,392	-	-	-	-	-	-	-	-	-	-
4b.4.8	NRC Fees	-	-	-	-	-	-	1,416	142	1,557	1,557	-	-	-	-	-	-	-	-	-	-
4b.4.9	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	940	141	1,081	1,081	-	-	-	-	-	-	-	-	-	-

Table D
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
40-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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 Period-Dependent Costs (continued)																					
4b.4.10	Corporate Allocations	-	-	-	-	-	-	2,345	235	2,580	2,580	-	-	-	-	-	-	-	-	-	-
4b.4.11	Security Staff Cost	-	-	-	-	-	-	4,709	706	5,415	5,415	-	-	-	-	-	-	-	-	-	152,857
4b.4.12	DOC Staff Cost	-	-	-	-	-	-	31,447	4,717	36,164	36,164	-	-	-	-	-	-	-	-	-	327,726
4b.4.13	Utility Staff Cost	-	-	-	-	-	-	43,754	6,563	50,318	50,318	-	-	-	-	-	-	-	-	-	577,189
4b.4	Subtotal Period 4b Period-Dependent Costs	1,247	8,498	135	27	-	336	90,377	15,299	115,920	115,920	-	-	-	6,638	-	-	-	132,753	216	1,057,771
4b.0	TOTAL PERIOD 4b COST	5,062	34,366	1,793	2,692	12,839	7,672	95,153	28,297	187,876	176,419	-	11,457	157,119	60,942	-	-	-	10,773,730	586,701	1,072,251
PERIOD 4f - License Termination																					
Period 4f Direct Decommissioning Activities																					
4f.1.1	ORISE confirmatory survey	-	-	-	-	-	-	163	49	212	212	-	-	-	-	-	-	-	-	-	-
4f.1.2	Terminate license									a											
4f.1	Subtotal Period 4f Activity Costs	-	-	-	-	-	-	163	49	212	212	-	-	-	-	-	-	-	-	-	-
Period 4f Additional Costs																					
4f.2.1	License Termination Survey	-	-	-	-	-	-	8,248	2,474	10,723	10,723	-	-	-	-	-	-	-	-	153,878	6,240
4f.2	Subtotal Period 4f Additional Costs	-	-	-	-	-	-	8,248	2,474	10,723	10,723	-	-	-	-	-	-	-	-	153,878	6,240
Period 4f Collateral Costs																					
4f.3.1	DOC staff relocation expenses	-	-	-	-	-	-	1,080	162	1,242	1,242	-	-	-	-	-	-	-	-	-	-
4f.3	Subtotal Period 4f Collateral Costs	-	-	-	-	-	-	1,080	162	1,242	1,242	-	-	-	-	-	-	-	-	-	-
Period 4f Period-Dependent Costs																					
4f.4.2	Property taxes	-	-	-	-	-	-	212	21	233	233	-	-	-	-	-	-	-	-	-	-
4f.4.3	Health physics supplies	-	736	-	-	-	-	-	184	920	920	-	-	-	-	-	-	-	-	-	-
4f.4.4	Disposal of DAW generated	-	-	7	1	-	18	-	5	32	32	-	-	-	353	-	-	-	7,050	11	-
4f.4.5	Plant energy budget	-	-	-	-	-	-	254	38	292	292	-	-	-	-	-	-	-	-	-	-
4f.4.6	NRC Fees	-	-	-	-	-	-	457	46	503	503	-	-	-	-	-	-	-	-	-	-
4f.4.7	Corporate Allocations	-	-	-	-	-	-	756	76	832	832	-	-	-	-	-	-	-	-	-	-
4f.4.8	Security Staff Cost	-	-	-	-	-	-	727	109	836	836	-	-	-	-	-	-	-	-	-	18,926
4f.4.9	DOC Staff Cost	-	-	-	-	-	-	5,685	853	6,538	6,538	-	-	-	-	-	-	-	-	-	57,566
4f.4.10	Utility Staff Cost	-	-	-	-	-	-	6,427	964	7,391	7,391	-	-	-	-	-	-	-	-	-	74,914
4f.4	Subtotal Period 4f Period-Dependent Costs	-	736	7	1	-	18	14,518	2,296	17,576	17,576	-	-	-	353	-	-	-	7,050	11	151,406
4f.0	TOTAL PERIOD 4f COST	-	736	7	1	-	18	24,009	4,981	29,752	29,752	-	-	-	353	-	-	-	7,050	153,889	157,646
PERIOD 4 TOTALS		5,470	68,664	19,772	10,655	24,758	53,034	176,634	75,537	434,523	419,040	-	15,483	313,266	137,730	501	406	2,217	24,009,090	1,117,634	1,885,771
PERIOD 5b - Site Restoration																					
Period 5b Direct Decommissioning Activities																					
Demolition of Remaining Site Buildings																					
5b.1.1.1	Reactor	-	5,191	-	-	-	-	-	779	5,969	-	-	5,969	-	-	-	-	-	-	59,292	-
5b.1.1.2	Auxiliary	-	4,194	-	-	-	-	-	629	4,823	-	-	4,823	-	-	-	-	-	-	49,968	-
5b.1.1.3	Auxiliary Boiler	-	39	-	-	-	-	-	6	45	-	-	45	-	-	-	-	-	-	619	-
5b.1.1.4	Barge Facility	-	1,595	-	-	-	-	-	239	1,834	-	-	1,834	-	-	-	-	-	-	18,771	-
5b.1.1.5	Circulating & Service Water Pumphouse	-	328	-	-	-	-	-	49	377	-	-	377	-	-	-	-	-	-	4,345	-
5b.1.1.6	Communication Corridor - Clean	-	1,346	-	-	-	-	-	202	1,548	-	-	1,548	-	-	-	-	-	-	17,215	-
5b.1.1.7	Communication Corridor - Contaminated	-	60	-	-	-	-	-	9	69	-	-	69	-	-	-	-	-	-	674	-
5b.1.1.8	Cooling Tower Concrete	-	918	-	-	-	-	-	138	1,056	-	-	1,056	-	-	-	-	-	-	13,472	-
5b.1.1.9	Diesel Generator	-	499	-	-	-	-	-	75	574	-	-	574	-	-	-	-	-	-	5,492	-
5b.1.1.10	Essential Service Water Pumphouse	-	306	-	-	-	-	-	46	352	-	-	352	-	-	-	-	-	-	3,938	-
5b.1.1.11	Fire Water Pumphouse	-	29	-	-	-	-	-	4	33	-	-	33	-	-	-	-	-	-	382	-
5b.1.1.12	Flex Building Storage	-	557	-	-	-	-	-	84	641	-	-	641	-	-	-	-	-	-	7,590	-
5b.1.1.13	Fuel Building	-	2,092	-	-	-	-	-	314	2,405	-	-	2,405	-	-	-	-	-	-	22,580	-
5b.1.1.14	Hot Machine Shop	-	25	-	-	-	-	-	4	29	-	-	29	-	-	-	-	-	-	417	-
5b.1.1.15	Intake	-	382	-	-	-	-	-	57	440	-	-	440	-	-	-	-	-	-	4,224	-
5b.1.1.16	Misc. Structures	-	2,487	-	-	-	-	-	373	2,861	-	-	2,861	-	-	-	-	-	-	27,921	-
5b.1.1.17	Miscellaneous Site Foundations	-	382	-	-	-	-	-	57	439	-	-	439	-	-	-	-	-	-	5,483	-
5b.1.1.18	Outage Maintenance	-	192	-	-	-	-	-	29	220	-	-	220	-	-	-	-	-	-	3,190	-
5b.1.1.19	RAM Storage Building	-	69	-	-	-	-	-	10	79	-	-	79	-	-	-	-	-	-	1,081	-
5b.1.1.20	Radioactive and Personnel Tunnel	-	29	-	-	-	-	-	4	34	-	-	34	-	-	-	-	-	-	386	-
5b.1.1.21	Radwaste	-	1,872	-	-	-	-	-	281	2,153	-	-	2,153	-	-	-	-	-	-	21,798	-
5b.1.1.22	Radwaste Drum Storage	-	279	-	-	-	-	-	42	321	-	-	321	-	-	-	-	-	-	3,840	-
5b.1.1.23	Reactor Head Assembly Building	-	81	-	-	-	-	-	12	94	-	-	94	-	-	-	-	-	-	1,357	-
5b.1.1.24	Security Additions	-	2,257	-	-	-	-	-	339	2,595	-	-	2,595	-	-	-	-	-	-	20,977	-

Table D
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
40-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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.1.1.25	Service	-	527	-	-	-	-	-	79	606	-	-	606	-	-	-	-	-	-	6,045	-
5b.1.1.26	Sludge Pump Station & Lagoon	-	26	-	-	-	-	-	4	30	-	-	30	-	-	-	-	-	-	313	-
5b.1.1.27	Steam Generator Replacement Bldgs	-	1,231	-	-	-	-	-	185	1,415	-	-	1,415	-	-	-	-	-	-	15,693	-
5b.1.1.28	Turbine Building	-	3,580	-	-	-	-	-	537	4,117	-	-	4,117	-	-	-	-	-	-	55,694	-
5b.1.1.29	Turbine Pedestal	-	1,092	-	-	-	-	-	164	1,256	-	-	1,256	-	-	-	-	-	-	10,928	-
5b.1.1.30	U.H.S. Cooling Tower	-	662	-	-	-	-	-	99	761	-	-	761	-	-	-	-	-	-	6,681	-
5b.1.1.31	Water Treatment Plant	-	1	-	-	-	-	-	0	1	-	-	1	-	-	-	-	-	-	9	-
5b.1.1	Totals	-	32,329	-	-	-	-	-	4,849	37,178	-	-	37,178	-	-	-	-	-	-	390,372	-
Site Closeout Activities																					
5b.1.2	BackFill Site	-	8,631	-	-	-	-	-	1,295	9,926	-	-	9,926	-	-	-	-	-	-	15,861	-
5b.1.3	Grade & landscape site	-	132	-	-	-	-	-	20	152	-	-	152	-	-	-	-	-	-	592	-
5b.1.4	Final report to NRC	-	-	-	-	-	-	197	30	226	226	-	-	-	-	-	-	-	-	-	1,560
5b.1	Subtotal Period 5b Activity Costs	-	41,092	-	-	-	-	197	6,193	47,482	226	-	47,256	-	-	-	-	-	-	406,825	1,560
Period 5b Additional Costs																					
5b.2.1	Concrete Crushing	-	1,194	-	-	-	-	9	180	1,384	-	-	1,384	-	-	-	-	-	-	5,976	-
5b.2.2	Mine Area Backfill	-	4,988	-	-	-	-	-	748	5,736	-	-	5,736	-	-	-	-	-	-	15,960	-
5b.2.3	Cooling Tower Discharge & Intake Pipe Flow Fill	-	3,778	-	-	-	-	-	567	4,345	-	-	4,345	-	-	-	-	-	-	9,588	-
5b.2.4	Cooling Tower Demolition	-	4,272	-	-	-	-	-	641	4,913	-	-	4,913	-	-	-	-	-	-	21,619	-
5b.2.5	Excavation of Underground Services	-	1,668	-	-	-	-	761	364	2,793	-	-	2,793	-	-	-	-	-	-	14,164	-
5b.2.6	Construction Debris	-	-	-	-	-	-	2,480	372	2,852	-	-	2,852	-	-	-	-	-	-	-	-
5b.2	Subtotal Period 5b Additional Costs	-	15,901	-	-	-	-	3,250	2,873	22,023	-	-	22,023	-	-	-	-	-	-	67,307	-
Period 5b Collateral Costs																					
5b.3.1	Small tool allowance	-	402	-	-	-	-	-	60	462	-	-	462	-	-	-	-	-	-	-	-
5b.3.2	Corporate Allocations	-	-	-	-	-	-	1,504	150	1,655	-	-	1,655	-	-	-	-	-	-	-	-
5b.3	Subtotal Period 5b Collateral Costs	-	402	-	-	-	-	1,504	211	2,117	-	-	2,117	-	-	-	-	-	-	-	-
Period 5b Period-Dependent Costs																					
5b.4.2	Property taxes	-	-	-	-	-	-	421	42	463	-	-	463	-	-	-	-	-	-	-	-
5b.4.3	Heavy equipment rental	-	4,254	-	-	-	-	-	638	4,892	-	-	4,892	-	-	-	-	-	-	-	-
5b.4.4	Plant energy budget	-	-	-	-	-	-	252	38	290	-	-	290	-	-	-	-	-	-	-	-
5b.4.5	Security Staff Cost	-	-	-	-	-	-	1,446	217	1,663	-	-	1,663	-	-	-	-	-	-	-	37,646
5b.4.6	DOC Staff Cost	-	-	-	-	-	-	11,002	1,650	12,652	-	-	12,652	-	-	-	-	-	-	-	106,663
5b.4.7	Utility Staff Cost	-	-	-	-	-	-	5,200	780	5,980	-	-	5,980	-	-	-	-	-	-	-	61,174
5b.4	Subtotal Period 5b Period-Dependent Costs	-	4,254	-	-	-	-	18,321	3,365	25,940	-	-	25,940	-	-	-	-	-	-	-	205,483
5b.0	TOTAL PERIOD 5b COST	-	61,649	-	-	-	-	23,272	12,642	97,563	226	-	97,336	-	-	-	-	-	-	474,132	207,043
PERIOD 5 TOTALS		-	61,649	-	-	-	-	23,272	12,642	97,563	226	-	97,336	-	-	-	-	-	-	474,132	207,043
TOTAL COST TO DECOMMISSION		**11,857**	**140,534**	**20,164**	**11,270**	**24,758**	**54,456**	**668,212**	**160,502**	**1,091,753**	**887,947**	**89,388**	**114,417**	**313,266**	**148,204**	**501**	**406**	**2,217**	**24,309,290**	**1,689,226**	**7,484,788**

TOTAL COST TO DECOMMISSION WITH 17.24% CONTINGENCY:	**$1,091,753**	**thousands of 2014 dollars**
TOTAL NRC LICENSE TERMINATION COST IS 81.33% OR:	**$887,947**	**thousands of 2014 dollars**
SPENT FUEL MANAGEMENT COST IS 8.19% OR:	**$89,388**	**thousands of 2014 dollars**
NON-NUCLEAR DEMOLITION COST IS 10.48% OR:	**$114,417**	**thousands of 2014 dollars**
TOTAL PRIMARY SITE RADWASTE VOLUME BURIED:	**149,111**	**cubic feet**
TOTAL GREATER THAN CLASS C RADWASTE VOLUME GENERATED:	**2,217**	**cubic feet**
TOTAL SCRAP METAL REMOVED:	**70,654**	**tons**
TOTAL CRAFT LABOR REQUIREMENTS:	**1,689,226**	**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 ALTERNATIVE DECOMMISSIONING COST ESTIMATE
40-YEAR OPERATING LIFE with
DIRECT DISPOSAL OF LOW-LEVEL RADIOACTIVE WASTE

Table E
Callaway Energy Center
DECON Alternative Decommissioning Cost Estimate
40-Year Operating Life with Direct Disposal of Low-Level Radioactive Waste
(thousands of 2014 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	-	-	-	-	-	-	164	25	189	189	-	-	-	-	-	-	-	-	-	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	-	-	-	-	-	-	252	38	290	290	-	-	-	-	-	-	-	-	-	2,000
1a.1.7	Review plant dwgs & specs.	-	-	-	-	-	-	580	87	667	667	-	-	-	-	-	-	-	-	-	4,600
1a.1.8	Perform detailed rad survey									a											
1a.1.9	Estimate by-product inventory	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1a.1.10	End product description	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1a.1.11	Detailed by-product inventory	-	-	-	-	-	-	164	25	189	189	-	-	-	-	-	-	-	-	-	1,300
1a.1.12	Define major work sequence	-	-	-	-	-	-	946	142	1,088	1,088	-	-	-	-	-	-	-	-	-	7,500
1a.1.13	Perform SER and EA	-	-	-	-	-	-	391	59	450	450	-	-	-	-	-	-	-	-	-	3,100
1a.1.14	Perform Site-Specific Cost Study	-	-	-	-	-	-	630	95	725	725	-	-	-	-	-	-	-	-	-	5,000
1a.1.15	Prepare/submit License Termination Plan	-	-	-	-	-	-	516	77	594	594	-	-	-	-	-	-	-	-	-	4,096
1a.1.16	Receive NRC approval of termination plan									a											
Activity Specifications																					
1a.1.17.1	Plant & temporary facilities	-	-	-	-	-	-	620	93	713	642	-	71	-	-	-	-	-	-	-	4,920
1a.1.17.2	Plant systems	-	-	-	-	-	-	525	79	604	544	-	60	-	-	-	-	-	-	-	4,167
1a.1.17.3	NSSS Decontamination Flush	-	-	-	-	-	-	63	9	73	73	-	-	-	-	-	-	-	-	-	500
1a.1.17.4	Reactor internals	-	-	-	-	-	-	895	134	1,030	1,030	-	-	-	-	-	-	-	-	-	7,100
1a.1.17.5	Reactor vessel	-	-	-	-	-	-	820	123	943	943	-	-	-	-	-	-	-	-	-	6,500
1a.1.17.6	Biological shield	-	-	-	-	-	-	63	9	73	73	-	-	-	-	-	-	-	-	-	500
1a.1.17.7	Steam generators	-	-	-	-	-	-	393	59	452	452	-	-	-	-	-	-	-	-	-	3,120
1a.1.17.8	Reinforced concrete	-	-	-	-	-	-	202	30	232	116	-	116	-	-	-	-	-	-	-	1,600
1a.1.17.9	Main Turbine	-	-	-	-	-	-	50	8	58	-	-	58	-	-	-	-	-	-	-	400
1a.1.17.10	Main Condensers	-	-	-	-	-	-	50	8	58	-	-	58	-	-	-	-	-	-	-	400
1a.1.17.11	Plant structures & buildings	-	-	-	-	-	-	393	59	452	226	-	226	-	-	-	-	-	-	-	3,120
1a.1.17.12	Waste management	-	-	-	-	-	-	580	87	667	667	-	-	-	-	-	-	-	-	-	4,600
1a.1.17.13	Facility & site closeout	-	-	-	-	-	-	113	17	131	65	-	65	-	-	-	-	-	-	-	900
1a.1.17	Total	-	-	-	-	-	-	4,770	715	5,485	4,830	-	655	-	-	-	-	-	-	-	37,827
Planning & Site Preparations																					
1a.1.18	Prepare dismantling sequence	-	-	-	-	-	-	303	45	348	348	-	-	-	-	-	-	-	-	-	2,400
1a.1.19	Plant prep. & temp. svces	-	-	-	-	-	-	3,000	450	3,450	3,450	-	-	-	-	-	-	-	-	-	-
1a.1.20	Design water clean-up system	-	-	-	-	-	-	177	26	203	203	-	-	-	-	-	-	-	-	-	1,400
1a.1.21	Rigging/Cont. Cntrl Envlps/tooling/etc.	-	-	-	-	-	-	2,300	345	2,645	2,645	-	-	-	-	-	-	-	-	-	-
1a.1.22	Procure casks/liners & containers	-	-	-	-	-	-	155	23	178	178	-	-	-	-	-	-	-	-	-	1,230
1a.1	Subtotal Period 1a Activity Costs	-	-	-	-	-	-	14,599	2,190	16,789	16,134	-	655	-	-	-	-	-	-	-	73,753
Period 1a Collateral Costs																					
1a.3.1	Spent Fuel Transfer	-	-	-	-	-	-	2,880	432	3,312	-	3,312	-	-	-	-	-	-	-	-	-
1a.3	Subtotal Period 1a Collateral Costs	-	-	-	-	-	-	2,880	432	3,312	-	3,312	-	-	-	-	-	-	-	-	-
Period 1a Period-Dependent Costs																					
1a.4.1	Insurance	-	-	-	-	-	-	1,902	190	2,092	2,092	-	-	-	-	-	-	-	-	-	-
1a.4.2	Property taxes	-	-	-	-	-	-	280	28	308	308	-	-	-	-	-	-	-	-	-	-
1a.4.3	Health physics supplies	-	497	-	-	-	-	-	124	621	621	-	-	-	-	-	-	-	-	-	-
1a.4.4	Heavy equipment rental	-	523	-	-	-	-	-	78	602	602	-	-	-	-	-	-	-	-	-	-
1a.4.5	Disposal of DAW generated	-	-	12	3	-	31	-	9	55	55	-	-	-	610	-	-	-	12,190	20	-
1a.4.6	Plant energy budget	-	-	-	-	-	-	1,677	252	1,928	1,928	-	-	-	-	-	-	-	-	-	-
1a.4.7	NRC Fees	-	-	-	-	-	-	1,181	118	1,299	1,299	-	-	-	-	-	-	-	-	-	-
1a.4.8	Emergency Planning Fees	-	-	-	-	-	-	1,490	149	1,638	-	1,638	-	-	-	-	-	-	-	-	-
1a.4.9	INPO Fees	-	-	-	-	-	-	336	50	386	386	-	-	-	-	-	-	-	-	-	-
1a.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	791	119	910	-	910	-	-	-	-	-	-	-	-	-
1a.4.11	ISFSI Operating Costs	-	-	-	-	-	-	95	14	110	-	110	-	-	-	-	-	-	-	-	-
1a.4.12	Corporate Allocations	-	-	-	-	-	-	1,000	100	1,100	1,100	-	-	-	-	-	-	-	-	-	-
1a.4.13	Security Staff Cost	-	-	-	-	-	-	11,224	1,684	12,908	12,908	-	-	-	-	-	-	-	-	-	275,314
1a.4.14	Utility Staff Cost	-	-	-	-	-	-	31,458	4,719	36,177	36,177	-	-	-	-	-	-	-	-	-	423,400
1a.4	Subtotal Period 1a Period-Dependent Costs	-	1,020	12	3	-	31	51,433	7,634	60,133	57,475	2,658	-	-	610	-	-	-	12,190	20	698,714
1a.0	TOTAL PERIOD 1a COST	-	1,020	12	3	-	31	68,913	10,256	80,235	73,610	5,970	655	-	610	-	-	-	12,190	20	772,467

Table E
Callaway Energy Center
DECON Alternative Decommissioning Cost Estimate
40-Year Operating Life with Direct Disposal of Low-Level Radioactive Waste
(thousands of 2014 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	-	-	-	-	-	-	597	90	686	618	-	69	-	-	-	-	-	-	-	4,733
1b.1.1.2	NSSS Decontamination Flush	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.3	Reactor internals	-	-	-	-	-	-	315	47	363	363	-	-	-	-	-	-	-	-	-	2,500
1b.1.1.4	Remaining buildings	-	-	-	-	-	-	170	26	196	49	-	147	-	-	-	-	-	-	-	1,350
1b.1.1.5	CRD cooling assembly	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.6	CRD housings & ICI tubes	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.7	Incore instrumentation	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.8	Reactor vessel	-	-	-	-	-	-	458	69	526	526	-	-	-	-	-	-	-	-	-	3,630
1b.1.1.9	Facility closeout	-	-	-	-	-	-	151	23	174	87	-	87	-	-	-	-	-	-	-	1,200
1b.1.1.10	Missile shields	-	-	-	-	-	-	57	9	65	65	-	-	-	-	-	-	-	-	-	450
1b.1.1.11	Biological shield	-	-	-	-	-	-	151	23	174	174	-	-	-	-	-	-	-	-	-	1,200
1b.1.1.12	Steam generators	-	-	-	-	-	-	580	87	667	667	-	-	-	-	-	-	-	-	-	4,600
1b.1.1.13	Reinforced concrete	-	-	-	-	-	-	126	19	145	73	-	73	-	-	-	-	-	-	-	1,000
1b.1.1.14	Main Turbine	-	-	-	-	-	-	197	30	226	-	-	226	-	-	-	-	-	-	-	1,560
1b.1.1.15	Main Condensers	-	-	-	-	-	-	197	30	226	-	-	226	-	-	-	-	-	-	-	1,560
1b.1.1.16	Auxiliary building	-	-	-	-	-	-	344	52	396	356	-	40	-	-	-	-	-	-	-	2,730
1b.1.1.17	Reactor building	-	-	-	-	-	-	344	52	396	356	-	40	-	-	-	-	-	-	-	2,730
1b.1.1	Total	-	-	-	-	-	-	4,192	629	4,820	3,914	-	907	-	-	-	-	-	-	-	33,243
1b.1.2	Decon primary loop	648	-	-	-	-	-	-	324	971	971	-	-	-	-	-	-	-	-	1,067	-
1b.1	Subtotal Period 1b Activity Costs	648	-	-	-	-	-	4,192	953	5,792	4,885	-	907	-	-	-	-	-	-	1,067	33,243
Period 1b Additional Costs																					
1b.2.1	Spent fuel pool isolation	-	-	-	-	-	-	10,813	1,622	12,434	12,434	-	-	-	-	-	-	-	-	-	-
1b.2.2	Site Characterization	-	-	-	-	-	-	2,824	847	3,671	3,671	-	-	-	-	-	-	-	-	19,100	7,852
1b.2	Subtotal Period 1b Additional Costs	-	-	-	-	-	-	13,636	2,469	16,105	16,105	-	-	-	-	-	-	-	-	19,100	7,852
Period 1b Collateral Costs																					
1b.3.1	Decon equipment	893	-	-	-	-	-	-	134	1,026	1,026	-	-	-	-	-	-	-	-	-	-
1b.3.2	DOC staff relocation expenses	-	-	-	-	-	-	1,080	162	1,242	1,242	-	-	-	-	-	-	-	-	-	-
1b.3.3	Process decommissioning water waste	45	-	28	73	-	126	-	68	339	339	-	-	-	283	-	-	-	16,989	55	-
1b.3.4	Process decommissioning chemical flush waste	2	-	75	280	-	3,753	-	989	5,098	5,098	-	-	-	-	788	-	-	83,917	147	-
1b.3.5	Small tool allowance	-	2	-	-	-	-	-	0	2	2	-	-	-	-	-	-	-	-	-	-
1b.3.6	Pipe cutting equipment	-	1,100	-	-	-	-	-	165	1,265	1,265	-	-	-	-	-	-	-	-	-	-
1b.3.7	Decon rig	1,500	-	-	-	-	-	-	225	1,725	1,725	-	-	-	-	-	-	-	-	-	-
1b.3.8	Spent Fuel Transfer	-	-	-	-	-	-	1,440	216	1,656	-	1,656	-	-	-	-	-	-	-	-	-
1b.3	Subtotal Period 1b Collateral Costs	2,439	1,102	103	352	-	3,878	2,520	1,958	12,353	10,697	1,656	-	-	283	788	-	-	100,906	203	-
Period 1b Period-Dependent Costs																					
1b.4.1	Decon supplies	27	-	-	-	-	-	-	7	34	34	-	-	-	-	-	-	-	-	-	-
1b.4.2	Insurance	-	-	-	-	-	-	959	96	1,055	1,055	-	-	-	-	-	-	-	-	-	-
1b.4.3	Property taxes	-	-	-	-	-	-	141	14	155	155	-	-	-	-	-	-	-	-	-	-
1b.4.4	Health physics supplies	-	281	-	-	-	-	-	70	351	351	-	-	-	-	-	-	-	-	-	-
1b.4.5	Heavy equipment rental	-	264	-	-	-	-	-	40	303	303	-	-	-	-	-	-	-	-	-	-
1b.4.6	Disposal of DAW generated	-	-	7	1	-	18	-	6	33	33	-	-	-	360	-	-	-	7,197	12	-
1b.4.7	Plant energy budget	-	-	-	-	-	-	1,691	254	1,944	1,944	-	-	-	-	-	-	-	-	-	-
1b.4.8	NRC Fees	-	-	-	-	-	-	348	35	383	383	-	-	-	-	-	-	-	-	-	-
1b.4.9	Emergency Planning Fees	-	-	-	-	-	-	751	75	826	-	826	-	-	-	-	-	-	-	-	-
1b.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	399	60	459	-	459	-	-	-	-	-	-	-	-	-
1b.4.11	ISFSI Operating Costs	-	-	-	-	-	-	48	7	55	-	55	-	-	-	-	-	-	-	-	-
1b.4.12	Corporate Allocations	-	-	-	-	-	-	504	50	555	555	-	-	-	-	-	-	-	-	-	-
1b.4.13	Security Staff Cost	-	-	-	-	-	-	5,141	771	5,913	5,913	-	-	-	-	-	-	-	-	-	124,910
1b.4.14	DOC Staff Cost	-	-	-	-	-	-	6,322	948	7,271	7,271	-	-	-	-	-	-	-	-	-	64,137
1b.4.15	Utility Staff Cost	-	-	-	-	-	-	15,943	2,392	18,335	18,335	-	-	-	-	-	-	-	-	-	214,491
1b.4	Subtotal Period 1b Period-Dependent Costs	27	545	7	1	-	18	32,248	4,824	37,671	36,331	1,340	-	-	360	-	-	-	7,197	12	403,538
1b.0	TOTAL PERIOD 1b COST	3,114	1,647	111	354	-	3,897	52,595	10,204	71,921	68,019	2,996	907	-	643	788	-	-	108,103	20,381	444,633
PERIOD 1 TOTALS		3,114	2,666	123	356	-	3,928	121,508	20,460	152,156	141,628	8,966	1,562	-	1,253	788	-	-	120,293	20,401	1,217,100

Table E
Callaway Energy Center
DECON Alternative Decommissioning Cost Estimate
40-Year Operating Life with Direct Disposal of Low-Level Radioactive Waste
(thousands of 2014 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	174	186	24	32	-	519	-	270	1,205	1,205	-	-	-	1,227	-	-	-	140,300	6,838	-
2a.1.1.2	Pressurizer Relief Tank	29	25	7	9	-	135	-	57	262	262	-	-	-	328	-	-	-	36,395	1,068	-
2a.1.1.3	Reactor Coolant Pumps & Motors	89	93	134	220	-	1,031	-	372	1,938	1,938	-	-	-	3,386	-	-	-	816,140	4,188	100
2a.1.1.4	Pressurizer	47	55	621	168	-	1,138	-	409	2,437	2,437	-	-	-	3,739	-	-	-	293,734	2,534	1,875
2a.1.1.5	Steam Generators	369	5,359	3,228	2,933	-	11,253	-	5,101	28,243	28,243	-	-	-	63,478	-	-	-	3,570,150	23,233	3,500
2a.1.1.6	Retired Steam Generator Units	-	-	2,358	2,882	-	11,116	-	3,447	19,803	19,803	-	-	-	62,808	-	-	-	3,349,305	10,800	2,250
2a.1.1.7	CRDMs/ICIs/Service Structure Removal	148	83	226	55	-	318	-	205	1,035	1,035	-	-	-	3,881	-	-	-	86,025	4,285	-
2a.1.1.8	Reactor Vessel Internals	132	3,560	10,594	1,506	-	18,554	330	15,088	49,763	49,763	-	-	-	1,878	963	393	-	329,968	31,550	1,394
2a.1.1.9	Vessel & Internals GTCC Disposal	-	-	-	-	-	10,749	-	1,612	12,361	12,361	-	-	-	-	-	-	2,217	433,180	-	-
2a.1.1.10	Reactor Vessel	110	6,391	2,412	1,120	-	3,107	330	7,334	20,803	20,803	-	-	-	9,391	-	-	-	961,214	31,550	1,394
2a.1.1	Totals	1,098	15,753	19,603	8,923	-	57,920	660	33,894	137,852	137,852	-	-	-	150,116	963	393	2,217	10,016,410	116,046	10,513
Removal of Major Equipment																					
2a.1.2	Main Turbine/Generator	-	496	2,841	460	-	12,168	-	3,519	19,483	19,483	-	-	-	54,809	-	-	-	3,622,746	9,888	-
2a.1.3	Main Condensers	-	1,383	1,438	980	-	15,731	-	4,570	24,102	24,102	-	-	-	64,324	-	-	-	4,251,703	27,762	-
Cascading Costs from Clean Building Demolition																					
2a.1.4.1	Reactor	-	915	-	-	-	-	-	137	1,052	1,052	-	-	-	-	-	-	-	-	10,442	-
2a.1.4.2	Auxiliary	-	466	-	-	-	-	-	70	536	536	-	-	-	-	-	-	-	-	5,551	-
2a.1.4.3	Hot Machine Shop	-	1	-	-	-	-	-	0	1	1	-	-	-	-	-	-	-	-	16	-
2a.1.4.4	Radwaste	-	97	-	-	-	-	-	15	111	111	-	-	-	-	-	-	-	-	1,108	-
2a.1.4.5	Fuel Building	-	227	-	-	-	-	-	34	261	261	-	-	-	-	-	-	-	-	2,395	-
2a.1.4	Totals	-	1,705	-	-	-	-	-	256	1,961	1,961	-	-	-	-	-	-	-	-	19,512	-
Disposal of Plant Systems																					
2a.1.5.1	100 Aux.Bldg Non-System Specific RCA	-	688	108	83	-	1,336	-	529	2,745	2,745	-	-	-	5,463	-	-	-	361,115	13,677	-
2a.1.5.2	100 Auxiliary Bldg Non-System Specific	-	113	12	9	-	152	-	69	355	355	-	-	-	621	-	-	-	41,078	2,291	-
2a.1.5.3	AB - Main Steam	-	267	-	-	-	-	-	40	308	-	-	308	-	-	-	-	-	-	5,833	-
2a.1.5.4	AB - Main Steam RCA	-	78	33	24	-	379	-	121	634	634	-	-	-	1,547	-	-	-	102,339	1,580	-
2a.1.5.5	AC - Main Turbine	-	263	-	-	-	-	-	39	302	-	-	302	-	-	-	-	-	-	5,641	-
2a.1.5.6	AD - Condensate	-	290	-	-	-	-	-	43	333	-	-	333	-	-	-	-	-	-	6,144	-
2a.1.5.7	AE - Feedwater	-	200	-	-	-	-	-	30	229	-	-	229	-	-	-	-	-	-	4,271	-
2a.1.5.8	AF - Feedwater Heater Extraction	-	247	-	-	-	-	-	37	285	-	-	285	-	-	-	-	-	-	5,352	-
2a.1.5.9	AK - Condensate Demineralizer	-	91	-	-	-	-	-	14	105	-	-	105	-	-	-	-	-	-	1,944	-
2a.1.5.10	AL - Auxiliary Feedwater	-	40	-	-	-	-	-	6	46	-	-	46	-	-	-	-	-	-	852	-
2a.1.5.11	AQ - Condensate & Feedwater Chem Addtn	-	22	-	-	-	-	-	3	26	-	-	26	-	-	-	-	-	-	468	-
2a.1.5.12	BM - Steam Generator Blowdown	-	119	18	12	-	200	-	84	434	434	-	-	-	832	-	-	-	54,081	2,415	-
2a.1.5.13	BM - Steam Generator Blowdown - RCA	-	372	71	45	-	726	-	288	1,502	1,502	-	-	-	2,963	-	-	-	196,194	7,221	-
2a.1.5.14	BN - Borated Refueling Water Storage	-	343	90	66	-	1,067	-	371	1,937	1,937	-	-	-	4,482	-	-	-	288,402	7,044	-
2a.1.5.15	CA - Steam Seal	-	21	-	-	-	-	-	3	24	-	-	24	-	-	-	-	-	-	455	-
2a.1.5.16	CB - Main Turbine Lube Oil	-	59	-	-	-	-	-	9	68	-	-	68	-	-	-	-	-	-	1,207	-
2a.1.5.17	CC - Generator Hydrogen Seal & CO2	-	10	-	-	-	-	-	1	11	-	-	11	-	-	-	-	-	-	198	-
2a.1.5.18	CD - Generator Seal Oil	-	14	-	-	-	-	-	2	16	-	-	16	-	-	-	-	-	-	287	-
2a.1.5.19	CE - Stator Cooling Water	-	12	-	-	-	-	-	2	13	-	-	13	-	-	-	-	-	-	241	-
2a.1.5.20	CF - Lube Oil Storage Xfer & Prfication	-	39	-	-	-	-	-	6	44	-	-	44	-	-	-	-	-	-	812	-
2a.1.5.21	CG - Condenser Air Removal	-	31	-	-	-	-	-	5	36	-	-	36	-	-	-	-	-	-	657	-
2a.1.5.22	CH - Main Turbine Control Oil	-	60	-	-	-	-	-	9	69	-	-	69	-	-	-	-	-	-	1,219	-
2a.1.5.23	DA - Circulating Water	-	345	-	-	-	-	-	52	397	-	-	397	-	-	-	-	-	-	7,502	-
2a.1.5.24	DB - Cooling Tower Makeup & Blowdown	-	58	-	-	-	-	-	9	67	-	-	67	-	-	-	-	-	-	1,260	-
2a.1.5.25	DD - Cooling Water Chemical Control Sys	-	51	-	-	-	-	-	8	59	-	-	59	-	-	-	-	-	-	1,084	-
2a.1.5.26	DD - Cooling Wtr Chem Control RCA	-	274	65	39	-	630	-	238	1,246	1,246	-	-	-	2,569	-	-	-	170,188	5,095	-
2a.1.5.27	EJ - Residual Heat Removal	-	397	92	67	-	1,072	-	386	2,014	2,014	-	-	-	4,385	-	-	-	289,618	8,105	-
2a.1.5.28	EM - High Pressure Coolant Injection	-	335	39	24	-	391	-	189	979	979	-	-	-	1,599	-	-	-	105,795	6,672	-
2a.1.5.29	EN - Containment Spray	-	218	51	33	-	532	-	198	1,031	1,031	-	-	-	2,179	-	-	-	143,862	4,242	-
2a.1.5.30	EP - Accumulator Safety Injection	-	176	33	21	-	345	-	137	711	711	-	-	-	1,433	-	-	-	93,158	3,516	-
2a.1.5.31	FA - Auxiliary Steam Generator	-	24	-	-	-	-	-	4	27	-	-	27	-	-	-	-	-	-	521	-
2a.1.5.32	FB - Auxiliary Steam	-	98	-	-	-	-	-	15	112	-	-	112	-	-	-	-	-	-	2,106	-
2a.1.5.33	FB - Auxiliary Steam RCA	-	83	15	9	-	144	-	60	310	310	-	-	-	589	-	-	-	39,026	1,569	-
2a.1.5.34	FC - Auxiliary Turbines	-	63	-	-	-	-	-	9	72	-	-	72	-	-	-	-	-	-	1,320	-
2a.1.5.35	FE - Auxiliary Steam Chemical Addition	-	5	-	-	-	-	-	1	6	-	-	6	-	-	-	-	-	-	105	-
2a.1.5.36	GE - Turbine Building HVAC	-	175	-	-	-	-	-	26	201	-	-	201	-	-	-	-	-	-	3,957	-
2a.1.5.37	GS - Containment Hydrogen Control	-	77	13	9	-	141	-	57	297	297	-	-	-	577	-	-	-	38,159	1,574	-
2a.1.5.38	HE - Boron Recycle	383	508	72	49	-	786	-	529	2,327	2,327	-	-	-	3,280	-	-	-	212,463	16,718	-

Table E
Callaway Energy Center
DECON Alternative Decommissioning Cost Estimate
40-Year Operating Life with Direct Disposal of Low-Level Radioactive Waste
(thousands of 2014 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.1.5.39	HF - Secondary Liquid Waste	701	998	165	114	-	1,833	-	1,092	4,902	4,902	-	-	-	7,644	-	-	-	495,358	32,027	-
2a.1.5.40	JA - Auxiliary Oil & Transfer	-	32	-	-	-	-	-	5	36	-	-	36	-	-	-	-	-	-	690	-
2a.1.5.41	KS - Bulk Chemical Storage	-	91	93	70	-	1,127	-	324	1,705	1,705	-	-	-	4,620	-	-	-	304,465	2,002	-
2a.1.5.42	LE - Oily Waste	-	179	-	-	-	-	-	27	206	-	-	206	-	-	-	-	-	-	3,865	-
2a.1.5.43	LE - Oily Waste RCA	-	237	36	25	-	397	-	166	862	862	-	-	-	1,623	-	-	-	107,381	4,372	-
2a.1.5.44	Turbine Bldg Non-System Specific	-	742	-	-	-	-	-	111	853	-	-	853	-	-	-	-	-	-	15,405	-
2a.1.5	Totals	1,084	8,543	1,004	702	-	11,258	-	5,354	27,943	23,992	-	3,951	-	46,409	-	-	-	3,042,681	193,518	-
2a.1.6	Scaffolding in support of decommissioning	-	1,598	24	17	-	266	-	471	2,376	2,376	-	-	-	1,087	-	-	-	71,859	36,741	-
2a.1	Subtotal Period 2a Activity Costs	2,182	29,478	24,909	11,082	-	97,343	660	48,063	213,717	209,766	-	3,951	-	316,745	963	393	2,217	21,005,400	403,467	10,513
Period 2a Additional Costs																					
2a.2.1	Remedial Action Surveys	-	-	-	-	-	-	1,666	500	2,166	2,166	-	-	-	-	-	-	-	-	34,112	-
2a.2	Subtotal Period 2a Additional Costs	-	-	-	-	-	-	1,666	500	2,166	2,166	-	-	-	-	-	-	-	-	34,112	-
Period 2a Collateral Costs																					
2a.3.1	Process decommissioning water waste	197	-	126	324	-	562	-	300	1,509	1,509	-	-	-	1,266	-	-	-	75,934	247	-
2a.3.2	Process decommissioning chemical flush waste	1	-	39	146	-	323	-	107	616	616	-	-	-	410	-	-	-	43,711	77	-
2a.3.3	Small tool allowance	-	341	-	-	-	-	-	51	392	353	-	39	-	-	-	-	-	-	-	-
2a.3.4	Spent Fuel Transfer	-	-	-	-	-	-	4,320	648	4,968	-	4,968	-	-	-	-	-	-	-	-	-
2a.3.5	On-site survey and release of 60.87 tons clean metallic waste	-	-	-	-	-	-	84	8	92	92	-	-	-	-	-	-	-	-	-	-
2a.3	Subtotal Period 2a Collateral Costs	198	341	165	470	-	885	4,404	1,115	7,578	2,571	4,968	39	-	1,676	-	-	-	119,644	324	-
Period 2a Period-Dependent Costs																					
2a.4.1	Decon supplies	89	-	-	-	-	-	-	22	112	112	-	-	-	-	-	-	-	-	-	-
2a.4.2	Insurance	-	-	-	-	-	-	1,512	151	1,663	1,663	-	-	-	-	-	-	-	-	-	-
2a.4.3	Property taxes	-	-	-	-	-	-	459	46	505	455	-	51	-	-	-	-	-	-	-	-
2a.4.4	Health physics supplies	-	2,848	-	-	-	-	-	712	3,560	3,560	-	-	-	-	-	-	-	-	-	-
2a.4.5	Heavy equipment rental	-	3,300	-	-	-	-	-	495	3,795	3,795	-	-	-	-	-	-	-	-	-	-
2a.4.6	Disposal of DAW generated	-	-	122	25	-	305	-	92	543	543	-	-	-	6,016	-	-	-	120,328	196	-
2a.4.7	Plant energy budget	-	-	-	-	-	-	2,614	392	3,006	3,006	-	-	-	-	-	-	-	-	-	-
2a.4.8	NRC Fees	-	-	-	-	-	-	1,028	103	1,130	1,130	-	-	-	-	-	-	-	-	-	-
2a.4.9	Emergency Planning Fees	-	-	-	-	-	-	1,529	153	1,682	-	1,682	-	-	-	-	-	-	-	-	-
2a.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	1,298	195	1,493	-	1,493	-	-	-	-	-	-	-	-	-
2a.4.11	ISFSI Operating Costs	-	-	-	-	-	-	157	24	180	-	180	-	-	-	-	-	-	-	-	-
2a.4.12	Corporate Allocations	-	-	-	-	-	-	1,641	164	1,805	1,805	-	-	-	-	-	-	-	-	-	-
2a.4.13	Security Staff Cost	-	-	-	-	-	-	16,738	2,511	19,248	19,248	-	-	-	-	-	-	-	-	-	406,635
2a.4.14	DOC Staff Cost	-	-	-	-	-	-	25,196	3,779	28,975	28,975	-	-	-	-	-	-	-	-	-	260,137
2a.4.15	Utility Staff Cost	-	-	-	-	-	-	36,771	5,516	42,287	42,287	-	-	-	-	-	-	-	-	-	484,334
2a.4	Subtotal Period 2a Period-Dependent Costs	89	6,149	122	25	-	305	88,943	14,355	109,987	106,581	3,355	51	-	6,016	-	-	-	120,328	196	1,151,107
2a.0	TOTAL PERIOD 2a COST	2,469	35,968	25,196	11,577	-	98,533	95,673	64,033	333,448	321,084	8,323	4,041	-	324,437	963	393	2,217	21,245,370	438,100	1,161,620
PERIOD 2b - Site Decontamination																					
Period 2b Direct Decommissioning Activities																					
Disposal of Plant Systems																					
2b.1.1.1	200 Reactor Bldg Non-System Specific	-	90	7	6	-	93	-	47	243	243	-	-	-	378	-	-	-	25,015	1,765	-
2b.1.1.2	200 Reactor Bldg Non-System Specific RCA	-	557	68	52	-	835	-	363	1,875	1,875	-	-	-	3,414	-	-	-	225,673	10,554	-
2b.1.1.3	300 Control Bldg Non-System Specific	-	176	30	23	-	375	-	144	748	748	-	-	-	1,532	-	-	-	101,230	3,471	-
2b.1.1.4	300 Control Bldg Non-System Specific Cln	-	1,394	-	-	-	-	-	209	1,603	-	-	1,603	-	-	-	-	-	-	29,076	-
2b.1.1.5	700 Radwaste Bldg Non-Sys Specific RCA	-	1,131	180	138	-	2,221	-	877	4,547	4,547	-	-	-	9,083	-	-	-	600,401	22,261	-
2b.1.1.6	700 Radwaste Bldg Non-System Specific	-	182	19	15	-	245	-	111	573	573	-	-	-	1,002	-	-	-	66,210	3,667	-
2b.1.1.7	AN - Demineralized Wtr Storage & Xfer	-	153	-	-	-	-	-	23	176	-	-	176	-	-	-	-	-	-	3,283	-
2b.1.1.8	AN - Demineralized Wtr Strg & Xfer RCA	-	40	6	3	-	56	-	25	131	131	-	-	-	227	-	-	-	15,047	753	-
2b.1.1.9	AP - Condensate Storage & Transfer	-	89	-	-	-	-	-	13	102	-	-	102	-	-	-	-	-	-	1,794	-
2b.1.1.10	BB - Reactor Coolant System	-	343	62	45	-	716	-	277	1,442	1,442	-	-	-	2,987	-	-	-	193,423	7,115	-
2b.1.1.11	BG - Chemical & Volume Control	794	972	184	129	-	2,063	-	1,193	5,334	5,334	-	-	-	8,476	-	-	-	557,570	28,266	-
2b.1.1.12	BL - Reactor Makeup Water	-	309	48	33	-	532	-	220	1,143	1,143	-	-	-	2,234	-	-	-	143,824	6,176	-
2b.1.1.13	DE - Intake & Water Treatment	-	121	-	-	-	-	-	18	139	-	-	139	-	-	-	-	-	-	2,517	-
2b.1.1.14	DE - Intake & Water Treatment RCA	-	252	173	130	-	2,090	-	622	3,268	3,268	-	-	-	8,546	-	-	-	564,970	5,351	-
2b.1.1.15	EA - Service Water	-	144	-	-	-	-	-	22	166	-	-	166	-	-	-	-	-	-	3,145	-
2b.1.1.16	EA - Service Water RCA	-	45	18	14	-	219	-	70	366	366	-	-	-	895	-	-	-	59,193	876	-
2b.1.1.17	EB - Closed Cooling Water	-	59	-	-	-	-	-	9	68	-	-	68	-	-	-	-	-	-	1,267	-
2b.1.1.18	EF - Essential Service Water	-	334	-	-	-	-	-	50	385	-	-	385	-	-	-	-	-	-	7,244	-

Table E
Callaway Energy Center
DECON Alternative Decommissioning Cost Estimate
40-Year Operating Life with Direct Disposal of Low-Level Radioactive Waste
(thousands of 2014 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
Disposal of Plant Systems (continued)																					
2b.1.1.19	EF - Essential Service Water RCA	-	200	79	58	-	935	-	300	1,572	1,572	-	-	-	3,820	-	-	-	252,595	4,018	-
2b.1.1.20	EG - Component Cooling Water RCA	-	247	-	-	-	-	-	37	284	-	-	284	-	-	-	-	-	-	5,335	-
2b.1.1.21	GA - Plant Heating	-	89	-	-	-	-	-	13	102	-	-	102	-	-	-	-	-	-	1,912	-
2b.1.1.22	GA - Plant Heating RCA	-	97	13	7	-	114	-	55	285	285	-	-	-	463	-	-	-	30,707	1,795	-
2b.1.1.23	GB - Central Chilled Water	-	84	-	-	-	-	-	13	96	-	-	96	-	-	-	-	-	-	1,803	-
2b.1.1.24	GB - Central Chilled Water RCA	-	26	4	2	-	33	-	16	81	81	-	-	-	136	-	-	-	8,983	490	-
2b.1.1.25	GD - Essential Serv Wtr Pumphouse HVAC	-	18	-	-	-	-	-	3	21	-	-	21	-	-	-	-	-	-	427	-
2b.1.1.26	GF - Miscellaneous Building HVAC	-	122	29	22	-	356	-	126	655	655	-	-	-	1,457	-	-	-	96,294	2,081	-
2b.1.1.27	GH - Radwaste Building HVAC	-	188	35	28	-	449	-	167	867	867	-	-	-	1,834	-	-	-	121,259	3,502	-
2b.1.1.28	GK - Control Building HVAC	-	168	-	-	-	-	-	25	193	-	-	193	-	-	-	-	-	-	3,959	-
2b.1.1.29	GL - Auxiliary Building HVAC	-	466	75	59	-	943	-	369	1,911	1,911	-	-	-	3,855	-	-	-	254,809	8,590	-
2b.1.1.30	GM - Diesel Generator Building HVAC	-	29	-	-	-	-	-	4	34	-	-	34	-	-	-	-	-	-	695	-
2b.1.1.31	GN - Containment Cooling	-	514	116	90	-	1,449	-	516	2,685	2,685	-	-	-	5,923	-	-	-	391,577	9,749	-
2b.1.1.32	GP - Containment Intgratd Leak Rate Test	-	39	9	6	-	102	-	37	193	193	-	-	-	417	-	-	-	27,580	768	-
2b.1.1.33	GR - Containment Atmospheric Control	-	19	16	12	-	200	-	58	306	306	-	-	-	818	-	-	-	54,092	413	-
2b.1.1.34	GT - Containment Purge HVAC	-	120	30	24	-	383	-	132	690	690	-	-	-	1,566	-	-	-	103,488	2,297	-
2b.1.1.35	HA - Gaseous Radwaste	-	363	60	40	-	641	-	263	1,367	1,367	-	-	-	2,664	-	-	-	173,231	7,097	-
2b.1.1.36	HB - Liquid Radwaste	764	880	148	100	-	1,610	-	1,034	4,535	4,535	-	-	-	6,735	-	-	-	435,032	31,019	-
2b.1.1.37	HC - Solid Radwaste	-	376	64	45	-	729	-	289	1,503	1,503	-	-	-	3,006	-	-	-	196,927	7,493	-
2b.1.1.38	HD - Decontamination	-	104	19	13	-	212	-	83	431	431	-	-	-	877	-	-	-	57,198	2,072	-
2b.1.1.39	JE - Emergency Fuel Oil	-	62	-	-	-	-	-	9	71	-	-	71	-	-	-	-	-	-	1,260	-
2b.1.1.40	KA - Compressed Air	-	195	-	-	-	-	-	29	224	-	-	224	-	-	-	-	-	-	4,187	-
2b.1.1.41	KA - Compressed Air RCA	-	130	17	9	-	143	-	71	370	370	-	-	-	583	-	-	-	38,661	2,380	-
2b.1.1.42	KB - Breathing Air	-	24	-	-	-	-	-	4	28	-	-	28	-	-	-	-	-	-	516	-
2b.1.1.43	KB - Breathing Air RCA	-	20	2	1	-	13	-	8	43	43	-	-	-	52	-	-	-	3,439	406	-
2b.1.1.44	KC - Fire Protection	-	378	-	-	-	-	-	57	435	-	-	435	-	-	-	-	-	-	8,376	-
2b.1.1.45	KC - Fire Protection RCA	-	403	81	49	-	782	-	311	1,625	1,625	-	-	-	3,189	-	-	-	211,239	7,245	-
2b.1.1.46	KD - Domestic Water	-	176	-	-	-	-	-	26	203	-	-	203	-	-	-	-	-	-	3,837	-
2b.1.1.47	KD - Domestic Water RCA	-	26	4	3	-	44	-	18	95	95	-	-	-	178	-	-	-	11,809	468	-
2b.1.1.48	KE - Fuel Handling & Storage Rctor vssl	-	19	12	10	-	154	-	46	241	241	-	-	-	632	-	-	-	41,743	388	-
2b.1.1.49	KH - Service Gas (CO2 N2 H2 & O2)	-	56	-	-	-	-	-	8	64	-	-	64	-	-	-	-	-	-	1,226	-
2b.1.1.50	KH - Service Gas (CO2 N2 H2 & O2) RCA	-	254	43	27	-	430	-	179	933	933	-	-	-	1,756	-	-	-	116,282	4,575	-
2b.1.1.51	KJ - Standby Diesel Engine	-	327	-	-	-	-	-	49	376	-	-	376	-	-	-	-	-	-	6,749	-
2b.1.1.52	LA - Sanitary Drains	-	44	-	-	-	-	-	7	51	-	-	51	-	-	-	-	-	-	972	-
2b.1.1.53	LA - Sanitary Drains RCA	-	106	21	14	-	224	-	87	452	452	-	-	-	916	-	-	-	60,583	1,854	-
2b.1.1.54	LB - Roof Drains	-	59	-	-	-	-	-	9	68	-	-	68	-	-	-	-	-	-	1,276	-
2b.1.1.55	LB - Roof Drains RCA	-	144	32	23	-	375	-	136	711	711	-	-	-	1,534	-	-	-	101,455	2,757	-
2b.1.1.56	LD - Chemical & Detergent Waste	67	121	13	9	-	140	-	101	451	451	-	-	-	574	-	-	-	37,788	3,503	-
2b.1.1.57	LF - Floor & Equipment Drains	-	1,493	177	128	-	2,056	-	924	4,778	4,778	-	-	-	8,419	-	-	-	555,570	29,417	-
2b.1.1.58	RM - Process Sampling & Analysis	-	138	18	11	-	176	-	82	424	424	-	-	-	717	-	-	-	47,503	2,792	-
2b.1.1.59	SJ - Nuclear Sampling	-	79	13	7	-	120	-	52	272	272	-	-	-	491	-	-	-	32,515	1,632	-
2b.1.1.60	UB - Servces Stores Site Security Bldg	-	177	-	-	-	-	-	27	204	-	-	204	-	-	-	-	-	-	3,815	-
2b.1.1.61	Yard Non-System Specific	-	29	-	-	-	-	-	4	33	-	-	33	-	-	-	-	-	-	603	-
2b.1.1	Totals	1,624	14,999	1,925	1,387	-	22,255	-	10,080	52,271	47,144	-	5,127	-	91,385	-	-	-	6,014,917	324,332	-
2b.1.2	Scaffolding in support of decommissioning	-	1,997	30	21	-	332	-	589	2,969	2,969	-	-	-	1,359	-	-	-	89,823	45,926	-
Decontamination of Site Buildings																					
2b.1.3.1	Reactor	1,243	1,884	164	634	-	2,588	-	1,851	8,364	8,364	-	-	-	29,904	-	-	-	2,479,534	55,944	-
2b.1.3.2	Auxiliary	660	381	44	107	-	590	-	593	2,375	2,375	-	-	-	5,513	-	-	-	422,631	19,456	-
2b.1.3.3	Communication Corridor - Contaminated	15	7	0	2	-	8	-	11	43	43	-	-	-	95	-	-	-	7,935	395	-
2b.1.3.4	Hot Machine Shop	18	14	0	2	-	6	-	14	55	55	-	-	-	103	-	-	-	8,892	597	-
2b.1.3.5	RAM Storage Building	45	16	1	5	-	16	-	31	115	115	-	-	-	238	-	-	-	19,255	1,162	-
2b.1.3.6	Radioactive and Personnel Tunnel	6	12	0	1	-	3	-	7	31	31	-	-	-	58	-	-	-	5,022	334	-
2b.1.3.7	Radwaste	352	185	18	54	-	269	-	299	1,176	1,176	-	-	-	2,663	-	-	-	212,823	10,011	-
2b.1.3.8	Radwaste Drum Storage	40	19	2	6	-	25	-	32	123	123	-	-	-	274	-	-	-	22,567	1,093	-
2b.1.3.9	Reactor Head Assembly Building	34	-	-	-	-	-	-	17	52	52	-	-	-	-	-	-	-	-	691	-
2b.1.3.10	Steam Generator Replacement Bldgs	236	-	-	-	-	-	-	118	354	354	-	-	-	-	-	-	-	-	4,358	-
2b.1.3	Totals	2,649	2,518	229	811	-	3,505	-	2,975	12,687	12,687	-	-	-	38,848	-	-	-	3,178,660	94,042	-
2b.1	Subtotal Period 2b Activity Costs	4,273	19,514	2,184	2,219	-	26,093	-	13,644	67,927	62,800	-	5,127	-	131,592	-	-	-	9,283,399	464,300	-
Period 2b Additional Costs																					
2b.2.1	Remedial Action Surveys	-	-	-	-	-	-	2,395	718	3,113	3,113	-	-	-	-	-	-	-	-	49,026	-
2b.2.2	Sanitary Treatment Lagoon	-	6	93	92	-	280	-	95	567	567	-	-	-	4,608	-	-	-	392,140	423	-
2b.2.3	Cooling Tower Asbestos Panel Removal	-	4,893	-	122	-	-	490	826	6,330	-	-	6,330	-	-	-	-	-	-	71,419	-
2b.2.4	Operational Equipment	-	-	17	92	-	1,083	-	286	1,478	1,478	-	-	-	11,710	-	-	-	292,750	32	-

Table E
Callaway Energy Center
DECON Alternative Decommissioning Cost Estimate
40-Year Operating Life with Direct Disposal of Low-Level Radioactive Waste
(thousands of 2014 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 (continued)																					
2b.2.5	Retired Reactor Closure Head	-	113	552	895	-	768	-	410	2,738	2,738	-	-	-	2,764	-	-	-	338,540	3,157	2,000
2b.2	Subtotal Period 2b Additional Costs	-	5,012	662	1,201	-	2,131	2,884	2,335	14,226	7,897	-	6,330	-	19,082	-	-	-	1,023,430	124,057	2,000
Period 2b Collateral Costs																					
2b.3.1	Process decommissioning water waste	169	-	111	286	-	495	-	262	1,323	1,323	-	-	-	1,116	-	-	-	66,939	218	-
2b.3.2	Process decommissioning chemical flush waste	3	-	128	475	-	1,055	-	349	2,010	2,010	-	-	-	1,338	-	-	-	142,540	250	-
2b.3.3	Small tool allowance	-	421	-	-	-	-	-	63	484	484	-	-	-	-	-	-	-	-	-	-
2b.3.4	Spent Fuel Transfer	-	-	-	-	-	-	6,480	972	7,452	-	7,452	-	-	-	-	-	-	-	-	-
2b.3.5	On-site survey and release of 297.3 tons clean metallic waste	-	-	-	-	-	-	410	41	451	451	-	-	-	-	-	-	-	-	-	-
2b.3	Subtotal Period 2b Collateral Costs	172	421	239	761	-	1,550	6,890	1,688	11,720	4,268	7,452	-	-	2,453	-	-	-	209,479	468	-
Period 2b Period-Dependent Costs																					
2b.4.1	Decon supplies	1,213	-	-	-	-	-	-	303	1,516	1,516	-	-	-	-	-	-	-	-	-	-
2b.4.2	Insurance	-	-	-	-	-	-	2,173	217	2,391	2,391	-	-	-	-	-	-	-	-	-	-
2b.4.3	Property taxes	-	-	-	-	-	-	660	66	726	726	-	-	-	-	-	-	-	-	-	-
2b.4.4	Health physics supplies	-	3,890	-	-	-	-	-	973	4,863	4,863	-	-	-	-	-	-	-	-	-	-
2b.4.5	Heavy equipment rental	-	4,696	-	-	-	-	-	704	5,401	5,401	-	-	-	-	-	-	-	-	-	-
2b.4.6	Disposal of DAW generated	-	-	135	27	-	337	-	102	602	602	-	-	-	6,667	-	-	-	133,346	217	-
2b.4.7	Plant energy budget	-	-	-	-	-	-	2,967	445	3,412	3,412	-	-	-	-	-	-	-	-	-	-
2b.4.8	NRC Fees	-	-	-	-	-	-	1,477	148	1,625	1,625	-	-	-	-	-	-	-	-	-	-
2b.4.9	Emergency Planning Fees	-	-	-	-	-	-	2,198	220	2,418	-	2,418	-	-	-	-	-	-	-	-	-
2b.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	1,866	280	2,146	-	2,146	-	-	-	-	-	-	-	-	-
2b.4.11	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	473	71	544	544	-	-	-	-	-	-	-	-	-	-
2b.4.12	ISFSI Operating Costs	-	-	-	-	-	-	225	34	259	-	259	-	-	-	-	-	-	-	-	-
2b.4.13	Corporate Allocations	-	-	-	-	-	-	2,359	236	2,595	2,595	-	-	-	-	-	-	-	-	-	-
2b.4.14	Security Staff Cost	-	-	-	-	-	-	24,059	3,609	27,667	27,667	-	-	-	-	-	-	-	-	-	584,496
2b.4.15	DOC Staff Cost	-	-	-	-	-	-	34,908	5,236	40,145	40,145	-	-	-	-	-	-	-	-	-	359,160
2b.4.16	Utility Staff Cost	-	-	-	-	-	-	50,771	7,616	58,386	58,386	-	-	-	-	-	-	-	-	-	666,660
2b.4	Subtotal Period 2b Period-Dependent Costs	1,213	8,587	135	27	-	337	124,136	20,259	154,695	149,872	4,823	-	-	6,667	-	-	-	133,346	217	1,610,316
2b.0	TOTAL PERIOD 2b COST	5,658	33,534	3,221	4,208	-	30,112	133,911	37,926	248,569	224,837	12,275	11,457	-	159,795	-	-	-	10,649,650	589,042	1,612,316
PERIOD 2d - Decontamination Following Wet Fuel Storage																					
Period 2d Direct Decommissioning Activities																					
2d.1.1	Remove spent fuel racks	831	82	293	107	-	1,709	-	909	3,930	3,930	-	-	-	6,988	-	-	-	461,925	1,925	-
Disposal of Plant Systems																					
2d.1.2.1	600 Fuel Bldg Non-Specific Systems RCA	-	306	45	35	-	561	-	226	1,173	1,173	-	-	-	2,292	-	-	-	151,497	5,946	-
2d.1.2.2	600 Fuel Bldg Non-System Specific	-	48	5	4	-	59	-	28	144	144	-	-	-	242	-	-	-	16,023	957	-
2d.1.2.3	EC - Fuel Pool Cooling & Cleanup	-	406	65	45	-	725	-	296	1,537	1,537	-	-	-	2,965	-	-	-	196,026	8,118	-
2d.1.2.4	GA- Plant Heating Fuel Building	-	23	2	1	-	19	-	11	56	56	-	-	-	78	-	-	-	5,152	451	-
2d.1.2.5	GG - Fuel Building HVAC	-	256	54	43	-	691	-	249	1,294	1,294	-	-	-	2,825	-	-	-	186,756	4,745	-
2d.1.2.6	KC- Fire Protection Fuel Building	-	119	23	14	-	220	-	89	464	464	-	-	-	896	-	-	-	59,340	2,166	-
2d.1.2	Totals	-	1,158	194	142	-	2,275	-	899	4,668	4,668	-	-	-	9,298	-	-	-	614,793	22,383	-
Decontamination of Site Buildings																					
2d.1.3.1	Fuel Building	777	854	64	53	-	564	-	758	3,070	3,070	-	-	-	3,048	-	-	-	220,127	31,665	-
2d.1.3	Totals	777	854	64	53	-	564	-	758	3,070	3,070	-	-	-	3,048	-	-	-	220,127	31,665	-
2d.1.4	Scaffolding in support of decommissioning	-	399	6	4	-	66	-	118	594	594	-	-	-	272	-	-	-	17,965	9,185	-
2d.1	Subtotal Period 2d Activity Costs	1,608	2,494	557	306	-	4,615	-	2,683	12,263	12,263	-	-	-	19,606	-	-	-	1,314,809	65,158	-
Period 2d Additional Costs																					
2d.2.1	License Termination Survey Planning	-	-	-	-	-	-	1,495	448	1,943	1,943	-	-	-	-	-	-	-	-	-	12,480
2d.2.2	Remedial Action Surveys	-	-	-	-	-	-	676	203	879	879	-	-	-	-	-	-	-	-	13,839	-
2d.2	Subtotal Period 2d Additional Costs	-	-	-	-	-	-	2,171	651	2,822	2,822	-	-	-	-	-	-	-	-	13,839	12,480
Period 2d Collateral Costs																					
2d.3.1	Process decommissioning water waste	90	-	60	154	-	267	-	141	712	712	-	-	-	601	-	-	-	36,060	117	-
2d.3.3	Small tool allowance	-	65	-	-	-	-	-	10	75	75	-	-	-	-	-	-	-	-	-	-
2d.3.4	Decommissioning Equipment Disposition	-	-	118	81	-	1,294	-	347	1,840	1,840	-	-	-	5,290	-	-	-	349,678	88	-
2d.3	Subtotal Period 2d Collateral Costs	90	65	178	235	-	1,561	-	498	2,626	2,626	-	-	-	5,891	-	-	-	385,738	205	-

Table E
Callaway Energy Center
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(thousands of 2014 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	176	-	-	-	-	-	-	44	220	220	-	-	-	-	-	-	-	-	-	-
2d.4.2	Insurance	-	-	-	-	-	-	613	61	675	675	-	-	-	-	-	-	-	-	-	-
2d.4.3	Property taxes	-	-	-	-	-	-	186	19	205	205	-	-	-	-	-	-	-	-	-	-
2d.4.4	Health physics supplies	-	664	-	-	-	-	-	166	830	830	-	-	-	-	-	-	-	-	-	-
2d.4.5	Heavy equipment rental	-	1,325	-	-	-	-	-	199	1,524	1,524	-	-	-	-	-	-	-	-	-	-
2d.4.6	Disposal of DAW generated	-	-	42	9	-	105	-	32	188	188	-	-	-	2,081	-	-	-	41,624	68	-
2d.4.7	Plant energy budget	-	-	-	-	-	-	447	67	514	514	-	-	-	-	-	-	-	-	-	-
2d.4.8	NRC Fees	-	-	-	-	-	-	355	35	390	390	-	-	-	-	-	-	-	-	-	-
2d.4.9	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	267	40	307	307	-	-	-	-	-	-	-	-	-	-
2d.4.10	Corporate Allocations	-	-	-	-	-	-	666	67	732	732	-	-	-	-	-	-	-	-	-	-
2d.4.11	Security Staff Cost	-	-	-	-	-	-	1,337	201	1,537	1,537	-	-	-	-	-	-	-	-	-	43,393
2d.4.12	DOC Staff Cost	-	-	-	-	-	-	6,755	1,013	7,769	7,769	-	-	-	-	-	-	-	-	-	69,429
2d.4.13	Utility Staff Cost	-	-	-	-	-	-	10,274	1,541	11,815	11,815	-	-	-	-	-	-	-	-	-	131,220
2d.4	Subtotal Period 2d Period-Dependent Costs	176	1,990	42	9	-	105	20,899	3,485	26,706	26,706	-	-	-	2,081	-	-	-	41,624	68	244,041
2d.0	TOTAL PERIOD 2d COST	1,875	4,549	777	549	-	6,281	23,070	7,317	44,417	44,417	-	-	-	27,579	-	-	-	1,742,171	79,269	256,521
PERIOD 2f - License Termination																					
Period 2f Direct Decommissioning Activities																					
2f.1.1	ORISE confirmatory survey	-	-	-	-	-	-	157	47	204	204	-	-	-	-	-	-	-	-	-	-
2f.1.2	Terminate license									a											
2f.1	Subtotal Period 2f Activity Costs	-	-	-	-	-	-	157	47	204	204	-	-	-	-	-	-	-	-	-	-
Period 2f Additional Costs																					
2f.2.1	License Termination Survey	-	-	-	-	-	-	8,248	2,474	10,723	10,723	-	-	-	-	-	-	-	-	153,878	6,240
2f.2	Subtotal Period 2f Additional Costs	-	-	-	-	-	-	8,248	2,474	10,723	10,723	-	-	-	-	-	-	-	-	153,878	6,240
Period 2f Collateral Costs																					
2f.3.1	DOC staff relocation expenses	-	-	-	-	-	-	1,080	162	1,242	1,242	-	-	-	-	-	-	-	-	-	-
2f.3	Subtotal Period 2f Collateral Costs	-	-	-	-	-	-	1,080	162	1,242	1,242	-	-	-	-	-	-	-	-	-	-
Period 2f Period-Dependent Costs																					
2f.4.2	Property taxes	-	-	-	-	-	-	212	21	233	233	-	-	-	-	-	-	-	-	-	-
2f.4.3	Health physics supplies	-	736	-	-	-	-	-	184	920	920	-	-	-	-	-	-	-	-	-	-
2f.4.4	Disposal of DAW generated	-	-	7	1	-	18	-	5	32	32	-	-	-	353	-	-	-	7,050	11	-
2f.4.5	Plant energy budget	-	-	-	-	-	-	254	38	292	292	-	-	-	-	-	-	-	-	-	-
2f.4.6	NRC Fees	-	-	-	-	-	-	457	46	503	503	-	-	-	-	-	-	-	-	-	-
2f.4.7	Corporate Allocations	-	-	-	-	-	-	756	76	832	832	-	-	-	-	-	-	-	-	-	-
2f.4.8	Security Staff Cost	-	-	-	-	-	-	727	109	836	836	-	-	-	-	-	-	-	-	-	18,926
2f.4.9	DOC Staff Cost	-	-	-	-	-	-	5,685	853	6,538	6,538	-	-	-	-	-	-	-	-	-	57,566
2f.4.10	Utility Staff Cost	-	-	-	-	-	-	6,427	964	7,391	7,391	-	-	-	-	-	-	-	-	-	74,914
2f.4	Subtotal Period 2f Period-Dependent Costs	-	736	7	1	-	18	14,518	2,296	17,576	17,576	-	-	-	353	-	-	-	7,050	11	151,406
2f.0	TOTAL PERIOD 2f COST	-	736	7	1	-	18	24,002	4,979	29,744	29,744	-	-	-	353	-	-	-	7,050	153,889	157,646
PERIOD 2 TOTALS		10,002	74,786	29,201	16,335	-	134,943	276,656	114,254	656,178	620,082	20,598	15,498	-	512,163	963	393	2,217	33,644,240	1,260,301	3,188,103
PERIOD 3b - Site Restoration																					
Period 3b Direct Decommissioning Activities																					
Demolition of Remaining Site Buildings																					
3b.1.1.1	Reactor	-	5,191	-	-	-	-	-	779	5,969	-	-	5,969	-	-	-	-	-	-	59,292	-
3b.1.1.2	Auxiliary	-	4,194	-	-	-	-	-	629	4,823	-	-	4,823	-	-	-	-	-	-	49,968	-
3b.1.1.3	Auxiliary Boiler	-	39	-	-	-	-	-	6	45	-	-	45	-	-	-	-	-	-	619	-
3b.1.1.4	Barge Facility	-	1,595	-	-	-	-	-	239	1,834	-	-	1,834	-	-	-	-	-	-	18,771	-
3b.1.1.5	Circulating & Service Water Pumphouse	-	328	-	-	-	-	-	49	377	-	-	377	-	-	-	-	-	-	4,345	-
3b.1.1.6	Communication Corridor - Clean	-	1,346	-	-	-	-	-	202	1,548	-	-	1,548	-	-	-	-	-	-	17,215	-
3b.1.1.7	Communication Corridor - Contaminated	-	60	-	-	-	-	-	9	69	-	-	69	-	-	-	-	-	-	674	-
3b.1.1.8	Cooling Tower Concrete	-	918	-	-	-	-	-	138	1,056	-	-	1,056	-	-	-	-	-	-	13,472	-
3b.1.1.9	Diesel Generator	-	499	-	-	-	-	-	75	574	-	-	574	-	-	-	-	-	-	5,492	-
3b.1.1.10	Essential Service Water Pumphouse	-	306	-	-	-	-	-	46	352	-	-	352	-	-	-	-	-	-	3,938	-
3b.1.1.11	Fire Water Pumphouse	-	29	-	-	-	-	-	4	33	-	-	33	-	-	-	-	-	-	382	-
3b.1.1.12	Flex Building Storage	-	557	-	-	-	-	-	84	641	-	-	641	-	-	-	-	-	-	7,590	-
3b.1.1.13	Hot Machine Shop	-	25	-	-	-	-	-	4	29	-	-	29	-	-	-	-	-	-	417	-
3b.1.1.14	Intake	-	382	-	-	-	-	-	57	440	-	-	440	-	-	-	-	-	-	4,224	-

Table E
Callaway Energy Center
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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.1.1.15	Misc. Structures	-	2,487	-	-	-	-	-	373	2,861	-	-	2,861	-	-	-	-	-	-	27,921	-
3b.1.1.16	Miscellaneous Site Foundations	-	382	-	-	-	-	-	57	439	-	-	439	-	-	-	-	-	-	5,483	-
3b.1.1.17	Outage Maintenance	-	192	-	-	-	-	-	29	220	-	-	220	-	-	-	-	-	-	3,190	-
3b.1.1.18	RAM Storage Building	-	69	-	-	-	-	-	10	79	-	-	79	-	-	-	-	-	-	1,081	-
3b.1.1.19	Radioactive and Personnel Tunnel	-	29	-	-	-	-	-	4	34	-	-	34	-	-	-	-	-	-	386	-
3b.1.1.20	Radwaste	-	1,872	-	-	-	-	-	281	2,153	-	-	2,153	-	-	-	-	-	-	21,798	-
3b.1.1.21	Radwaste Drum Storage	-	279	-	-	-	-	-	42	321	-	-	321	-	-	-	-	-	-	3,840	-
3b.1.1.22	Reactor Head Assembly Building	-	81	-	-	-	-	-	12	94	-	-	94	-	-	-	-	-	-	1,357	-
3b.1.1.23	Security Additions	-	2,257	-	-	-	-	-	339	2,595	-	-	2,595	-	-	-	-	-	-	20,977	-
3b.1.1.24	Service	-	527	-	-	-	-	-	79	606	-	-	606	-	-	-	-	-	-	6,045	-
3b.1.1.25	Sludge Pump Station & Lagoon	-	26	-	-	-	-	-	4	30	-	-	30	-	-	-	-	-	-	313	-
3b.1.1.26	Steam Generator Replacement Bldgs	-	1,231	-	-	-	-	-	185	1,415	-	-	1,415	-	-	-	-	-	-	15,693	-
3b.1.1.27	Turbine Building	-	3,580	-	-	-	-	-	537	4,117	-	-	4,117	-	-	-	-	-	-	55,694	-
3b.1.1.28	Turbine Pedestal	-	1,092	-	-	-	-	-	164	1,256	-	-	1,256	-	-	-	-	-	-	10,928	-
3b.1.1.29	U.H.S. Cooling Tower	-	662	-	-	-	-	-	99	761	-	-	761	-	-	-	-	-	-	6,681	-
3b.1.1.30	Water Treatment Plant	-	1	-	-	-	-	-	0	1	-	-	1	-	-	-	-	-	-	9	-
3b.1.1.31	Fuel Building	-	2,092	-	-	-	-	-	314	2,405	-	-	2,405	-	-	-	-	-	-	22,580	-
3b.1.1	Totals	-	32,329	-	-	-	-	-	4,849	37,178	-	-	37,178	-	-	-	-	-	-	390,372	-
Site Closeout Activities																					
3b.1.2	BackFill Site	-	8,631	-	-	-	-	-	1,295	9,926	-	-	9,926	-	-	-	-	-	-	15,861	-
3b.1.3	Grade & landscape site	-	132	-	-	-	-	-	20	152	-	-	152	-	-	-	-	-	-	592	-
3b.1.4	Final report to NRC	-	-	-	-	-	-	197	30	226	226	-	-	-	-	-	-	-	-	-	1,560
3b.1	Subtotal Period 3b Activity Costs	-	41,092	-	-	-	-	197	6,193	47,482	226	-	47,256	-	-	-	-	-	-	406,825	1,560
Period 3b Additional Costs																					
3b.2.1	Concrete Crushing	-	1,194	-	-	-	-	9	180	1,384	-	-	1,384	-	-	-	-	-	-	5,976	-
3b.2.2	Mine Area Backfill	-	4,988	-	-	-	-	-	748	5,736	-	-	5,736	-	-	-	-	-	-	15,960	-
3b.2.3	Cooling Tower Discharge & Intake Pipe Flow Fill	-	3,778	-	-	-	-	-	567	4,345	-	-	4,345	-	-	-	-	-	-	9,588	-
3b.2.4	Cooling Tower Demolition	-	4,272	-	-	-	-	-	641	4,913	-	-	4,913	-	-	-	-	-	-	21,619	-
3b.2.5	Excavation of Underground Services	-	1,668	-	-	-	-	761	364	2,793	-	-	2,793	-	-	-	-	-	-	14,164	-
3b.2.6	Construction Debris	-	-	-	-	-	-	2,480	372	2,852	-	-	2,852	-	-	-	-	-	-	-	-
3b.2	Subtotal Period 3b Additional Costs	-	15,901	-	-	-	-	3,250	2,873	22,023	-	-	22,023	-	-	-	-	-	-	67,307	-
Period 3b Collateral Costs																					
3b.3.1	Small tool allowance	-	402	-	-	-	-	-	60	462	-	-	462	-	-	-	-	-	-	-	-
3b.3.2	Corporate Allocations	-	-	-	-	-	-	1,504	150	1,655	-	-	1,655	-	-	-	-	-	-	-	-
3b.3	Subtotal Period 3b Collateral Costs	-	402	-	-	-	-	1,504	211	2,117	-	-	2,117	-	-	-	-	-	-	-	-
Period 3b Period-Dependent Costs																					
3b.4.2	Property taxes	-	-	-	-	-	-	421	42	463	-	-	463	-	-	-	-	-	-	-	-
3b.4.3	Heavy equipment rental	-	4,254	-	-	-	-	-	638	4,892	-	-	4,892	-	-	-	-	-	-	-	-
3b.4.4	Plant energy budget	-	-	-	-	-	-	252	38	290	-	-	290	-	-	-	-	-	-	-	-
3b.4.5	Security Staff Cost	-	-	-	-	-	-	1,446	217	1,663	-	-	1,663	-	-	-	-	-	-	-	37,646
3b.4.6	DOC Staff Cost	-	-	-	-	-	-	11,002	1,650	12,652	-	-	12,652	-	-	-	-	-	-	-	106,663
3b.4.7	Utility Staff Cost	-	-	-	-	-	-	5,200	780	5,980	-	-	5,980	-	-	-	-	-	-	-	61,174
3b.4	Subtotal Period 3b Period-Dependent Costs	-	4,254	-	-	-	-	18,321	3,365	25,940	-	-	25,940	-	-	-	-	-	-	-	205,483
3b.0	TOTAL PERIOD 3b COST	-	61,649	-	-	-	-	23,272	12,642	97,563	226	-	97,336	-	-	-	-	-	-	474,132	207,043
PERIOD 3 TOTALS		-	61,649	-	-	-	-	23,272	12,642	97,563	226	-	97,336	-	-	-	-	-	-	474,132	207,043
TOTAL COST TO DECOMMISSION		**13,117**	**139,102**	**29,324**	**16,691**	**-**	**138,871**	**421,436**	**147,356**	**905,897**	**761,937**	**29,564**	**114,396**	**-**	**513,415**	**1,750**	**393**	**2,217**	**33,764,540**	**1,754,833**	**4,612,246**

Table E
Callaway Energy Center
DECON Alternative Decommissioning Cost Estimate
40-Year Operating Life with Direct Disposal of Low-Level Radioactive Waste
(thousands of 2014 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 19.43% CONTINGENCY:	**$905,897**	**thousands of 2014 dollars**
TOTAL NRC LICENSE TERMINATION COST IS 84.11% OR:	**$761,937**	**thousands of 2014 dollars**
SPENT FUEL MANAGEMENT COST IS 3.26% OR:	**$29,564**	**thousands of 2014 dollars**
NON-NUCLEAR DEMOLITION COST IS 12.63% OR:	**$114,396**	**thousands of 2014 dollars**
TOTAL LOW-LEVEL RADIOACTIVE WASTE VOLUME BURIED (EXCLUDING GTCC):	**515,558**	**cubic feet**
TOTAL GREATER THAN CLASS C RADWASTE VOLUME GENERATED:	**2,217**	**cubic feet**
TOTAL SCRAP METAL REMOVED:	**68,413**	**tons**
TOTAL CRAFT LABOR REQUIREMENTS:	**1,754,833**	**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 ALTERNATIVE DECOMMISSIONING COST ESTIMATE
40-YEAR OPERATING LIFE with
DIRECT DISPOSAL OF LOW-LEVEL RADIOACTIVE WASTE

Table F
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
40-Year Operating Life with Direct Disposal of Low-Level Radioactive Waste
(thousands of 2014 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	-	-	-	-	-	-	380	114	494	494	-	-	-	-	-	-	-	-	-	-
1a.1.2	Prepare preliminary decommissioning cost	-	-	-	-	-	-	164	25	189	189	-	-	-	-	-	-	-	-	-	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	-	-	-	-	-	-	252	38	290	290	-	-	-	-	-	-	-	-	-	2,000
1a.1.8	Review plant dwgs & specs.	-	-	-	-	-	-	164	25	189	189	-	-	-	-	-	-	-	-	-	1,300
1a.1.9	Perform detailed rad survey									a											
1a.1.10	Estimate by-product inventory	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1a.1.11	End product description	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1a.1.12	Detailed by-product inventory	-	-	-	-	-	-	189	28	218	218	-	-	-	-	-	-	-	-	-	1,500
1a.1.13	Define major work sequence	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1a.1.14	Perform SER and EA	-	-	-	-	-	-	391	59	450	450	-	-	-	-	-	-	-	-	-	3,100
1a.1.15	Perform Site-Specific Cost Study	-	-	-	-	-	-	630	95	725	725	-	-	-	-	-	-	-	-	-	5,000
Activity Specifications																					
1a.1.16.1	Prepare plant and facilities for SAFSTOR	-	-	-	-	-	-	620	93	713	713	-	-	-	-	-	-	-	-	-	4,920
1a.1.16.2	Plant systems	-	-	-	-	-	-	525	79	604	604	-	-	-	-	-	-	-	-	-	4,167
1a.1.16.3	Plant structures and buildings	-	-	-	-	-	-	393	59	452	452	-	-	-	-	-	-	-	-	-	3,120
1a.1.16.4	Waste management	-	-	-	-	-	-	252	38	290	290	-	-	-	-	-	-	-	-	-	2,000
1a.1.16.5	Facility and site dormancy	-	-	-	-	-	-	252	38	290	290	-	-	-	-	-	-	-	-	-	2,000
1a.1.16	Total	-	-	-	-	-	-	2,044	307	2,350	2,350	-	-	-	-	-	-	-	-	-	16,207
Detailed Work Procedures																					
1a.1.17.1	Plant systems	-	-	-	-	-	-	149	22	172	172	-	-	-	-	-	-	-	-	-	1,183
1a.1.17.2	Facility closeout & dormancy	-	-	-	-	-	-	151	23	174	174	-	-	-	-	-	-	-	-	-	1,200
1a.1.17	Total	-	-	-	-	-	-	301	45	346	346	-	-	-	-	-	-	-	-	-	2,383
1a.1.18	Procure vacuum drying system	-	-	-	-	-	-	13	2	15	15	-	-	-	-	-	-	-	-	-	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	-	-	-	-	-	-	4,905	793	5,698	5,698	-	-	-	-	-	-	-	-	-	35,890
Period 1a Collateral Costs																					
1a.3.1	Spent Fuel Transfer	-	-	-	-	-	-	2,880	432	3,312	-	3,312	-	-	-	-	-	-	-	-	-
1a.3	Subtotal Period 1a Collateral Costs	-	-	-	-	-	-	2,880	432	3,312	-	3,312	-	-	-	-	-	-	-	-	-
Period 1a Period-Dependent Costs																					
1a.4.1	Insurance	-	-	-	-	-	-	1,902	190	2,092	2,092	-	-	-	-	-	-	-	-	-	-
1a.4.2	Property taxes	-	-	-	-	-	-	280	28	308	308	-	-	-	-	-	-	-	-	-	-
1a.4.3	Health physics supplies	-	497	-	-	-	-	-	124	621	621	-	-	-	-	-	-	-	-	-	-
1a.4.4	Heavy equipment rental	-	523	-	-	-	-	-	78	602	602	-	-	-	-	-	-	-	-	-	-
1a.4.5	Disposal of DAW generated	-	-	12	3	-	31	-	9	55	55	-	-	-	610	-	-	-	12,190	20	-
1a.4.6	Plant energy budget	-	-	-	-	-	-	1,677	252	1,928	1,928	-	-	-	-	-	-	-	-	-	-
1a.4.7	NRC Fees	-	-	-	-	-	-	1,181	118	1,299	1,299	-	-	-	-	-	-	-	-	-	-
1a.4.8	Emergency Planning Fees	-	-	-	-	-	-	1,490	149	1,638	-	1,638	-	-	-	-	-	-	-	-	-
1a.4.9	INPO Fees	-	-	-	-	-	-	336	50	386	386	-	-	-	-	-	-	-	-	-	-
1a.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	791	119	910	-	910	-	-	-	-	-	-	-	-	-
1a.4.11	ISFSI Operating Costs	-	-	-	-	-	-	95	14	110	-	110	-	-	-	-	-	-	-	-	-
1a.4.12	Corporate Allocations	-	-	-	-	-	-	1,000	100	1,100	1,100	-	-	-	-	-	-	-	-	-	-
1a.4.13	Security Staff Cost	-	-	-	-	-	-	11,224	1,684	12,908	12,908	-	-	-	-	-	-	-	-	-	275,314
1a.4.14	Utility Staff Cost	-	-	-	-	-	-	31,458	4,719	36,177	36,177	-	-	-	-	-	-	-	-	-	423,400
1a.4	Subtotal Period 1a Period-Dependent Costs	-	1,020	12	3	-	31	51,433	7,634	60,133	57,475	2,658	-	-	610	-	-	-	12,190	20	698,714
1a.0	TOTAL PERIOD 1a COST	-	1,020	12	3	-	31	59,219	8,859	69,144	63,174	5,970	-	-	610	-	-	-	12,190	20	734,604

Table F
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
40-Year Operating Life with Direct Disposal of Low-Level Radioactive Waste
(thousands of 2014 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	1,225	-	-	-	-	-	-	612	1,837	1,837	-	-	-	-	-	-	-	24,102	-
1b.1.1.2	Auxiliary	621	-	-	-	-	-	-	311	932	932	-	-	-	-	-	-	-	12,527	-
1b.1.1.3	Communication Corridor - Contaminated	14	-	-	-	-	-	-	7	21	21	-	-	-	-	-	-	-	276	-
1b.1.1.4	Fuel Building	766	-	-	-	-	-	-	383	1,149	1,149	-	-	-	-	-	-	-	14,371	-
1b.1.1.5	Hot Machine Shop	17	-	-	-	-	-	-	9	26	26	-	-	-	-	-	-	-	344	-
1b.1.1.6	RAM Storage Building	43	-	-	-	-	-	-	21	64	64	-	-	-	-	-	-	-	865	-
1b.1.1.7	Radioactive and Personnel Tunnel	5	-	-	-	-	-	-	2	7	7	-	-	-	-	-	-	-	91	-
1b.1.1.8	Radwaste	300	-	-	-	-	-	-	150	450	450	-	-	-	-	-	-	-	5,964	-
1b.1.1.9	Radwaste Drum Storage	34	-	-	-	-	-	-	17	51	51	-	-	-	-	-	-	-	671	-
1b.1.1.10	Reactor Head Assembly Building	31	-	-	-	-	-	-	16	47	47	-	-	-	-	-	-	-	614	-
1b.1.1	Totals	3,055	-	-	-	-	-	-	1,528	4,583	4,583	-	-	-	-	-	-	-	59,826	-
1b.1	Subtotal Period 1b Activity Costs	3,055	-	-	-	-	-	-	1,528	4,583	4,583	-	-	-	-	-	-	-	59,826	-
Period 1b Collateral Costs																					
1b.3.1	Decon equipment	893	-	-	-	-	-	-	134	1,026	1,026	-	-	-	-	-	-	-	-	-	-
1b.3.2	Process decommissioning water waste	172	-	108	278	-	482	-	259	1,299	1,299	-	-	-	1,085	-	-	-	65,106	212	-
1b.3.4	Small tool allowance	-	48	-	-	-	-	-	7	55	55	-	-	-	-	-	-	-	-	-	-
1b.3.5	Spent Fuel Transfer	-	-	-	-	-	-	720	108	828	-	828	-	-	-	-	-	-	-	-	-
1b.3	Subtotal Period 1b Collateral Costs	1,064	48	108	278	-	482	720	508	3,209	2,381	828	-	-	1,085	-	-	-	65,106	212	-
Period 1b Period-Dependent Costs																					
1b.4.1	Decon supplies	1,133	-	-	-	-	-	-	283	1,417	1,417	-	-	-	-	-	-	-	-	-	-
1b.4.2	Insurance	-	-	-	-	-	-	479	48	527	527	-	-	-	-	-	-	-	-	-	-
1b.4.3	Property taxes	-	-	-	-	-	-	71	7	78	78	-	-	-	-	-	-	-	-	-	-
1b.4.4	Health physics supplies	-	401	-	-	-	-	-	100	502	502	-	-	-	-	-	-	-	-	-	-
1b.4.5	Heavy equipment rental	-	132	-	-	-	-	-	20	152	152	-	-	-	-	-	-	-	-	-	-
1b.4.6	Disposal of DAW generated	-	-	15	3	-	37	-	11	67	67	-	-	-	740	-	-	-	14,798	24	-
1b.4.7	Plant energy budget	-	-	-	-	-	-	423	63	486	486	-	-	-	-	-	-	-	-	-	-
1b.4.8	NRC Fees	-	-	-	-	-	-	174	17	191	191	-	-	-	-	-	-	-	-	-	-
1b.4.9	Emergency Planning Fees	-	-	-	-	-	-	375	38	413	-	413	-	-	-	-	-	-	-	-	-
1b.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	199	30	229	-	229	-	-	-	-	-	-	-	-	-
1b.4.11	ISFSI Operating Costs	-	-	-	-	-	-	24	4	28	-	28	-	-	-	-	-	-	-	-	-
1b.4.12	Corporate Allocations	-	-	-	-	-	-	252	25	277	277	-	-	-	-	-	-	-	-	-	-
1b.4.13	Security Staff Cost	-	-	-	-	-	-	2,312	347	2,659	2,659	-	-	-	-	-	-	-	-	-	55,515
1b.4.14	Utility Staff Cost	-	-	-	-	-	-	7,929	1,189	9,118	9,118	-	-	-	-	-	-	-	-	-	106,720
1b.4	Subtotal Period 1b Period-Dependent Costs	1,133	533	15	3	-	37	12,239	2,183	16,144	15,474	670	-	-	740	-	-	-	14,798	24	162,235
1b.0	TOTAL PERIOD 1b COST	5,253	581	123	281	-	519	12,959	4,219	23,936	22,438	1,498	-	-	1,825	-	-	-	79,905	60,061	162,235
PERIOD 1c - Preparations for SAFSTOR Dormancy																					
Period 1c Direct Decommissioning Activities																					
1c.1.1	Prepare support equipment for storage	-	444	-	-	-	-	-	67	510	510	-	-	-	-	-	-	-	3,000	-	
1c.1.2	Install containment pressure equal. lines	-	38	-	-	-	-	-	6	44	44	-	-	-	-	-	-	-	700	-	
1c.1.3	Interim survey prior to dormancy	-	-	-	-	-	-	733	220	953	953	-	-	-	-	-	-	-	14,124	-	
1c.1.4	Secure building accesses									a											
1c.1.5	Prepare & submit interim report	-	-	-	-	-	-	74	11	85	85	-	-	-	-	-	-	-	-	583	
1c.1	Subtotal Period 1c Activity Costs	-	482	-	-	-	-	806	303	1,592	1,592	-	-	-	-	-	-	-	17,824	583	
Period 1c Additional Costs																					
1c.2.1	Spent fuel pool isolation	-	-	-	-	-	-	10,813	1,622	12,434	12,434	-	-	-	-	-	-	-	-	-	-
1c.2	Subtotal Period 1c Additional Costs	-	-	-	-	-	-	10,813	1,622	12,434	12,434	-	-	-	-	-	-	-	-	-	-
Period 1c Collateral Costs																					
1c.3.1	Process decommissioning water waste	187	-	118	303	-	525	-	282	1,415	1,415	-	-	-	1,183	-	-	-	70,966	231	-
1c.3.3	Small tool allowance	-	3	-	-	-	-	-	1	4	4	-	-	-	-	-	-	-	-	-	-
1c.3.4	Spent Fuel Transfer	-	-	-	-	-	-	720	108	828	-	828	-	-	-	-	-	-	-	-	-
1c.3	Subtotal Period 1c Collateral Costs	187	3	118	303	-	525	720	390	2,247	1,419	828	-	-	1,183	-	-	-	70,966	231	-

Table F
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
40-Year Operating Life with Direct Disposal of Low-Level Radioactive Waste
(thousands of 2014 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	-	-	-	-	-	-	479	48	527	527	-	-	-	-	-	-	-	-	-	-
1c.4.2	Property taxes	-	-	-	-	-	-	71	7	78	78	-	-	-	-	-	-	-	-	-	-
1c.4.3	Health physics supplies	-	208	-	-	-	-	-	52	260	260	-	-	-	-	-	-	-	-	-	-
1c.4.4	Heavy equipment rental	-	132	-	-	-	-	-	20	152	152	-	-	-	-	-	-	-	-	-	-
1c.4.5	Disposal of DAW generated	-	-	3	1	-	8	-	2	14	14	-	-	-	154	-	-	-	3,073	5	-
1c.4.6	Plant energy budget	-	-	-	-	-	-	423	63	486	486	-	-	-	-	-	-	-	-	-	-
1c.4.7	NRC Fees	-	-	-	-	-	-	174	17	191	191	-	-	-	-	-	-	-	-	-	-
1c.4.8	Emergency Planning Fees	-	-	-	-	-	-	375	38	413	-	413	-	-	-	-	-	-	-	-	-
1c.4.9	Spent Fuel Pool O&M	-	-	-	-	-	-	199	30	229	-	229	-	-	-	-	-	-	-	-	-
1c.4.10	ISFSI Operating Costs	-	-	-	-	-	-	24	4	28	-	28	-	-	-	-	-	-	-	-	-
1c.4.11	Corporate Allocations	-	-	-	-	-	-	252	25	277	277	-	-	-	-	-	-	-	-	-	-
1c.4.12	Security Staff Cost	-	-	-	-	-	-	2,312	347	2,659	2,659	-	-	-	-	-	-	-	-	-	55,515
1c.4.13	Utility Staff Cost	-	-	-	-	-	-	7,929	1,189	9,118	9,118	-	-	-	-	-	-	-	-	-	106,720
1c.4	Subtotal Period 1c Period-Dependent Costs	-	340	3	1	-	8	12,239	1,842	14,433	13,763	670	-	-	154	-	-	-	3,073	5	162,235
1c.0	TOTAL PERIOD 1c COST	187	825	121	304	-	533	24,578	4,158	30,706	29,208	1,498	-	-	1,336	-	-	-	74,038	18,060	162,819
PERIOD 1 TOTALS		5,440	2,427	256	588	-	1,083	96,756	17,236	123,785	114,819	8,966	-	-	3,771	-	-	-	166,133	78,141	1,059,658
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	-	-	-	-	-	-	320	48	368	368	-	-	-	-	-	-	-	-	-	-
2a.1.5	Maintenance supplies	-	-	-	-	-	-	556	139	695	695	-	-	-	-	-	-	-	-	-	-
2a.1	Subtotal Period 2a Activity Costs	-	-	-	-	-	-	876	187	1,063	1,063	-	-	-	-	-	-	-	-	-	-
Period 2a Collateral Costs																					
2a.3.1	Spent Fuel Transfer	-	-	-	-	-	-	10,800	1,620	12,420	-	12,420	-	-	-	-	-	-	-	-	-
2a.3	Subtotal Period 2a Collateral Costs	-	-	-	-	-	-	10,800	1,620	12,420	-	12,420	-	-	-	-	-	-	-	-	-
Period 2a Period-Dependent Costs																					
2a.4.1	Insurance	-	-	-	-	-	-	3,686	369	4,054	3,332	722	-	-	-	-	-	-	-	-	-
2a.4.2	Property taxes	-	-	-	-	-	-	1,119	112	1,231	1,231	-	-	-	-	-	-	-	-	-	-
2a.4.3	Health physics supplies	-	797	-	-	-	-	-	199	996	996	-	-	-	-	-	-	-	-	-	-
2a.4.4	Disposal of DAW generated	-	-	19	4	-	47	-	14	83	83	-	-	-	920	-	-	-	18,406	30	-
2a.4.5	Plant energy budget	-	-	-	-	-	-	1,341	201	1,543	771	771	-	-	-	-	-	-	-	-	-
2a.4.6	NRC Fees	-	-	-	-	-	-	1,157	116	1,273	1,273	-	-	-	-	-	-	-	-	-	-
2a.4.7	Emergency Planning Fees	-	-	-	-	-	-	3,727	373	4,100	-	4,100	-	-	-	-	-	-	-	-	-
2a.4.8	Spent Fuel Pool O&M	-	-	-	-	-	-	3,164	475	3,639	-	3,639	-	-	-	-	-	-	-	-	-
2a.4.9	ISFSI Operating Costs	-	-	-	-	-	-	382	57	439	-	439	-	-	-	-	-	-	-	-	-
2a.4.10	Security Staff Cost	-	-	-	-	-	-	36,697	5,504	42,201	6,594	35,607	-	-	-	-	-	-	-	-	881,006
2a.4.11	Utility Staff Cost	-	-	-	-	-	-	24,718	3,708	28,425	5,702	22,724	-	-	-	-	-	-	-	-	329,543
2a.4	Subtotal Period 2a Period-Dependent Costs	-	797	19	4	-	47	75,992	11,128	87,985	19,983	68,002	-	-	920	-	-	-	18,406	30	1,210,549
2a.0	TOTAL PERIOD 2a COST	-	797	19	4	-	47	87,667	12,934	101,468	21,045	80,422	-	-	920	-	-	-	18,406	30	1,210,549
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	-	-	-	-	-	-	3,886	583	4,469	4,469	-	-	-	-	-	-	-	-	-	-
2c.1.5	Maintenance supplies	-	-	-	-	-	-	6,744	1,686	8,430	8,430	-	-	-	-	-	-	-	-	-	-
2c.1	Subtotal Period 2c Activity Costs	-	-	-	-	-	-	10,630	2,269	12,899	12,899	-	-	-	-	-	-	-	-	-	-
Period 2c Period-Dependent Costs																					
2c.4.1	Insurance	-	-	-	-	-	-	36,772	3,677	40,450	40,450	-	-	-	-	-	-	-	-	-	-
2c.4.2	Property taxes	-	-	-	-	-	-	13,586	1,359	14,944	14,944	-	-	-	-	-	-	-	-	-	-
2c.4.3	Health physics supplies	-	4,413	-	-	-	-	-	1,103	5,516	5,516	-	-	-	-	-	-	-	-	-	-
2c.4.4	Disposal of DAW generated	-	-	100	20	-	250	-	76	446	446	-	-	-	4,942	-	-	-	98,844	161	-
2c.4.5	Plant energy budget	-	-	-	-	-	-	8,141	1,221	9,363	9,363	-	-	-	-	-	-	-	-	-	-
2c.4.6	NRC Fees	-	-	-	-	-	-	12,317	1,232	13,549	13,549	-	-	-	-	-	-	-	-	-	-
2c.4.7	Security Staff Cost	-	-	-	-	-	-	69,597	10,440	80,037	80,037	-	-	-	-	-	-	-	-	-	1,519,029
2c.4.8	Utility Staff Cost	-	-	-	-	-	-	60,184	9,028	69,212	69,212	-	-	-	-	-	-	-	-	-	886,100

Table F
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
40-Year Operating Life with Direct Disposal of Low-Level Radioactive Waste
(thousands of 2014 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	Subtotal Period 2c Period-Dependent Costs	-	4,413	100	20	-	250	200,598	28,135	233,516	233,516	-	-	-	4,942	-	-	-	98,844	161	2,405,129
2c.0	TOTAL PERIOD 2c COST	-	4,413	100	20	-	250	211,228	30,404	246,415	246,415	-	-	-	4,942	-	-	-	98,844	161	2,405,129
PERIOD 2 TOTALS		-	5,209	119	24	-	297	298,896	43,338	347,883	267,461	80,422	-	-	5,863	-	-	-	117,251	191	3,615,677
PERIOD 3a - Reactivate Site Following SAFSTOR Dormancy																					
Period 3a Direct Decommissioning Activities																					
3a.1.1	Prepare preliminary decommissioning cost	-	-	-	-	-	-	164	25	189	189	-	-	-	-	-	-	-	-	-	1,300
3a.1.2	Review plant dwgs & specs.	-	-	-	-	-	-	580	87	667	667	-	-	-	-	-	-	-	-	-	4,600
3a.1.3	Perform detailed rad survey									a											
3a.1.4	End product description	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
3a.1.5	Detailed by-product inventory	-	-	-	-	-	-	164	25	189	189	-	-	-	-	-	-	-	-	-	1,300
3a.1.6	Define major work sequence	-	-	-	-	-	-	946	142	1,088	1,088	-	-	-	-	-	-	-	-	-	7,500
3a.1.7	Perform SER and EA	-	-	-	-	-	-	391	59	450	450	-	-	-	-	-	-	-	-	-	3,100
3a.1.8	Perform Site-Specific Cost Study	-	-	-	-	-	-	630	95	725	725	-	-	-	-	-	-	-	-	-	5,000
3a.1.9	Prepare/submit License Termination Plan	-	-	-	-	-	-	516	77	594	594	-	-	-	-	-	-	-	-	-	4,096
3a.1.10	Receive NRC approval of termination plan									a											
Activity Specifications																					
3a.1.11.1	Re-activate plant & temporary facilities	-	-	-	-	-	-	929	139	1,069	962	-	107	-	-	-	-	-	-	-	7,370
3a.1.11.2	Plant systems	-	-	-	-	-	-	525	79	604	544	-	60	-	-	-	-	-	-	-	4,167
3a.1.11.3	Reactor internals	-	-	-	-	-	-	895	134	1,030	1,030	-	-	-	-	-	-	-	-	-	7,100
3a.1.11.4	Reactor vessel	-	-	-	-	-	-	820	123	943	943	-	-	-	-	-	-	-	-	-	6,500
3a.1.11.5	Biological shield	-	-	-	-	-	-	63	9	73	73	-	-	-	-	-	-	-	-	-	500
3a.1.11.6	Steam generators	-	-	-	-	-	-	393	59	452	452	-	-	-	-	-	-	-	-	-	3,120
3a.1.11.7	Reinforced concrete	-	-	-	-	-	-	202	30	232	116	-	116	-	-	-	-	-	-	-	1,600
3a.1.11.8	Main Turbine	-	-	-	-	-	-	50	8	58	-	-	58	-	-	-	-	-	-	-	400
3a.1.11.9	Main Condensers	-	-	-	-	-	-	50	8	58	-	-	58	-	-	-	-	-	-	-	400
3a.1.11.10	Plant structures & buildings	-	-	-	-	-	-	393	59	452	226	-	226	-	-	-	-	-	-	-	3,120
3a.1.11.11	Waste management	-	-	-	-	-	-	580	87	667	667	-	-	-	-	-	-	-	-	-	4,600
3a.1.11.12	Facility & site closeout	-	-	-	-	-	-	113	17	131	65	-	65	-	-	-	-	-	-	-	900
3a.1.11	Total	-	-	-	-	-	-	5,015	752	5,768	5,077	-	691	-	-	-	-	-	-	-	39,777
Planning & Site Preparations																					
3a.1.12	Prepare dismantling sequence	-	-	-	-	-	-	303	45	348	348	-	-	-	-	-	-	-	-	-	2,400
3a.1.13	Plant prep. & temp. svces	-	-	-	-	-	-	3,000	450	3,450	3,450	-	-	-	-	-	-	-	-	-	-
3a.1.14	Design water clean-up system	-	-	-	-	-	-	177	26	203	203	-	-	-	-	-	-	-	-	-	1,400
3a.1.15	Rigging/Cont. Cntrl Envlps/tooling/etc.	-	-	-	-	-	-	2,300	345	2,645	2,645	-	-	-	-	-	-	-	-	-	-
3a.1.16	Procure casks/liners & containers	-	-	-	-	-	-	155	23	178	178	-	-	-	-	-	-	-	-	-	1,230
3a.1	Subtotal Period 3a Activity Costs	-	-	-	-	-	-	14,467	2,170	16,637	15,946	-	691	-	-	-	-	-	-	-	72,703
Period 3a Period-Dependent Costs																					
3a.4.1	Insurance	-	-	-	-	-	-	382	38	420	420	-	-	-	-	-	-	-	-	-	-
3a.4.2	Property taxes	-	-	-	-	-	-	141	14	155	155	-	-	-	-	-	-	-	-	-	-
3a.4.3	Health physics supplies	-	219	-	-	-	-	-	55	273	273	-	-	-	-	-	-	-	-	-	-
3a.4.4	Heavy equipment rental	-	264	-	-	-	-	-	40	303	303	-	-	-	-	-	-	-	-	-	-
3a.4.5	Disposal of DAW generated	-	-	5	1	-	13	-	4	23	23	-	-	-	259	-	-	-	5,186	8	-
3a.4.6	Plant energy budget	-	-	-	-	-	-	845	127	972	972	-	-	-	-	-	-	-	-	-	-
3a.4.7	NRC Fees	-	-	-	-	-	-	191	19	210	210	-	-	-	-	-	-	-	-	-	-
3a.4.8	Corporate Allocations	-	-	-	-	-	-	504	50	555	555	-	-	-	-	-	-	-	-	-	-
3a.4.9	Security Staff Cost	-	-	-	-	-	-	1,012	152	1,164	1,164	-	-	-	-	-	-	-	-	-	32,857
3a.4.10	Utility Staff Cost	-	-	-	-	-	-	9,856	1,478	11,334	11,334	-	-	-	-	-	-	-	-	-	130,377
3a.4	Subtotal Period 3a Period-Dependent Costs	-	483	5	1	-	13	12,931	1,977	15,410	15,410	-	-	-	259	-	-	-	5,186	8	163,234
3a.0	TOTAL PERIOD 3a COST	-	483	5	1	-	13	27,398	4,147	32,047	31,356	-	691	-	259	-	-	-	5,186	8	235,937
PERIOD 3b - Decommissioning Preparations																					
Period 3b Direct Decommissioning Activities																					
Detailed Work Procedures																					
3b.1.1.1	Plant systems	-	-	-	-	-	-	597	90	686	618	-	69	-	-	-	-	-	-	-	4,733
3b.1.1.2	Reactor internals	-	-	-	-	-	-	315	47	363	363	-	-	-	-	-	-	-	-	-	2,500
3b.1.1.3	Remaining buildings	-	-	-	-	-	-	170	26	196	49	-	147	-	-	-	-	-	-	-	1,350
3b.1.1.4	CRD cooling assembly	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
3b.1.1.5	CRD housings & ICI tubes	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000

Table F
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
40-Year Operating Life with Direct Disposal of Low-Level Radioactive Waste
(thousands of 2014 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			
Detailed Work Procedures (continued)																					
3b.1.1.6	Incore instrumentation	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
3b.1.1.7	Reactor vessel	-	-	-	-	-	-	458	69	526	526	-	-	-	-	-	-	-	-	-	3,630
3b.1.1.8	Facility closeout	-	-	-	-	-	-	151	23	174	87	-	87	-	-	-	-	-	-	-	1,200
3b.1.1.9	Missile shields	-	-	-	-	-	-	57	9	65	65	-	-	-	-	-	-	-	-	-	450
3b.1.1.10	Biological shield	-	-	-	-	-	-	151	23	174	174	-	-	-	-	-	-	-	-	-	1,200
3b.1.1.11	Steam generators	-	-	-	-	-	-	580	87	667	667	-	-	-	-	-	-	-	-	-	4,600
3b.1.1.12	Reinforced concrete	-	-	-	-	-	-	126	19	145	73	-	73	-	-	-	-	-	-	-	1,000
3b.1.1.13	Main Turbine	-	-	-	-	-	-	197	30	226	-	-	226	-	-	-	-	-	-	-	1,560
3b.1.1.14	Main Condensers	-	-	-	-	-	-	197	30	226	-	-	226	-	-	-	-	-	-	-	1,560
3b.1.1.15	Auxiliary building	-	-	-	-	-	-	344	52	396	356	-	40	-	-	-	-	-	-	-	2,730
3b.1.1.16	Reactor building	-	-	-	-	-	-	344	52	396	356	-	40	-	-	-	-	-	-	-	2,730
3b.1.1	Total	-	-	-	-	-	-	4,066	610	4,675	3,769	-	907	-	-	-	-	-	-	-	32,243
3b.1	Subtotal Period 3b Activity Costs	-	-	-	-	-	-	4,066	610	4,675	3,769	-	907	-	-	-	-	-	-	-	32,243
Period 3b Additional Costs																					
3b.2.1	Site Characterization	-	-	-	-	-	-	2,824	847	3,671	3,671	-	-	-	-	-	-	-	-	19,100	7,852
3b.2	Subtotal Period 3b Additional Costs	-	-	-	-	-	-	2,824	847	3,671	3,671	-	-	-	-	-	-	-	-	19,100	7,852
Period 3b Collateral Costs																					
3b.3.1	Decon equipment	893	-	-	-	-	-	-	134	1,026	1,026	-	-	-	-	-	-	-	-	-	-
3b.3.2	DOC staff relocation expenses	-	-	-	-	-	-	1,080	162	1,242	1,242	-	-	-	-	-	-	-	-	-	-
3b.3.3	Pipe cutting equipment	-	1,100	-	-	-	-	-	165	1,265	1,265	-	-	-	-	-	-	-	-	-	-
3b.3	Subtotal Period 3b Collateral Costs	893	1,100	-	-	-	-	1,080	461	3,533	3,533	-	-	-	-	-	-	-	-	-	-
Period 3b Period-Dependent Costs																					
3b.4.1	Decon supplies	54	-	-	-	-	-	-	14	68	68	-	-	-	-	-	-	-	-	-	-
3b.4.2	Insurance	-	-	-	-	-	-	921	92	1,014	1,014	-	-	-	-	-	-	-	-	-	-
3b.4.3	Property taxes	-	-	-	-	-	-	280	28	308	308	-	-	-	-	-	-	-	-	-	-
3b.4.4	Health physics supplies	-	478	-	-	-	-	-	120	598	598	-	-	-	-	-	-	-	-	-	-
3b.4.5	Heavy equipment rental	-	523	-	-	-	-	-	78	602	602	-	-	-	-	-	-	-	-	-	-
3b.4.6	Disposal of DAW generated	-	-	12	2	-	29	-	9	53	53	-	-	-	582	-	-	-	11,636	19	-
3b.4.7	Plant energy budget	-	-	-	-	-	-	1,677	252	1,928	1,928	-	-	-	-	-	-	-	-	-	-
3b.4.8	NRC Fees	-	-	-	-	-	-	378	38	416	416	-	-	-	-	-	-	-	-	-	-
3b.4.9	Corporate Allocations	-	-	-	-	-	-	1,000	100	1,100	1,100	-	-	-	-	-	-	-	-	-	-
3b.4.10	Security Staff Cost	-	-	-	-	-	-	2,008	301	2,309	2,309	-	-	-	-	-	-	-	-	-	65,179
3b.4.11	DOC Staff Cost	-	-	-	-	-	-	11,473	1,721	13,194	13,194	-	-	-	-	-	-	-	-	-	116,800
3b.4.12	Utility Staff Cost	-	-	-	-	-	-	19,551	2,933	22,484	22,484	-	-	-	-	-	-	-	-	-	258,629
3b.4	Subtotal Period 3b Period-Dependent Costs	54	1,002	12	2	-	29	37,288	5,685	44,072	44,072	-	-	-	582	-	-	-	11,636	19	440,607
3b.0	TOTAL PERIOD 3b COST	947	2,102	12	2	-	29	45,257	7,603	55,952	55,045	-	907	-	582	-	-	-	11,636	19,119	480,702
PERIOD 3 TOTALS		947	2,584	17	3	-	43	72,655	11,750	87,999	86,401	-	1,597	-	841	-	-	-	16,822	19,127	716,639
PERIOD 4a - Large Component Removal																					
Period 4a Direct Decommissioning Activities																					
Nuclear Steam Supply System Removal																					
4a.1.1.1	Reactor Coolant Piping	36	169	24	24	-	519	-	196	967	967	-	-	-	1,227	-	-	-	140,300	3,957	-
4a.1.1.2	Pressurizer Relief Tank	6	23	7	7	-	135	-	44	221	221	-	-	-	328	-	-	-	36,395	594	-
4a.1.1.3	Reactor Coolant Pumps & Motors	20	82	70	206	-	1,031	-	326	1,735	1,735	-	-	-	3,386	-	-	-	816,140	2,700	80
4a.1.1.4	Pressurizer	10	55	433	156	-	1,138	-	370	2,161	2,161	-	-	-	3,739	-	-	-	241,053	1,538	1,500
4a.1.1.5	Steam Generators	76	5,359	2,279	2,882	-	11,253	-	4,851	26,701	26,701	-	-	-	62,808	-	-	-	3,349,305	20,508	2,250
4a.1.1.6	Retired Steam Generator Units	-	-	2,279	2,882	-	11,116	-	3,439	19,716	19,716	-	-	-	62,808	-	-	-	3,349,305	10,800	2,250
4a.1.1.7	CRDMs/ICIs/Service Structure Removal	30	81	226	42	-	318	-	144	842	842	-	-	-	3,881	-	-	-	86,025	2,135	-
4a.1.1.8	Reactor Vessel Internals	55	3,199	9,914	698	-	13,904	279	12,074	40,125	40,125	-	-	-	2,437	501	406	-	327,518	26,217	1,181
4a.1.1.9	Vessel & Internals GTCC Disposal	-	-	-	-	-	10,749	-	1,612	12,361	12,361	-	-	-	-	-	-	2,217	433,180	-	-
4a.1.1.10	Reactor Vessel	95	6,030	2,008	1,086	-	3,087	279	6,929	19,514	19,514	-	-	-	9,361	-	-	-	960,909	26,217	1,181
4a.1.1	Totals	328	14,999	17,239	7,982	-	53,251	559	29,986	124,343	124,343	-	-	-	149,974	501	406	2,217	9,740,131	94,665	8,441
Removal of Major Equipment																					
4a.1.2	Main Turbine/Generator	-	438	2,841	421	-	12,168	-	3,499	19,366	19,366	-	-	-	54,809	-	-	-	3,622,746	8,721	-
4a.1.3	Main Condensers	-	1,240	1,438	980	-	15,731	-	4,534	23,923	23,923	-	-	-	64,324	-	-	-	4,251,703	24,802	-
Cascading Costs from Clean Building Demolition																					
4a.1.4.1	Reactor	-	915	-	-	-	-	-	137	1,052	1,052	-	-	-	-	-	-	-	-	10,442	-
4a.1.4.2	Auxiliary	-	466	-	-	-	-	-	70	536	536	-	-	-	-	-	-	-	-	5,551	-
4a.1.4.3	Fuel Building	-	227	-	-	-	-	-	34	261	261	-	-	-	-	-	-	-	-	2,395	-

Table F
Callaway Energy Center
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(thousands of 2014 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			
Cascading Costs from Clean Building Demolition (continued)																					
4a.1.4.4	Hot Machine Shop	-	1	-	-	-	-	-	0	1	1	-	-	-	-	-	-	-	-	16	-
4a.1.4.5	Radwaste	-	97	-	-	-	-	-	15	111	111	-	-	-	-	-	-	-	-	1,108	-
4a.1.4	Totals	-	1,705	-	-	-	-	-	256	1,961	1,961	-	-	-	-	-	-	-	-	19,512	-
Disposal of Plant Systems																					
4a.1.5.1	100 Aux.Bldg Non-System Specific RCA	-	688	108	83	-	1,336	-	529	2,745	2,745	-	-	-	5,463	-	-	-	361,115	13,677	-
4a.1.5.2	100 Auxiliary Bldg Non-System Specific	-	102	12	9	-	152	-	66	341	341	-	-	-	621	-	-	-	41,078	2,047	-
4a.1.5.3	AB - Main Steam	-	267	-	-	-	-	-	40	308	-	-	308	-	-	-	-	-	-	5,833	-
4a.1.5.4	AB - Main Steam RCA	-	78	33	24	-	379	-	121	634	634	-	-	-	1,547	-	-	-	102,339	1,580	-
4a.1.5.5	AC - Main Turbine	-	263	-	-	-	-	-	39	302	-	-	302	-	-	-	-	-	-	5,641	-
4a.1.5.6	AD - Condensate	-	290	-	-	-	-	-	43	333	-	-	333	-	-	-	-	-	-	6,144	-
4a.1.5.7	AE - Feedwater	-	200	-	-	-	-	-	30	229	-	-	229	-	-	-	-	-	-	4,271	-
4a.1.5.8	AF - Feedwater Heater Extraction	-	247	-	-	-	-	-	37	285	-	-	285	-	-	-	-	-	-	5,352	-
4a.1.5.9	AK - Condensate Demineralizer	-	91	-	-	-	-	-	14	105	-	-	105	-	-	-	-	-	-	1,944	-
4a.1.5.10	AL - Auxiliary Feedwater	-	40	-	-	-	-	-	6	46	-	-	46	-	-	-	-	-	-	852	-
4a.1.5.11	AQ - Condensate & Feedwater Chem Addtn	-	22	-	-	-	-	-	3	26	-	-	26	-	-	-	-	-	-	468	-
4a.1.5.12	BM - Steam Generator Blowdown	-	108	18	12	-	200	-	81	420	420	-	-	-	832	-	-	-	54,081	2,164	-
4a.1.5.13	BM - Steam Generator Blowdown - RCA	-	372	71	45	-	726	-	288	1,502	1,502	-	-	-	2,963	-	-	-	196,194	7,221	-
4a.1.5.14	BN - Borated Refueling Water Storage	-	306	90	66	-	1,067	-	362	1,892	1,892	-	-	-	4,482	-	-	-	288,402	6,282	-
4a.1.5.15	CA - Steam Seal	-	21	-	-	-	-	-	3	24	-	-	24	-	-	-	-	-	-	455	-
4a.1.5.16	CB - Main Turbine Lube Oil	-	59	-	-	-	-	-	9	68	-	-	68	-	-	-	-	-	-	1,207	-
4a.1.5.17	CC - Generator Hydrogen Seal & CO2	-	10	-	-	-	-	-	1	11	-	-	11	-	-	-	-	-	-	198	-
4a.1.5.18	CD - Generator Seal Oil	-	14	-	-	-	-	-	2	16	-	-	16	-	-	-	-	-	-	287	-
4a.1.5.19	CE - Stator Cooling Water	-	12	-	-	-	-	-	2	13	-	-	13	-	-	-	-	-	-	241	-
4a.1.5.20	CF - Lube Oil Storage Xfer & Prfication	-	39	-	-	-	-	-	6	44	-	-	44	-	-	-	-	-	-	812	-
4a.1.5.21	CG - Condenser Air Removal	-	31	-	-	-	-	-	5	36	-	-	36	-	-	-	-	-	-	657	-
4a.1.5.22	CH - Main Turbine Control Oil	-	60	-	-	-	-	-	9	69	-	-	69	-	-	-	-	-	-	1,219	-
4a.1.5.23	DA - Circulating Water	-	345	-	-	-	-	-	52	397	-	-	397	-	-	-	-	-	-	7,502	-
4a.1.5.24	DB - Cooling Tower Makeup & Blowdown	-	58	-	-	-	-	-	9	67	-	-	67	-	-	-	-	-	-	1,260	-
4a.1.5.25	DD - Cooling Water Chemical Control Sys	-	51	-	-	-	-	-	8	59	-	-	59	-	-	-	-	-	-	1,084	-
4a.1.5.26	DD - Cooling Wtr Chem Control RCA	-	274	65	39	-	630	-	238	1,246	1,246	-	-	-	2,569	-	-	-	170,188	5,095	-
4a.1.5.27	EJ - Residual Heat Removal	-	358	92	67	-	1,072	-	377	1,965	1,965	-	-	-	4,385	-	-	-	289,618	7,249	-
4a.1.5.28	EM - High Pressure Coolant Injection	-	304	39	24	-	391	-	181	940	940	-	-	-	1,599	-	-	-	105,795	5,976	-
4a.1.5.29	EN - Containment Spray	-	218	51	33	-	532	-	198	1,031	1,031	-	-	-	2,179	-	-	-	143,862	4,242	-
4a.1.5.30	EP - Accumulator Safety Injection	-	160	33	21	-	345	-	133	691	691	-	-	-	1,433	-	-	-	93,158	3,163	-
4a.1.5.31	FA - Auxiliary Steam Generator	-	24	-	-	-	-	-	4	27	-	-	27	-	-	-	-	-	-	521	-
4a.1.5.32	FB - Auxiliary Steam	-	98	-	-	-	-	-	15	112	-	-	112	-	-	-	-	-	-	2,106	-
4a.1.5.33	FB - Auxiliary Steam RCA	-	83	15	9	-	144	-	60	310	310	-	-	-	589	-	-	-	39,026	1,569	-
4a.1.5.34	FC - Auxiliary Turbines	-	63	-	-	-	-	-	9	72	-	-	72	-	-	-	-	-	-	1,320	-
4a.1.5.35	FE - Auxiliary Steam Chemical Addition	-	5	-	-	-	-	-	1	6	-	-	6	-	-	-	-	-	-	105	-
4a.1.5.36	GE - Turbine Building HVAC	-	175	-	-	-	-	-	26	201	-	-	201	-	-	-	-	-	-	3,957	-
4a.1.5.37	GS - Containment Hydrogen Control	-	70	13	9	-	141	-	55	288	288	-	-	-	577	-	-	-	38,159	1,415	-
4a.1.5.38	HE - Boron Recycle	-	461	72	49	-	786	-	326	1,694	1,694	-	-	-	3,280	-	-	-	212,463	9,046	-
4a.1.5.39	HF - Secondary Liquid Waste	-	903	165	114	-	1,833	-	717	3,732	3,732	-	-	-	7,644	-	-	-	495,358	18,015	-
4a.1.5.40	JA - Auxiliary Oil & Transfer	-	32	-	-	-	-	-	5	36	-	-	36	-	-	-	-	-	-	690	-
4a.1.5.41	KS - Bulk Chemical Storage	-	91	93	70	-	1,127	-	324	1,705	1,705	-	-	-	4,620	-	-	-	304,465	2,002	-
4a.1.5.42	LE - Oily Waste	-	179	-	-	-	-	-	27	206	-	-	206	-	-	-	-	-	-	3,865	-
4a.1.5.43	LE - Oily Waste RCA	-	237	36	25	-	397	-	166	862	862	-	-	-	1,623	-	-	-	107,381	4,372	-
4a.1.5.44	Turbine Bldg Non-System Specific	-	742	-	-	-	-	-	111	853	-	-	853	-	-	-	-	-	-	15,405	-
4a.1.5	Totals	-	8,248	1,004	702	-	11,258	-	4,738	25,949	21,998	-	3,951	-	46,409	-	-	-	3,042,681	168,513	-
4a.1.6	Scaffolding in support of decommissioning	-	1,464	24	17	-	266	-	437	2,208	2,208	-	-	-	1,087	-	-	-	71,859	33,634	-
4a.1	Subtotal Period 4a Activity Costs	328	28,094	22,546	10,101	-	92,674	559	43,450	197,750	193,799	-	3,951	-	316,603	501	406	2,217	20,729,120	349,847	8,441
Period 4a Additional Costs																					
4a.2.1	Remedial Action Surveys	-	-	-	-	-	-	1,399	420	1,819	1,819	-	-	-	-	-	-	-	-	28,645	-
4a.2	Subtotal Period 4a Additional Costs	-	-	-	-	-	-	1,399	420	1,819	1,819	-	-	-	-	-	-	-	-	28,645	-
Period 4a Collateral Costs																					
4a.3.1	Process decommissioning water waste	5	-	8	20	-	35	-	15	82	82	-	-	-	78	-	-	-	4,708	15	-
4a.3.3	Small tool allowance	-	288	-	-	-	-	-	43	331	298	-	33	-	-	-	-	-	-	-	-
4a.3.4	On-site survey and release of 60.87 tons clean metallic waste	-	-	-	-	-	-	84	8	92	92	-	-	-	-	-	-	-	-	-	-
4a.3	Subtotal Period 4a Collateral Costs	5	288	8	20	-	35	84	67	506	473	-	33	-	78	-	-	-	4,708	15	-

Table F
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
40-Year Operating Life with Direct Disposal of Low-Level Radioactive Waste
(thousands of 2014 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 Period-Dependent Costs																					
4a.4.1	Decon supplies	75	-	-	-	-	-	-	19	94	94	-	-	-	-	-	-	-	-	-	-
4a.4.2	Insurance	-	-	-	-	-	-	1,270	127	1,397	1,397	-	-	-	-	-	-	-	-	-	-
4a.4.3	Property taxes	-	-	-	-	-	-	386	39	424	382	-	42	-	-	-	-	-	-	-	-
4a.4.4	Health physics supplies	-	2,416	-	-	-	-	-	604	3,020	3,020	-	-	-	-	-	-	-	-	-	-
4a.4.5	Heavy equipment rental	-	2,771	-	-	-	-	-	416	3,187	3,187	-	-	-	-	-	-	-	-	-	-
4a.4.6	Disposal of DAW generated	-	-	100	20	-	250	-	75	445	445	-	-	-	4,929	-	-	-	98,589	161	-
4a.4.7	Plant energy budget	-	-	-	-	-	-	2,195	329	2,525	2,525	-	-	-	-	-	-	-	-	-	-
4a.4.8	NRC Fees	-	-	-	-	-	-	832	83	915	915	-	-	-	-	-	-	-	-	-	-
4a.4.9	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	552	83	635	635	-	-	-	-	-	-	-	-	-	-
4a.4.10	Corporate Allocations	-	-	-	-	-	-	1,378	138	1,516	1,516	-	-	-	-	-	-	-	-	-	-
4a.4.11	Security Staff Cost	-	-	-	-	-	-	2,767	415	3,182	3,182	-	-	-	-	-	-	-	-	-	89,821
4a.4.12	DOC Staff Cost	-	-	-	-	-	-	18,947	2,842	21,788	21,788	-	-	-	-	-	-	-	-	-	198,326
4a.4.13	Utility Staff Cost	-	-	-	-	-	-	27,104	4,066	31,170	31,170	-	-	-	-	-	-	-	-	-	359,286
4a.4	Subtotal Period 4a Period-Dependent Costs	75	5,187	100	20	-	250	55,430	9,235	70,298	70,255	-	42	-	4,929	-	-	-	98,589	161	647,433
4a.0	TOTAL PERIOD 4a COST	408	33,569	22,654	10,141	-	92,958	57,472	53,171	270,373	266,346	-	4,027	-	321,611	501	406	2,217	20,832,410	378,668	655,874
PERIOD 4b - Site Decontamination																					
Period 4b Direct Decommissioning Activities																					
4b.1.1	Remove spent fuel racks	753	82	293	107	-	1,709	-	870	3,814	3,814	-	-	-	6,988	-	-	-	461,925	1,925	-
Disposal of Plant Systems																					
4b.1.2.1	200 Reactor Bldg Non-System Specific	-	81	7	6	-	93	-	45	232	232	-	-	-	378	-	-	-	25,015	1,579	-
4b.1.2.2	200 Reactor Bldg Non-System Specific RCA	-	557	68	52	-	835	-	363	1,875	1,875	-	-	-	3,414	-	-	-	225,673	10,554	-
4b.1.2.3	300 Control Bldg Non-System Specific	-	176	30	23	-	375	-	144	748	748	-	-	-	1,532	-	-	-	101,230	3,471	-
4b.1.2.4	300 Control Bldg Non-System Specific Cln	-	1,394	-	-	-	-	-	209	1,603	-	-	1,603	-	-	-	-	-	-	29,076	-
4b.1.2.5	600 Fuel Bldg Non-Specific Systems RCA	-	306	45	35	-	561	-	226	1,173	1,173	-	-	-	2,292	-	-	-	151,497	5,946	-
4b.1.2.6	600 Fuel Bldg Non-System Specific	-	43	5	4	-	59	-	27	138	138	-	-	-	242	-	-	-	16,023	856	-
4b.1.2.7	700 Radwaste Bldg Non-Sys Specific RCA	-	1,131	180	138	-	2,221	-	877	4,547	4,547	-	-	-	9,083	-	-	-	600,401	22,261	-
4b.1.2.8	700 Radwaste Bldg Non-System Specific	-	164	19	15	-	245	-	107	550	550	-	-	-	1,002	-	-	-	66,210	3,278	-
4b.1.2.9	AN - Demineralized Wtr Storage & Xfer	-	153	-	-	-	-	-	23	176	-	-	176	-	-	-	-	-	-	3,283	-
4b.1.2.10	AN - Demineralized Wtr Strg & Xfer RCA	-	40	6	3	-	56	-	25	131	131	-	-	-	227	-	-	-	15,047	753	-
4b.1.2.11	AP - Condensate Storage & Transfer	-	89	-	-	-	-	-	13	102	-	-	102	-	-	-	-	-	-	1,794	-
4b.1.2.12	BB - Reactor Coolant System	-	309	62	45	-	716	-	269	1,400	1,400	-	-	-	2,987	-	-	-	193,423	6,379	-
4b.1.2.13	BG - Chemical & Volume Control	-	880	184	129	-	2,063	-	774	4,030	4,030	-	-	-	8,476	-	-	-	557,570	17,466	-
4b.1.2.14	BL - Reactor Makeup Water	-	280	48	33	-	532	-	213	1,107	1,107	-	-	-	2,234	-	-	-	143,824	5,547	-
4b.1.2.15	DE - Intake & Water Treatment	-	121	-	-	-	-	-	18	139	-	-	139	-	-	-	-	-	-	2,517	-
4b.1.2.16	DE - Intake & Water Treatment RCA	-	252	173	130	-	2,090	-	622	3,268	3,268	-	-	-	8,546	-	-	-	564,970	5,351	-
4b.1.2.17	EA - Service Water	-	144	-	-	-	-	-	22	166	-	-	166	-	-	-	-	-	-	3,145	-
4b.1.2.18	EA - Service Water RCA	-	45	18	14	-	219	-	70	366	366	-	-	-	895	-	-	-	59,193	876	-
4b.1.2.19	EB - Closed Cooling Water	-	59	-	-	-	-	-	9	68	-	-	68	-	-	-	-	-	-	1,267	-
4b.1.2.20	EC - Fuel Pool Cooling & Cleanup	-	367	65	45	-	725	-	286	1,489	1,489	-	-	-	2,965	-	-	-	196,026	7,264	-
4b.1.2.21	EF - Essential Service Water	-	334	-	-	-	-	-	50	385	-	-	385	-	-	-	-	-	-	7,244	-
4b.1.2.22	EF - Essential Service Water RCA	-	200	79	58	-	935	-	300	1,572	1,572	-	-	-	3,820	-	-	-	252,595	4,018	-
4b.1.2.23	EG - Component Cooling Water RCA	-	247	-	-	-	-	-	37	284	-	-	284	-	-	-	-	-	-	5,335	-
4b.1.2.24	GA - Plant Heating	-	89	-	-	-	-	-	13	102	-	-	102	-	-	-	-	-	-	1,912	-
4b.1.2.25	GA - Plant Heating RCA	-	97	13	7	-	114	-	55	285	285	-	-	-	463	-	-	-	30,707	1,795	-
4b.1.2.26	GA- Plant Heating Fuel Building	-	21	2	1	-	19	-	10	54	54	-	-	-	78	-	-	-	5,152	404	-
4b.1.2.27	GB - Central Chilled Water	-	84	-	-	-	-	-	13	96	-	-	96	-	-	-	-	-	-	1,803	-
4b.1.2.28	GB - Central Chilled Water RCA	-	26	4	2	-	33	-	16	81	81	-	-	-	136	-	-	-	8,983	490	-
4b.1.2.29	GD - Essential Serv Wtr Pumphouse HVAC	-	18	-	-	-	-	-	3	21	-	-	21	-	-	-	-	-	-	427	-
4b.1.2.30	GF - Miscellaneous Building HVAC	-	122	29	22	-	356	-	126	655	655	-	-	-	1,457	-	-	-	96,294	2,081	-
4b.1.2.31	GG - Fuel Building HVAC	-	232	54	43	-	691	-	243	1,263	1,263	-	-	-	2,825	-	-	-	186,756	4,129	-
4b.1.2.32	GH - Radwaste Building HVAC	-	170	35	28	-	449	-	162	844	844	-	-	-	1,834	-	-	-	121,259	3,054	-
4b.1.2.33	GK - Control Building HVAC	-	168	-	-	-	-	-	25	193	-	-	193	-	-	-	-	-	-	3,959	-
4b.1.2.34	GL - Auxiliary Building HVAC	-	422	75	59	-	943	-	357	1,856	1,856	-	-	-	3,855	-	-	-	254,809	7,470	-
4b.1.2.35	GM - Diesel Generator Building HVAC	-	29	-	-	-	-	-	4	34	-	-	34	-	-	-	-	-	-	695	-
4b.1.2.36	GN - Containment Cooling	-	465	116	90	-	1,449	-	504	2,624	2,624	-	-	-	5,923	-	-	-	391,577	8,572	-
4b.1.2.37	GP - Containment Intgratd Leak Rate Test	-	39	9	6	-	102	-	37	193	193	-	-	-	417	-	-	-	27,580	768	-
4b.1.2.38	GR - Containment Atmospheric Control	-	17	16	12	-	200	-	58	304	304	-	-	-	818	-	-	-	54,092	372	-
4b.1.2.39	GT - Containment Purge HVAC	-	109	30	24	-	383	-	130	676	676	-	-	-	1,566	-	-	-	103,488	2,016	-
4b.1.2.40	HA - Gaseous Radwaste	-	331	60	40	-	641	-	255	1,327	1,327	-	-	-	2,664	-	-	-	173,231	6,388	-
4b.1.2.41	HB - Liquid Radwaste	-	799	148	100	-	1,610	-	632	3,289	3,289	-	-	-	6,735	-	-	-	435,032	15,662	-
4b.1.2.42	HC - Solid Radwaste	-	341	64	45	-	729	-	281	1,459	1,459	-	-	-	3,006	-	-	-	196,927	6,719	-
4b.1.2.43	HD - Decontamination	-	94	19	13	-	212	-	80	418	418	-	-	-	877	-	-	-	57,198	1,855	-
4b.1.2.44	JE - Emergency Fuel Oil	-	62	-	-	-	-	-	9	71	-	-	71	-	-	-	-	-	-	1,260	-
4b.1.2.45	KA - Compressed Air	-	195	-	-	-	-	-	29	224	-	-	224	-	-	-	-	-	-	4,187	-

Table F
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
40-Year Operating Life with Direct Disposal of Low-Level Radioactive Waste
(thousands of 2014 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.1.2.46	KA - Compressed Air RCA	-	130	17	9	-	143	-	71	370	370	-	-	-	583	-	-	-	38,661	2,380	-
4b.1.2.47	KB - Breathing Air	-	24	-	-	-	-	-	4	28	-	-	28	-	-	-	-	-	-	516	-
4b.1.2.48	KB - Breathing Air RCA	-	20	2	1	-	13	-	8	43	43	-	-	-	52	-	-	-	3,439	406	-
4b.1.2.49	KC - Fire Protection	-	378	-	-	-	-	-	57	435	-	-	435	-	-	-	-	-	-	8,376	-
4b.1.2.50	KC - Fire Protection RCA	-	403	81	49	-	782	-	311	1,625	1,625	-	-	-	3,189	-	-	-	211,239	7,245	-
4b.1.2.51	KC- Fire Protection Fuel Building	-	119	23	14	-	220	-	89	464	464	-	-	-	896	-	-	-	59,340	2,166	-
4b.1.2.52	KD - Domestic Water	-	176	-	-	-	-	-	26	203	-	-	203	-	-	-	-	-	-	3,837	-
4b.1.2.53	KD - Domestic Water RCA	-	26	4	3	-	44	-	18	95	95	-	-	-	178	-	-	-	11,809	468	-
4b.1.2.54	KE - Fuel Handling & Storage Rctor vssl	-	17	12	10	-	154	-	45	238	238	-	-	-	632	-	-	-	41,743	349	-
4b.1.2.55	KH - Service Gas (CO2 N2 H2 & O2)	-	56	-	-	-	-	-	8	64	-	-	64	-	-	-	-	-	-	1,226	-
4b.1.2.56	KH - Service Gas (CO2 N2 H2 & O2) RCA	-	254	43	27	-	430	-	179	933	933	-	-	-	1,756	-	-	-	116,282	4,575	-
4b.1.2.57	KJ - Standby Diesel Engine	-	327	-	-	-	-	-	49	376	-	-	376	-	-	-	-	-	-	6,749	-
4b.1.2.58	LA - Sanitary Drains	-	44	-	-	-	-	-	7	51	-	-	51	-	-	-	-	-	-	972	-
4b.1.2.59	LA - Sanitary Drains RCA	-	106	21	14	-	224	-	87	452	452	-	-	-	916	-	-	-	60,583	1,854	-
4b.1.2.60	LB - Roof Drains	-	59	-	-	-	-	-	9	68	-	-	68	-	-	-	-	-	-	1,276	-
4b.1.2.61	LB - Roof Drains RCA	-	144	32	23	-	375	-	136	711	711	-	-	-	1,534	-	-	-	101,455	2,757	-
4b.1.2.62	LD - Chemical & Detergent Waste	-	110	13	9	-	140	-	65	336	336	-	-	-	574	-	-	-	37,788	2,159	-
4b.1.2.63	LF - Floor & Equipment Drains	-	1,353	177	128	-	2,056	-	889	4,603	4,603	-	-	-	8,419	-	-	-	555,570	26,325	-
4b.1.2.64	RM - Process Sampling & Analysis	-	123	18	11	-	176	-	78	406	406	-	-	-	717	-	-	-	47,503	2,481	-
4b.1.2.65	SJ - Nuclear Sampling	-	71	13	7	-	120	-	50	261	261	-	-	-	491	-	-	-	32,515	1,451	-
4b.1.2.66	UB - Servces Stores Site Security Bldg	-	177	-	-	-	-	-	27	204	-	-	204	-	-	-	-	-	-	3,815	-
4b.1.2.67	Yard Non-System Specific	-	29	-	-	-	-	-	4	33	-	-	33	-	-	-	-	-	-	603	-
4b.1.2	Totals	-	15,449	2,120	1,529	-	24,530	-	9,990	53,617	48,490	-	5,127	-	100,683	-	-	-	6,629,709	307,267	-
4b.1.3	Scaffolding in support of decommissioning	-	2,196	36	25	-	399	-	656	3,312	3,312	-	-	-	1,631	-	-	-	107,788	50,451	-
Decontamination of Site Buildings																					
4b.1.4.1	Reactor	1,115	1,610	162	619	-	2,547	-	1,706	7,759	7,759	-	-	-	29,220	-	-	-	2,420,236	48,617	-
4b.1.4.2	Auxiliary	581	225	39	65	-	478	-	480	1,868	1,868	-	-	-	3,646	-	-	-	260,859	15,280	-
4b.1.4.3	Communication Corridor - Contaminated	13	3	0	1	-	5	-	9	32	32	-	-	-	54	-	-	-	4,377	307	-
4b.1.4.4	Fuel Building	693	723	62	42	-	536	-	674	2,730	2,730	-	-	-	2,568	-	-	-	178,565	27,559	-
4b.1.4.5	Hot Machine Shop	16	6	0	1	-	3	-	10	37	37	-	-	-	51	-	-	-	4,446	421	-
4b.1.4.6	RAM Storage Building	40	8	1	3	-	10	-	25	86	86	-	-	-	133	-	-	-	10,093	920	-
4b.1.4.7	Radioactive and Personnel Tunnel	5	6	0	1	-	2	-	4	18	18	-	-	-	29	-	-	-	2,532	195	-
4b.1.4.8	Radwaste	309	104	16	32	-	209	-	239	909	909	-	-	-	1,669	-	-	-	126,675	7,826	-
4b.1.4.9	Radwaste Drum Storage	35	10	1	3	-	18	-	25	93	93	-	-	-	162	-	-	-	12,889	851	-
4b.1.4.10	Reactor Head Assembly Building	31	-	-	-	-	-	-	16	47	47	-	-	-	-	-	-	-	-	614	-
4b.1.4.11	Steam Generator Replacement Bldgs	211	-	-	-	-	-	-	105	316	316	-	-	-	-	-	-	-	-	3,885	-
4b.1.4	Totals	3,049	2,696	282	766	-	3,809	-	3,293	13,894	13,894	-	-	-	37,532	-	-	-	3,020,672	106,474	-
4b.1	Subtotal Period 4b Activity Costs	3,802	20,422	2,731	2,426	-	30,447	-	14,809	74,638	69,511	-	5,127	-	146,835	-	-	-	10,220,090	466,116	-
Period 4b Additional Costs																					
4b.2.1	License Termination Survey Planning	-	-	-	-	-	-	1,495	448	1,943	1,943	-	-	-	-	-	-	-	-	-	12,480
4b.2.2	Remedial Action Surveys	-	-	-	-	-	-	2,381	714	3,095	3,095	-	-	-	-	-	-	-	-	48,748	-
4b.2.3	Sanitary Treatment Lagoon	-	6	93	92	-	280	-	95	567	567	-	-	-	4,608	-	-	-	392,140	423	-
4b.2.4	Cooling Tower Asbestos Panel Removal	-	4,893	-	122	-	-	490	826	6,330	-	-	6,330	-	-	-	-	-	-	71,419	-
4b.2.5	Operational Equipment	-	-	17	92	-	1,083	-	286	1,478	1,478	-	-	-	11,710	-	-	-	292,750	32	-
4b.2.6	Retired Reactor Closure Head	-	113	552	895	-	768	-	410	2,738	2,738	-	-	-	2,764	-	-	-	338,540	3,157	2,000
4b.2	Subtotal Period 4b Additional Costs	-	5,012	662	1,201	-	2,131	4,366	2,779	16,152	9,822	-	6,330	-	19,082	-	-	-	1,023,430	123,780	14,480
Period 4b Collateral Costs																					
4b.3.1	Process decommissioning water waste	13	-	21	55	-	95	-	40	224	224	-	-	-	214	-	-	-	12,834	42	-
4b.3.3	Small tool allowance	-	434	-	-	-	-	-	65	499	499	-	-	-	-	-	-	-	-	-	-
4b.3.4	Decommissioning Equipment Disposition	-	-	118	81	-	1,294	-	347	1,840	1,840	-	-	-	5,290	-	-	-	349,678	88	-
4b.3.5	On-site survey and release of 297.3 tons clean metallic waste	-	-	-	-	-	-	410	41	451	451	-	-	-	-	-	-	-	-	-	-
4b.3	Subtotal Period 4b Collateral Costs	13	434	140	135	-	1,389	410	494	3,014	3,014	-	-	-	5,504	-	-	-	362,512	130	-
Period 4b Period-Dependent Costs																					
4b.4.1	Decon supplies	1,247	-	-	-	-	-	-	312	1,559	1,559	-	-	-	-	-	-	-	-	-	-
4b.4.2	Insurance	-	-	-	-	-	-	2,161	216	2,377	2,377	-	-	-	-	-	-	-	-	-	-
4b.4.3	Property taxes	-	-	-	-	-	-	656	66	722	722	-	-	-	-	-	-	-	-	-	-
4b.4.4	Health physics supplies	-	3,845	-	-	-	-	-	961	4,807	4,807	-	-	-	-	-	-	-	-	-	-
4b.4.5	Heavy equipment rental	-	4,669	-	-	-	-	-	700	5,369	5,369	-	-	-	-	-	-	-	-	-	-
4b.4.6	Disposal of DAW generated	-	-	135	27	-	336	-	102	600	600	-	-	-	6,638	-	-	-	132,753	216	-
4b.4.7	Plant energy budget	-	-	-	-	-	-	2,949	442	3,392	3,392	-	-	-	-	-	-	-	-	-	-
4b.4.8	NRC Fees	-	-	-	-	-	-	1,416	142	1,557	1,557	-	-	-	-	-	-	-	-	-	-
4b.4.9	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	940	141	1,081	1,081	-	-	-	-	-	-	-	-	-	-

Table F
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
40-Year Operating Life with Direct Disposal of Low-Level Radioactive Waste
(thousands of 2014 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 Period-Dependent Costs (continued)																					
4b.4.10	Corporate Allocations	-	-	-	-	-	-	2,345	235	2,580	2,580	-	-	-	-	-	-	-	-	-	-
4b.4.11	Security Staff Cost	-	-	-	-	-	-	4,709	706	5,415	5,415	-	-	-	-	-	-	-	-	-	152,857
4b.4.12	DOC Staff Cost	-	-	-	-	-	-	31,447	4,717	36,164	36,164	-	-	-	-	-	-	-	-	-	327,726
4b.4.13	Utility Staff Cost	-	-	-	-	-	-	43,754	6,563	50,318	50,318	-	-	-	-	-	-	-	-	-	577,189
4b.4	Subtotal Period 4b Period-Dependent Costs	1,247	8,514	135	27	-	336	90,377	15,303	115,940	115,940	-	-	-	6,638	-	-	-	132,753	216	1,057,771
4b.0	TOTAL PERIOD 4b COST	5,062	34,383	3,667	3,790	-	34,303	95,153	33,385	209,744	198,287	-	11,457	-	178,059	-	-	-	11,738,790	590,242	1,072,251
PERIOD 4f - License Termination																					
Period 4f Direct Decommissioning Activities																					
4f.1.1	ORISE confirmatory survey	-	-	-	-	-	-	163	49	212	212	-	-	-	-	-	-	-	-	-	-
4f.1.2	Terminate license									a											
4f.1	Subtotal Period 4f Activity Costs	-	-	-	-	-	-	163	49	212	212	-	-	-	-	-	-	-	-	-	-
Period 4f Additional Costs																					
4f.2.1	License Termination Survey	-	-	-	-	-	-	8,248	2,474	10,723	10,723	-	-	-	-	-	-	-	-	153,878	6,240
4f.2	Subtotal Period 4f Additional Costs	-	-	-	-	-	-	8,248	2,474	10,723	10,723	-	-	-	-	-	-	-	-	153,878	6,240
Period 4f Collateral Costs																					
4f.3.1	DOC staff relocation expenses	-	-	-	-	-	-	1,080	162	1,242	1,242	-	-	-	-	-	-	-	-	-	-
4f.3	Subtotal Period 4f Collateral Costs	-	-	-	-	-	-	1,080	162	1,242	1,242	-	-	-	-	-	-	-	-	-	-
Period 4f Period-Dependent Costs																					
4f.4.2	Property taxes	-	-	-	-	-	-	212	21	233	233	-	-	-	-	-	-	-	-	-	-
4f.4.3	Health physics supplies	-	736	-	-	-	-	-	184	920	920	-	-	-	-	-	-	-	-	-	-
4f.4.4	Disposal of DAW generated	-	-	7	1	-	18	-	5	32	32	-	-	-	353	-	-	-	7,050	11	-
4f.4.5	Plant energy budget	-	-	-	-	-	-	254	38	292	292	-	-	-	-	-	-	-	-	-	-
4f.4.6	NRC Fees	-	-	-	-	-	-	457	46	503	503	-	-	-	-	-	-	-	-	-	-
4f.4.7	Corporate Allocations	-	-	-	-	-	-	756	76	832	832	-	-	-	-	-	-	-	-	-	-
4f.4.8	Security Staff Cost	-	-	-	-	-	-	727	109	836	836	-	-	-	-	-	-	-	-	-	18,926
4f.4.9	DOC Staff Cost	-	-	-	-	-	-	5,685	853	6,538	6,538	-	-	-	-	-	-	-	-	-	57,566
4f.4.10	Utility Staff Cost	-	-	-	-	-	-	6,427	964	7,391	7,391	-	-	-	-	-	-	-	-	-	74,914
4f.4	Subtotal Period 4f Period-Dependent Costs	-	736	7	1	-	18	14,518	2,296	17,576	17,576	-	-	-	353	-	-	-	7,050	11	151,406
4f.0	TOTAL PERIOD 4f COST	-	736	7	1	-	18	24,009	4,981	29,752	29,752	-	-	-	353	-	-	-	7,050	153,889	157,646
PERIOD 4 TOTALS		5,470	68,688	26,328	13,933	-	127,279	176,634	91,538	509,869	494,385	-	15,483	-	500,022	501	406	2,217	32,578,250	1,122,800	1,885,771
PERIOD 5b - Site Restoration																					
Period 5b Direct Decommissioning Activities																					
Demolition of Remaining Site Buildings																					
5b.1.1.1	Reactor	-	5,191	-	-	-	-	-	779	5,969	-	-	5,969	-	-	-	-	-	-	59,292	-
5b.1.1.2	Auxiliary	-	4,194	-	-	-	-	-	629	4,823	-	-	4,823	-	-	-	-	-	-	49,968	-
5b.1.1.3	Auxiliary Boiler	-	39	-	-	-	-	-	6	45	-	-	45	-	-	-	-	-	-	619	-
5b.1.1.4	Barge Facility	-	1,595	-	-	-	-	-	239	1,834	-	-	1,834	-	-	-	-	-	-	18,771	-
5b.1.1.5	Circulating & Service Water Pumphouse	-	328	-	-	-	-	-	49	377	-	-	377	-	-	-	-	-	-	4,345	-
5b.1.1.6	Communication Corridor - Clean	-	1,346	-	-	-	-	-	202	1,548	-	-	1,548	-	-	-	-	-	-	17,215	-
5b.1.1.7	Communication Corridor - Contaminated	-	60	-	-	-	-	-	9	69	-	-	69	-	-	-	-	-	-	674	-
5b.1.1.8	Cooling Tower Concrete	-	918	-	-	-	-	-	138	1,056	-	-	1,056	-	-	-	-	-	-	13,472	-
5b.1.1.9	Diesel Generator	-	499	-	-	-	-	-	75	574	-	-	574	-	-	-	-	-	-	5,492	-
5b.1.1.10	Essential Service Water Pumphouse	-	306	-	-	-	-	-	46	352	-	-	352	-	-	-	-	-	-	3,938	-
5b.1.1.11	Fire Water Pumphouse	-	29	-	-	-	-	-	4	33	-	-	33	-	-	-	-	-	-	382	-
5b.1.1.12	Flex Building Storage	-	557	-	-	-	-	-	84	641	-	-	641	-	-	-	-	-	-	7,590	-
5b.1.1.13	Fuel Building	-	2,092	-	-	-	-	-	314	2,405	-	-	2,405	-	-	-	-	-	-	22,580	-
5b.1.1.14	Hot Machine Shop	-	25	-	-	-	-	-	4	29	-	-	29	-	-	-	-	-	-	417	-
5b.1.1.15	Intake	-	382	-	-	-	-	-	57	440	-	-	440	-	-	-	-	-	-	4,224	-
5b.1.1.16	Misc. Structures	-	2,487	-	-	-	-	-	373	2,861	-	-	2,861	-	-	-	-	-	-	27,921	-
5b.1.1.17	Miscellaneous Site Foundations	-	382	-	-	-	-	-	57	439	-	-	439	-	-	-	-	-	-	5,483	-
5b.1.1.18	Outage Maintenance	-	192	-	-	-	-	-	29	220	-	-	220	-	-	-	-	-	-	3,190	-
5b.1.1.19	RAM Storage Building	-	69	-	-	-	-	-	10	79	-	-	79	-	-	-	-	-	-	1,081	-
5b.1.1.20	Radioactive and Personnel Tunnel	-	29	-	-	-	-	-	4	34	-	-	34	-	-	-	-	-	-	386	-
5b.1.1.21	Radwaste	-	1,872	-	-	-	-	-	281	2,153	-	-	2,153	-	-	-	-	-	-	21,798	-
5b.1.1.22	Radwaste Drum Storage	-	279	-	-	-	-	-	42	321	-	-	321	-	-	-	-	-	-	3,840	-
5b.1.1.23	Reactor Head Assembly Building	-	81	-	-	-	-	-	12	94	-	-	94	-	-	-	-	-	-	1,357	-
5b.1.1.24	Security Additions	-	2,257	-	-	-	-	-	339	2,595	-	-	2,595	-	-	-	-	-	-	20,977	-

Table F
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
40-Year Operating Life with Direct Disposal of Low-Level Radioactive Waste
(thousands of 2014 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.1.1.25	Service	-	527	-	-	-	-	-	79	606	-	-	606	-	-	-	-	-	-	6,045	-
5b.1.1.26	Sludge Pump Station & Lagoon	-	26	-	-	-	-	-	4	30	-	-	30	-	-	-	-	-	-	313	-
5b.1.1.27	Steam Generator Replacement Bldgs	-	1,231	-	-	-	-	-	185	1,415	-	-	1,415	-	-	-	-	-	-	15,693	-
5b.1.1.28	Turbine Building	-	3,580	-	-	-	-	-	537	4,117	-	-	4,117	-	-	-	-	-	-	55,694	-
5b.1.1.29	Turbine Pedestal	-	1,092	-	-	-	-	-	164	1,256	-	-	1,256	-	-	-	-	-	-	10,928	-
5b.1.1.30	U.H.S. Cooling Tower	-	662	-	-	-	-	-	99	761	-	-	761	-	-	-	-	-	-	6,681	-
5b.1.1.31	Water Treatment Plant	-	1	-	-	-	-	-	0	1	-	-	1	-	-	-	-	-	-	9	-
5b.1.1	Totals	-	32,329	-	-	-	-	-	4,849	37,178	-	-	37,178	-	-	-	-	-	-	390,372	-
Site Closeout Activities																					
5b.1.2	BackFill Site	-	8,631	-	-	-	-	-	1,295	9,926	-	-	9,926	-	-	-	-	-	-	15,861	-
5b.1.3	Grade & landscape site	-	132	-	-	-	-	-	20	152	-	-	152	-	-	-	-	-	-	592	-
5b.1.4	Final report to NRC	-	-	-	-	-	-	197	30	226	226	-	-	-	-	-	-	-	-	-	1,560
5b.1	Subtotal Period 5b Activity Costs	-	41,092	-	-	-	-	197	6,193	47,482	226	-	47,256	-	-	-	-	-	-	406,825	1,560
Period 5b Additional Costs																					
5b.2.1	Concrete Crushing	-	1,194	-	-	-	-	9	180	1,384	-	-	1,384	-	-	-	-	-	-	5,976	-
5b.2.2	Mine Area Backfill	-	4,988	-	-	-	-	-	748	5,736	-	-	5,736	-	-	-	-	-	-	15,960	-
5b.2.3	Cooling Tower Discharge & Intake Pipe Flow Fill	-	3,778	-	-	-	-	-	567	4,345	-	-	4,345	-	-	-	-	-	-	9,588	-
5b.2.4	Cooling Tower Demolition	-	4,272	-	-	-	-	-	641	4,913	-	-	4,913	-	-	-	-	-	-	21,619	-
5b.2.5	Excavation of Underground Services	-	1,668	-	-	-	-	761	364	2,793	-	-	2,793	-	-	-	-	-	-	14,164	-
5b.2.6	Construction Debris	-	-	-	-	-	-	2,480	372	2,852	-	-	2,852	-	-	-	-	-	-	-	-
5b.2	Subtotal Period 5b Additional Costs	-	15,901	-	-	-	-	3,250	2,873	22,023	-	-	22,023	-	-	-	-	-	-	67,307	-
Period 5b Collateral Costs																					
5b.3.1	Small tool allowance	-	402	-	-	-	-	-	60	462	-	-	462	-	-	-	-	-	-	-	-
5b.3.2	Corporate Allocations	-	-	-	-	-	-	1,504	150	1,655	-	-	1,655	-	-	-	-	-	-	-	-
5b.3	Subtotal Period 5b Collateral Costs	-	402	-	-	-	-	1,504	211	2,117	-	-	2,117	-	-	-	-	-	-	-	-
Period 5b Period-Dependent Costs																					
5b.4.2	Property taxes	-	-	-	-	-	-	421	42	463	-	-	463	-	-	-	-	-	-	-	-
5b.4.3	Heavy equipment rental	-	4,254	-	-	-	-	-	638	4,892	-	-	4,892	-	-	-	-	-	-	-	-
5b.4.4	Plant energy budget	-	-	-	-	-	-	252	38	290	-	-	290	-	-	-	-	-	-	-	-
5b.4.5	Security Staff Cost	-	-	-	-	-	-	1,446	217	1,663	-	-	1,663	-	-	-	-	-	-	-	37,646
5b.4.6	DOC Staff Cost	-	-	-	-	-	-	11,002	1,650	12,652	-	-	12,652	-	-	-	-	-	-	-	106,663
5b.4.7	Utility Staff Cost	-	-	-	-	-	-	5,200	780	5,980	-	-	5,980	-	-	-	-	-	-	-	61,174
5b.4	Subtotal Period 5b Period-Dependent Costs	-	4,254	-	-	-	-	18,321	3,365	25,940	-	-	25,940	-	-	-	-	-	-	-	205,483
5b.0	TOTAL PERIOD 5b COST	-	61,649	-	-	-	-	23,272	12,642	97,563	226	-	97,336	-	-	-	-	-	-	474,132	207,043
PERIOD 5 TOTALS		-	61,649	-	-	-	-	23,272	12,642	97,563	226	-	97,336	-	-	-	-	-	-	474,132	207,043
TOTAL COST TO DECOMMISSION		**11,857**	**140,557**	**26,720**	**14,548**	**-**	**128,701**	**668,212**	**176,503**	**1,167,098**	**963,293**	**89,388**	**114,417**	**-**	**510,496**	**501**	**406**	**2,217**	**32,878,460**	**1,694,392**	**7,484,788**

TOTAL COST TO DECOMMISSION WITH 17.82% CONTINGENCY:	**$1,167,098**	**thousands of 2014 dollars**
TOTAL NRC LICENSE TERMINATION COST IS 82.54% OR:	**$963,293**	**thousands of 2014 dollars**
SPENT FUEL MANAGEMENT COST IS 7.66% OR:	**$89,388**	**thousands of 2014 dollars**
NON-NUCLEAR DEMOLITION COST IS 9.8% OR:	**$114,417**	**thousands of 2014 dollars**
TOTAL LOW-LEVEL RADIOACTIVE WASTE VOLUME BURIED (EXCLUDING GTCC):	**511,403**	**cubic feet**
TOTAL GREATER THAN CLASS C RADWASTE VOLUME GENERATED:	**2,217**	**cubic feet**
TOTAL SCRAP METAL REMOVED:	**68,515**	**tons**
TOTAL CRAFT LABOR REQUIREMENTS:	**1,694,392**	**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

DECON ALTERNATIVE DECOMMISSIONING COST ESTIMATE
60-YEAR OPERATING LIFE with
LOW-LEVEL RADIOACTIVE WASTE PROCESSING

TABLE G-1
DECON ALTERNATIVE
60-YEAR PLANT OPERATING LIFE with
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
TOTAL ANNUAL EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other [1]	Total [2]
2044	13,836	1,655	396	8	1,612	17,507
2045	70,021	10,773	2,325	2,016	12,890	98,024
2046	79,218	29,003	2,437	33,861	24,285	168,804
2047	78,126	31,219	1,809	42,108	20,099	173,361
2048	69,172	14,561	1,450	10,079	8,664	103,926
2049	68,983	14,522	1,446	10,051	8,641	103,642
2050	49,657	8,492	956	8,271	6,289	73,664
2051	34,224	9,547	331	21	2,424	46,547
2052	32,080	29,448	193	0	3,320	65,042
2053	7,012	6,437	42	0	726	14,217
Total	502,328	155,657	11,386	106,415	88,948	864,734

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

TABLE G-1a
DECON ALTERNATIVE
60-YEAR PLANT OPERATING LIFE with
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
LICENSE TERMINATION EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2044	13,276	379	396	8	1,066	15,125
2045	67,064	4,573	2,325	2,016	10,232	86,209
2046	75,013	22,852	2,437	33,861	22,036	156,197
2047	73,677	25,015	1,809	42,108	18,007	160,616
2048	63,256	7,458	1,450	10,079	6,315	88,559
2049	63,084	7,438	1,446	10,051	6,298	88,317
2050	47,911	6,396	956	8,271	5,595	69,129
2051	25,239	1,259	277	21	1,489	28,286
2052	151	0	0	0	0	151
2053	33	0	0	0	0	33
Total	428,704	75,369	11,096	106,415	71,038	692,622

TABLE G-1b
DECON ALTERNATIVE
60-YEAR PLANT OPERATING LIFE with
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
SPENT FUEL MANAGEMENT EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2044	425	1,276	0	0	546	2,248
2045	2,067	6,200	0	0	2,658	10,924
2046	2,029	6,086	0	0	2,228	10,342
2047	2,023	6,070	0	0	2,045	10,138
2048	2,112	6,335	0	0	2,050	10,497
2049	2,106	6,318	0	0	2,045	10,469
2050	623	1,869	0	0	605	3,098
2051	0	0	0	0	0	0
2052	0	0	0	0	0	0
2053	0	0	0	0	0	0
Total	11,385	34,155	0	0	12,176	57,716

TABLE G-1c
DECON ALTERNATIVE
60-YEAR PLANT OPERATING LIFE with
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
SITE RESTORATION EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2044	135	0	0	0	0	135
2045	890	0	0	0	0	890
2046	2,176	66	0	0	22	2,264
2047	2,425	134	0	0	47	2,607
2048	3,803	768	0	0	299	4,870
2049	3,793	766	0	0	298	4,857
2050	1,122	227	0	0	88	1,437
2051	8,986	8,287	54	0	934	18,262
2052	31,929	29,448	193	0	3,320	64,891
2053	6,979	6,437	42	0	726	14,184
Total	62,239	46,133	290	0	5,734	114,396

Table G-2
Callaway Energy Center
DECON Alternative Decommissioning Cost Estimate
60-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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	-	-	-	-	-	-	164	25	189	189	-	-	-	-	-	-	-	-	-	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	-	-	-	-	-	-	252	38	290	290	-	-	-	-	-	-	-	-	-	2,000
1a.1.7	Review plant dwgs & specs.	-	-	-	-	-	-	580	87	667	667	-	-	-	-	-	-	-	-	-	4,600
1a.1.8	Perform detailed rad survey									a											
1a.1.9	Estimate by-product inventory	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1a.1.10	End product description	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1a.1.11	Detailed by-product inventory	-	-	-	-	-	-	164	25	189	189	-	-	-	-	-	-	-	-	-	1,300
1a.1.12	Define major work sequence	-	-	-	-	-	-	946	142	1,088	1,088	-	-	-	-	-	-	-	-	-	7,500
1a.1.13	Perform SER and EA	-	-	-	-	-	-	391	59	450	450	-	-	-	-	-	-	-	-	-	3,100
1a.1.14	Perform Site-Specific Cost Study	-	-	-	-	-	-	630	95	725	725	-	-	-	-	-	-	-	-	-	5,000
1a.1.15	Prepare/submit License Termination Plan	-	-	-	-	-	-	516	77	594	594	-	-	-	-	-	-	-	-	-	4,096
1a.1.16	Receive NRC approval of termination plan									a											
Activity Specifications																					
1a.1.17.1	Plant & temporary facilities	-	-	-	-	-	-	620	93	713	642	-	71	-	-	-	-	-	-	-	4,920
1a.1.17.2	Plant systems	-	-	-	-	-	-	525	79	604	544	-	60	-	-	-	-	-	-	-	4,167
1a.1.17.3	NSSS Decontamination Flush	-	-	-	-	-	-	63	9	73	73	-	-	-	-	-	-	-	-	-	500
1a.1.17.4	Reactor internals	-	-	-	-	-	-	895	134	1,030	1,030	-	-	-	-	-	-	-	-	-	7,100
1a.1.17.5	Reactor vessel	-	-	-	-	-	-	820	123	943	943	-	-	-	-	-	-	-	-	-	6,500
1a.1.17.6	Biological shield	-	-	-	-	-	-	63	9	73	73	-	-	-	-	-	-	-	-	-	500
1a.1.17.7	Steam generators	-	-	-	-	-	-	393	59	452	452	-	-	-	-	-	-	-	-	-	3,120
1a.1.17.8	Reinforced concrete	-	-	-	-	-	-	202	30	232	116	-	116	-	-	-	-	-	-	-	1,600
1a.1.17.9	Main Turbine	-	-	-	-	-	-	50	8	58	-	-	58	-	-	-	-	-	-	-	400
1a.1.17.10	Main Condensers	-	-	-	-	-	-	50	8	58	-	-	58	-	-	-	-	-	-	-	400
1a.1.17.11	Plant structures & buildings	-	-	-	-	-	-	393	59	452	226	-	226	-	-	-	-	-	-	-	3,120
1a.1.17.12	Waste management	-	-	-	-	-	-	580	87	667	667	-	-	-	-	-	-	-	-	-	4,600
1a.1.17.13	Facility & site closeout	-	-	-	-	-	-	113	17	131	65	-	65	-	-	-	-	-	-	-	900
1a.1.17	Total	-	-	-	-	-	-	4,770	715	5,485	4,830	-	655	-	-	-	-	-	-	-	37,827
Planning & Site Preparations																					
1a.1.18	Prepare dismantling sequence	-	-	-	-	-	-	303	45	348	348	-	-	-	-	-	-	-	-	-	2,400
1a.1.19	Plant prep. & temp. svces	-	-	-	-	-	-	3,000	450	3,450	3,450	-	-	-	-	-	-	-	-	-	-
1a.1.20	Design water clean-up system	-	-	-	-	-	-	177	26	203	203	-	-	-	-	-	-	-	-	-	1,400
1a.1.21	Rigging/Cont. Cntrl Envlps/tooling/etc.	-	-	-	-	-	-	2,300	345	2,645	2,645	-	-	-	-	-	-	-	-	-	-
1a.1.22	Procure casks/liners & containers	-	-	-	-	-	-	155	23	178	178	-	-	-	-	-	-	-	-	-	1,230
1a.1	Subtotal Period 1a Activity Costs	-	-	-	-	-	-	14,599	2,190	16,789	16,134	-	655	-	-	-	-	-	-	-	73,753
Period 1a Collateral Costs																					
1a.3.1	Spent Fuel Transfer	-	-	-	-	-	-	7,200	1,080	8,280	-	8,280	-	-	-	-	-	-	-	-	-
1a.3	Subtotal Period 1a Collateral Costs	-	-	-	-	-	-	7,200	1,080	8,280	-	8,280	-	-	-	-	-	-	-	-	-
Period 1a Period-Dependent Costs																					
1a.4.1	Insurance	-	-	-	-	-	-	1,902	190	2,092	2,092	-	-	-	-	-	-	-	-	-	-
1a.4.2	Property taxes	-	-	-	-	-	-	280	28	308	308	-	-	-	-	-	-	-	-	-	-
1a.4.3	Health physics supplies	-	497	-	-	-	-	-	124	621	621	-	-	-	-	-	-	-	-	-	-
1a.4.4	Heavy equipment rental	-	523	-	-	-	-	-	78	602	602	-	-	-	-	-	-	-	-	-	-
1a.4.5	Disposal of DAW generated	-	-	12	3	-	31	-	9	55	55	-	-	-	610	-	-	-	12,190	20	-
1a.4.6	Plant energy budget	-	-	-	-	-	-	1,677	252	1,928	1,928	-	-	-	-	-	-	-	-	-	-
1a.4.7	NRC Fees	-	-	-	-	-	-	1,181	118	1,299	1,299	-	-	-	-	-	-	-	-	-	-
1a.4.8	Emergency Planning Fees	-	-	-	-	-	-	1,490	149	1,638	-	1,638	-	-	-	-	-	-	-	-	-
1a.4.9	INPO Fees	-	-	-	-	-	-	336	50	386	386	-	-	-	-	-	-	-	-	-	-
1a.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	791	119	910	-	910	-	-	-	-	-	-	-	-	-
1a.4.11	ISFSI Operating Costs	-	-	-	-	-	-	95	14	110	-	110	-	-	-	-	-	-	-	-	-
1a.4.12	Corporate Allocations	-	-	-	-	-	-	1,000	100	1,100	1,100	-	-	-	-	-	-	-	-	-	-
1a.4.13	Security Staff Cost	-	-	-	-	-	-	11,224	1,684	12,908	12,908	-	-	-	-	-	-	-	-	-	275,314
1a.4.14	Utility Staff Cost	-	-	-	-	-	-	31,458	4,719	36,177	36,177	-	-	-	-	-	-	-	-	-	423,400
1a.4	Subtotal Period 1a Period-Dependent Costs	-	1,020	12	3	-	31	51,433	7,634	60,133	57,475	2,658	-	-	610	-	-	-	12,190	20	698,714

Table G-2
Callaway Energy Center
DECON Alternative Decommissioning Cost Estimate
60-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
1a.0	TOTAL PERIOD 1a COST	-	1,020	12	3	-	31	73,233	10,904	85,203	73,610	10,938	655	-	610	-	-	-	12,190	20	772,467
PERIOD 1b - Decommissioning Preparations																					
Period 1b Direct Decommissioning Activities																					
Detailed Work Procedures																					
1b.1.1.1	Plant systems	-	-	-	-	-	-	597	90	686	618	-	69	-	-	-	-	-	-	-	4,733
1b.1.1.2	NSSS Decontamination Flush	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.3	Reactor internals	-	-	-	-	-	-	315	47	363	363	-	-	-	-	-	-	-	-	-	2,500
1b.1.1.4	Remaining buildings	-	-	-	-	-	-	170	26	196	49	-	147	-	-	-	-	-	-	-	1,350
1b.1.1.5	CRD cooling assembly	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.6	CRD housings & ICI tubes	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.7	Incore instrumentation	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.8	Reactor vessel	-	-	-	-	-	-	458	69	526	526	-	-	-	-	-	-	-	-	-	3,630
1b.1.1.9	Facility closeout	-	-	-	-	-	-	151	23	174	87	-	87	-	-	-	-	-	-	-	1,200
1b.1.1.10	Missile shields	-	-	-	-	-	-	57	9	65	65	-	-	-	-	-	-	-	-	-	450
1b.1.1.11	Biological shield	-	-	-	-	-	-	151	23	174	174	-	-	-	-	-	-	-	-	-	1,200
1b.1.1.12	Steam generators	-	-	-	-	-	-	580	87	667	667	-	-	-	-	-	-	-	-	-	4,600
1b.1.1.13	Reinforced concrete	-	-	-	-	-	-	126	19	145	73	-	73	-	-	-	-	-	-	-	1,000
1b.1.1.14	Main Turbine	-	-	-	-	-	-	197	30	226	-	-	226	-	-	-	-	-	-	-	1,560
1b.1.1.15	Main Condensers	-	-	-	-	-	-	197	30	226	-	-	226	-	-	-	-	-	-	-	1,560
1b.1.1.16	Auxiliary building	-	-	-	-	-	-	344	52	396	356	-	40	-	-	-	-	-	-	-	2,730
1b.1.1.17	Reactor building	-	-	-	-	-	-	344	52	396	356	-	40	-	-	-	-	-	-	-	2,730
1b.1.1	Total	-	-	-	-	-	-	4,192	629	4,820	3,914	-	907	-	-	-	-	-	-	-	33,243
1b.1.2	Decon primary loop	648	-	-	-	-	-	-	324	971	971	-	-	-	-	-	-	-	-	1,067	-
1b.1	Subtotal Period 1b Activity Costs	648	-	-	-	-	-	4,192	953	5,792	4,885	-	907	-	-	-	-	-	-	1,067	33,243
Period 1b Additional Costs																					
1b.2.1	Spent fuel pool isolation	-	-	-	-	-	-	10,813	1,622	12,434	12,434	-	-	-	-	-	-	-	-	-	-
1b.2.2	Site Characterization	-	-	-	-	-	-	2,824	847	3,671	3,671	-	-	-	-	-	-	-	-	19,100	7,852
1b.2	Subtotal Period 1b Additional Costs	-	-	-	-	-	-	13,636	2,469	16,105	16,105	-	-	-	-	-	-	-	-	19,100	7,852
Period 1b Collateral Costs																					
1b.3.1	Decon equipment	893	-	-	-	-	-	-	134	1,026	1,026	-	-	-	-	-	-	-	-	-	-
1b.3.2	DOC staff relocation expenses	-	-	-	-	-	-	1,080	162	1,242	1,242	-	-	-	-	-	-	-	-	-	-
1b.3.3	Process decommissioning water waste	45	-	28	73	-	126	-	68	339	339	-	-	-	283	-	-	-	16,989	55	-
1b.3.4	Process decommissioning chemical flush waste	2	-	75	280	-	3,753	-	989	5,098	5,098	-	-	-	-	788	-	-	83,917	147	-
1b.3.5	Small tool allowance	-	2	-	-	-	-	-	0	2	2	-	-	-	-	-	-	-	-	-	-
1b.3.6	Pipe cutting equipment	-	1,100	-	-	-	-	-	165	1,265	1,265	-	-	-	-	-	-	-	-	-	-
1b.3.7	Decon rig	1,500	-	-	-	-	-	-	225	1,725	1,725	-	-	-	-	-	-	-	-	-	-
1b.3.8	Spent Fuel Transfer	-	-	-	-	-	-	3,600	540	4,140	-	4,140	-	-	-	-	-	-	-	-	-
1b.3	Subtotal Period 1b Collateral Costs	2,439	1,102	103	352	-	3,878	4,680	2,282	14,837	10,697	4,140	-	-	283	788	-	-	100,906	203	-
Period 1b Period-Dependent Costs																					
1b.4.1	Decon supplies	27	-	-	-	-	-	-	7	34	34	-	-	-	-	-	-	-	-	-	-
1b.4.2	Insurance	-	-	-	-	-	-	959	96	1,055	1,055	-	-	-	-	-	-	-	-	-	-
1b.4.3	Property taxes	-	-	-	-	-	-	141	14	155	155	-	-	-	-	-	-	-	-	-	-
1b.4.4	Health physics supplies	-	281	-	-	-	-	-	70	351	351	-	-	-	-	-	-	-	-	-	-
1b.4.5	Heavy equipment rental	-	264	-	-	-	-	-	40	303	303	-	-	-	-	-	-	-	-	-	-
1b.4.6	Disposal of DAW generated	-	-	7	1	-	18	-	6	33	33	-	-	-	360	-	-	-	7,197	12	-
1b.4.7	Plant energy budget	-	-	-	-	-	-	1,691	254	1,944	1,944	-	-	-	-	-	-	-	-	-	-
1b.4.8	NRC Fees	-	-	-	-	-	-	348	35	383	383	-	-	-	-	-	-	-	-	-	-
1b.4.9	Emergency Planning Fees	-	-	-	-	-	-	751	75	826	-	826	-	-	-	-	-	-	-	-	-
1b.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	399	60	459	-	459	-	-	-	-	-	-	-	-	-
1b.4.11	ISFSI Operating Costs	-	-	-	-	-	-	48	7	55	-	55	-	-	-	-	-	-	-	-	-
1b.4.12	Corporate Allocations	-	-	-	-	-	-	504	50	555	555	-	-	-	-	-	-	-	-	-	-
1b.4.13	Security Staff Cost	-	-	-	-	-	-	5,141	771	5,913	5,913	-	-	-	-	-	-	-	-	-	124,910
1b.4.14	DOC Staff Cost	-	-	-	-	-	-	6,322	948	7,271	7,271	-	-	-	-	-	-	-	-	-	64,137
1b.4.15	Utility Staff Cost	-	-	-	-	-	-	15,943	2,392	18,335	18,335	-	-	-	-	-	-	-	-	-	214,491
1b.4	Subtotal Period 1b Period-Dependent Costs	27	545	7	1	-	18	32,248	4,824	37,671	36,331	1,340	-	-	360	-	-	-	7,197	12	403,538
1b.0	TOTAL PERIOD 1b COST	3,114	1,647	111	354	-	3,897	54,755	10,528	74,405	68,019	5,480	907	-	643	788	-	-	108,103	20,381	444,633
PERIOD 1 TOTALS		3,114	2,666	123	356	-	3,928	127,988	21,432	159,608	141,628	16,418	1,562	-	1,253	788	-	-	120,293	20,401	1,217,100

Table G-2
Callaway Energy Center
DECON Alternative Decommissioning Cost Estimate
60-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
PERIOD 2a - Large Component Removal																					
Period 2a Direct Decommissioning Activities																					
Nuclear Steam Supply System Removal																					
2a.1.1.1	Reactor Coolant Piping	174	186	24	32	-	519	-	270	1,205	1,205	-	-	-	1,227	-	-	-	140,300	6,838	-
2a.1.1.2	Pressurizer Relief Tank	29	25	7	9	-	135	-	57	262	262	-	-	-	328	-	-	-	36,395	1,068	-
2a.1.1.3	Reactor Coolant Pumps & Motors	89	93	134	220	-	1,031	-	372	1,938	1,938	-	-	-	3,386	-	-	-	816,140	4,188	100
2a.1.1.4	Pressurizer	47	55	621	168	-	1,138	-	409	2,437	2,437	-	-	-	3,739	-	-	-	293,734	2,534	1,875
2a.1.1.5	Steam Generators	369	5,359	3,228	2,742	2,599	7,066	-	4,415	25,780	25,780	-	-	40,262	23,217	-	-	-	3,570,150	23,233	3,500
2a.1.1.6	Retired Steam Generator Units	-	-	2,358	2,691	2,599	6,862	-	2,745	17,256	17,256	-	-	40,262	22,546	-	-	-	3,349,305	10,800	2,250
2a.1.1.7	CRDMs/ICIs/Service Structure Removal	148	83	226	55	-	318	-	205	1,035	1,035	-	-	-	3,881	-	-	-	86,025	4,285	-
2a.1.1.8	Reactor Vessel Internals	132	3,560	10,594	1,506	-	18,554	330	15,088	49,763	49,763	-	-	-	1,878	963	393	-	329,968	31,550	1,394
2a.1.1.9	Vessel & Internals GTCC Disposal	-	-	-	-	-	10,749	-	1,612	12,361	12,361	-	-	-	-	-	-	2,217	433,180	-	-
2a.1.1.10	Reactor Vessel	110	6,391	2,412	1,120	-	3,107	330	7,334	20,803	20,803	-	-	-	9,391	-	-	-	961,214	31,550	1,394
2a.1.1	Totals	1,098	15,753	19,603	8,543	5,199	49,479	660	32,507	132,841	132,841	-	-	80,523	69,593	963	393	2,217	10,016,410	116,046	10,513
Removal of Major Equipment																					
2a.1.2	Main Turbine/Generator	-	496	397	34	608	608	-	412	2,556	2,556	-	-	4,921	2,740	-	-	-	476,404	9,888	-
2a.1.3	Main Condensers	-	1,383	228	81	714	787	-	685	3,878	3,878	-	-	7,701	3,216	-	-	-	559,114	27,762	-
Cascading Costs from Clean Building Demolition																					
2a.1.4.1	Reactor	-	915	-	-	-	-	-	137	1,052	1,052	-	-	-	-	-	-	-	-	10,442	-
2a.1.4.2	Auxiliary	-	466	-	-	-	-	-	70	536	536	-	-	-	-	-	-	-	-	5,551	-
2a.1.4.3	Hot Machine Shop	-	1	-	-	-	-	-	0	1	1	-	-	-	-	-	-	-	-	16	-
2a.1.4.4	Radwaste	-	97	-	-	-	-	-	15	111	111	-	-	-	-	-	-	-	-	1,108	-
2a.1.4.5	Fuel Building	-	227	-	-	-	-	-	34	261	261	-	-	-	-	-	-	-	-	2,395	-
2a.1.4	Totals	-	1,705	-	-	-	-	-	256	1,961	1,961	-	-	-	-	-	-	-	-	19,512	-
Disposal of Plant Systems																					
2a.1.5.1	100 Aux.Bldg Non-System Specific RCA	-	688	12	29	638	-	-	273	1,640	1,640	-	-	7,629	-	-	-	-	309,812	13,471	-
2a.1.5.2	100 Auxiliary Bldg Non-System Specific	-	113	6	6	40	69	-	53	287	287	-	-	474	282	-	-	-	37,889	2,282	-
2a.1.5.3	AB - Main Steam	-	267	-	-	-	-	-	40	308	-	-	308	-	-	-	-	-	-	5,833	-
2a.1.5.4	AB - Main Steam RCA	-	78	3	8	180	-	-	48	318	318	-	-	2,156	-	-	-	-	87,550	1,515	-
2a.1.5.5	AC - Main Turbine	-	263	-	-	-	-	-	39	302	-	-	302	-	-	-	-	-	-	5,641	-
2a.1.5.6	AD - Condensate	-	290	-	-	-	-	-	43	333	-	-	333	-	-	-	-	-	-	6,144	-
2a.1.5.7	AE - Feedwater	-	200	-	-	-	-	-	30	229	-	-	229	-	-	-	-	-	-	4,271	-
2a.1.5.8	AF - Feedwater Heater Extraction	-	247	-	-	-	-	-	37	285	-	-	285	-	-	-	-	-	-	5,352	-
2a.1.5.9	AK - Condensate Demineralizer	-	91	-	-	-	-	-	14	105	-	-	105	-	-	-	-	-	-	1,944	-
2a.1.5.10	AL - Auxiliary Feedwater	-	40	-	-	-	-	-	6	46	-	-	46	-	-	-	-	-	-	852	-
2a.1.5.11	AQ - Condensate & Feedwater Chem Addtn	-	22	-	-	-	-	-	3	26	-	-	26	-	-	-	-	-	-	468	-
2a.1.5.12	BM - Steam Generator Blowdown	-	119	6	6	75	46	-	54	307	307	-	-	892	191	-	-	-	48,810	2,394	-
2a.1.5.13	BM - Steam Generator Blowdown - RCA	-	372	6	15	344	-	-	147	885	885	-	-	4,109	-	-	-	-	166,857	7,066	-
2a.1.5.14	BN - Borated Refueling Water Storage	-	343	19	29	461	129	-	193	1,174	1,174	-	-	5,512	533	-	-	-	258,692	6,939	-
2a.1.5.15	CA - Steam Seal	-	21	-	-	-	-	-	3	24	-	-	24	-	-	-	-	-	-	455	-
2a.1.5.16	CB - Main Turbine Lube Oil	-	59	-	-	-	-	-	9	68	-	-	68	-	-	-	-	-	-	1,207	-
2a.1.5.17	CC - Generator Hydrogen Seal & CO2	-	10	-	-	-	-	-	1	11	-	-	11	-	-	-	-	-	-	198	-
2a.1.5.18	CD - Generator Seal Oil	-	14	-	-	-	-	-	2	16	-	-	16	-	-	-	-	-	-	287	-
2a.1.5.19	CE - Stator Cooling Water	-	12	-	-	-	-	-	2	13	-	-	13	-	-	-	-	-	-	241	-
2a.1.5.20	CF - Lube Oil Storage Xfer & Prfication	-	39	-	-	-	-	-	6	44	-	-	44	-	-	-	-	-	-	812	-
2a.1.5.21	CG - Condenser Air Removal	-	31	-	-	-	-	-	5	36	-	-	36	-	-	-	-	-	-	657	-
2a.1.5.22	CH - Main Turbine Control Oil	-	60	-	-	-	-	-	9	69	-	-	69	-	-	-	-	-	-	1,219	-
2a.1.5.23	DA - Circulating Water	-	345	-	-	-	-	-	52	397	-	-	397	-	-	-	-	-	-	7,502	-
2a.1.5.24	DB - Cooling Tower Makeup & Blowdown	-	58	-	-	-	-	-	9	67	-	-	67	-	-	-	-	-	-	1,260	-
2a.1.5.25	DD - Cooling Water Chemical Control Sys	-	51	-	-	-	-	-	8	59	-	-	59	-	-	-	-	-	-	1,084	-
2a.1.5.26	DD - Cooling Wtr Chem Control RCA	-	274	5	13	297	-	-	116	706	706	-	-	3,555	-	-	-	-	144,376	4,951	-
2a.1.5.27	EJ - Residual Heat Removal	-	397	54	47	230	590	-	294	1,611	1,611	-	-	2,744	2,413	-	-	-	270,908	8,042	-
2a.1.5.28	EM - High Pressure Coolant Injection	-	335	17	15	110	159	-	144	780	780	-	-	1,315	648	-	-	-	96,322	6,633	-
2a.1.5.29	EN - Containment Spray	-	218	5	11	253	-	-	95	581	581	-	-	3,026	-	-	-	-	122,874	4,134	-
2a.1.5.30	EP - Accumulator Safety Injection	-	176	10	10	134	69	-	84	482	482	-	-	1,599	283	-	-	-	83,562	3,478	-
2a.1.5.31	FA - Auxiliary Steam Generator	-	24	-	-	-	-	-	4	27	-	-	27	-	-	-	-	-	-	521	-
2a.1.5.32	FB - Auxiliary Steam	-	98	-	-	-	-	-	15	112	-	-	112	-	-	-	-	-	-	2,106	-
2a.1.5.33	FB - Auxiliary Steam RCA	-	83	1	3	68	-	-	31	187	187	-	-	816	-	-	-	-	33,148	1,537	-
2a.1.5.34	FC - Auxiliary Turbines	-	63	-	-	-	-	-	9	72	-	-	72	-	-	-	-	-	-	1,320	-
2a.1.5.35	FE - Auxiliary Steam Chemical Addition	-	5	-	-	-	-	-	1	6	-	-	6	-	-	-	-	-	-	105	-
2a.1.5.36	GE - Turbine Building HVAC	-	175	-	-	-	-	-	26	201	-	-	201	-	-	-	-	-	-	3,957	-
2a.1.5.37	GS - Containment Hydrogen Control	-	77	4	4	55	26	-	35	201	201	-	-	658	104	-	-	-	33,630	1,559	-
2a.1.5.38	HE - Boron Recycle	383	508	36	31	218	341	-	445	1,961	1,961	-	-	2,600	1,411	-	-	-	197,879	16,660	-

Table G-2
Callaway Energy Center
DECON Alternative Decommissioning Cost Estimate
60-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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
Disposal of Plant Systems (continued)																					
2a.1.5.39	HF - Secondary Liquid Waste	701	998	80	72	517	775	-	890	4,033	4,033	-	-	6,186	3,203	-	-	-	460,585	31,896	-
2a.1.5.40	JA - Auxiliary Oil & Transfer	-	32	-	-	-	-	-	5	36	-	-	36	-	-	-	-	-	-	690	-
2a.1.5.41	KS - Bulk Chemical Storage	-	91	10	24	539	-	-	108	773	773	-	-	6,449	-	-	-	-	261,890	1,825	-
2a.1.5.42	LE - Oily Waste	-	179	-	-	-	-	-	27	206	-	-	206	-	-	-	-	-	-	3,865	-
2a.1.5.43	LE - Oily Waste RCA	-	237	3	8	189	-	-	89	527	527	-	-	2,256	-	-	-	-	91,628	4,296	-
2a.1.5.44	Turbine Bldg Non-System Specific	-	742	-	-	-	-	-	111	853	-	-	853	-	-	-	-	-	-	15,405	-
2a.1.5	Totals	1,084	8,543	277	333	4,348	2,204	-	3,615	20,402	16,451	-	3,951	51,976	9,068	-	-	-	2,706,410	192,076	-
2a.1.6	Scaffolding in support of decommissioning	-	1,598	27	7	114	27	-	427	2,200	2,200	-	-	1,233	109	-	-	-	62,671	36,741	-
2a.1	Subtotal Period 2a Activity Costs	2,182	29,478	20,532	8,998	10,983	53,104	660	37,901	163,839	159,887	-	3,951	146,354	84,726	963	393	2,217	13,821,010	402,025	10,513
Period 2a Additional Costs																					
2a.2.1	Remedial Action Surveys	-	-	-	-	-	-	1,666	500	2,166	2,166	-	-	-	-	-	-	-	-	34,112	-
2a.2	Subtotal Period 2a Additional Costs	-	-	-	-	-	-	1,666	500	2,166	2,166	-	-	-	-	-	-	-	-	34,112	-
Period 2a Collateral Costs																					
2a.3.1	Process decommissioning water waste	197	-	126	324	-	562	-	300	1,509	1,509	-	-	-	1,265	-	-	-	75,906	247	-
2a.3.2	Process decommissioning chemical flush waste	1	-	39	146	-	323	-	107	616	616	-	-	-	410	-	-	-	43,711	77	-
2a.3.3	Small tool allowance	-	341	-	-	-	-	-	51	392	353	-	39	-	-	-	-	-	-	-	-
2a.3.4	Spent Fuel Transfer	-	-	-	-	-	-	11,520	1,728	13,248	-	13,248	-	-	-	-	-	-	-	-	-
2a.3.5	On-site survey and release of 60.87 tons clean metallic waste	-	-	-	-	-	-	84	8	92	92	-	-	-	-	-	-	-	-	-	-
2a.3	Subtotal Period 2a Collateral Costs	198	341	165	470	-	885	11,604	2,195	15,858	2,571	13,248	39	-	1,675	-	-	-	119,617	323	-
Period 2a Period-Dependent Costs																					
2a.4.1	Decon supplies	89	-	-	-	-	-	-	22	112	112	-	-	-	-	-	-	-	-	-	-
2a.4.2	Insurance	-	-	-	-	-	-	1,512	151	1,663	1,663	-	-	-	-	-	-	-	-	-	-
2a.4.3	Property taxes	-	-	-	-	-	-	459	46	505	455	-	51	-	-	-	-	-	-	-	-
2a.4.4	Health physics supplies	-	2,842	-	-	-	-	-	710	3,552	3,552	-	-	-	-	-	-	-	-	-	-
2a.4.5	Heavy equipment rental	-	3,300	-	-	-	-	-	495	3,795	3,795	-	-	-	-	-	-	-	-	-	-
2a.4.6	Disposal of DAW generated	-	-	122	25	-	305	-	92	543	543	-	-	-	6,016	-	-	-	120,328	196	-
2a.4.7	Plant energy budget	-	-	-	-	-	-	2,614	392	3,006	3,006	-	-	-	-	-	-	-	-	-	-
2a.4.8	NRC Fees	-	-	-	-	-	-	1,028	103	1,130	1,130	-	-	-	-	-	-	-	-	-	-
2a.4.9	Emergency Planning Fees	-	-	-	-	-	-	1,529	153	1,682	-	1,682	-	-	-	-	-	-	-	-	-
2a.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	1,298	195	1,493	-	1,493	-	-	-	-	-	-	-	-	-
2a.4.11	ISFSI Operating Costs	-	-	-	-	-	-	157	24	180	-	180	-	-	-	-	-	-	-	-	-
2a.4.12	Corporate Allocations	-	-	-	-	-	-	1,641	164	1,805	1,805	-	-	-	-	-	-	-	-	-	-
2a.4.13	Security Staff Cost	-	-	-	-	-	-	16,738	2,511	19,248	19,248	-	-	-	-	-	-	-	-	-	406,635
2a.4.14	DOC Staff Cost	-	-	-	-	-	-	25,196	3,779	28,975	28,975	-	-	-	-	-	-	-	-	-	260,137
2a.4.15	Utility Staff Cost	-	-	-	-	-	-	36,771	5,516	42,287	42,287	-	-	-	-	-	-	-	-	-	484,334
2a.4	Subtotal Period 2a Period-Dependent Costs	89	6,142	122	25	-	305	88,943	14,353	109,979	106,573	3,355	51	-	6,016	-	-	-	120,328	196	1,151,107
2a.0	TOTAL PERIOD 2a COST	2,469	35,961	20,819	9,492	10,983	54,294	102,873	54,948	291,841	271,197	16,603	4,041	146,354	92,418	963	393	2,217	14,060,950	436,657	1,161,620
PERIOD 2b - Site Decontamination																					
Period 2b Direct Decommissioning Activities																					
Disposal of Plant Systems																					
2b.1.1.1	200 Reactor Bldg Non-System Specific	-	90	4	4	23	45	-	38	204	204	-	-	269	186	-	-	-	23,204	1,760	-
2b.1.1.2	200 Reactor Bldg Non-System Specific RCA	-	557	7	18	399	-	-	203	1,184	1,184	-	-	4,768	-	-	-	-	193,612	10,425	-
2b.1.1.3	300 Control Bldg Non-System Specific	-	176	3	8	179	-	-	72	439	439	-	-	2,139	-	-	-	-	86,849	3,413	-
2b.1.1.4	300 Control Bldg Non-System Specific Cln	-	1,394	-	-	-	-	-	209	1,603	-	-	1,603	-	-	-	-	-	-	29,076	-
2b.1.1.5	700 Radwaste Bldg Non-Sys Specific RCA	-	1,131	19	48	1,061	-	-	451	2,710	2,710	-	-	12,684	-	-	-	-	515,103	21,919	-
2b.1.1.6	700 Radwaste Bldg Non-System Specific	-	182	11	10	59	121	-	87	471	471	-	-	705	497	-	-	-	61,467	3,653	-
2b.1.1.7	AN - Demineralized Wtr Storage & Xfer	-	153	-	-	-	-	-	23	176	-	-	176	-	-	-	-	-	-	3,283	-
2b.1.1.8	AN - Demineralized Wtr Strg & Xfer RCA	-	40	0	1	26	-	-	14	83	83	-	-	314	-	-	-	-	12,759	740	-
2b.1.1.9	AP - Condensate Storage & Transfer	-	89	-	-	-	-	-	13	102	-	-	102	-	-	-	-	-	-	1,794	-
2b.1.1.10	BB - Reactor Coolant System	-	343	36	32	152	405	-	218	1,185	1,185	-	-	1,812	1,685	-	-	-	182,942	7,074	-
2b.1.1.11	BG - Chemical & Volume Control	794	972	114	94	413	1,203	-	1,028	4,616	4,616	-	-	4,931	4,928	-	-	-	525,509	28,147	-
2b.1.1.12	BL - Reactor Makeup Water	-	309	22	20	161	204	-	158	874	874	-	-	1,928	850	-	-	-	133,562	6,136	-
2b.1.1.13	DE - Intake & Water Treatment	-	121	-	-	-	-	-	18	139	-	-	139	-	-	-	-	-	-	2,517	-
2b.1.1.14	DE - Intake & Water Treatment RCA	-	252	18	45	997	-	-	221	1,533	1,533	-	-	11,923	-	-	-	-	484,206	5,014	-
2b.1.1.15	EA - Service Water	-	144	-	-	-	-	-	22	166	-	-	166	-	-	-	-	-	-	3,145	-
2b.1.1.16	EA - Service Water RCA	-	45	2	5	104	-	-	28	184	184	-	-	1,248	-	-	-	-	50,693	839	-
2b.1.1.17	EB - Closed Cooling Water	-	59	-	-	-	-	-	9	68	-	-	68	-	-	-	-	-	-	1,267	-
2b.1.1.18	EF - Essential Service Water	-	334	-	-	-	-	-	50	385	-	-	385	-	-	-	-	-	-	7,244	-

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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
Disposal of Plant Systems (continued)																					
2b.1.1.19	EF - Essential Service Water RCA	-	200	8	20	446	-	-	121	794	794	-	-	5,326	-	-	-	-	216,287	3,862	-
2b.1.1.20	EG - Component Cooling Water RCA	-	247	-	-	-	-	-	37	284	-	-	284	-	-	-	-	-	-	5,335	-
2b.1.1.21	GA - Plant Heating	-	89	-	-	-	-	-	13	102	-	-	102	-	-	-	-	-	-	1,912	-
2b.1.1.22	GA - Plant Heating RCA	-	97	1	2	53	-	-	33	186	186	-	-	638	-	-	-	-	25,924	1,765	-
2b.1.1.23	GB - Central Chilled Water	-	84	-	-	-	-	-	13	96	-	-	96	-	-	-	-	-	-	1,803	-
2b.1.1.24	GB - Central Chilled Water RCA	-	26	0	1	16	-	-	9	52	52	-	-	187	-	-	-	-	7,591	482	-
2b.1.1.25	GD - Essential Serv Wtr Pumphouse HVAC	-	18	-	-	-	-	-	3	21	-	-	21	-	-	-	-	-	-	427	-
2b.1.1.26	GF - Miscellaneous Building HVAC	-	122	3	8	170	-	-	58	361	361	-	-	2,034	-	-	-	-	82,602	2,026	-
2b.1.1.27	GH - Radwaste Building HVAC	-	188	6	11	203	24	-	85	516	516	-	-	2,425	98	-	-	-	104,941	3,455	-
2b.1.1.28	GK - Control Building HVAC	-	168	-	-	-	-	-	25	193	-	-	193	-	-	-	-	-	-	3,959	-
2b.1.1.29	GL - Auxiliary Building HVAC	-	466	12	23	424	56	-	199	1,179	1,179	-	-	5,064	228	-	-	-	220,713	8,491	-
2b.1.1.30	GM - Diesel Generator Building HVAC	-	29	-	-	-	-	-	4	34	-	-	34	-	-	-	-	-	-	695	-
2b.1.1.31	GN - Containment Cooling	-	514	24	38	616	157	-	268	1,617	1,617	-	-	7,367	643	-	-	-	341,701	9,601	-
2b.1.1.32	GP - Containment Intgratd Leak Rate Test	-	39	1	2	49	-	-	17	108	108	-	-	580	-	-	-	-	23,570	750	-
2b.1.1.33	GR - Containment Atmospheric Control	-	19	2	5	91	10	-	22	149	149	-	-	1,086	41	-	-	-	46,792	392	-
2b.1.1.34	GT - Containment Purge HVAC	-	120	6	10	163	42	-	67	408	408	-	-	1,948	170	-	-	-	90,362	2,259	-
2b.1.1.35	HA - Gaseous Radwaste	-	363	22	21	233	163	-	172	973	973	-	-	2,782	666	-	-	-	156,977	7,037	-
2b.1.1.36	HB - Liquid Radwaste	764	880	73	62	465	663	-	854	3,760	3,760	-	-	5,560	2,745	-	-	-	404,879	30,903	-
2b.1.1.37	HC - Solid Radwaste	-	376	35	31	177	362	-	219	1,199	1,199	-	-	2,114	1,487	-	-	-	183,748	7,445	-
2b.1.1.38	HD - Decontamination	-	104	6	6	82	42	-	50	290	290	-	-	983	171	-	-	-	51,237	2,051	-
2b.1.1.39	JE - Emergency Fuel Oil	-	62	-	-	-	-	-	9	71	-	-	71	-	-	-	-	-	-	1,260	-
2b.1.1.40	KA - Compressed Air	-	195	-	-	-	-	-	29	224	-	-	224	-	-	-	-	-	-	4,187	-
2b.1.1.41	KA - Compressed Air RCA	-	130	1	3	67	-	-	43	244	244	-	-	801	-	-	-	-	32,538	2,339	-
2b.1.1.42	KB - Breathing Air	-	24	-	-	-	-	-	4	28	-	-	28	-	-	-	-	-	-	516	-
2b.1.1.43	KB - Breathing Air RCA	-	20	0	0	6	-	-	6	32	32	-	-	71	-	-	-	-	2,874	402	-
2b.1.1.44	KC - Fire Protection	-	378	-	-	-	-	-	57	435	-	-	435	-	-	-	-	-	-	8,376	-
2b.1.1.45	KC - Fire Protection RCA	-	403	7	17	369	-	-	159	954	954	-	-	4,411	-	-	-	-	179,151	7,064	-
2b.1.1.46	KD - Domestic Water	-	176	-	-	-	-	-	26	203	-	-	203	-	-	-	-	-	-	3,837	-
2b.1.1.47	KD - Domestic Water RCA	-	26	0	1	21	-	-	10	58	58	-	-	247	-	-	-	-	10,039	459	-
2b.1.1.48	KE - Fuel Handling & Storage Rctor vssl	-	19	4	5	55	39	-	24	145	145	-	-	661	158	-	-	-	37,295	375	-
2b.1.1.49	KH - Service Gas (CO2 N2 H2 & O2)	-	56	-	-	-	-	-	8	64	-	-	64	-	-	-	-	-	-	1,226	-
2b.1.1.50	KH - Service Gas (CO2 N2 H2 & O2) RCA	-	254	4	9	204	-	-	96	566	566	-	-	2,433	-	-	-	-	98,813	4,481	-
2b.1.1.51	KJ - Standby Diesel Engine	-	327	-	-	-	-	-	49	376	-	-	376	-	-	-	-	-	-	6,749	-
2b.1.1.52	LA - Sanitary Drains	-	44	-	-	-	-	-	7	51	-	-	51	-	-	-	-	-	-	972	-
2b.1.1.53	LA - Sanitary Drains RCA	-	106	2	5	106	-	-	43	263	263	-	-	1,273	-	-	-	-	51,684	1,811	-
2b.1.1.54	LB - Roof Drains	-	59	-	-	-	-	-	9	68	-	-	68	-	-	-	-	-	-	1,276	-
2b.1.1.55	LB - Roof Drains RCA	-	144	3	8	179	-	-	64	398	398	-	-	2,139	-	-	-	-	86,858	2,694	-
2b.1.1.56	LD - Chemical & Detergent Waste	67	121	5	5	42	52	-	84	376	376	-	-	504	211	-	-	-	34,402	3,490	-
2b.1.1.57	LF - Floor & Equipment Drains	-	1,493	121	101	313	1,399	-	797	4,224	4,224	-	-	3,739	5,724	-	-	-	529,989	29,320	-
2b.1.1.58	RM - Process Sampling & Analysis	-	138	8	6	55	59	-	59	325	325	-	-	661	240	-	-	-	42,764	2,774	-
2b.1.1.59	SJ - Nuclear Sampling	-	79	6	4	35	45	-	38	208	208	-	-	423	184	-	-	-	29,429	1,620	-
2b.1.1.60	UB - Servces Stores Site Security Bldg	-	177	-	-	-	-	-	27	204	-	-	204	-	-	-	-	-	-	3,815	-
2b.1.1.61	Yard Non-System Specific	-	29	-	-	-	-	-	4	33	-	-	33	-	-	-	-	-	-	603	-
2b.1.1	Totals	1,624	14,999	597	687	8,213	5,091	-	6,783	37,995	32,868	-	5,127	98,179	20,912	-	-	-	5,363,064	321,744	-
2b.1.2	Scaffolding in support of decommissioning	-	1,997	34	8	143	33	-	534	2,750	2,750	-	-	1,541	136	-	-	-	78,338	45,926	-
Decontamination of Site Buildings																					
2b.1.3.1	Reactor	1,243	1,884	75	590	502	1,564	-	1,655	7,512	7,512	-	-	5,995	25,485	-	-	-	2,446,171	55,809	-
2b.1.3.2	Auxiliary	660	381	14	92	172	242	-	527	2,087	2,087	-	-	2,058	3,823	-	-	-	412,089	19,424	-
2b.1.3.3	Communication Corridor - Contaminated	15	7	0	2	1	5	-	11	40	40	-	-	17	83	-	-	-	7,854	395	-
2b.1.3.4	Hot Machine Shop	18	14	0	2	-	6	-	14	55	55	-	-	-	103	-	-	-	8,892	597	-
2b.1.3.5	RAM Storage Building	45	16	1	5	2	13	-	31	112	112	-	-	19	213	-	-	-	19,136	1,162	-
2b.1.3.6	Radioactive and Personnel Tunnel	6	12	0	1	-	3	-	7	31	31	-	-	-	58	-	-	-	5,022	334	-
2b.1.3.7	Radwaste	352	185	7	48	71	126	-	272	1,060	1,060	-	-	844	2,022	-	-	-	208,617	9,997	-
2b.1.3.8	Radwaste Drum Storage	40	19	1	5	6	14	-	30	114	114	-	-	66	226	-	-	-	22,243	1,092	-
2b.1.3.9	Reactor Head Assembly Building	34	-	-	-	-	-	-	17	52	52	-	-	-	-	-	-	-	-	691	-
2b.1.3.10	Steam Generator Replacement Bldgs	236	-	-	-	-	-	-	118	354	354	-	-	-	-	-	-	-	-	4,358	-
2b.1.3	Totals	2,649	2,518	98	745	753	1,973	-	2,682	11,417	11,417	-	-	8,999	32,013	-	-	-	3,130,024	93,858	-
2b.1	Subtotal Period 2b Activity Costs	4,273	19,514	729	1,440	9,109	7,097	-	9,999	52,162	47,035	-	5,127	108,720	53,060	-	-	-	8,571,427	461,528	-
Period 2b Additional Costs																					
2b.2.1	Remedial Action Surveys	-	-	-	-	-	-	2,395	718	3,113	3,113	-	-	-	-	-	-	-	-	49,026	-
2b.2.2	Sanitary Treatment Lagoon	-	6	93	92	-	280	-	95	567	567	-	-	-	4,608	-	-	-	392,140	423	-
2b.2.3	Cooling Tower Asbestos Panel Removal	-	4,893	-	122	-	-	490	826	6,330	-	-	6,330	-	-	-	-	-	-	71,419	-
2b.2.4	Operational Equipment	-	-	17	37	603	-	-	98	755	755	-	-	11,710	-	-	-	-	292,750	32	-

Table G-2
Callaway Energy Center
DECON Alternative Decommissioning Cost Estimate
60-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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 2b Additional Costs (continued)																					
2b.2.5	Retired Reactor Closure Head	-	113	552	895	-	768	-	410	2,738	2,738	-	-	-	2,764	-	-	-	338,540	3,157	2,000
2b.2	Subtotal Period 2b Additional Costs	-	5,012	662	1,146	603	1,048	2,884	2,146	13,502	7,173	-	6,330	11,710	7,372	-	-	-	1,023,430	124,057	2,000
Period 2b Collateral Costs																					
2b.3.1	Process decommissioning water waste	169	-	111	286	-	495	-	262	1,323	1,323	-	-	-	1,115	-	-	-	66,898	217	-
2b.3.2	Process decommissioning chemical flush waste	3	-	128	475	-	1,055	-	349	2,010	2,010	-	-	-	1,338	-	-	-	142,540	250	-
2b.3.3	Small tool allowance	-	421	-	-	-	-	-	63	484	484	-	-	-	-	-	-	-	-	-	-
2b.3.4	Spent Fuel Transfer	-	-	-	-	-	-	17,280	2,592	19,872	-	19,872	-	-	-	-	-	-	-	-	-
2b.3.5	On-site survey and release of 297.3 tons clean metallic waste	-	-	-	-	-	-	410	41	451	451	-	-	-	-	-	-	-	-	-	-
2b.3	Subtotal Period 2b Collateral Costs	172	421	239	761	-	1,550	17,690	3,308	24,139	4,267	19,872	-	-	2,453	-	-	-	209,438	468	-
Period 2b Period-Dependent Costs																					
2b.4.1	Decon supplies	1,213	-	-	-	-	-	-	303	1,516	1,516	-	-	-	-	-	-	-	-	-	-
2b.4.2	Insurance	-	-	-	-	-	-	2,173	217	2,391	2,391	-	-	-	-	-	-	-	-	-	-
2b.4.3	Property taxes	-	-	-	-	-	-	660	66	726	726	-	-	-	-	-	-	-	-	-	-
2b.4.4	Health physics supplies	-	3,878	-	-	-	-	-	969	4,847	4,847	-	-	-	-	-	-	-	-	-	-
2b.4.5	Heavy equipment rental	-	4,696	-	-	-	-	-	704	5,401	5,401	-	-	-	-	-	-	-	-	-	-
2b.4.6	Disposal of DAW generated	-	-	135	27	-	337	-	102	602	602	-	-	-	6,667	-	-	-	133,346	217	-
2b.4.7	Plant energy budget	-	-	-	-	-	-	2,967	445	3,412	3,412	-	-	-	-	-	-	-	-	-	-
2b.4.8	NRC Fees	-	-	-	-	-	-	1,477	148	1,625	1,625	-	-	-	-	-	-	-	-	-	-
2b.4.9	Emergency Planning Fees	-	-	-	-	-	-	2,198	220	2,418	-	2,418	-	-	-	-	-	-	-	-	-
2b.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	1,866	280	2,146	-	2,146	-	-	-	-	-	-	-	-	-
2b.4.11	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	473	71	544	544	-	-	-	-	-	-	-	-	-	-
2b.4.12	ISFSI Operating Costs	-	-	-	-	-	-	225	34	259	-	259	-	-	-	-	-	-	-	-	-
2b.4.13	Corporate Allocations	-	-	-	-	-	-	2,359	236	2,595	2,595	-	-	-	-	-	-	-	-	-	-
2b.4.14	Security Staff Cost	-	-	-	-	-	-	24,059	3,609	27,667	27,667	-	-	-	-	-	-	-	-	-	584,496
2b.4.15	DOC Staff Cost	-	-	-	-	-	-	34,908	5,236	40,145	40,145	-	-	-	-	-	-	-	-	-	359,160
2b.4.16	Utility Staff Cost	-	-	-	-	-	-	50,771	7,616	58,386	58,386	-	-	-	-	-	-	-	-	-	666,660
2b.4	Subtotal Period 2b Period-Dependent Costs	1,213	8,574	135	27	-	337	124,136	20,256	154,679	149,856	4,823	-	-	6,667	-	-	-	133,346	217	1,610,316
2b.0	TOTAL PERIOD 2b COST	5,658	33,521	1,765	3,374	9,712	10,033	144,711	35,709	244,483	208,331	24,695	11,457	120,430	69,552	-	-	-	9,937,641	586,270	1,612,316
PERIOD 2d - Decontamination Following Wet Fuel Storage																					
Period 2d Direct Decommissioning Activities																					
2d.1.1	Remove spent fuel racks	831	82	293	107	-	1,709	-	909	3,930	3,930	-	-	-	6,988	-	-	-	461,925	1,925	-
Disposal of Plant Systems																					
2d.1.2.1	600 Fuel Bldg Non-Specific Systems RCA	-	306	5	12	268	-	-	119	710	710	-	-	3,200	-	-	-	-	129,974	5,859	-
2d.1.2.2	600 Fuel Bldg Non-System Specific	-	48	3	2	14	29	-	22	119	119	-	-	170	120	-	-	-	14,877	954	-
2d.1.2.3	EC - Fuel Pool Cooling & Cleanup	-	406	27	26	218	267	-	207	1,151	1,151	-	-	2,602	1,090	-	-	-	177,753	8,051	-
2d.1.2.4	GA- Plant Heating Fuel Building	-	23	1	1	4	10	-	9	48	48	-	-	50	41	-	-	-	4,770	449	-
2d.1.2.5	GG - Fuel Building HVAC	-	256	9	16	312	38	-	124	755	755	-	-	3,729	155	-	-	-	161,671	4,673	-
2d.1.2.6	KC- Fire Protection Fuel Building	-	119	2	5	104	-	-	46	276	276	-	-	1,239	-	-	-	-	50,329	2,115	-
2d.1.2	Totals	-	1,158	46	63	919	344	-	528	3,058	3,058	-	-	10,991	1,407	-	-	-	539,374	22,102	-
Decontamination of Site Buildings																					
2d.1.3.1	Fuel Building	777	854	9	32	226	83	-	663	2,644	2,644	-	-	2,705	1,064	-	-	-	199,826	31,561	-
2d.1.3	Totals	777	854	9	32	226	83	-	663	2,644	2,644	-	-	2,705	1,064	-	-	-	199,826	31,561	-
2d.1.4	Scaffolding in support of decommissioning	-	399	7	2	29	7	-	107	550	550	-	-	308	27	-	-	-	15,668	9,185	-
2d.1	Subtotal Period 2d Activity Costs	1,608	2,494	355	203	1,174	2,143	-	2,205	10,183	10,183	-	-	14,004	9,486	-	-	-	1,216,793	64,772	-
Period 2d Additional Costs																					
2d.2.1	License Termination Survey Planning	-	-	-	-	-	-	1,495	448	1,943	1,943	-	-	-	-	-	-	-	-	-	12,480
2d.2.2	Remedial Action Surveys	-	-	-	-	-	-	676	203	879	879	-	-	-	-	-	-	-	-	13,839	-
2d.2	Subtotal Period 2d Additional Costs	-	-	-	-	-	-	2,171	651	2,822	2,822	-	-	-	-	-	-	-	-	13,839	12,480
Period 2d Collateral Costs																					
2d.3.1	Process decommissioning water waste	90	-	60	154	-	267	-	141	712	712	-	-	-	601	-	-	-	36,055	117	-
2d.3.3	Small tool allowance	-	65	-	-	-	-	-	10	75	75	-	-	-	-	-	-	-	-	-	-
2d.3.4	Decommissioning Equipment Disposition	-	-	134	39	556	129	-	135	993	993	-	-	6,000	529	-	-	-	304,968	88	-
2d.3	Subtotal Period 2d Collateral Costs	90	65	193	193	556	396	-	286	1,779	1,779	-	-	6,000	1,130	-	-	-	341,023	205	-

Table G-2
Callaway Energy Center
DECON Alternative Decommissioning Cost Estimate
60-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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	176	-	-	-	-	-	-	44	220	220	-	-	-	-	-	-	-	-	-	-
2d.4.2	Insurance	-	-	-	-	-	-	613	61	675	675	-	-	-	-	-	-	-	-	-	-
2d.4.3	Property taxes	-	-	-	-	-	-	186	19	205	205	-	-	-	-	-	-	-	-	-	-
2d.4.4	Health physics supplies	-	662	-	-	-	-	-	166	828	828	-	-	-	-	-	-	-	-	-	-
2d.4.5	Heavy equipment rental	-	1,325	-	-	-	-	-	199	1,524	1,524	-	-	-	-	-	-	-	-	-	-
2d.4.6	Disposal of DAW generated	-	-	42	9	-	105	-	32	188	188	-	-	-	2,081	-	-	-	41,624	68	-
2d.4.7	Plant energy budget	-	-	-	-	-	-	447	67	514	514	-	-	-	-	-	-	-	-	-	-
2d.4.8	NRC Fees	-	-	-	-	-	-	355	35	390	390	-	-	-	-	-	-	-	-	-	-
2d.4.9	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	267	40	307	307	-	-	-	-	-	-	-	-	-	-
2d.4.10	Corporate Allocations	-	-	-	-	-	-	666	67	732	732	-	-	-	-	-	-	-	-	-	-
2d.4.11	Security Staff Cost	-	-	-	-	-	-	1,337	201	1,537	1,537	-	-	-	-	-	-	-	-	-	43,393
2d.4.12	DOC Staff Cost	-	-	-	-	-	-	6,755	1,013	7,769	7,769	-	-	-	-	-	-	-	-	-	69,429
2d.4.13	Utility Staff Cost	-	-	-	-	-	-	10,274	1,541	11,815	11,815	-	-	-	-	-	-	-	-	-	131,220
2d.4	Subtotal Period 2d Period-Dependent Costs	176	1,988	42	9	-	105	20,899	3,484	26,704	26,704	-	-	-	2,081	-	-	-	41,624	68	244,041
2d.0	TOTAL PERIOD 2d COST	1,875	4,547	590	404	1,730	2,644	23,070	6,626	41,488	41,488	-	-	20,004	12,697	-	-	-	1,599,439	78,884	256,521
PERIOD 2f - License Termination																					
Period 2f Direct Decommissioning Activities																					
2f.1.1	ORISE confirmatory survey	-	-	-	-	-	-	163	49	212	212	-	-	-	-	-	-	-	-	-	-
2f.1.2	Terminate license									a											
2f.1	Subtotal Period 2f Activity Costs	-	-	-	-	-	-	163	49	212	212	-	-	-	-	-	-	-	-	-	-
Period 2f Additional Costs																					
2f.2.1	License Termination Survey	-	-	-	-	-	-	8,248	2,474	10,723	10,723	-	-	-	-	-	-	-	-	153,878	6,240
2f.2	Subtotal Period 2f Additional Costs	-	-	-	-	-	-	8,248	2,474	10,723	10,723	-	-	-	-	-	-	-	-	153,878	6,240
Period 2f Collateral Costs																					
2f.3.1	DOC staff relocation expenses	-	-	-	-	-	-	1,080	162	1,242	1,242	-	-	-	-	-	-	-	-	-	-
2f.3	Subtotal Period 2f Collateral Costs	-	-	-	-	-	-	1,080	162	1,242	1,242	-	-	-	-	-	-	-	-	-	-
Period 2f Period-Dependent Costs																					
2f.4.2	Property taxes	-	-	-	-	-	-	212	21	233	233	-	-	-	-	-	-	-	-	-	-
2f.4.3	Health physics supplies	-	736	-	-	-	-	-	184	920	920	-	-	-	-	-	-	-	-	-	-
2f.4.4	Disposal of DAW generated	-	-	7	1	-	18	-	5	32	32	-	-	-	353	-	-	-	7,050	11	-
2f.4.5	Plant energy budget	-	-	-	-	-	-	254	38	292	292	-	-	-	-	-	-	-	-	-	-
2f.4.6	NRC Fees	-	-	-	-	-	-	457	46	503	503	-	-	-	-	-	-	-	-	-	-
2f.4.7	Corporate Allocations	-	-	-	-	-	-	756	76	832	832	-	-	-	-	-	-	-	-	-	-
2f.4.8	Security Staff Cost	-	-	-	-	-	-	727	109	836	836	-	-	-	-	-	-	-	-	-	18,926
2f.4.9	DOC Staff Cost	-	-	-	-	-	-	5,685	853	6,538	6,538	-	-	-	-	-	-	-	-	-	57,566
2f.4.10	Utility Staff Cost	-	-	-	-	-	-	6,427	964	7,391	7,391	-	-	-	-	-	-	-	-	-	74,914
2f.4	Subtotal Period 2f Period-Dependent Costs	-	736	7	1	-	18	14,518	2,296	17,576	17,576	-	-	-	353	-	-	-	7,050	11	151,406
2f.0	TOTAL PERIOD 2f COST	-	736	7	1	-	18	24,009	4,981	29,752	29,752	-	-	-	353	-	-	-	7,050	153,889	157,646
PERIOD 2 TOTALS		10,002	74,765	23,182	13,272	22,426	66,989	294,662	102,265	607,564	550,768	41,298	15,498	286,787	175,020	963	393	2,217	25,605,080	1,255,701	3,188,103
PERIOD 3b - Site Restoration																					
Period 3b Direct Decommissioning Activities																					
Demolition of Remaining Site Buildings																					
3b.1.1.1	Reactor	-	5,191	-	-	-	-	-	779	5,969	-	-	5,969	-	-	-	-	-	-	59,292	-
3b.1.1.2	Auxiliary	-	4,194	-	-	-	-	-	629	4,823	-	-	4,823	-	-	-	-	-	-	49,968	-
3b.1.1.3	Auxiliary Boiler	-	39	-	-	-	-	-	6	45	-	-	45	-	-	-	-	-	-	619	-
3b.1.1.4	Barge Facility	-	1,595	-	-	-	-	-	239	1,834	-	-	1,834	-	-	-	-	-	-	18,771	-
3b.1.1.5	Circulating & Service Water Pumphouse	-	328	-	-	-	-	-	49	377	-	-	377	-	-	-	-	-	-	4,345	-
3b.1.1.6	Communication Corridor - Clean	-	1,346	-	-	-	-	-	202	1,548	-	-	1,548	-	-	-	-	-	-	17,215	-
3b.1.1.7	Communication Corridor - Contaminated	-	60	-	-	-	-	-	9	69	-	-	69	-	-	-	-	-	-	674	-
3b.1.1.8	Cooling Tower Concrete	-	918	-	-	-	-	-	138	1,056	-	-	1,056	-	-	-	-	-	-	13,472	-
3b.1.1.9	Diesel Generator	-	499	-	-	-	-	-	75	574	-	-	574	-	-	-	-	-	-	5,492	-
3b.1.1.10	Essential Service Water Pumphouse	-	306	-	-	-	-	-	46	352	-	-	352	-	-	-	-	-	-	3,938	-
3b.1.1.11	Fire Water Pumphouse	-	29	-	-	-	-	-	4	33	-	-	33	-	-	-	-	-	-	382	-
3b.1.1.12	Flex Building Storage	-	557	-	-	-	-	-	84	641	-	-	641	-	-	-	-	-	-	7,590	-
3b.1.1.13	Hot Machine Shop	-	25	-	-	-	-	-	4	29	-	-	29	-	-	-	-	-	-	417	-
3b.1.1.14	Intake	-	382	-	-	-	-	-	57	440	-	-	440	-	-	-	-	-	-	4,224	-

Table G-2
Callaway Energy Center
DECON Alternative Decommissioning Cost Estimate
60-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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.1.1.15	Misc. Structures	-	2,487	-	-	-	-	-	373	2,861	-	-	2,861	-	-	-	-	-	-	27,921	-
3b.1.1.16	Miscellaneous Site Foundations	-	382	-	-	-	-	-	57	439	-	-	439	-	-	-	-	-	-	5,483	-
3b.1.1.17	Outage Maintenance	-	192	-	-	-	-	-	29	220	-	-	220	-	-	-	-	-	-	3,190	-
3b.1.1.18	RAM Storage Building	-	69	-	-	-	-	-	10	79	-	-	79	-	-	-	-	-	-	1,081	-
3b.1.1.19	Radioactive and Personnel Tunnel	-	29	-	-	-	-	-	4	34	-	-	34	-	-	-	-	-	-	386	-
3b.1.1.20	Radwaste	-	1,872	-	-	-	-	-	281	2,153	-	-	2,153	-	-	-	-	-	-	21,798	-
3b.1.1.21	Radwaste Drum Storage	-	279	-	-	-	-	-	42	321	-	-	321	-	-	-	-	-	-	3,840	-
3b.1.1.22	Reactor Head Assembly Building	-	81	-	-	-	-	-	12	94	-	-	94	-	-	-	-	-	-	1,357	-
3b.1.1.23	Security Additions	-	2,257	-	-	-	-	-	339	2,595	-	-	2,595	-	-	-	-	-	-	20,977	-
3b.1.1.24	Service	-	527	-	-	-	-	-	79	606	-	-	606	-	-	-	-	-	-	6,045	-
3b.1.1.25	Sludge Pump Station & Lagoon	-	26	-	-	-	-	-	4	30	-	-	30	-	-	-	-	-	-	313	-
3b.1.1.26	Steam Generator Replacement Bldgs	-	1,231	-	-	-	-	-	185	1,415	-	-	1,415	-	-	-	-	-	-	15,693	-
3b.1.1.27	Turbine Building	-	3,580	-	-	-	-	-	537	4,117	-	-	4,117	-	-	-	-	-	-	55,694	-
3b.1.1.28	Turbine Pedestal	-	1,092	-	-	-	-	-	164	1,256	-	-	1,256	-	-	-	-	-	-	10,928	-
3b.1.1.29	U.H.S. Cooling Tower	-	662	-	-	-	-	-	99	761	-	-	761	-	-	-	-	-	-	6,681	-
3b.1.1.30	Water Treatment Plant	-	1	-	-	-	-	-	0	1	-	-	1	-	-	-	-	-	-	9	-
3b.1.1.31	Fuel Building	-	2,092	-	-	-	-	-	314	2,405	-	-	2,405	-	-	-	-	-	-	22,580	-
3b.1.1	Totals	-	32,329	-	-	-	-	-	4,849	37,178	-	-	37,178	-	-	-	-	-	-	390,372	-
Site Closeout Activities																					
3b.1.2	BackFill Site	-	8,631	-	-	-	-	-	1,295	9,926	-	-	9,926	-	-	-	-	-	-	15,861	-
3b.1.3	Grade & landscape site	-	132	-	-	-	-	-	20	152	-	-	152	-	-	-	-	-	-	592	-
3b.1.4	Final report to NRC	-	-	-	-	-	-	197	30	226	226	-	-	-	-	-	-	-	-	-	1,560
3b.1	Subtotal Period 3b Activity Costs	-	41,092	-	-	-	-	197	6,193	47,482	226	-	47,256	-	-	-	-	-	-	406,825	1,560
Period 3b Additional Costs																					
3b.2.1	Concrete Crushing	-	1,194	-	-	-	-	9	180	1,384	-	-	1,384	-	-	-	-	-	-	5,976	-
3b.2.2	Mine Area Backfill	-	4,988	-	-	-	-	-	748	5,736	-	-	5,736	-	-	-	-	-	-	15,960	-
3b.2.3	Cooling Tower Discharge & Intake Pipe Flow Fill	-	3,778	-	-	-	-	-	567	4,345	-	-	4,345	-	-	-	-	-	-	9,588	-
3b.2.4	Cooling Tower Demolition	-	4,272	-	-	-	-	-	641	4,913	-	-	4,913	-	-	-	-	-	-	21,619	-
3b.2.5	Excavation of Underground Services	-	1,668	-	-	-	-	761	364	2,793	-	-	2,793	-	-	-	-	-	-	14,164	-
3b.2.6	Construction Debris	-	-	-	-	-	-	2,480	372	2,852	-	-	2,852	-	-	-	-	-	-	-	-
3b.2	Subtotal Period 3b Additional Costs	-	15,901	-	-	-	-	3,250	2,873	22,023	-	-	22,023	-	-	-	-	-	-	67,307	-
Period 3b Collateral Costs																					
3b.3.1	Small tool allowance	-	402	-	-	-	-	-	60	462	-	-	462	-	-	-	-	-	-	-	-
3b.3.2	Corporate Allocations	-	-	-	-	-	-	1,504	150	1,655	-	-	1,655	-	-	-	-	-	-	-	-
3b.3	Subtotal Period 3b Collateral Costs	-	402	-	-	-	-	1,504	211	2,117	-	-	2,117	-	-	-	-	-	-	-	-
Period 3b Period-Dependent Costs																					
3b.4.2	Property taxes	-	-	-	-	-	-	421	42	463	-	-	463	-	-	-	-	-	-	-	-
3b.4.3	Heavy equipment rental	-	4,254	-	-	-	-	-	638	4,892	-	-	4,892	-	-	-	-	-	-	-	-
3b.4.4	Plant energy budget	-	-	-	-	-	-	252	38	290	-	-	290	-	-	-	-	-	-	-	-
3b.4.5	Security Staff Cost	-	-	-	-	-	-	1,446	217	1,663	-	-	1,663	-	-	-	-	-	-	-	37,646
3b.4.6	DOC Staff Cost	-	-	-	-	-	-	11,002	1,650	12,652	-	-	12,652	-	-	-	-	-	-	-	106,663
3b.4.7	Utility Staff Cost	-	-	-	-	-	-	5,200	780	5,980	-	-	5,980	-	-	-	-	-	-	-	61,174
3b.4	Subtotal Period 3b Period-Dependent Costs	-	4,254	-	-	-	-	18,321	3,365	25,940	-	-	25,940	-	-	-	-	-	-	-	205,483
3b.0	TOTAL PERIOD 3b COST	-	61,649	-	-	-	-	23,272	12,642	97,563	226	-	97,336	-	-	-	-	-	-	474,132	207,043
PERIOD 3 TOTALS		-	61,649	-	-	-	-	23,272	12,642	97,563	226	-	97,336	-	-	-	-	-	-	474,132	207,043
TOTAL COST TO DECOMMISSION		**13,116**	**139,081**	**23,305**	**13,628**	**22,426**	**70,917**	**445,922**	**136,339**	**864,734**	**692,622**	**57,716**	**114,396**	**286,787**	**176,272**	**1,750**	**393**	**2,217**	**25,725,380**	**1,750,233**	**4,612,246**

Table G-2
Callaway Energy Center
DECON Alternative Decommissioning Cost Estimate
60-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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 18.72% CONTINGENCY:	**$864,734**	**thousands of 2014 dollars**
TOTAL NRC LICENSE TERMINATION COST IS 80.1% OR:	**$692,622**	**thousands of 2014 dollars**
SPENT FUEL MANAGEMENT COST IS 6.67% OR:	**$57,716**	**thousands of 2014 dollars**
NON-NUCLEAR DEMOLITION COST IS 13.23% OR:	**$114,396**	**thousands of 2014 dollars**
TOTAL LOW-LEVEL RADIOACTIVE WASTE VOLUME BURIED (EXCLUDING GTCC):	**178,415**	**cubic feet**
TOTAL GREATER THAN CLASS C RADWASTE VOLUME GENERATED:	**2,217**	**cubic feet**
TOTAL SCRAP METAL REMOVED:	**70,547**	**tons**
TOTAL CRAFT LABOR REQUIREMENTS:	**1,750,233**	**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 H

DETAILED COST ANALYSIS

SAFSTOR ALTERNATIVE DECOMMISSIONING COST ESTIMATE
60-YEAR OPERATING LIFE with
LOW-LEVEL RADIOACTIVE WASTE PROCESSING

TABLE H-1
SAFSTOR ALTERNATIVE
60-YEAR PLANT OPERATING LIFE with
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
TOTAL ANNUAL EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other [1]	Total [2]
2044	11,662	1,550	396	8	1,612	15,228
2045	58,679	10,660	1,928	560	7,919	79,746
2046	30,505	8,716	846	796	17,502	58,367
2047	19,735	6,502	386	15	3,697	30,335
2048	19,789	6,520	387	15	3,707	30,418
2049	19,735	6,502	386	15	3,697	30,335
2050	8,046	2,142	250	9	2,103	12,549
2051	3,134	309	193	6	1,432	5,075
2052	3,143	310	193	6	1,436	5,089
2053	3,134	309	193	6	1,432	5,075
2054	3,134	309	193	6	1,432	5,075
2055	3,134	309	193	6	1,432	5,075
2056	3,143	310	193	6	1,436	5,089
2057	3,134	309	193	6	1,432	5,075
2058	3,134	309	193	6	1,432	5,075
2059	3,134	309	193	6	1,432	5,075
2060	3,143	310	193	6	1,436	5,089
2061	3,134	309	193	6	1,432	5,075
2062	3,134	309	193	6	1,432	5,075
2063	3,134	309	193	6	1,432	5,075
2064	3,143	310	193	6	1,436	5,089
2065	3,134	309	193	6	1,432	5,075
2066	3,134	309	193	6	1,432	5,075
2067	3,134	309	193	6	1,432	5,075
2068	3,143	310	193	6	1,436	5,089
2069	3,134	309	193	6	1,432	5,075
2070	3,134	309	193	6	1,432	5,075
2071	3,134	309	193	6	1,432	5,075
2072	3,143	310	193	6	1,436	5,089
2073	3,134	309	193	6	1,432	5,075

TABLE H-1 (continued)
SAFSTOR ALTERNATIVE
60-YEAR PLANT OPERATING LIFE with
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
TOTAL ANNUAL EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other [1]	Total [2]
2074	3,134	309	193	6	1,432	5,075
2075	3,134	309	193	6	1,432	5,075
2076	3,143	310	193	6	1,436	5,089
2077	3,134	309	193	6	1,432	5,075
2078	3,134	309	193	6	1,432	5,075
2079	3,134	309	193	6	1,432	5,075
2080	3,143	310	193	6	1,436	5,089
2081	3,134	309	193	6	1,432	5,075
2082	3,134	309	193	6	1,432	5,075
2083	3,134	309	193	6	1,432	5,075
2084	3,143	310	193	6	1,436	5,089
2085	3,134	309	193	6	1,432	5,075
2086	3,134	309	193	6	1,432	5,075
2087	3,134	309	193	6	1,432	5,075
2088	3,143	310	193	6	1,436	5,089
2089	3,134	309	193	6	1,432	5,075
2090	3,134	309	193	6	1,432	5,075
2091	3,134	309	193	6	1,432	5,075
2092	3,143	310	193	6	1,436	5,089
2093	3,134	309	193	6	1,432	5,075
2094	3,134	309	193	6	1,432	5,075
2095	3,134	309	193	6	1,432	5,075
2096	3,143	310	193	6	1,436	5,089
2097	3,134	309	193	6	1,432	5,075
2098	12,946	687	511	11	1,658	15,813
2099	49,150	4,498	1,928	35	2,782	58,394
2100	56,762	21,138	1,863	30,185	14,925	124,874
2101	59,507	22,359	1,716	34,155	16,363	134,100
2102	53,708	8,092	1,446	10,385	6,479	80,111
2103	53,708	8,092	1,446	10,385	6,479	80,111

TABLE H-1 (continued)
SAFSTOR ALTERNATIVE
60-YEAR PLANT OPERATING LIFE with
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
TOTAL ANNUAL EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other [1]	Total [2]
2104	35,383	7,635	394	478	2,524	46,415
2105	31,992	29,368	193	0	3,311	64,864
2106	9,642	8,851	58	0	998	19,548
Total	678,357	167,861	23,204	87,354	163,128	1,119,905

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

TABLE H-1a
SAFSTOR ALTERNATIVE
60-YEAR PLANT OPERATING LIFE with
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
LICENSE TERMINATION EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2044	11,237	274	396	8	1,066	12,981
2045	56,528	4,207	1,928	560	5,261	68,484
2046	18,126	2,263	711	796	15,148	37,044
2047	3,134	447	193	15	1,472	5,261
2048	3,143	449	193	15	1,476	5,276
2049	3,134	447	193	15	1,472	5,261
2050	3,134	350	193	9	1,444	5,130
2051	3,134	309	193	6	1,432	5,075
2052	3,143	310	193	6	1,436	5,089
2053	3,134	309	193	6	1,432	5,075
2054	3,134	309	193	6	1,432	5,075
2055	3,134	309	193	6	1,432	5,075
2056	3,143	310	193	6	1,436	5,089
2057	3,134	309	193	6	1,432	5,075
2058	3,134	309	193	6	1,432	5,075
2059	3,134	309	193	6	1,432	5,075
2060	3,143	310	193	6	1,436	5,089
2061	3,134	309	193	6	1,432	5,075
2062	3,134	309	193	6	1,432	5,075
2063	3,134	309	193	6	1,432	5,075
2064	3,143	310	193	6	1,436	5,089
2065	3,134	309	193	6	1,432	5,075
2066	3,134	309	193	6	1,432	5,075
2067	3,134	309	193	6	1,432	5,075
2068	3,143	310	193	6	1,436	5,089
2069	3,134	309	193	6	1,432	5,075
2070	3,134	309	193	6	1,432	5,075
2071	3,134	309	193	6	1,432	5,075
2072	3,143	310	193	6	1,436	5,089
2073	3,134	309	193	6	1,432	5,075

TABLE H-1a (continued)
SAFSTOR ALTERNATIVE
60-YEAR PLANT OPERATING LIFE with
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
LICENSE TERMINATION EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2074	3,134	309	193	6	1,432	5,075
2075	3,134	309	193	6	1,432	5,075
2076	3,143	310	193	6	1,436	5,089
2077	3,134	309	193	6	1,432	5,075
2078	3,134	309	193	6	1,432	5,075
2079	3,134	309	193	6	1,432	5,075
2080	3,143	310	193	6	1,436	5,089
2081	3,134	309	193	6	1,432	5,075
2082	3,134	309	193	6	1,432	5,075
2083	3,134	309	193	6	1,432	5,075
2084	3,143	310	193	6	1,436	5,089
2085	3,134	309	193	6	1,432	5,075
2086	3,134	309	193	6	1,432	5,075
2087	3,134	309	193	6	1,432	5,075
2088	3,143	310	193	6	1,436	5,089
2089	3,134	309	193	6	1,432	5,075
2090	3,134	309	193	6	1,432	5,075
2091	3,134	309	193	6	1,432	5,075
2092	3,143	310	193	6	1,436	5,089
2093	3,134	309	193	6	1,432	5,075
2094	3,134	309	193	6	1,432	5,075
2095	3,134	309	193	6	1,432	5,075
2096	3,143	310	193	6	1,436	5,089
2097	3,134	309	193	6	1,432	5,075
2098	12,695	687	511	11	1,658	15,561
2099	48,095	4,498	1,928	35	2,782	57,339
2100	54,580	21,065	1,863	30,185	14,904	122,598
2101	56,413	22,051	1,716	34,155	16,251	130,586
2102	49,893	7,322	1,446	10,385	6,179	75,225
2103	49,893	7,322	1,446	10,385	6,179	75,225

TABLE H-1a (continued)
SAFSTOR ALTERNATIVE
60-YEAR PLANT OPERATING LIFE with
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
LICENSE TERMINATION EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2104	28,760	1,648	355	478	1,840	33,080
2105	150	0	0	0	0	150
2106	45	0	0	0	0	45
Total	546,366	87,580	22,143	87,354	144,505	887,947

TABLE H-1b
SAFSTOR ALTERNATIVE
60-YEAR PLANT OPERATING LIFE with
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
SPENT FUEL MANAGEMENT EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2044	425	1,276	0	0	546	2,248
2045	2,151	6,453	0	0	2,658	11,262
2046	12,379	6,454	135	0	2,354	21,323
2047	16,601	6,055	193	0	2,225	25,074
2048	16,646	6,071	193	0	2,231	25,142
2049	16,601	6,055	193	0	2,225	25,074
2050	4,912	1,792	57	0	658	7,419
Total	69,716	34,155	771	0	12,898	117,540

TABLE H-1c
SAFSTOR ALTERNATIVE
60-YEAR PLANT OPERATING LIFE with
LOW-LEVEL RADIOACTIVE WASTE OFF-SITE PROCESSING
SITE RESTORATION EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2044-97	0	0	0	0	0	0
2098	252	0	0	0	0	252
2099	1,055	0	0	0	0	1,055
2100	2,182	73	0	0	21	2,276
2101	3,095	307	0	0	112	3,514
2102	3,815	770	0	0	300	4,885
2103	3,815	770	0	0	300	4,885
2104	6,623	5,988	39	0	684	13,334
2105	31,842	29,368	193	0	3,311	64,714
2106	9,596	8,851	58	0	998	19,503
Total	62,275	46,127	290	0	5,726	114,417

Table H-2
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
60-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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	-	-	-	-	-	-	380	114	494	494	-	-	-	-	-	-	-	-	-	-
1a.1.2	Prepare preliminary decommissioning cost	-	-	-	-	-	-	164	25	189	189	-	-	-	-	-	-	-	-	-	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	-	-	-	-	-	-	252	38	290	290	-	-	-	-	-	-	-	-	-	2,000
1a.1.8	Review plant dwgs & specs.	-	-	-	-	-	-	164	25	189	189	-	-	-	-	-	-	-	-	-	1,300
1a.1.9	Perform detailed rad survey									a											
1a.1.10	Estimate by-product inventory	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1a.1.11	End product description	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1a.1.12	Detailed by-product inventory	-	-	-	-	-	-	189	28	218	218	-	-	-	-	-	-	-	-	-	1,500
1a.1.13	Define major work sequence	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
1a.1.14	Perform SER and EA	-	-	-	-	-	-	391	59	450	450	-	-	-	-	-	-	-	-	-	3,100
1a.1.15	Perform Site-Specific Cost Study	-	-	-	-	-	-	630	95	725	725	-	-	-	-	-	-	-	-	-	5,000
Activity Specifications																					
1a.1.16.1	Prepare plant and facilities for SAFSTOR	-	-	-	-	-	-	620	93	713	713	-	-	-	-	-	-	-	-	-	4,920
1a.1.16.2	Plant systems	-	-	-	-	-	-	525	79	604	604	-	-	-	-	-	-	-	-	-	4,167
1a.1.16.3	Plant structures and buildings	-	-	-	-	-	-	393	59	452	452	-	-	-	-	-	-	-	-	-	3,120
1a.1.16.4	Waste management	-	-	-	-	-	-	252	38	290	290	-	-	-	-	-	-	-	-	-	2,000
1a.1.16.5	Facility and site dormancy	-	-	-	-	-	-	252	38	290	290	-	-	-	-	-	-	-	-	-	2,000
1a.1.16	Total	-	-	-	-	-	-	2,044	307	2,350	2,350	-	-	-	-	-	-	-	-	-	16,207
Detailed Work Procedures																					
1a.1.17.1	Plant systems	-	-	-	-	-	-	149	22	172	172	-	-	-	-	-	-	-	-	-	1,183
1a.1.17.2	Facility closeout & dormancy	-	-	-	-	-	-	151	23	174	174	-	-	-	-	-	-	-	-	-	1,200
1a.1.17	Total	-	-	-	-	-	-	301	45	346	346	-	-	-	-	-	-	-	-	-	2,383
1a.1.18	Procure vacuum drying system	-	-	-	-	-	-	13	2	15	15	-	-	-	-	-	-	-	-	-	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	-	-	-	-	-	-	4,905	793	5,698	5,698	-	-	-	-	-	-	-	-	-	35,890
Period 1a Collateral Costs																					
1a.3.1	Spent Fuel Transfer	-	-	-	-	-	-	7,200	1,080	8,280	-	8,280	-	-	-	-	-	-	-	-	-
1a.3	Subtotal Period 1a Collateral Costs	-	-	-	-	-	-	7,200	1,080	8,280	-	8,280	-	-	-	-	-	-	-	-	-
Period 1a Period-Dependent Costs																					
1a.4.1	Insurance	-	-	-	-	-	-	1,902	190	2,092	2,092	-	-	-	-	-	-	-	-	-	-
1a.4.2	Property taxes	-	-	-	-	-	-	280	28	308	308	-	-	-	-	-	-	-	-	-	-
1a.4.3	Health physics supplies	-	497	-	-	-	-	-	124	621	621	-	-	-	-	-	-	-	-	-	-
1a.4.4	Heavy equipment rental	-	523	-	-	-	-	-	78	602	602	-	-	-	-	-	-	-	-	-	-
1a.4.5	Disposal of DAW generated	-	-	12	3	-	31	-	9	55	55	-	-	-	610	-	-	-	12,190	20	-
1a.4.6	Plant energy budget	-	-	-	-	-	-	1,677	252	1,928	1,928	-	-	-	-	-	-	-	-	-	-
1a.4.7	NRC Fees	-	-	-	-	-	-	1,181	118	1,299	1,299	-	-	-	-	-	-	-	-	-	-
1a.4.8	Emergency Planning Fees	-	-	-	-	-	-	1,490	149	1,638	-	1,638	-	-	-	-	-	-	-	-	-
1a.4.9	INPO Fees	-	-	-	-	-	-	336	50	386	386	-	-	-	-	-	-	-	-	-	-
1a.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	791	119	910	-	910	-	-	-	-	-	-	-	-	-
1a.4.11	ISFSI Operating Costs	-	-	-	-	-	-	95	14	110	-	110	-	-	-	-	-	-	-	-	-
1a.4.12	Corporate Allocations	-	-	-	-	-	-	1,000	100	1,100	1,100	-	-	-	-	-	-	-	-	-	-
1a.4.13	Security Staff Cost	-	-	-	-	-	-	11,224	1,684	12,908	12,908	-	-	-	-	-	-	-	-	-	275,314
1a.4.14	Utility Staff Cost	-	-	-	-	-	-	31,458	4,719	36,177	36,177	-	-	-	-	-	-	-	-	-	423,400
1a.4	Subtotal Period 1a Period-Dependent Costs	-	1,020	12	3	-	31	51,433	7,634	60,133	57,475	2,658	-	-	610	-	-	-	12,190	20	698,714
1a.0	TOTAL PERIOD 1a COST	-	1,020	12	3	-	31	63,539	9,507	74,112	63,174	10,938	-	-	610	-	-	-	12,190	20	734,604

Table H-2
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
60-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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	1,225	-	-	-	-	-	-	612	1,837	1,837	-	-	-	-	-	-	-	-	24,102	-
1b.1.1.2	Auxiliary	621	-	-	-	-	-	-	311	932	932	-	-	-	-	-	-	-	-	12,527	-
1b.1.1.3	Communication Corridor - Contaminated	14	-	-	-	-	-	-	7	21	21	-	-	-	-	-	-	-	-	276	-
1b.1.1.4	Fuel Building	766	-	-	-	-	-	-	383	1,149	1,149	-	-	-	-	-	-	-	-	14,371	-
1b.1.1.5	Hot Machine Shop	17	-	-	-	-	-	-	9	26	26	-	-	-	-	-	-	-	-	344	-
1b.1.1.6	RAM Storage Building	43	-	-	-	-	-	-	21	64	64	-	-	-	-	-	-	-	-	865	-
1b.1.1.7	Radioactive and Personnel Tunnel	5	-	-	-	-	-	-	2	7	7	-	-	-	-	-	-	-	-	91	-
1b.1.1.8	Radwaste	300	-	-	-	-	-	-	150	450	450	-	-	-	-	-	-	-	-	5,964	-
1b.1.1.9	Radwaste Drum Storage	34	-	-	-	-	-	-	17	51	51	-	-	-	-	-	-	-	-	671	-
1b.1.1.10	Reactor Head Assembly Building	31	-	-	-	-	-	-	16	47	47	-	-	-	-	-	-	-	-	614	-
1b.1.1	Totals	3,055	-	-	-	-	-	-	1,528	4,583	4,583	-	-	-	-	-	-	-	-	59,826	-
1b.1	Subtotal Period 1b Activity Costs	3,055	-	-	-	-	-	-	1,528	4,583	4,583	-	-	-	-	-	-	-	-	59,826	-
Period 1b Collateral Costs																					
1b.3.1	Decon equipment	893	-	-	-	-	-	-	134	1,026	1,026	-	-	-	-	-	-	-	-	-	-
1b.3.2	Process decommissioning water waste	172	-	108	278	-	482	-	259	1,299	1,299	-	-	-	1,085	-	-	-	65,106	212	-
1b.3.4	Small tool allowance	-	48	-	-	-	-	-	7	55	55	-	-	-	-	-	-	-	-	-	-
1b.3.5	Spent Fuel Transfer	-	-	-	-	-	-	2,160	324	2,484	-	2,484	-	-	-	-	-	-	-	-	-
1b.3	Subtotal Period 1b Collateral Costs	1,064	48	108	278	-	482	2,160	724	4,865	2,381	2,484	-	-	1,085	-	-	-	65,106	212	-
Period 1b Period-Dependent Costs																					
1b.4.1	Decon supplies	1,133	-	-	-	-	-	-	283	1,417	1,417	-	-	-	-	-	-	-	-	-	-
1b.4.2	Insurance	-	-	-	-	-	-	479	48	527	527	-	-	-	-	-	-	-	-	-	-
1b.4.3	Property taxes	-	-	-	-	-	-	71	7	78	78	-	-	-	-	-	-	-	-	-	-
1b.4.4	Health physics supplies	-	401	-	-	-	-	-	100	502	502	-	-	-	-	-	-	-	-	-	-
1b.4.5	Heavy equipment rental	-	132	-	-	-	-	-	20	152	152	-	-	-	-	-	-	-	-	-	-
1b.4.6	Disposal of DAW generated	-	-	15	3	-	37	-	11	67	67	-	-	-	740	-	-	-	14,798	24	-
1b.4.7	Plant energy budget	-	-	-	-	-	-	423	63	486	486	-	-	-	-	-	-	-	-	-	-
1b.4.8	NRC Fees	-	-	-	-	-	-	174	17	191	191	-	-	-	-	-	-	-	-	-	-
1b.4.9	Emergency Planning Fees	-	-	-	-	-	-	375	38	413	-	413	-	-	-	-	-	-	-	-	-
1b.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	199	30	229	-	229	-	-	-	-	-	-	-	-	-
1b.4.11	ISFSI Operating Costs	-	-	-	-	-	-	24	4	28	-	28	-	-	-	-	-	-	-	-	-
1b.4.12	Corporate Allocations	-	-	-	-	-	-	252	25	277	277	-	-	-	-	-	-	-	-	-	-
1b.4.13	Security Staff Cost	-	-	-	-	-	-	2,312	347	2,659	2,659	-	-	-	-	-	-	-	-	-	55,515
1b.4.14	Utility Staff Cost	-	-	-	-	-	-	7,929	1,189	9,118	9,118	-	-	-	-	-	-	-	-	-	106,720
1b.4	Subtotal Period 1b Period-Dependent Costs	1,133	533	15	3	-	37	12,239	2,183	16,144	15,474	670	-	-	740	-	-	-	14,798	24	162,235
1b.0	TOTAL PERIOD 1b COST	5,253	581	123	281	-	519	14,399	4,435	25,592	22,438	3,154	-	-	1,825	-	-	-	79,905	60,061	162,235
PERIOD 1c - Preparations for SAFSTOR Dormancy																					
Period 1c Direct Decommissioning Activities																					
1c.1.1	Prepare support equipment for storage	-	444	-	-	-	-	-	67	510	510	-	-	-	-	-	-	-	-	3,000	-
1c.1.2	Install containment pressure equal. lines	-	38	-	-	-	-	-	6	44	44	-	-	-	-	-	-	-	-	700	-
1c.1.3	Interim survey prior to dormancy	-	-	-	-	-	-	733	220	953	953	-	-	-	-	-	-	-	-	14,124	-
1c.1.4	Secure building accesses									a											
1c.1.5	Prepare & submit interim report	-	-	-	-	-	-	74	11	85	85	-	-	-	-	-	-	-	-	-	583
1c.1	Subtotal Period 1c Activity Costs	-	482	-	-	-	-	806	303	1,592	1,592	-	-	-	-	-	-	-	-	17,824	583
Period 1c Additional Costs																					
1c.2.1	Spent fuel pool isolation	-	-	-	-	-	-	10,813	1,622	12,434	12,434	-	-	-	-	-	-	-	-	-	-
1c.2	Subtotal Period 1c Additional Costs	-	-	-	-	-	-	10,813	1,622	12,434	12,434	-	-	-	-	-	-	-	-	-	-
Period 1c Collateral Costs																					
1c.3.1	Process decommissioning water waste	187	-	118	303	-	525	-	282	1,415	1,415	-	-	-	1,183	-	-	-	70,966	231	-
1c.3.3	Small tool allowance	-	3	-	-	-	-	-	1	4	4	-	-	-	-	-	-	-	-	-	-
1c.3.4	Spent Fuel Transfer	-	-	-	-	-	-	2,160	324	2,484	-	2,484	-	-	-	-	-	-	-	-	-
1c.3	Subtotal Period 1c Collateral Costs	187	3	118	303	-	525	2,160	606	3,903	1,419	2,484	-	-	1,183	-	-	-	70,966	231	-

Table H-2
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
60-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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	-	-	-	-	-	-	479	48	527	527	-	-	-	-	-	-	-	-	-	-
1c.4.2	Property taxes	-	-	-	-	-	-	71	7	78	78	-	-	-	-	-	-	-	-	-	-
1c.4.3	Health physics supplies	-	208	-	-	-	-	-	52	260	260	-	-	-	-	-	-	-	-	-	-
1c.4.4	Heavy equipment rental	-	132	-	-	-	-	-	20	152	152	-	-	-	-	-	-	-	-	-	-
1c.4.5	Disposal of DAW generated	-	-	3	1	-	8	-	2	14	14	-	-	-	154	-	-	-	3,073	5	-
1c.4.6	Plant energy budget	-	-	-	-	-	-	423	63	486	486	-	-	-	-	-	-	-	-	-	-
1c.4.7	NRC Fees	-	-	-	-	-	-	174	17	191	191	-	-	-	-	-	-	-	-	-	-
1c.4.8	Emergency Planning Fees	-	-	-	-	-	-	375	38	413	-	413	-	-	-	-	-	-	-	-	-
1c.4.9	Spent Fuel Pool O&M	-	-	-	-	-	-	199	30	229	-	229	-	-	-	-	-	-	-	-	-
1c.4.10	ISFSI Operating Costs	-	-	-	-	-	-	24	4	28	-	28	-	-	-	-	-	-	-	-	-
1c.4.11	Corporate Allocations	-	-	-	-	-	-	252	25	277	277	-	-	-	-	-	-	-	-	-	-
1c.4.12	Security Staff Cost	-	-	-	-	-	-	2,312	347	2,659	2,659	-	-	-	-	-	-	-	-	-	55,515
1c.4.13	Utility Staff Cost	-	-	-	-	-	-	7,929	1,189	9,118	9,118	-	-	-	-	-	-	-	-	-	106,720
1c.4	Subtotal Period 1c Period-Dependent Costs	-	340	3	1	-	8	12,239	1,842	14,433	13,763	670	-	-	154	-	-	-	3,073	5	162,235
1c.0	TOTAL PERIOD 1c COST	187	825	121	304	-	533	26,018	4,374	32,362	29,208	3,154	-	-	1,336	-	-	-	74,038	18,060	162,819
PERIOD 1 TOTALS		5,440	2,427	256	588	-	1,083	103,956	18,316	132,065	114,819	17,246	-	-	3,771	-	-	-	166,133	78,141	1,059,658
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	-	-	-	-	-	-	320	48	368	368	-	-	-	-	-	-	-	-	-	-
2a.1.5	Maintenance supplies	-	-	-	-	-	-	556	139	695	695	-	-	-	-	-	-	-	-	-	-
2a.1	Subtotal Period 2a Activity Costs	-	-	-	-	-	-	876	187	1,063	1,063	-	-	-	-	-	-	-	-	-	-
Period 2a Collateral Costs																					
2a.3.1	Spent Fuel Transfer	-	-	-	-	-	-	28,080	4,212	32,292	-	32,292	-	-	-	-	-	-	-	-	-
2a.3	Subtotal Period 2a Collateral Costs	-	-	-	-	-	-	28,080	4,212	32,292	-	32,292	-	-	-	-	-	-	-	-	-
Period 2a Period-Dependent Costs																					
2a.4.1	Insurance	-	-	-	-	-	-	3,686	369	4,054	3,332	722	-	-	-	-	-	-	-	-	-
2a.4.2	Property taxes	-	-	-	-	-	-	1,119	112	1,231	1,231	-	-	-	-	-	-	-	-	-	-
2a.4.3	Health physics supplies	-	797	-	-	-	-	-	199	996	996	-	-	-	-	-	-	-	-	-	-
2a.4.4	Disposal of DAW generated	-	-	19	4	-	47	-	14	83	83	-	-	-	920	-	-	-	18,406	30	-
2a.4.5	Plant energy budget	-	-	-	-	-	-	1,341	201	1,543	771	771	-	-	-	-	-	-	-	-	-
2a.4.6	NRC Fees	-	-	-	-	-	-	1,157	116	1,273	1,273	-	-	-	-	-	-	-	-	-	-
2a.4.7	Emergency Planning Fees	-	-	-	-	-	-	3,727	373	4,100	-	4,100	-	-	-	-	-	-	-	-	-
2a.4.8	Spent Fuel Pool O&M	-	-	-	-	-	-	3,164	475	3,639	-	3,639	-	-	-	-	-	-	-	-	-
2a.4.9	ISFSI Operating Costs	-	-	-	-	-	-	382	57	439	-	439	-	-	-	-	-	-	-	-	-
2a.4.10	Security Staff Cost	-	-	-	-	-	-	36,697	5,504	42,201	6,594	35,607	-	-	-	-	-	-	-	-	881,006
2a.4.11	Utility Staff Cost	-	-	-	-	-	-	24,718	3,708	28,425	5,702	22,724	-	-	-	-	-	-	-	-	329,543
2a.4	Subtotal Period 2a Period-Dependent Costs	-	797	19	4	-	47	75,992	11,128	87,985	19,983	68,002	-	-	920	-	-	-	18,406	30	1,210,549
2a.0	TOTAL PERIOD 2a COST	-	797	19	4	-	47	104,947	15,526	121,340	21,045	100,294	-	-	920	-	-	-	18,406	30	1,210,549
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	-	-	-	-	-	-	3,886	583	4,469	4,469	-	-	-	-	-	-	-	-	-	-
2c.1.5	Maintenance supplies	-	-	-	-	-	-	6,744	1,686	8,430	8,430	-	-	-	-	-	-	-	-	-	-
2c.1	Subtotal Period 2c Activity Costs	-	-	-	-	-	-	10,630	2,269	12,899	12,899	-	-	-	-	-	-	-	-	-	-
Period 2c Period-Dependent Costs																					
2c.4.1	Insurance	-	-	-	-	-	-	36,772	3,677	40,450	40,450	-	-	-	-	-	-	-	-	-	-
2c.4.2	Property taxes	-	-	-	-	-	-	13,586	1,359	14,944	14,944	-	-	-	-	-	-	-	-	-	-
2c.4.3	Health physics supplies	-	4,413	-	-	-	-	-	1,103	5,516	5,516	-	-	-	-	-	-	-	-	-	-
2c.4.4	Disposal of DAW generated	-	-	100	20	-	250	-	76	446	446	-	-	-	4,942	-	-	-	98,844	161	-
2c.4.5	Plant energy budget	-	-	-	-	-	-	8,141	1,221	9,363	9,363	-	-	-	-	-	-	-	-	-	-
2c.4.6	NRC Fees	-	-	-	-	-	-	12,317	1,232	13,549	13,549	-	-	-	-	-	-	-	-	-	-

Table H-2
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
60-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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.4.7	Security Staff Cost	-	-	-	-	-	-	69,597	10,440	80,037	80,037	-	-	-	-	-	-	-	-	-	1,519,029
2c.4.8	Utility Staff Cost	-	-	-	-	-	-	60,184	9,028	69,212	69,212	-	-	-	-	-	-	-	-	-	886,100
2c.4	Subtotal Period 2c Period-Dependent Costs	-	4,413	100	20	-	250	200,598	28,135	233,516	233,516	-	-	-	4,942	-	-	-	98,844	161	2,405,129
2c.0	TOTAL PERIOD 2c COST	-	4,413	100	20	-	250	211,228	30,404	246,415	246,415	-	-	-	4,942	-	-	-	98,844	161	2,405,129
PERIOD 2 TOTALS		-	5,209	119	24	-	297	316,176	45,930	367,755	267,461	100,294	-	-	5,863	-	-	-	117,251	191	3,615,677
PERIOD 3a - Reactivate Site Following SAFSTOR Dormancy																					
Period 3a Direct Decommissioning Activities																					
3a.1.1	Prepare preliminary decommissioning cost	-	-	-	-	-	-	164	25	189	189	-	-	-	-	-	-	-	-	-	1,300
3a.1.2	Review plant dwgs & specs.	-	-	-	-	-	-	580	87	667	667	-	-	-	-	-	-	-	-	-	4,600
3a.1.3	Perform detailed rad survey									a											
3a.1.4	End product description	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
3a.1.5	Detailed by-product inventory	-	-	-	-	-	-	164	25	189	189	-	-	-	-	-	-	-	-	-	1,300
3a.1.6	Define major work sequence	-	-	-	-	-	-	946	142	1,088	1,088	-	-	-	-	-	-	-	-	-	7,500
3a.1.7	Perform SER and EA	-	-	-	-	-	-	391	59	450	450	-	-	-	-	-	-	-	-	-	3,100
3a.1.8	Perform Site-Specific Cost Study	-	-	-	-	-	-	630	95	725	725	-	-	-	-	-	-	-	-	-	5,000
3a.1.9	Prepare/submit License Termination Plan	-	-	-	-	-	-	516	77	594	594	-	-	-	-	-	-	-	-	-	4,096
3a.1.10	Receive NRC approval of termination plan									a											
Activity Specifications																					
3a.1.11.1	Re-activate plant & temporary facilities	-	-	-	-	-	-	929	139	1,069	962	-	107	-	-	-	-	-	-	-	7,370
3a.1.11.2	Plant systems	-	-	-	-	-	-	525	79	604	544	-	60	-	-	-	-	-	-	-	4,167
3a.1.11.3	Reactor internals	-	-	-	-	-	-	895	134	1,030	1,030	-	-	-	-	-	-	-	-	-	7,100
3a.1.11.4	Reactor vessel	-	-	-	-	-	-	820	123	943	943	-	-	-	-	-	-	-	-	-	6,500
3a.1.11.5	Biological shield	-	-	-	-	-	-	63	9	73	73	-	-	-	-	-	-	-	-	-	500
3a.1.11.6	Steam generators	-	-	-	-	-	-	393	59	452	452	-	-	-	-	-	-	-	-	-	3,120
3a.1.11.7	Reinforced concrete	-	-	-	-	-	-	202	30	232	116	-	116	-	-	-	-	-	-	-	1,600
3a.1.11.8	Main Turbine	-	-	-	-	-	-	50	8	58	-	-	58	-	-	-	-	-	-	-	400
3a.1.11.9	Main Condensers	-	-	-	-	-	-	50	8	58	-	-	58	-	-	-	-	-	-	-	400
3a.1.11.10	Plant structures & buildings	-	-	-	-	-	-	393	59	452	226	-	226	-	-	-	-	-	-	-	3,120
3a.1.11.11	Waste management	-	-	-	-	-	-	580	87	667	667	-	-	-	-	-	-	-	-	-	4,600
3a.1.11.12	Facility & site closeout	-	-	-	-	-	-	113	17	131	65	-	65	-	-	-	-	-	-	-	900
3a.1.11	Total	-	-	-	-	-	-	5,015	752	5,768	5,077	-	691	-	-	-	-	-	-	-	39,777
Planning & Site Preparations																					
3a.1.12	Prepare dismantling sequence	-	-	-	-	-	-	303	45	348	348	-	-	-	-	-	-	-	-	-	2,400
3a.1.13	Plant prep. & temp. svces	-	-	-	-	-	-	3,000	450	3,450	3,450	-	-	-	-	-	-	-	-	-	-
3a.1.14	Design water clean-up system	-	-	-	-	-	-	177	26	203	203	-	-	-	-	-	-	-	-	-	1,400
3a.1.15	Rigging/Cont. Cntrl Envlps/tooling/etc.	-	-	-	-	-	-	2,300	345	2,645	2,645	-	-	-	-	-	-	-	-	-	-
3a.1.16	Procure casks/liners & containers	-	-	-	-	-	-	155	23	178	178	-	-	-	-	-	-	-	-	-	1,230
3a.1	Subtotal Period 3a Activity Costs	-	-	-	-	-	-	14,467	2,170	16,637	15,946	-	691	-	-	-	-	-	-	-	72,703
Period 3a Period-Dependent Costs																					
3a.4.1	Insurance	-	-	-	-	-	-	382	38	420	420	-	-	-	-	-	-	-	-	-	-
3a.4.2	Property taxes	-	-	-	-	-	-	141	14	155	155	-	-	-	-	-	-	-	-	-	-
3a.4.3	Health physics supplies	-	219	-	-	-	-	-	55	273	273	-	-	-	-	-	-	-	-	-	-
3a.4.4	Heavy equipment rental	-	264	-	-	-	-	-	40	303	303	-	-	-	-	-	-	-	-	-	-
3a.4.5	Disposal of DAW generated	-	-	5	1	-	13	-	4	23	23	-	-	-	259	-	-	-	5,186	8	-
3a.4.6	Plant energy budget	-	-	-	-	-	-	845	127	972	972	-	-	-	-	-	-	-	-	-	-
3a.4.7	NRC Fees	-	-	-	-	-	-	191	19	210	210	-	-	-	-	-	-	-	-	-	-
3a.4.8	Corporate Allocations	-	-	-	-	-	-	504	50	555	555	-	-	-	-	-	-	-	-	-	-
3a.4.9	Security Staff Cost	-	-	-	-	-	-	1,012	152	1,164	1,164	-	-	-	-	-	-	-	-	-	32,857
3a.4.10	Utility Staff Cost	-	-	-	-	-	-	9,856	1,478	11,334	11,334	-	-	-	-	-	-	-	-	-	130,377
3a.4	Subtotal Period 3a Period-Dependent Costs	-	483	5	1	-	13	12,931	1,977	15,410	15,410	-	-	-	259	-	-	-	5,186	8	163,234
3a.0	TOTAL PERIOD 3a COST	-	483	5	1	-	13	27,398	4,147	32,047	31,356	-	691	-	259	-	-	-	5,186	8	235,937

Table H-2
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
60-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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	-	-	-	-	-	-	597	90	686	618	-	69	-	-	-	-	-	-	-	4,733
3b.1.1.2	Reactor internals	-	-	-	-	-	-	315	47	363	363	-	-	-	-	-	-	-	-	-	2,500
3b.1.1.3	Remaining buildings	-	-	-	-	-	-	170	26	196	49	-	147	-	-	-	-	-	-	-	1,350
3b.1.1.4	CRD cooling assembly	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
3b.1.1.5	CRD housings & ICI tubes	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
3b.1.1.6	Incore instrumentation	-	-	-	-	-	-	126	19	145	145	-	-	-	-	-	-	-	-	-	1,000
3b.1.1.7	Reactor vessel	-	-	-	-	-	-	458	69	526	526	-	-	-	-	-	-	-	-	-	3,630
3b.1.1.8	Facility closeout	-	-	-	-	-	-	151	23	174	87	-	87	-	-	-	-	-	-	-	1,200
3b.1.1.9	Missile shields	-	-	-	-	-	-	57	9	65	65	-	-	-	-	-	-	-	-	-	450
3b.1.1.10	Biological shield	-	-	-	-	-	-	151	23	174	174	-	-	-	-	-	-	-	-	-	1,200
3b.1.1.11	Steam generators	-	-	-	-	-	-	580	87	667	667	-	-	-	-	-	-	-	-	-	4,600
3b.1.1.12	Reinforced concrete	-	-	-	-	-	-	126	19	145	73	-	73	-	-	-	-	-	-	-	1,000
3b.1.1.13	Main Turbine	-	-	-	-	-	-	197	30	226	-	-	226	-	-	-	-	-	-	-	1,560
3b.1.1.14	Main Condensers	-	-	-	-	-	-	197	30	226	-	-	226	-	-	-	-	-	-	-	1,560
3b.1.1.15	Auxiliary building	-	-	-	-	-	-	344	52	396	356	-	40	-	-	-	-	-	-	-	2,730
3b.1.1.16	Reactor building	-	-	-	-	-	-	344	52	396	356	-	40	-	-	-	-	-	-	-	2,730
3b.1.1	Total	-	-	-	-	-	-	4,066	610	4,675	3,769	-	907	-	-	-	-	-	-	-	32,243
3b.1	Subtotal Period 3b Activity Costs	-	-	-	-	-	-	4,066	610	4,675	3,769	-	907	-	-	-	-	-	-	-	32,243
Period 3b Additional Costs																					
3b.2.1	Site Characterization	-	-	-	-	-	-	2,824	847	3,671	3,671	-	-	-	-	-	-	-	-	19,100	7,852
3b.2	Subtotal Period 3b Additional Costs	-	-	-	-	-	-	2,824	847	3,671	3,671	-	-	-	-	-	-	-	-	19,100	7,852
Period 3b Collateral Costs																					
3b.3.1	Decon equipment	893	-	-	-	-	-	-	134	1,026	1,026	-	-	-	-	-	-	-	-	-	-
3b.3.2	DOC staff relocation expenses	-	-	-	-	-	-	1,080	162	1,242	1,242	-	-	-	-	-	-	-	-	-	-
3b.3.3	Pipe cutting equipment	-	1,100	-	-	-	-	-	165	1,265	1,265	-	-	-	-	-	-	-	-	-	-
3b.3	Subtotal Period 3b Collateral Costs	893	1,100	-	-	-	-	1,080	461	3,533	3,533	-	-	-	-	-	-	-	-	-	-
Period 3b Period-Dependent Costs																					
3b.4.1	Decon supplies	54	-	-	-	-	-	-	14	68	68	-	-	-	-	-	-	-	-	-	-
3b.4.2	Insurance	-	-	-	-	-	-	921	92	1,014	1,014	-	-	-	-	-	-	-	-	-	-
3b.4.3	Property taxes	-	-	-	-	-	-	280	28	308	308	-	-	-	-	-	-	-	-	-	-
3b.4.4	Health physics supplies	-	478	-	-	-	-	-	120	598	598	-	-	-	-	-	-	-	-	-	-
3b.4.5	Heavy equipment rental	-	523	-	-	-	-	-	78	602	602	-	-	-	-	-	-	-	-	-	-
3b.4.6	Disposal of DAW generated	-	-	12	2	-	29	-	9	53	53	-	-	-	582	-	-	-	11,636	19	-
3b.4.7	Plant energy budget	-	-	-	-	-	-	1,677	252	1,928	1,928	-	-	-	-	-	-	-	-	-	-
3b.4.8	NRC Fees	-	-	-	-	-	-	378	38	416	416	-	-	-	-	-	-	-	-	-	-
3b.4.9	Corporate Allocations	-	-	-	-	-	-	1,000	100	1,100	1,100	-	-	-	-	-	-	-	-	-	-
3b.4.10	Security Staff Cost	-	-	-	-	-	-	2,008	301	2,309	2,309	-	-	-	-	-	-	-	-	-	65,179
3b.4.11	DOC Staff Cost	-	-	-	-	-	-	11,473	1,721	13,194	13,194	-	-	-	-	-	-	-	-	-	116,800
3b.4.12	Utility Staff Cost	-	-	-	-	-	-	19,551	2,933	22,484	22,484	-	-	-	-	-	-	-	-	-	258,629
3b.4	Subtotal Period 3b Period-Dependent Costs	54	1,002	12	2	-	29	37,288	5,685	44,072	44,072	-	-	-	582	-	-	-	11,636	19	440,607
3b.0	TOTAL PERIOD 3b COST	947	2,102	12	2	-	29	45,257	7,603	55,952	55,045	-	907	-	582	-	-	-	11,636	19,119	480,702
PERIOD 3 TOTALS		947	2,584	17	3	-	43	72,655	11,750	87,999	86,401	-	1,597	-	841	-	-	-	16,822	19,127	716,639
PERIOD 4a - Large Component Removal																					
Period 4a Direct Decommissioning Activities																					
Nuclear Steam Supply System Removal																					
4a.1.1.1	Reactor Coolant Piping	36	169	24	17	133	260	-	150	787	787	-	-	580	614	-	-	-	134,538	3,957	-
4a.1.1.2	Pressurizer Relief Tank	6	23	7	5	37	67	-	33	178	178	-	-	164	164	-	-	-	36,395	594	-
4a.1.1.3	Reactor Coolant Pumps & Motors	20	82	70	206	-	1,031	-	326	1,735	1,735	-	-	-	3,386	-	-	-	816,140	2,700	80
4a.1.1.4	Pressurizer	10	55	433	156	-	1,138	-	370	2,161	2,161	-	-	-	3,739	-	-	-	241,053	1,538	1,500
4a.1.1.5	Steam Generators	76	5,359	2,279	2,691	2,599	6,862	-	4,115	23,982	23,982	-	-	40,262	22,546	-	-	-	3,349,305	20,508	2,250
4a.1.1.6	Retired Steam Generator Units	-	-	2,279	2,691	2,599	6,862	-	2,737	17,169	17,169	-	-	40,262	22,546	-	-	-	3,349,305	10,800	2,250
4a.1.1.7	CRDMs/ICIs/Service Structure Removal	30	81	222	39	57	199	-	122	751	751	-	-	753	2,947	-	-	-	81,666	2,134	-
4a.1.1.8	Reactor Vessel Internals	55	3,199	9,914	698	-	13,904	279	12,074	40,125	40,125	-	-	-	2,437	501	406	-	327,518	26,217	1,181
4a.1.1.9	Vessel & Internals GTCC Disposal	-	-	-	-	-	10,749	-	1,612	12,361	12,361	-	-	-	-	-	-	2,217	433,180	-	-
4a.1.1.10	Reactor Vessel	95	6,030	2,008	1,086	-	3,087	279	6,929	19,514	19,514	-	-	-	9,361	-	-	-	960,909	26,217	1,181
4a.1.1	Totals	328	14,999	17,235	7,589	5,426	44,159	559	28,468	118,763	118,763	-	-	82,020	67,739	501	406	2,217	9,730,008	94,664	8,441

Table H-2
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
60-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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	-	438	268	12	640	-	-	234	1,593	1,593	-	-	5,180	-	-	-	-	310,807	8,721	-
4a.1.3	Main Condensers	-	1,240	164	34	751	-	-	444	2,634	2,634	-	-	8,106	-	-	-	-	364,767	24,802	-
Cascading Costs from Clean Building Demolition																					
4a.1.4.1	Reactor	-	915	-	-	-	-	-	137	1,052	1,052	-	-	-	-	-	-	-	-	10,442	-
4a.1.4.2	Auxiliary	-	466	-	-	-	-	-	70	536	536	-	-	-	-	-	-	-	-	5,551	-
4a.1.4.3	Fuel Building	-	227	-	-	-	-	-	34	261	261	-	-	-	-	-	-	-	-	2,395	-
4a.1.4.4	Hot Machine Shop	-	1	-	-	-	-	-	0	1	1	-	-	-	-	-	-	-	-	16	-
4a.1.4.5	Radwaste	-	97	-	-	-	-	-	15	111	111	-	-	-	-	-	-	-	-	1,108	-
4a.1.4	Totals	-	1,705	-	-	-	-	-	256	1,961	1,961	-	-	-	-	-	-	-	-	19,512	-
Disposal of Plant Systems																					
4a.1.5.1	100 Aux.Bldg Non-System Specific RCA	-	688	12	29	638	-	-	273	1,640	1,640	-	-	7,629	-	-	-	-	309,812	13,471	-
4a.1.5.2	100 Auxiliary Bldg Non-System Specific	-	102	2	4	69	8	-	38	222	222	-	-	824	31	-	-	-	35,534	2,031	-
4a.1.5.3	AB - Main Steam	-	267	-	-	-	-	-	40	308	-	-	308	-	-	-	-	-	-	5,833	-
4a.1.5.4	AB - Main Steam RCA	-	78	3	8	180	-	-	48	318	318	-	-	2,156	-	-	-	-	87,550	1,515	-
4a.1.5.5	AC - Main Turbine	-	263	-	-	-	-	-	39	302	-	-	302	-	-	-	-	-	-	5,641	-
4a.1.5.6	AD - Condensate	-	290	-	-	-	-	-	43	333	-	-	333	-	-	-	-	-	-	6,144	-
4a.1.5.7	AE - Feedwater	-	200	-	-	-	-	-	30	229	-	-	229	-	-	-	-	-	-	4,271	-
4a.1.5.8	AF - Feedwater Heater Extraction	-	247	-	-	-	-	-	37	285	-	-	285	-	-	-	-	-	-	5,352	-
4a.1.5.9	AK - Condensate Demineralizer	-	91	-	-	-	-	-	14	105	-	-	105	-	-	-	-	-	-	1,944	-
4a.1.5.10	AL - Auxiliary Feedwater	-	40	-	-	-	-	-	6	46	-	-	46	-	-	-	-	-	-	852	-
4a.1.5.11	AQ - Condensate & Feedwater Chem Addtn	-	22	-	-	-	-	-	3	26	-	-	26	-	-	-	-	-	-	468	-
4a.1.5.12	BM - Steam Generator Blowdown - RCA	-	372	6	15	344	-	-	147	885	885	-	-	4,109	-	-	-	-	166,857	7,066	-
4a.1.5.14	BN - Borated Refueling Water Storage	-	306	9	24	523	-	-	160	1,022	1,022	-	-	6,255	-	-	-	-	254,024	6,161	-
4a.1.5.15	CA - Steam Seal	-	21	-	-	-	-	-	3	24	-	-	24	-	-	-	-	-	-	455	-
4a.1.5.16	CB - Main Turbine Lube Oil	-	59	-	-	-	-	-	9	68	-	-	68	-	-	-	-	-	-	1,207	-
4a.1.5.17	CC - Generator Hydrogen Seal & CO2	-	10	-	-	-	-	-	1	11	-	-	11	-	-	-	-	-	-	198	-
4a.1.5.18	CD - Generator Seal Oil	-	14	-	-	-	-	-	2	16	-	-	16	-	-	-	-	-	-	287	-
4a.1.5.19	CE - Stator Cooling Water	-	12	-	-	-	-	-	2	13	-	-	13	-	-	-	-	-	-	241	-
4a.1.5.20	CF - Lube Oil Storage Xfer & Prfication	-	39	-	-	-	-	-	6	44	-	-	44	-	-	-	-	-	-	812	-
4a.1.5.21	CG - Condenser Air Removal	-	31	-	-	-	-	-	5	36	-	-	36	-	-	-	-	-	-	657	-
4a.1.5.22	CH - Main Turbine Control Oil	-	60	-	-	-	-	-	9	69	-	-	69	-	-	-	-	-	-	1,219	-
4a.1.5.23	DA - Circulating Water	-	345	-	-	-	-	-	52	397	-	-	397	-	-	-	-	-	-	7,502	-
4a.1.5.24	DB - Cooling Tower Makeup & Blowdown	-	58	-	-	-	-	-	9	67	-	-	67	-	-	-	-	-	-	1,260	-
4a.1.5.25	DD - Cooling Water Chemical Control Sys	-	51	-	-	-	-	-	8	59	-	-	59	-	-	-	-	-	-	1,084	-
4a.1.5.26	DD - Cooling Wtr Chem Control RCA	-	274	5	13	297	-	-	116	706	706	-	-	3,555	-	-	-	-	144,376	4,951	-
4a.1.5.27	EJ - Residual Heat Removal	-	358	31	35	375	285	-	225	1,309	1,309	-	-	4,481	1,166	-	-	-	259,047	7,147	-
4a.1.5.28	EM - High Pressure Coolant Injection	-	304	3	8	185	-	-	105	606	606	-	-	2,214	-	-	-	-	89,903	5,913	-
4a.1.5.29	EN - Containment Spray	-	218	5	11	253	-	-	95	581	581	-	-	3,026	-	-	-	-	122,874	4,134	-
4a.1.5.30	EP - Accumulator Safety Injection	-	160	3	7	166	-	-	66	403	403	-	-	1,989	-	-	-	-	80,762	3,112	-
4a.1.5.31	FA - Auxiliary Steam Generator	-	24	-	-	-	-	-	4	27	-	-	27	-	-	-	-	-	-	521	-
4a.1.5.32	FB - Auxiliary Steam	-	98	-	-	-	-	-	15	112	-	-	112	-	-	-	-	-	-	2,106	-
4a.1.5.33	FB - Auxiliary Steam RCA	-	83	1	3	68	-	-	31	187	187	-	-	816	-	-	-	-	33,148	1,537	-
4a.1.5.34	FC - Auxiliary Turbines	-	63	-	-	-	-	-	9	72	-	-	72	-	-	-	-	-	-	1,320	-
4a.1.5.35	FE - Auxiliary Steam Chemical Addition	-	5	-	-	-	-	-	1	6	-	-	6	-	-	-	-	-	-	105	-
4a.1.5.36	GE - Turbine Building HVAC	-	175	-	-	-	-	-	26	201	-	-	201	-	-	-	-	-	-	3,957	-
4a.1.5.37	GS - Containment Hydrogen Control	-	70	1	3	67	-	-	28	169	169	-	-	801	-	-	-	-	32,539	1,395	-
4a.1.5.38	HE - Boron Recycle	-	461	24	25	289	194	-	213	1,206	1,206	-	-	3,460	794	-	-	-	192,819	8,970	-
4a.1.5.39	HF - Secondary Liquid Waste	-	903	48	56	705	387	-	441	2,541	2,541	-	-	8,431	1,588	-	-	-	447,007	17,832	-
4a.1.5.40	JA - Auxiliary Oil & Transfer	-	32	-	-	-	-	-	5	36	-	-	36	-	-	-	-	-	-	690	-
4a.1.5.41	KS - Bulk Chemical Storage	-	91	10	24	539	-	-	108	773	773	-	-	6,449	-	-	-	-	261,890	1,825	-
4a.1.5.42	LE - Oily Waste	-	179	-	-	-	-	-	27	206	-	-	206	-	-	-	-	-	-	3,865	-
4a.1.5.43	LE - Oily Waste RCA	-	237	3	8	189	-	-	89	527	527	-	-	2,256	-	-	-	-	91,628	4,296	-
4a.1.5.44	Turbine Bldg Non-System Specific	-	742	-	-	-	-	-	111	853	-	-	853	-	-	-	-	-	-	15,405	-
4a.1.5	Totals	-	8,248	168	279	4,987	873	-	2,743	17,298	13,347	-	3,951	59,608	3,579	-	-	-	2,656,763	166,890	-
4a.1.6	Scaffolding in support of decommissioning	-	1,464	27	7	114	27	-	394	2,033	2,033	-	-	1,233	109	-	-	-	62,671	33,634	-
4a.1	Subtotal Period 4a Activity Costs	328	28,094	17,864	7,920	11,919	45,060	559	32,539	144,282	140,331	-	3,951	156,147	71,427	501	406	2,217	13,125,020	348,223	8,441
Period 4a Additional Costs																					
4a.2.1	Remedial Action Surveys	-	-	-	-	-	-	1,399	420	1,819	1,819	-	-	-	-	-	-	-	-	28,645	-
4a.2	Subtotal Period 4a Additional Costs	-	-	-	-	-	-	1,399	420	1,819	1,819	-	-	-	-	-	-	-	-	28,645	-

Table H-2
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
60-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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	-	8	20	-	35	-	15	82	82	-	-	-	78	-	-	-	4,704	15	-
4a.3.3	Small tool allowance	-	288	-	-	-	-	-	43	331	298	-	33	-	-	-	-	-	-	-	-
4a.3.4	On-site survey and release of 60.87 tons clean metallic waste	-	-	-	-	-	-	84	8	92	92	-	-	-	-	-	-	-	-	-	-
4a.3	Subtotal Period 4a Collateral Costs	5	288	8	20	-	35	84	67	506	473	-	33	-	78	-	-	-	4,704	15	-
Period 4a Period-Dependent Costs																					
4a.4.1	Decon supplies	75	-	-	-	-	-	-	19	94	94	-	-	-	-	-	-	-	-	-	-
4a.4.2	Insurance	-	-	-	-	-	-	1,270	127	1,397	1,397	-	-	-	-	-	-	-	-	-	-
4a.4.3	Property taxes	-	-	-	-	-	-	386	39	424	382	-	42	-	-	-	-	-	-	-	-
4a.4.4	Health physics supplies	-	2,408	-	-	-	-	-	602	3,010	3,010	-	-	-	-	-	-	-	-	-	-
4a.4.5	Heavy equipment rental	-	2,771	-	-	-	-	-	416	3,187	3,187	-	-	-	-	-	-	-	-	-	-
4a.4.6	Disposal of DAW generated	-	-	100	20	-	250	-	75	445	445	-	-	-	4,929	-	-	-	98,590	161	-
4a.4.7	Plant energy budget	-	-	-	-	-	-	2,195	329	2,525	2,525	-	-	-	-	-	-	-	-	-	-
4a.4.8	NRC Fees	-	-	-	-	-	-	832	83	915	915	-	-	-	-	-	-	-	-	-	-
4a.4.9	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	552	83	635	635	-	-	-	-	-	-	-	-	-	-
4a.4.10	Corporate Allocations	-	-	-	-	-	-	1,378	138	1,516	1,516	-	-	-	-	-	-	-	-	-	-
4a.4.11	Security Staff Cost	-	-	-	-	-	-	2,767	415	3,182	3,182	-	-	-	-	-	-	-	-	-	89,821
4a.4.12	DOC Staff Cost	-	-	-	-	-	-	18,947	2,842	21,788	21,788	-	-	-	-	-	-	-	-	-	198,326
4a.4.13	Utility Staff Cost	-	-	-	-	-	-	27,104	4,066	31,170	31,170	-	-	-	-	-	-	-	-	-	359,286
4a.4	Subtotal Period 4a Period-Dependent Costs	75	5,180	100	20	-	250	55,430	9,233	70,288	70,246	-	42	-	4,929	-	-	-	98,590	161	647,433
4a.0	TOTAL PERIOD 4a COST	408	33,562	17,972	7,961	11,919	45,344	57,472	42,258	216,895	212,868	-	4,027	156,147	76,435	501	406	2,217	13,228,310	377,044	655,874
PERIOD 4b - Site Decontamination																					
Period 4b Direct Decommissioning Activities																					
4b.1.1	Remove spent fuel racks	753	82	293	107	-	1,709	-	870	3,814	3,814	-	-	-	6,988	-	-	-	461,925	1,925	-
Disposal of Plant Systems																					
4b.1.2.1	200 Reactor Bldg Non-System Specific	-	81	1	2	42	5	-	28	159	159	-	-	502	19	-	-	-	21,639	1,569	-
4b.1.2.2	200 Reactor Bldg Non-System Specific RCA	-	557	7	18	399	-	-	203	1,184	1,184	-	-	4,768	-	-	-	-	193,612	10,425	-
4b.1.2.3	300 Control Bldg Non-System Specific	-	176	3	8	179	-	-	72	439	439	-	-	2,139	-	-	-	-	86,849	3,413	-
4b.1.2.4	300 Control Bldg Non-System Specific Cln	-	1,394	-	-	-	-	-	209	1,603	-	-	1,603	-	-	-	-	-	-	29,076	-
4b.1.2.5	600 Fuel Bldg Non-Specific Systems RCA	-	306	5	12	268	-	-	119	710	710	-	-	3,200	-	-	-	-	129,974	5,859	-
4b.1.2.6	600 Fuel Bldg Non-System Specific	-	43	1	1	27	3	-	16	91	91	-	-	322	12	-	-	-	13,860	850	-
4b.1.2.7	700 Radwaste Bldg Non-Sys Specific RCA	-	1,131	19	48	1,061	-	-	451	2,710	2,710	-	-	12,684	-	-	-	-	515,103	21,919	-
4b.1.2.8	700 Radwaste Bldg Non-System Specific	-	164	3	6	111	12	-	62	358	358	-	-	1,329	50	-	-	-	57,274	3,253	-
4b.1.2.9	AN - Demineralized Wtr Storage & Xfer	-	153	-	-	-	-	-	23	176	-	-	176	-	-	-	-	-	-	3,283	-
4b.1.2.10	AN - Demineralized Wtr Strg & Xfer RCA	-	40	0	1	26	-	-	14	83	83	-	-	314	-	-	-	-	12,759	740	-
4b.1.2.11	AP - Condensate Storage & Transfer	-	89	-	-	-	-	-	13	102	-	-	102	-	-	-	-	-	-	1,794	-
4b.1.2.12	BB - Reactor Coolant System	-	309	26	27	216	273	-	184	1,035	1,035	-	-	2,586	1,130	-	-	-	178,727	6,323	-
4b.1.2.13	BG - Chemical & Volume Control	-	880	69	70	685	633	-	498	2,836	2,836	-	-	8,192	2,586	-	-	-	503,667	17,275	-
4b.1.2.14	BL - Reactor Makeup Water	-	280	14	16	212	102	-	131	754	754	-	-	2,529	418	-	-	-	130,204	5,494	-
4b.1.2.15	DE - Intake & Water Treatment	-	121	-	-	-	-	-	18	139	-	-	139	-	-	-	-	-	-	2,517	-
4b.1.2.16	DE - Intake & Water Treatment RCA	-	252	18	45	997	-	-	221	1,533	1,533	-	-	11,923	-	-	-	-	484,206	5,014	-
4b.1.2.17	EA - Service Water	-	144	-	-	-	-	-	22	166	-	-	166	-	-	-	-	-	-	3,145	-
4b.1.2.18	EA - Service Water RCA	-	45	2	5	104	-	-	28	184	184	-	-	1,248	-	-	-	-	50,693	839	-
4b.1.2.19	EB - Closed Cooling Water	-	59	-	-	-	-	-	9	68	-	-	68	-	-	-	-	-	-	1,267	-
4b.1.2.20	EC - Fuel Pool Cooling & Cleanup	-	367	6	15	345	-	-	146	880	880	-	-	4,119	-	-	-	-	167,293	7,163	-
4b.1.2.21	EF - Essential Service Water	-	334	-	-	-	-	-	50	385	-	-	385	-	-	-	-	-	-	7,244	-
4b.1.2.22	EF - Essential Service Water RCA	-	200	8	20	446	-	-	121	794	794	-	-	5,326	-	-	-	-	216,287	3,862	-
4b.1.2.23	EG - Component Cooling Water RCA	-	247	-	-	-	-	-	37	284	-	-	284	-	-	-	-	-	-	5,335	-
4b.1.2.24	GA - Plant Heating	-	89	-	-	-	-	-	13	102	-	-	102	-	-	-	-	-	-	1,912	-
4b.1.2.25	GA - Plant Heating RCA	-	97	1	2	53	-	-	33	186	186	-	-	638	-	-	-	-	25,924	1,765	-
4b.1.2.26	GA- Plant Heating Fuel Building	-	21	0	0	9	-	-	7	37	37	-	-	107	-	-	-	-	4,351	400	-
4b.1.2.27	GB - Central Chilled Water	-	84	-	-	-	-	-	13	96	-	-	96	-	-	-	-	-	-	1,803	-
4b.1.2.28	GB - Central Chilled Water RCA	-	26	0	1	16	-	-	9	52	52	-	-	187	-	-	-	-	7,591	482	-
4b.1.2.29	GD - Essential Serv Wtr Pumphouse HVAC	-	18	-	-	-	-	-	3	21	-	-	21	-	-	-	-	-	-	427	-
4b.1.2.30	GF - Miscellaneous Building HVAC	-	122	3	8	170	-	-	58	361	361	-	-	2,034	-	-	-	-	82,602	2,026	-
4b.1.2.31	GG - Fuel Building HVAC	-	232	6	15	330	-	-	110	693	693	-	-	3,945	-	-	-	-	160,195	4,052	-
4b.1.2.32	GH - Radwaste Building HVAC	-	170	4	10	214	-	-	76	474	474	-	-	2,561	-	-	-	-	104,012	3,004	-
4b.1.2.33	GK - Control Building HVAC	-	168	-	-	-	-	-	25	193	-	-	193	-	-	-	-	-	-	3,959	-
4b.1.2.34	GL - Auxiliary Building HVAC	-	422	8	20	450	-	-	177	1,077	1,077	-	-	5,381	-	-	-	-	218,514	7,364	-
4b.1.2.35	GM - Diesel Generator Building HVAC	-	29	-	-	-	-	-	4	34	-	-	34	-	-	-	-	-	-	695	-
4b.1.2.36	GN - Containment Cooling	-	465	12	31	691	-	-	226	1,425	1,425	-	-	8,264	-	-	-	-	335,602	8,405	-
4b.1.2.37	GP - Containment Intgratd Leak Rate Test	-	39	1	2	49	-	-	17	108	108	-	-	580	-	-	-	-	23,570	750	-
4b.1.2.38	GR - Containment Atmospheric Control	-	17	2	4	96	-	-	20	139	139	-	-	1,143	-	-	-	-	46,407	350	-
4b.1.2.39	GT - Containment Purge HVAC	-	109	3	8	183	-	-	56	359	359	-	-	2,185	-	-	-	-	88,746	1,973	-

Table H-2
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60-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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.1.2.40	HA - Gaseous Radwaste	-	331	5	14	309	-	-	132	791	791	-	-	3,699	-	-	-	-	150,219	6,296	-
4b.1.2.41	HB - Liquid Radwaste	-	799	47	50	616	353	-	393	2,258	2,258	-	-	7,362	1,450	-	-	-	394,465	15,506	-
4b.1.2.42	HC - Solid Radwaste	-	341	23	24	250	211	-	181	1,030	1,030	-	-	2,985	862	-	-	-	178,137	6,652	-
4b.1.2.43	HD - Decontamination	-	94	6	6	82	42	-	48	278	278	-	-	983	171	-	-	-	51,237	1,835	-
4b.1.2.44	JE - Emergency Fuel Oil	-	62	-	-	-	-	-	9	71	-	-	71	-	-	-	-	-	-	1,260	-
4b.1.2.45	KA - Compressed Air	-	195	-	-	-	-	-	29	224	-	-	224	-	-	-	-	-	-	4,187	-
4b.1.2.46	KA - Compressed Air RCA	-	130	1	3	67	-	-	43	244	244	-	-	801	-	-	-	-	32,538	2,339	-
4b.1.2.47	KB - Breathing Air	-	24	-	-	-	-	-	4	28	-	-	28	-	-	-	-	-	-	516	-
4b.1.2.48	KB - Breathing Air RCA	-	20	0	0	6	-	-	6	32	32	-	-	71	-	-	-	-	2,874	402	-
4b.1.2.49	KC - Fire Protection	-	378	-	-	-	-	-	57	435	-	-	435	-	-	-	-	-	-	8,376	-
4b.1.2.50	KC - Fire Protection RCA	-	403	7	17	369	-	-	159	954	954	-	-	4,411	-	-	-	-	179,151	7,064	-
4b.1.2.51	KC- Fire Protection Fuel Building	-	119	2	5	104	-	-	46	276	276	-	-	1,239	-	-	-	-	50,329	2,115	-
4b.1.2.52	KD - Domestic Water	-	176	-	-	-	-	-	26	203	-	-	203	-	-	-	-	-	-	3,837	-
4b.1.2.53	KD - Domestic Water RCA	-	26	0	1	21	-	-	10	58	58	-	-	247	-	-	-	-	10,039	459	-
4b.1.2.54	KE - Fuel Handling & Storage Rctor vssl	-	17	1	3	74	-	-	16	111	111	-	-	882	-	-	-	-	35,813	332	-
4b.1.2.55	KH - Service Gas (CO2 N2 H2 & O2)	-	56	-	-	-	-	-	8	64	-	-	64	-	-	-	-	-	-	1,226	-
4b.1.2.56	KH - Service Gas (CO2 N2 H2 & O2) RCA	-	254	4	9	204	-	-	96	566	566	-	-	2,433	-	-	-	-	98,813	4,481	-
4b.1.2.57	KJ - Standby Diesel Engine	-	327	-	-	-	-	-	49	376	-	-	376	-	-	-	-	-	-	6,749	-
4b.1.2.58	LA - Sanitary Drains	-	44	-	-	-	-	-	7	51	-	-	51	-	-	-	-	-	-	972	-
4b.1.2.59	LA - Sanitary Drains RCA	-	106	2	5	106	-	-	43	263	263	-	-	1,273	-	-	-	-	51,684	1,811	-
4b.1.2.60	LB - Roof Drains	-	59	-	-	-	-	-	9	68	-	-	68	-	-	-	-	-	-	1,276	-
4b.1.2.61	LB - Roof Drains RCA	-	144	3	8	179	-	-	64	398	398	-	-	2,139	-	-	-	-	86,858	2,694	-
4b.1.2.62	LD - Chemical & Detergent Waste	-	110	1	3	67	-	-	38	218	218	-	-	797	-	-	-	-	32,369	2,139	-
4b.1.2.63	LF - Floor & Equipment Drains	-	1,353	82	80	557	887	-	664	3,624	3,624	-	-	6,660	3,627	-	-	-	510,199	26,164	-
4b.1.2.64	RM - Process Sampling & Analysis	-	123	1	4	83	-	-	44	255	255	-	-	990	-	-	-	-	40,200	2,450	-
4b.1.2.65	SJ - Nuclear Sampling	-	71	1	3	57	-	-	27	158	158	-	-	677	-	-	-	-	27,501	1,430	-
4b.1.2.66	UB - Servces Stores Site Security Bldg	-	177	-	-	-	-	-	27	204	-	-	204	-	-	-	-	-	-	3,815	-
4b.1.2.67	Yard Non-System Specific	-	29	-	-	-	-	-	4	33	-	-	33	-	-	-	-	-	-	603	-
4b.1.2	Totals	-	15,449	411	630	10,529	2,520	-	5,761	35,300	30,173	-	5,127	125,856	10,326	-	-	-	5,792,086	304,013	-
4b.1.3	Scaffolding in support of decommissioning	-	2,196	41	10	171	40	-	590	3,049	3,049	-	-	1,849	163	-	-	-	94,006	50,451	-
Decontamination of Site Buildings																					
4b.1.4.1	Reactor	1,115	1,610	74	574	502	1,523	-	1,510	6,907	6,907	-	-	5,995	24,801	-	-	-	2,386,873	48,482	-
4b.1.4.2	Auxiliary	581	225	9	50	172	130	-	413	1,581	1,581	-	-	2,058	1,956	-	-	-	250,317	15,248	-
4b.1.4.3	Communication Corridor - Contaminated	13	3	0	1	1	3	-	8	30	30	-	-	17	42	-	-	-	4,296	306	-
4b.1.4.4	Fuel Building	693	723	8	21	226	54	-	579	2,305	2,305	-	-	2,705	584	-	-	-	158,264	27,455	-
4b.1.4.5	Hot Machine Shop	16	6	0	1	-	3	-	10	37	37	-	-	-	51	-	-	-	4,446	421	-
4b.1.4.6	RAM Storage Building	40	8	0	2	2	6	-	24	83	83	-	-	19	107	-	-	-	9,974	919	-
4b.1.4.7	Radioactive and Personnel Tunnel	5	6	0	1	-	2	-	4	18	18	-	-	-	29	-	-	-	2,532	195	-
4b.1.4.8	Radwaste	309	104	4	26	71	67	-	212	793	793	-	-	844	1,028	-	-	-	122,469	7,811	-
4b.1.4.9	Radwaste Drum Storage	35	10	0	3	6	7	-	23	84	84	-	-	66	115	-	-	-	12,565	850	-
4b.1.4.10	Reactor Head Assembly Building	31	-	-	-	-	-	-	16	47	47	-	-	-	-	-	-	-	-	614	-
4b.1.4.11	Steam Generator Replacement Bldgs	211	-	-	-	-	-	-	105	316	316	-	-	-	-	-	-	-	-	3,885	-
4b.1.4	Totals	3,049	2,696	96	679	979	1,795	-	2,905	12,199	12,199	-	-	11,704	28,713	-	-	-	2,951,736	106,187	-
4b.1	Subtotal Period 4b Activity Costs	3,802	20,422	841	1,426	11,679	6,064	-	10,127	54,362	49,235	-	5,127	139,409	46,190	-	-	-	9,299,752	462,575	-
Period 4b Additional Costs																					
4b.2.1	License Termination Survey Planning	-	-	-	-	-	-	1,495	448	1,943	1,943	-	-	-	-	-	-	-	-	-	12,480
4b.2.2	Remedial Action Surveys	-	-	-	-	-	-	2,381	714	3,095	3,095	-	-	-	-	-	-	-	-	48,748	-
4b.2.3	Sanitary Treatment Lagoon	-	6	93	92	-	280	-	95	567	567	-	-	-	4,608	-	-	-	392,140	423	-
4b.2.4	Cooling Tower Asbestos Panel Removal	-	4,893	-	122	-	-	490	826	6,330	-	-	6,330	-	-	-	-	-	-	71,419	-
4b.2.5	Operational Equipment	-	-	17	37	603	-	-	98	755	755	-	-	11,710	-	-	-	-	292,750	32	-
4b.2.6	Retired Reactor Closure Head	-	113	552	895	-	768	-	410	2,738	2,738	-	-	-	2,764	-	-	-	338,540	3,157	2,000
4b.2	Subtotal Period 4b Additional Costs	-	5,012	662	1,146	603	1,048	4,366	2,591	15,428	9,098	-	6,330	11,710	7,372	-	-	-	1,023,430	123,780	14,480
Period 4b Collateral Costs																					
4b.3.1	Process decommissioning water waste	13	-	21	55	-	95	-	40	224	224	-	-	-	214	-	-	-	12,825	42	-
4b.3.3	Small tool allowance	-	434	-	-	-	-	-	65	499	499	-	-	-	-	-	-	-	-	-	-
4b.3.4	Decommissioning Equipment Disposition	-	-	134	39	556	129	-	135	993	993	-	-	6,000	529	-	-	-	304,968	88	-
4b.3.5	On-site survey and release of 297.3 tons clean metallic waste	-	-	-	-	-	-	410	41	451	451	-	-	-	-	-	-	-	-	-	-
4b.3	Subtotal Period 4b Collateral Costs	13	434	155	93	556	224	410	281	2,167	2,167	-	-	6,000	743	-	-	-	317,793	130	-
Period 4b Period-Dependent Costs																					
4b.4.1	Decon supplies	1,247	-	-	-	-	-	-	312	1,559	1,559	-	-	-	-	-	-	-	-	-	-
4b.4.2	Insurance	-	-	-	-	-	-	2,161	216	2,377	2,377	-	-	-	-	-	-	-	-	-	-
4b.4.3	Property taxes	-	-	-	-	-	-	656	66	722	722	-	-	-	-	-	-	-	-	-	-

Table H-2
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
60-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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 Period-Dependent Costs (continued)																					
4b.4.4	Health physics supplies	-	3,829	-	-	-	-	-	957	4,786	4,786	-	-	-	-	-	-	-	-	-	-
4b.4.5	Heavy equipment rental	-	4,669	-	-	-	-	-	700	5,369	5,369	-	-	-	-	-	-	-	-	-	-
4b.4.6	Disposal of DAW generated	-	-	135	27	-	336	-	102	600	600	-	-	-	6,638	-	-	-	132,753	216	-
4b.4.7	Plant energy budget	-	-	-	-	-	-	2,949	442	3,392	3,392	-	-	-	-	-	-	-	-	-	-
4b.4.8	NRC Fees	-	-	-	-	-	-	1,416	142	1,557	1,557	-	-	-	-	-	-	-	-	-	-
4b.4.9	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	940	141	1,081	1,081	-	-	-	-	-	-	-	-	-	-
4b.4.10	Corporate Allocations	-	-	-	-	-	-	2,345	235	2,580	2,580	-	-	-	-	-	-	-	-	-	-
4b.4.11	Security Staff Cost	-	-	-	-	-	-	4,709	706	5,415	5,415	-	-	-	-	-	-	-	-	-	152,857
4b.4.12	DOC Staff Cost	-	-	-	-	-	-	31,447	4,717	36,164	36,164	-	-	-	-	-	-	-	-	-	327,726
4b.4.13	Utility Staff Cost	-	-	-	-	-	-	43,754	6,563	50,318	50,318	-	-	-	-	-	-	-	-	-	577,189
4b.4	Subtotal Period 4b Period-Dependent Costs	1,247	8,498	135	27	-	336	90,377	15,299	115,920	115,920	-	-	-	6,638	-	-	-	132,753	216	1,057,771
4b.0	TOTAL PERIOD 4b COST	5,062	34,366	1,793	2,692	12,839	7,672	95,153	28,297	187,876	176,419	-	11,457	157,119	60,942	-	-	-	10,773,730	586,701	1,072,251
PERIOD 4f - License Termination																					
Period 4f Direct Decommissioning Activities																					
4f.1.1	ORISE confirmatory survey	-	-	-	-	-	-	163	49	212	212	-	-	-	-	-	-	-	-	-	-
4f.1.2	Terminate license									a											
4f.1	Subtotal Period 4f Activity Costs	-	-	-	-	-	-	163	49	212	212	-	-	-	-	-	-	-	-	-	-
Period 4f Additional Costs																					
4f.2.1	License Termination Survey	-	-	-	-	-	-	8,248	2,474	10,723	10,723	-	-	-	-	-	-	-	-	153,878	6,240
4f.2	Subtotal Period 4f Additional Costs	-	-	-	-	-	-	8,248	2,474	10,723	10,723	-	-	-	-	-	-	-	-	153,878	6,240
Period 4f Collateral Costs																					
4f.3.1	DOC staff relocation expenses	-	-	-	-	-	-	1,080	162	1,242	1,242	-	-	-	-	-	-	-	-	-	-
4f.3	Subtotal Period 4f Collateral Costs	-	-	-	-	-	-	1,080	162	1,242	1,242	-	-	-	-	-	-	-	-	-	-
Period 4f Period-Dependent Costs																					
4f.4.2	Property taxes	-	-	-	-	-	-	212	21	233	233	-	-	-	-	-	-	-	-	-	-
4f.4.3	Health physics supplies	-	736	-	-	-	-	-	184	920	920	-	-	-	-	-	-	-	-	-	-
4f.4.4	Disposal of DAW generated	-	-	7	1	-	18	-	5	32	32	-	-	-	353	-	-	-	7,050	11	-
4f.4.5	Plant energy budget	-	-	-	-	-	-	254	38	292	292	-	-	-	-	-	-	-	-	-	-
4f.4.6	NRC Fees	-	-	-	-	-	-	457	46	503	503	-	-	-	-	-	-	-	-	-	-
4f.4.7	Corporate Allocations	-	-	-	-	-	-	756	76	832	832	-	-	-	-	-	-	-	-	-	-
4f.4.8	Security Staff Cost	-	-	-	-	-	-	727	109	836	836	-	-	-	-	-	-	-	-	-	18,926
4f.4.9	DOC Staff Cost	-	-	-	-	-	-	5,685	853	6,538	6,538	-	-	-	-	-	-	-	-	-	57,566
4f.4.10	Utility Staff Cost	-	-	-	-	-	-	6,427	964	7,391	7,391	-	-	-	-	-	-	-	-	-	74,914
4f.4	Subtotal Period 4f Period-Dependent Costs	-	736	7	1	-	18	14,518	2,296	17,576	17,576	-	-	-	353	-	-	-	7,050	11	151,406
4f.0	TOTAL PERIOD 4f COST	-	736	7	1	-	18	24,009	4,981	29,752	29,752	-	-	-	353	-	-	-	7,050	153,889	157,646
PERIOD 4 TOTALS		5,470	68,664	19,772	10,655	24,758	53,034	176,634	75,537	434,523	419,040	-	15,483	313,266	137,730	501	406	2,217	24,009,090	1,117,634	1,885,771
PERIOD 5b - Site Restoration																					
Period 5b Direct Decommissioning Activities																					
Demolition of Remaining Site Buildings																					
5b.1.1.1	Reactor	-	5,191	-	-	-	-	-	779	5,969	-	-	5,969	-	-	-	-	-	-	59,292	-
5b.1.1.2	Auxiliary	-	4,194	-	-	-	-	-	629	4,823	-	-	4,823	-	-	-	-	-	-	49,968	-
5b.1.1.3	Auxiliary Boiler	-	39	-	-	-	-	-	6	45	-	-	45	-	-	-	-	-	-	619	-
5b.1.1.4	Barge Facility	-	1,595	-	-	-	-	-	239	1,834	-	-	1,834	-	-	-	-	-	-	18,771	-
5b.1.1.5	Circulating & Service Water Pumphouse	-	328	-	-	-	-	-	49	377	-	-	377	-	-	-	-	-	-	4,345	-
5b.1.1.6	Communication Corridor - Clean	-	1,346	-	-	-	-	-	202	1,548	-	-	1,548	-	-	-	-	-	-	17,215	-
5b.1.1.7	Communication Corridor - Contaminated	-	60	-	-	-	-	-	9	69	-	-	69	-	-	-	-	-	-	674	-
5b.1.1.8	Cooling Tower Concrete	-	918	-	-	-	-	-	138	1,056	-	-	1,056	-	-	-	-	-	-	13,472	-
5b.1.1.9	Diesel Generator	-	499	-	-	-	-	-	75	574	-	-	574	-	-	-	-	-	-	5,492	-
5b.1.1.10	Essential Service Water Pumphouse	-	306	-	-	-	-	-	46	352	-	-	352	-	-	-	-	-	-	3,938	-
5b.1.1.11	Fire Water Pumphouse	-	29	-	-	-	-	-	4	33	-	-	33	-	-	-	-	-	-	382	-
5b.1.1.12	Flex Building Storage	-	557	-	-	-	-	-	84	641	-	-	641	-	-	-	-	-	-	7,590	-
5b.1.1.13	Fuel Building	-	2,092	-	-	-	-	-	314	2,405	-	-	2,405	-	-	-	-	-	-	22,580	-
5b.1.1.14	Hot Machine Shop	-	25	-	-	-	-	-	4	29	-	-	29	-	-	-	-	-	-	417	-
5b.1.1.15	Intake	-	382	-	-	-	-	-	57	440	-	-	440	-	-	-	-	-	-	4,224	-
5b.1.1.16	Misc. Structures	-	2,487	-	-	-	-	-	373	2,861	-	-	2,861	-	-	-	-	-	-	27,921	-
5b.1.1.17	Miscellaneous Site Foundations	-	382	-	-	-	-	-	57	439	-	-	439	-	-	-	-	-	-	5,483	-
5b.1.1.18	Outage Maintenance	-	192	-	-	-	-	-	29	220	-	-	220	-	-	-	-	-	-	3,190	-

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															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Demolition of Remaining Site Buildings (continued)																					
5b.1.1.19	RAM Storage Building	-	69	-	-	-	-	-	10	79	-	-	79	-	-	-	-	-	-	1,081	-
5b.1.1.20	Radioactive and Personnel Tunnel	-	29	-	-	-	-	-	4	34	-	-	34	-	-	-	-	-	-	386	-
5b.1.1.21	Radwaste	-	1,872	-	-	-	-	-	281	2,153	-	-	2,153	-	-	-	-	-	-	21,798	-
5b.1.1.22	Radwaste Drum Storage	-	279	-	-	-	-	-	42	321	-	-	321	-	-	-	-	-	-	3,840	-
5b.1.1.23	Reactor Head Assembly Building	-	81	-	-	-	-	-	12	94	-	-	94	-	-	-	-	-	-	1,357	-
5b.1.1.24	Security Additions	-	2,257	-	-	-	-	-	339	2,595	-	-	2,595	-	-	-	-	-	-	20,977	-
5b.1.1.25	Service	-	527	-	-	-	-	-	79	606	-	-	606	-	-	-	-	-	-	6,045	-
5b.1.1.26	Sludge Pump Station & Lagoon	-	26	-	-	-	-	-	4	30	-	-	30	-	-	-	-	-	-	313	-
5b.1.1.27	Steam Generator Replacement Bldgs	-	1,231	-	-	-	-	-	185	1,415	-	-	1,415	-	-	-	-	-	-	15,693	-
5b.1.1.28	Turbine Building	-	3,580	-	-	-	-	-	537	4,117	-	-	4,117	-	-	-	-	-	-	55,694	-
5b.1.1.29	Turbine Pedestal	-	1,092	-	-	-	-	-	164	1,256	-	-	1,256	-	-	-	-	-	-	10,928	-
5b.1.1.30	U.H.S. Cooling Tower	-	662	-	-	-	-	-	99	761	-	-	761	-	-	-	-	-	-	6,681	-
5b.1.1.31	Water Treatment Plant	-	1	-	-	-	-	-	0	1	-	-	1	-	-	-	-	-	-	9	-
5b.1.1	Totals	-	32,329	-	-	-	-	-	4,849	37,178	-	-	37,178	-	-	-	-	-	-	390,372	-
Site Closeout Activities																					
5b.1.2	BackFill Site	-	8,631	-	-	-	-	-	1,295	9,926	-	-	9,926	-	-	-	-	-	-	15,861	-
5b.1.3	Grade & landscape site	-	132	-	-	-	-	-	20	152	-	-	152	-	-	-	-	-	-	592	-
5b.1.4	Final report to NRC	-	-	-	-	-	-	197	30	226	226	-	-	-	-	-	-	-	-	-	1,560
5b.1	Subtotal Period 5b Activity Costs	-	41,092	-	-	-	-	197	6,193	47,482	226	-	47,256	-	-	-	-	-	-	406,825	1,560
Period 5b Additional Costs																					
5b.2.1	Concrete Crushing	-	1,194	-	-	-	-	9	180	1,384	-	-	1,384	-	-	-	-	-	-	5,976	-
5b.2.2	Mine Area Backfill	-	4,988	-	-	-	-	-	748	5,736	-	-	5,736	-	-	-	-	-	-	15,960	-
5b.2.3	Cooling Tower Discharge & Intake Pipe Flow Fill	-	3,778	-	-	-	-	-	567	4,345	-	-	4,345	-	-	-	-	-	-	9,588	-
5b.2.4	Cooling Tower Demolition	-	4,272	-	-	-	-	-	641	4,913	-	-	4,913	-	-	-	-	-	-	21,619	-
5b.2.5	Excavation of Underground Services	-	1,668	-	-	-	-	761	364	2,793	-	-	2,793	-	-	-	-	-	-	14,164	-
5b.2.6	Construction Debris	-	-	-	-	-	-	2,480	372	2,852	-	-	2,852	-	-	-	-	-	-	-	-
5b.2	Subtotal Period 5b Additional Costs	-	15,901	-	-	-	-	3,250	2,873	22,023	-	-	22,023	-	-	-	-	-	-	67,307	-
Period 5b Collateral Costs																					
5b.3.1	Small tool allowance	-	402	-	-	-	-	-	60	462	-	-	462	-	-	-	-	-	-	-	-
5b.3.2	Corporate Allocations	-	-	-	-	-	-	1,504	150	1,655	-	-	1,655	-	-	-	-	-	-	-	-
5b.3	Subtotal Period 5b Collateral Costs	-	402	-	-	-	-	1,504	211	2,117	-	-	2,117	-	-	-	-	-	-	-	-
Period 5b Period-Dependent Costs																					
5b.4.2	Property taxes	-	-	-	-	-	-	421	42	463	-	-	463	-	-	-	-	-	-	-	-
5b.4.3	Heavy equipment rental	-	4,254	-	-	-	-	-	638	4,892	-	-	4,892	-	-	-	-	-	-	-	-
5b.4.4	Plant energy budget	-	-	-	-	-	-	252	38	290	-	-	290	-	-	-	-	-	-	-	-
5b.4.5	Security Staff Cost	-	-	-	-	-	-	1,446	217	1,663	-	-	1,663	-	-	-	-	-	-	-	37,646
5b.4.6	DOC Staff Cost	-	-	-	-	-	-	11,002	1,650	12,652	-	-	12,652	-	-	-	-	-	-	-	106,663
5b.4.7	Utility Staff Cost	-	-	-	-	-	-	5,200	780	5,980	-	-	5,980	-	-	-	-	-	-	-	61,174
5b.4	Subtotal Period 5b Period-Dependent Costs	-	4,254	-	-	-	-	18,321	3,365	25,940	-	-	25,940	-	-	-	-	-	-	-	205,483
5b.0	TOTAL PERIOD 5b COST	-	61,649	-	-	-	-	23,272	12,642	97,563	226	-	97,336	-	-	-	-	-	-	474,132	207,043
PERIOD 5 TOTALS		-	61,649	-	-	-	-	23,272	12,642	97,563	226	-	97,336	-	-	-	-	-	-	474,132	207,043
TOTAL COST TO DECOMMISSION		**11,857**	**140,534**	**20,164**	**11,270**	**24,758**	**54,456**	**692,692**	**164,174**	**1,119,905**	**887,947**	**117,540**	**114,417**	**313,266**	**148,204**	**501**	**406**	**2,217**	**24,309,290**	**1,689,226**	**7,484,788**

Table H-2
Callaway Energy Center
SAFSTOR Alternative Decommissioning Cost Estimate
60-Year Operating Life with Low-Level Radioactive Waste Processing
(thousands of 2014 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 17.18% CONTINGENCY:	**$1,119,905**	**thousands of 2014 dollars**
TOTAL NRC LICENSE TERMINATION COST IS 79.29% OR:	**$887,947**	**thousands of 2014 dollars**
SPENT FUEL MANAGEMENT COST IS 10.5% OR:	**$117,540**	**thousands of 2014 dollars**
NON-NUCLEAR DEMOLITION COST IS 10.22% OR:	**$114,417**	**thousands of 2014 dollars**
TOTAL LOW-LEVEL RADIOACTIVE WASTE VOLUME BURIED (EXCLUDING GTCC):	**149,111**	**cubic feet**
TOTAL GREATER THAN CLASS C RADWASTE VOLUME GENERATED:	**2,217**	**cubic feet**
TOTAL SCRAP METAL REMOVED:	**70,654**	**tons**
TOTAL CRAFT LABOR REQUIREMENTS:	**1,689,226**	**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