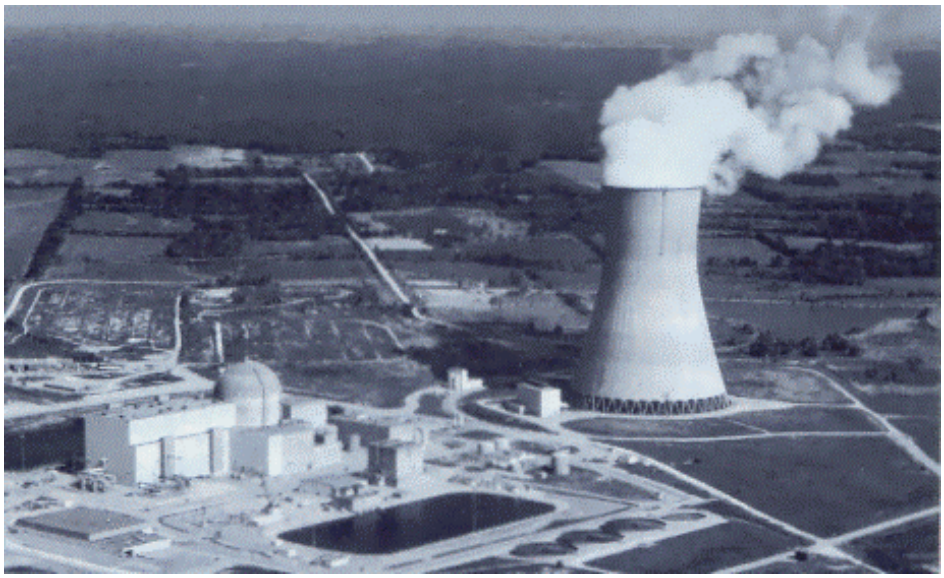
DECOMMISSIONING COST ANALYSIS

for the

CALLAWAY PLANT



prepared for

AmerenUE

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Attachment 1

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No.	CRA No.	Date	Item Revised	Reason for Revision
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EXECUTIVE SUMMARY

This report presents estimates of the cost to decommission the Callaway Plant (Callaway) for the selected decommissioning scenarios following the scheduled cessation of plant operations. The analysis relies upon site-specific, technical information from an evaluation prepared in 2002,[1] updated to reflect current assumptions pertaining to the disposition of the nuclear unit and relevant industry experience in undertaking such projects. The current estimates are designed to provide AmerenUE with sufficient information to assess its financial obligations, as they pertain to the eventual decommissioning of the nuclear unit.

The currently projected cost to decommission the station, assuming the DECON alternative, is estimated at $586.5 million, as reported in 2005 dollars. An estimate for a SAFSTOR alternative is also provided. The estimates 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 estimates incorporate a minimum cooling period of approximately 5½ years for the spent fuel that resides in the storage pool when operations cease. During this period, it is assumed the Department of Energy (DOE) will complete the transfer of the residual spent fuel inventory to a DOE repository. The estimates also include the dismantling of non-essential structures and limited restoration of the site.

Alternatives and Regulations

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

1 "Decommissioning Cost Analysis for the Callaway Plant," Document No. A22-1441-002, Rev. 0, TLG Services, Inc., August 2002.

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.

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 be completed within 60 years.

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, *e.g.*, 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, issued in July 2000, further described the methods and procedures acceptable to the NRC staff for implementing the requirements of the

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3 Ibid. Page FR24022, Column 3.
4 Ibid.
5 Ibid. Page FR24023, Column 2.
6 U.S. Code of Federal Regulations, Title 10, Parts 2, 50, and 51, "Decommissioning of Nuclear Power Reactors," Nuclear Regulatory Commission, Federal Register Volume 61, (p 39278 et seq.), July 29, 1996.

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

Methodology

The methodology used to develop the estimates described within this document follows the basic approach originally presented in the cost estimating guidelines[8] 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. This systematic approach for assembling decommissioning estimates ensures a high degree of confidence in the reliability of the resulting cost.

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."[9] The cost elements in the estimates are based on ideal conditions; therefore, the types of unforeseeable events that are almost certain to occur in decommissioning, based on industry experience, are addressed through a percentage contingency applied on a line-item basis. This contingency factor is a nearly universal element in all large-scale construction and demolition projects. It should be noted that contingency, as used in

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7 "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.

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

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

this analysis, does not account for price escalation and inflation in the cost of decommissioning over the remaining operating life of the station.

The use and role of contingency within decommissioning estimates is not a safety factor issue. Safety factors provide additional security and address situations that may never occur. Contingency funds, by contrast, are expected to be fully expended throughout the program. 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,[10] and its Amendments of 1985,[11] the states became ultimately responsible for the disposition of low-level radioactive waste generated within their own borders.

AmerenUE is currently able to access the disposal facility in Barnwell, South Carolina. However, in June 2000, South Carolina formally joined with Connecticut and New Jersey to form the Atlantic Compact. The legislation provides for South Carolina to gradually limit access to the Barnwell facility, with only Atlantic Compact members having access to the facility after mid-year 2008. Despite the closing of one of the two currently accessible commercial disposal sites, it is reasonable to assume that additional disposal capacity will be available to support reactor decommissioning, particularly for the isolation of the more highly radioactive material that is not suitable for disposal elsewhere. However, for estimating purposes, and as a proxy for future disposal facilities, waste disposal costs are estimated using available pricing schedules for the currently operating facilities, *i.e.*, at Barnwell and the Envirocare facility in Utah.

High-Level Radioactive Waste Management

Congress passed the "Nuclear Waste Policy Act"[12] (NWPA) in 1982, assigning the responsibility to the DOE for disposal of the spent nuclear fuel created by the commercial nuclear generating plants. Two permanent disposal facilities were envisioned, as well as an interim storage facility. To recover the cost, the legislation created a Nuclear Waste Fund through which money is collected from the sale of electricity generated by the power plants. The NWPA, along with the individual

10 "Low-Level Radioactive Waste Policy Act of 1980," Public Law 96-573, 1980.
11 "Low-Level Radioactive Waste Policy Amendments Act of 1985," Public Law 99-240, 1986.

disposal contracts with the utilities, specified that the DOE was to begin accepting spent fuel by January 31, 1998.

Since the original legislation, the DOE has announced several delays in the program schedule. By January 1998, the DOE had failed to initiate the disposal of spent nuclear fuel and high level waste, as required by the NWPA and the utility contracts. As a result, utilities have initiated legal action against the DOE. While legal actions continue, the DOE has no plans to receive spent fuel prior to completing the construction of its geologic repository.

Operation of DOE's yet-to-be constructed repository is contingent upon the review and approval of the facility's license application by the NRC, the successful resolution of pending litigation, and the development of a national transportation system. In 2005, the DOE stated that operations at the repository would not begin before 2012. The DOE has no plans for receiving spent fuel from commercial nuclear plant sites prior to this date and startup operations may be phased in, creating additional delays. However, for estimating purposes, AmerenUE has assumed that the high-level waste repository, or some interim storage facility, will be fully operational prior to the scheduled cessation of plant operations in 2024.

The NRC requires that licensees establish a program to manage and provide funding for the caretaking of all irradiated fuel at the reactor site until title of the fuel is transferred to the DOE.[13] For estimating purposes, AmerenUE has assumed that all spent fuel will be removed to the DOE high-level waste repository within 5½ years after shutdown. Interim storage of the fuel, until the DOE has completed the transfer, will be in the pool located in the fuel building. The pool will be isolated, allowing AmerenUE to proceed with decommissioning (or safe-storage preparations) in the shortest time possible.

At shutdown, the spent fuel pool is expected to be at capacity. Over the next 5½ years the assemblies will be packaged into multipurpose canisters for transfer to the final repository. It is assumed that the 5½ years also provides the necessary cooling period for the final core to meet DOE's transport system requirements for decay heat.

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

13 "Domestic Licensing of Production and Utilization Facilities," U.S. Code of Federal Regulations, Title 10, Part 50.54 (bb).

Site Restoration

The efficient removal of the contaminated materials at the site may result in damage to many of the site structures. Blasting, coring, drilling, and the other decontamination activities will substantially damage power block structures, potentially weakening the footings and structural supports. Prompt demolition once the license is terminated 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 is more efficient and less costly than if the process were deferred. Experience at shutdown generating stations has shown that plant facilities quickly degrade without maintenance, adding additional expense and creating potential hazards to the public and the demolition work force. Consequently, this analysis assumes that non-essential site structures within the restricted access area are removed to a nominal depth of three feet below the local grade level wherever possible. The site is then backfilled, graded and stabilized.

Summary

The costs to decommission Callaway are evaluated for both the DECON and SAFSTOR decommissioning alternatives. 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. Decommissioning will be accomplished within the 60-year period required by current NRC regulations.

The scenarios analyzed for the purpose of generating the estimates are described in Section 2. The assumptions are presented in Section 3, along with schedules of annual expenditures. The major cost contributors are identified in Section 6, with detailed activity costs, waste volumes, and associated manpower requirements delineated in Appendices C and D. Cost summaries for the two scenarios are provided at the end of this section for the major cost components.

SUMMARY OF DECOMMISSIONING COST ELEMENTS
DECON
(thousands of 2005 dollars)

Cost Element	Total
Decontamination	16,105
Removal	111,336
Packaging	12,703
Transportation	8,830
Waste Disposal	75,337
Off-site Waste Processing	23,358
Program Management [1]	258,579
Spent Fuel Pool Isolation	9,900
Spent Fuel Related	36,966
Insurance and Regulatory Fees	7,767
Energy	6,268
Characterization and Licensing Surveys	10,623
Property Taxes	2,780
Miscellaneous Equipment / Site Services	5,964
Total [2]	586,515
NRC License Termination	479,167
Spent Fuel Management [3]	36,966
Site Restoration	70,382
Total [2]	586,515

[1] Includes engineering and security
[2] Columns may not add due to rounding
[3] Includes spent fuel loading/packaging costs

SUMMARY OF DECOMMISSIONING COST ELEMENTS
SAFSTOR
(thousands of 2005 dollars)

Cost Element	Total
Decontamination	13,305
Removal	110,883
Packaging	10,623
Transportation	6,393
Waste Disposal	48,781
Off-site Waste Processing	27,195
Program Management [1]	383,194
Spent Fuel Pool Isolation	9,900
Spent Fuel Related	36,966
Insurance and Regulatory Fees	48,390
Energy	12,936
Characterization and Licensing Surveys	12,009
Property Taxes	20,296
Miscellaneous Equipment / Site Services	18,273
Total [2]	759,143

NRC License Termination	631,743
Spent Fuel Management [3]	57,009
Site Restoration	70,391
Total [2]	759,143

[1] Includes engineering and security
[2] Columns may not add due to rounding
[3] Includes fuel loading/packaging costs

1. INTRODUCTION

This report presents estimates of the costs to decommission the Callaway Plant (Callaway) following a scheduled cessation of plant operations. The supporting analysis was designed to provide AmerenUE, the plant's owner, with sufficient information to assess its financial obligations, as they pertain to the eventual decommissioning of the nuclear station. It is not a detailed engineering document, but a financial analysis prepared in advance of the detailed engineering that will be required to carry out the decommissioning.

1.1 OBJECTIVES OF STUDY

The objectives of this study are 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 the purposes of this study, the final shutdown date (license expiration) is projected to be October of 2024, based upon a 40 year operating life. This date was used as input to scheduling the decommissioning activities.

1.2 SITE DESCRIPTION

The nuclear unit is located in Callaway County, South 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 1233.6 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.[1]* 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,"[2] 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

* Annotated references for citations in Sections 1-6 are provided in Section 7.

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,[3] 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.[4] However, 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, the unresolved issues associated with the disposition of greater-than-Class C material (GTCC), 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.[5] 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 Nuclear Waste Policy Act

Congress passed the Nuclear Waste Policy Act[6] (NWPA) in 1982, assigning the responsibility for disposal of the spent nuclear fuel created by the commercial nuclear generating plants to the U.S. Department of Energy (DOE). Two permanent disposal facilities and an interim storage facility were envisioned. To recover the cost, the legislation created a Nuclear Waste Fund through which money is collected from the sale of electricity generated by the power plants. The NWPA, along with the individual disposal contracts with the utilities, specified that the DOE was to begin accepting spent fuel by January 31, 1998.

After pursuing a national site selection process, the NWPA was amended in 1987 to designate Yucca Mountain, Nevada, as the only site to be evaluated for geologic disposal of high-level waste. Also in 1987, the DOE announced a five-year delay (1998 to 2003) in the opening date for the repository. Two years later, in 1989, an additional seven-year delay was announced, primarily due to problems in obtaining the permits necessary from the state of Nevada to perform the required characterization of the site. In 2005, the DOE stated that operations at the repository would not begin before 2012 due to delays in the license application.

The NRC requires that licensees 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, pursuant to Title 10 of the Code of Federal Regulations (10 CFR), §50.54 (bb).[7] This funding requirement is fulfilled through inclusion of certain high-level waste cost elements in the decommissioning estimates, as identified in Section 3.

For estimating purposes, AmerenUE has assumed that all spent fuel will be removed to a DOE high-level waste repository within 5½ years after shutdown. Interim storage of the fuel, until the DOE has completed the transfer, will be in the storage pool located in the fuel building. The pool will be isolated, allowing AmerenUE to proceed with decommissioning (or safe-storage preparations) in the shortest time possible.

At shutdown, the spent fuel pool is expected to be at capacity. Over the next 5½ years the assemblies will be packaged into multipurpose canisters for transfer to the final repository. It is assumed that the 5½ years also provides the necessary cooling period for the final core to meet DOE's transport system requirements for decay heat.

1.3.2 Low-Level Radioactive Waste Acts

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. Congress passed the "Low-Level Radioactive Waste Policy Act" in 1980,[8] declaring the states as being ultimately responsible for the disposition of low-level radioactive waste generated within their own borders. The federal law encouraged the formation of regional groups or compacts to implement this objective safely, efficiently, and economically, and set a target date of 1986 for implementation. After little progress, the "Low-Level Radioactive Waste Policy Amendments Act of 1985,"[9] extended the implementation schedule, with specific milestones and stiff sanctions for non-compliance. Subsequent court rulings have substantially diluted those sanctions. To date, no new compact facilities have been successfully sited, licensed and constructed.

AmerenUE is currently able to access the disposal facility in Barnwell, South Carolina. However, in June 2000, South Carolina formally joined with Connecticut and New Jersey to form the Atlantic Compact. The legislation provides for South Carolina to gradually limit access to the Barnwell facility, with only Atlantic Compact members having access to the facility after mid-year 2008. Despite the closing of one of the two currently accessible commercial disposal sites, it is reasonable to assume that additional disposal capacity will be available to support reactor decommissioning, particularly for the isolation of the more highly radioactive material that is not suitable for disposal elsewhere.

For estimating purposes, and as a proxy for future disposal facilities, waste disposal costs are generated using pricing for the currently operating Envirocare facility in Clive, Utah. Since Envirocare does not have a license to dispose of more highly radioactive waste (Class B and C), pricing for the Barnwell facility is also used.

1.3.3 Radiological Criteria for License Termination

In 1997, the NRC published Subpart E, "Radiological Criteria for License Termination,"[10] 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).[11] An additional and separate limit of 4 millirem per year, as defined in 40 CFR §141.16, is applied to drinking water.[12]

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)[13] 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 the Callaway nuclear unit 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 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. However, the study does estimate the costs incurred with transferring the fuel from the pool to a DOE transport cask.

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 5½ years following the cessation of operations before the inventory resident at shutdown can be transferred to the DOE.

- 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 auxiliary and fuel buildings 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)."[14] 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 final termination of the license.

The NRC will terminate the operating license 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 facility is suitable for release.

2.1.3 Period 3 - Site Restoration

Following completion of decommissioning operations, site restoration activities will begin. Efficient removal of the contaminated materials and verification that residual radionuclide concentrations are below the NRC limits will result in substantial damage to many of the structures. Although performed in a controlled, safe manner, blasting, coring, drilling, scarification (surface removal), and the other decontamination activities will substantially degrade power block structures including the reactor, auxiliary, fuel and radwaste buildings. Under certain circumstances, verifying that subsurface radionuclide concentrations meet NRC site release requirements will require removal of grade slabs and lower floors, potentially weakening footings and structural supports. This removal activity will be necessary for those facilities and plant areas where historical records, when available, indicate the potential for radionuclides having been present in the soil, where system failures have been recorded, or where it is required to confirm that subsurface process and drain lines were not breached over the operating life of the station.

Prompt 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 DOE transport casks, following the minimum required cooling period in the spent fuel pool.

- 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 5½ years of the cessation of operations. Once emptied, the pool is secured for storage and decommissioned along with the power block structures in Period 4.

After an optional 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 building 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 thirty to forty 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 2002 analysis.[15] This information was reviewed for the current analysis and updated as deemed appropriate. The site-specific considerations and assumptions used in the previous evaluation were also revisited. Modifications were incorporated where new information was available or experience from ongoing decommissioning programs provided viable alternatives or improved processes.

3.2 METHODOLOGY

The methodology used to develop the estimates follows the basic approach originally presented in the AIF/NESP-036 study report, "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates,"[16] and the DOE "Decommissioning Handbook."[17] 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.[18]

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.

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.

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 40%
- 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 radiologically 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"[19] 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.

The use and role of contingency within decommissioning estimates is not a "safety factor issue." Safety factors provide additional security and address situations that may never occur. Contingency funds are expected to be fully expended throughout the program. They also provide assurance that sufficient funding is available to accomplish the intended tasks. An estimate without contingency, or from which contingency has been removed, can disrupt the orderly progression of events and jeopardize a successful conclusion to the decommissioning process.

For example, the most technologically challenging task in decommissioning a commercial nuclear station is the disposition of the reactor vessel and internal components, now highly radioactive after a lifetime of exposure to core activity. The disposition of these components forms the basis of the critical path (schedule) for decommissioning operations. Cost and schedule are interdependent, and any deviation in schedule has a significant impact on cost for performing a specific activity.

Disposition of the reactor vessel internals involves the underwater cutting of complex components that are highly radioactive. Costs are based upon optimum segmentation, handling, and packaging scenarios. The schedule is primarily dependent upon the turnaround time for the heavily shielded shipping casks, including preparation, loading, and decontamination of the containers for transport. The number of casks required is a function of the pieces generated in the segmentation activity, a value calculated on optimum performance of the tooling employed in cutting the various subassemblies. The expected optimization, however, may not be achieved, resulting in delays and additional program costs. For this reason, contingency must be included to mitigate the consequences of the expected inefficiencies inherent in this complex activity, along with related concerns associated with the operation of highly specialized tooling, field conditions, and water clarity.

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%
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%
Characterization and Termination Surveys	30%
Construction	15%
Taxes and Fees	10%
Insurance	10%
Staffing	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 Appendix C and D). For example, the composite contingency value reported for the DECON alternative in Appendix C is approximately 19.0%.

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, *e.g.*, 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, *e.g.*, the start and rate of acceptance of spent fuel by the DOE.

- Pricing changes for basic inputs, such as labor, energy, materials, and burial. Some of these inputs may vary slightly, *e.g.* -10% to +20%; burial could vary from -50% to +200% or more.

It has been TLG's experience that the results of a risk analysis, when compared with the base case estimate for decommissioning, indicate that the chances of the base decommissioning estimate's being too high is a low probability, and the chances that the estimate is too low is a

higher probability. This is mostly due to the pricing uncertainty for low-level radioactive waste burial, and to a lesser extent due to schedule increases from changes in plant conditions and to pricing variations in the cost of labor (both craft and staff). 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, AmerenUE has assumed that all spent fuel will be removed to the DOE high-level waste repository within 5½ years after shutdown. Interim storage of the fuel, until the DOE has completed the transfer, will be in the spent fuel pool located in the fuel building on the Callaway site. This will allow AmerenUE to proceed with decommissioning (or safe-storage) operations in the shortest time possible. A delay in the startup of the repository, or a decrease in the spent fuel acceptance rate, will correspondingly prolong the transfer process and result in the fuel remaining at the Callaway site longer.

At shutdown, the spent fuel pool is expected to be at capacity. Over the next 5½ years the assemblies will be packaged into multipurpose canisters for transfer to the final repository. It is assumed that the 5½ years also provides the necessary cooling period for the final core to meet DOE's transport system requirements for decay heat. Once the pool is emptied, the spent fuel storage and handling facilities are available for decommissioning. Operation and maintenance costs for the spent fuel pool are included within the estimate as well as the costs for transferal of spent fuel to the DOE.

Canister Loading and Transfer

An average cost of $100,000 is used for the labor and equipment to seal each spent fuel canister once it is loaded. An additional cost of $200,000 is used for the labor to load/transport the spent fuel from the pool to a DOE transport vehicle (assuming the DOE casks are welded multi-purpose canister designs within a storage or transportation overpack).

Operations and Maintenance

An annual cost (excluding labor) of approximately $941,000 is used for operation and maintenance of the spent fuel pool. Pool operations are expected to continue approximately 5½ years after the cessation of operations.

GTCC

The dismantling of the reactor internals will 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 Commission 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. As such, the estimates to decommission the Callaway reactor include an allowance for the disposition of GTCC material.

For purposes of this study, GTCC is packaged in the same canisters used to transport spent fuel. Disposal costs are based upon a cost equivalent to that envisioned for the spent fuel. It is not anticipated that the DOE would accept this waste prior to completing the transfer of spent fuel. Therefore, until such time as the DOE is ready to accept GTCC waste, it is reasonable to assume that this material would remain in storage with the spent fuel in the storage pool at the Callaway site (for the DECON alternative). In the SAFSTOR scenario, the GTCC material is generated after the fuel has been removed. As such, the GTCC is assumed to be disposed of as it is generated during reactor vessel segmentation operations.

3.4.2 Reactor Vessel and Internal Components

The NSSS (reactor vessel and reactor coolant system components) will be decontaminated using chemical agents prior to the start of cutting operations (for DECON alternative only). A decontamination factor (average reduction) of 10 is assumed for the process.

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 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. 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 unit 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

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.

Disposal costs are based upon the displaced volume of the units. Each component is then loaded onto a rail car for transport to the disposal facility.

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 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.

3.4.5 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.[20] 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 §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.

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 material requiring controlled disposal are based upon the mileage to the Envirocare facility in Clive, Utah. Memphis, Tennessee, is used as the destination for off-site processing. Transportation costs are estimated using published tariffs from Tri-State Motor Transit.[21]

3.4.6 Low-Level Radioactive Waste Disposal

To the greatest extent practical, metallic material generated in the decontamination and dismantling processes is treated to reduce the total volume requiring controlled disposal. The treated material, meeting the regulatory and/or site release criterion, is released as scrap, requiring no further cost consideration. Conditioning and recovery of the waste stream is performed off site at a licensed processing center.

The Envirocare facility is used as a proxy for the future disposal of decommissioning waste. Since Envirocare does not have a license for Class B or C material, the Barnwell rates are also used, as appropriate. Surcharges are added for the highly activated components, *e.g.*, generated in the segmentation of the reactor vessel.

3.4.7 Site Conditions Following Decommissioning

The NRC will terminate (or amend) the site license if 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.

Non-essential structures or buildings severely damaged in the decontamination process are removed to a nominal depth of three feet below grade. Concrete rubble generated from demolition activities is processed and made available as clean fill for the power block foundations. Excess construction debris is trucked off site as an alternative to onsite disposal. The excavations will be regraded such that the power block area will have a final contour consistent with adjacent surroundings. Non-contaminated underground piping (except the service water and circulating water piping) will be abandoned without special considerations. Accessible circulating and service water piping will be removed/collapsed and backfilled to eliminate the potential for collapse after the site is released for unrestricted access. Site utilities and service piping are abandoned in place. Asphalt surfaces in the immediate vicinity of site buildings are broken up and the material used for backfill on site, if needed. 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 the Envirocare facility.

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

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

AmerenUE will manage the decontamination and dismantling of the station in addition to maintaining site security, radiological health and safety, quality assurance and overall site administration during the decommissioning. Personnel costs are based upon average salary information provided by AmerenUE. Overhead costs are included for site and corporate support, reduced commensurate with the staffing of the project.

AmerenUE will hire a Decommissioning Operations Contractor (DOC) to manage the decommissioning. Contract personnel will provide engineering services, *e.g.*, for preparing the activity specifications, work procedures, activation, and structural analyses, under the direction of AmerenUE.

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

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

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.[22] 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[23] and CR-0672,[24] 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. More extensive activation (at very low levels) of the interior structures within containment has been detected at several reactors and the owners have elected to dispose of the affected material at a controlled facility rather than reuse the material as fill on site or send it to a landfill. The ultimate disposition of the material removed from the containment building will depend upon the site release criteria selected, as well as the designated end use for the site.

3.5.4 General

Transition Activities

Existing warehouses are cleared of non-essential material and remain for use by AmerenUE 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. The disposal of operating wastes and any associated legacy wastes during this initial period is not considered a decommissioning expense.

- 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.

Scrap and Salvage

The existing plant equipment is considered obsolete and suitable for scrap as deadweight quantities only. AmerenUE 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 and the limits for coverage defined in the NRC's proposed rulemaking "Financial Protection Requirements for Permanently Shutdown Nuclear Power Reactors."[25] 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 are provided for each scenario in Tables 3.1 and 3.2. Four tables are provided for each decommissioning alternative delineating the total cost as well as the individual cost contributors of License Termination, Spent Fuel Management and Site Restoration. Decommissioning costs are reported in the year of projected expenditure; however, the values are provided

in 2005 dollars. Costs are not inflated, escalated, or discounted over the period of expenditure. The annual expenditures are based upon the detailed activity costs reported in Appendix C and D, along with the timelines presented in Section 4.

As discussed in Section 3.4.2, it is not anticipated that the DOE would accept the GTCC waste prior to completing the transfer of spent fuel. Since the fuel is removed from the site well before decommissioning commences in the SAFSTOR scenario, the disposal of the GTCC is assumed to be concurrent with the disposal of the reactor vessel internals. 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.

TABLE 3.1
SCHEDULE OF DECON EXPENDITURES
(2005 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other[1]	Total
2024	9,300,421	1,049,398	219,311	7,270	814,712	11,391,112
2025	49,390,232	9,711,869	1,286,625	2,650,098	4,315,244	67,354,069
2026	58,285,497	22,613,056	1,348,617	28,726,311	12,551,720	123,525,201
2027	53,101,991	17,920,197	967,162	29,594,787	12,932,371	114,516,509
2028	45,479,622	8,664,228	802,679	8,494,024	3,860,161	67,300,713
2029	45,355,361	8,640,555	800,486	8,470,816	3,849,614	67,116,831
2030	35,972,731	5,352,091	529,271	7,660,011	2,620,695	52,134,800
2031	26,770,247	5,594,789	183,344	25,397	590,774	33,164,551
2032	26,737,800	13,865,253	107,024	0	330,680	41,040,757
2033	5,844,328	3,030,656	23,393	0	72,280	8,970,657
	356,238,230	96,442,093	6,267,912	85,628,714	41,938,251	586,515,200

[1] Includes property taxes, insurance, fees, energy, and equipment/materials

TABLE 3.1a
SCHEDULE OF DECON EXPENDITURES
LICENSE TERMINATION
(2005 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2024	8,930,507	251,881	219,311	7,270	490,835	9,899,804
2025	47,393,006	5,784,386	1,286,625	2,650,098	2,739,045	59,853,161
2026	55,091,719	18,655,371	1,348,617	28,726,311	10,952,391	114,774,410
2027	49,795,955	14,039,781	967,162	29,594,787	11,330,421	105,728,107
2028	42,425,015	4,823,235	802,679	8,494,024	2,279,642	58,824,595
2029	42,309,100	4,810,057	800,486	8,470,816	2,273,414	58,663,872
2030	35,071,372	4,218,684	529,271	7,660,011	2,154,313	49,633,650
2031	19,278,481	1,692,819	153,225	25,397	497,714	21,647,636
2032	116,573	0	0	0	0	116,573
2033	25,480	0	0	0	0	25,480
	300,437,209	54,276,213	6,107,376	85,628,714	32,717,775	479,167,288

TABLE 3.1b
SCHEDULE OF DECON EXPENDITURES
SPENT FUEL MANAGEMENT
(2005 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2024	265,839	797,517	0	0	323,877	1,387,233
2025	1,309,161	3,927,483	0	0	1,576,200	6,812,844
2026	1,306,643	3,919,928	0	0	1,576,200	6,802,771
2027	1,277,409	3,832,228	0	0	1,576,200	6,685,837
2028	1,270,944	3,812,832	0	0	1,580,519	6,664,295
2029	1,267,471	3,802,414	0	0	1,576,201	6,646,086
2030	375,033	1,125,098	0	0	466,383	1,966,513
2031	0	0	0	0	0	0
2032	0	0	0	0	0	0
2033	0	0	0	0	0	0
	7,072,500	21,217,500	0	0	8,675,580	36,965,580

TABLE 3.1c
SCHEDULE OF DECON EXPENDITURES
SITE RESTORATION
(2005 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2024	104,075	0	0	0	0	104,075
2025	688,064	0	0	0	0	688,064
2026	1,887,132	37,756	0	0	23,129	1,948,018
2027	2,028,626	48,188	0	0	25,750	2,102,564
2028	1,783,665	28,161	0	0	0	1,811,827
2029	1,778,792	28,084	0	0	0	1,806,876
2030	526,327	8,310	0	0	0	534,637
2031	7,491,766	3,901,970	30,119	0	93,060	11,516,915
2032	26,621,227	13,865,253	107,024	0	330,680	40,924,183
2033	5,818,847	3,030,656	23,393	0	72,280	8,945,177
	48,728,522	20,948,380	160,536	0	544,898	70,382,336

TABLE 3.2
SCHEDULE OF SAFSTOR EXPENDITURES
(2005 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2024	7,518,479	961,654	219,311	7,270	814,712	9,521,426
2025	38,657,552	7,002,014	1,067,314	938,423	4,163,185	51,828,489
2026	21,965,607	10,563,736	468,449	1,379,271	3,423,132	37,800,194
2027	8,170,223	4,073,668	213,463	35,381	2,757,958	15,250,691
2028	8,192,607	4,084,828	214,048	35,478	2,765,514	15,292,474
2029	8,170,223	4,073,668	213,463	35,381	2,757,958	15,250,691
2030	3,879,111	1,386,389	138,312	35,381	1,590,381	7,029,575
2031	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2032	2,081,530	257,809	107,024	35,478	1,102,740	3,584,581
2033	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2034	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2035	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2036	2,081,530	257,809	107,024	35,478	1,102,740	3,584,581
2037	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2038	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2039	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2040	2,081,530	257,809	107,024	35,478	1,102,740	3,584,581
2041	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2042	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2043	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2044	2,081,530	257,809	107,024	35,478	1,102,740	3,584,581
2045	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2046	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2047	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2048	2,081,530	257,809	107,024	35,478	1,102,740	3,584,581
2049	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2050	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2051	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2052	2,081,530	257,809	107,024	35,478	1,102,740	3,584,581
2053	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2054	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2055	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2056	2,081,530	257,809	107,024	35,478	1,102,740	3,584,581
2057	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2058	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2059	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2060	2,081,530	257,809	107,024	35,478	1,102,740	3,584,581
2061	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2062	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787

TABLE 3.2 (continued)
SCHEDULE OF SAFSTOR EXPENDITURES
(2005 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other[1]	Total
2063	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2064	2,081,530	257,809	107,024	35,478	1,102,740	3,584,581
2065	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2066	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2067	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2068	2,081,530	257,809	107,024	35,478	1,102,740	3,584,581
2069	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2070	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2071	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2072	2,081,530	257,809	107,024	35,478	1,102,740	3,584,581
2073	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2074	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2075	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2076	2,081,530	257,809	107,024	35,478	1,102,740	3,584,581
2077	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2078	19,082,631	850,755	493,596	35,381	1,110,302	21,572,665
2079	36,001,028	3,432,040	1,067,314	35,381	1,199,701	41,735,463
2080	50,379,286	18,886,101	1,022,136	30,370,467	15,764,536	116,422,525
2081	40,876,120	7,526,489	842,593	12,761,436	5,231,563	67,238,202
2082	38,155,264	4,327,374	800,485	7,618,654	2,252,750	53,154,528
2083	38,155,264	4,327,374	800,485	7,618,654	2,252,750	53,154,528
2084	26,565,102	4,802,353	216,241	339,849	684,651	32,608,195
2085	26,664,746	13,827,370	106,731	0	329,776	40,928,623
2086	7,962,897	4,129,269	31,873	0	98,481	12,222,520
	478,029,000	106,347,473	12,935,700	62,910,465	98,920,667	759,143,304

[1] Includes property taxes, insurance, fees, energy, and equipment/materials

TABLE 3.2a
SCHEDULE OF SAFSTOR EXPENDITURES
LICENSE TERMINATION
(2005 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2024	7,252,640	164,137	219,311	7,270	490,835	8,134,193
2025	37,348,391	3,074,531	1,067,314	938,423	2,586,985	45,015,644
2026	17,282,443	6,660,664	393,590	1,379,271	1,789,398	27,505,366
2027	2,075,842	257,105	106,731	35,381	1,099,727	3,574,787
2028	2,081,529	257,810	107,024	35,478	1,102,740	3,584,581
2029	2,075,842	257,105	106,731	35,381	1,099,727	3,574,787
2030	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2031	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2032	2,081,530	257,809	107,024	35,478	1,102,740	3,584,581
2033	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2034	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2035	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2036	2,081,530	257,809	107,024	35,478	1,102,740	3,584,581
2037	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2038	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2039	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2040	2,081,530	257,809	107,024	35,478	1,102,740	3,584,581
2041	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2042	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2043	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2044	2,081,530	257,809	107,024	35,478	1,102,740	3,584,581
2045	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2046	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2047	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2048	2,081,530	257,809	107,024	35,478	1,102,740	3,584,581
2049	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2050	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2051	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2052	2,081,530	257,809	107,024	35,478	1,102,740	3,584,581
2053	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2054	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2055	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2056	2,081,530	257,809	107,024	35,478	1,102,740	3,584,581
2057	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2058	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2059	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2060	2,081,530	257,809	107,024	35,478	1,102,740	3,584,581
2061	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2062	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787

TABLE 3.2a (continued)
SCHEDULE OF SAFSTOR EXPENDITURES
LICENSE TERMINATION
(2005 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2063	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2064	2,081,530	257,809	107,024	35,478	1,102,740	3,584,581
2065	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2066	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2067	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2068	2,081,530	257,809	107,024	35,478	1,102,740	3,584,581
2069	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2070	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2071	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2072	2,081,530	257,809	107,024	35,478	1,102,740	3,584,581
2073	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2074	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2075	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2076	2,081,530	257,809	107,024	35,478	1,102,740	3,584,581
2077	2,075,843	257,105	106,731	35,381	1,099,727	3,574,787
2078	18,656,043	850,755	493,596	35,381	1,110,302	21,146,077
2079	35,263,932	3,432,040	1,067,314	35,381	1,199,701	40,998,367
2080	47,756,038	18,825,716	1,022,136	30,370,467	15,734,811	113,709,168
2081	39,053,391	7,493,315	842,593	12,761,436	5,225,057	65,375,793
2082	36,580,420	4,302,510	800,485	7,618,654	2,252,750	51,554,819
2083	36,580,420	4,302,510	800,485	7,618,654	2,252,750	51,554,819
2084	21,045,213	1,960,090	194,310	339,849	616,888	24,156,350
2085	116,254	0	0	0	0	116,254
2086	34,717	0	0	0	0	34,717
	402,911,818	64,187,783	12,348,238	62,910,465	89,384,719	631,743,023

TABLE 3.2b
SCHEDULE OF SAFSTOR EXPENDITURES
SPENT FUEL MANAGEMENT
(2005 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2024	265,839	797,517	0	0	323,877	1,387,233
2025	1,309,161	3,927,483	0	0	1,576,200	6,812,844
2026	4,683,164	3,903,072	74,858	0	1,633,734	10,294,829
2027	6,094,380	3,816,563	106,731	0	1,658,231	11,675,905
2028	6,111,077	3,827,019	107,024	0	1,662,774	11,707,893
2029	6,094,380	3,816,563	106,731	0	1,658,231	11,675,905
2030	1,803,269	1,129,284	31,581	0	490,655	3,454,788
2031	0	0	0	0	0	0
2032	0	0	0	0	0	0
2033	0	0	0	0	0	0
2034	0	0	0	0	0	0
2035	0	0	0	0	0	0
2036	0	0	0	0	0	0
2037	0	0	0	0	0	0
2038	0	0	0	0	0	0
2039	0	0	0	0	0	0
2040	0	0	0	0	0	0
2041	0	0	0	0	0	0
2042	0	0	0	0	0	0
2043	0	0	0	0	0	0
2044	0	0	0	0	0	0
2045	0	0	0	0	0	0
2046	0	0	0	0	0	0
2047	0	0	0	0	0	0
2048	0	0	0	0	0	0
2049	0	0	0	0	0	0
2050	0	0	0	0	0	0
2051	0	0	0	0	0	0
2052	0	0	0	0	0	0
2053	0	0	0	0	0	0
2054	0	0	0	0	0	0
2055	0	0	0	0	0	0
2056	0	0	0	0	0	0
2057	0	0	0	0	0	0
2058	0	0	0	0	0	0
2059	0	0	0	0	0	0
2060	0	0	0	0	0	0
2061	0	0	0	0	0	0
2062	0	0	0	0	0	0

TABLE 3.2b (continued)
SCHEDULE OF SAFSTOR EXPENDITURES
SPENT FUEL MANAGEMENT
(2005 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2063	0	0	0	0	0	0
2064	0	0	0	0	0	0
2065	0	0	0	0	0	0
2066	0	0	0	0	0	0
2067	0	0	0	0	0	0
2068	0	0	0	0	0	0
2069	0	0	0	0	0	0
2070	0	0	0	0	0	0
2071	0	0	0	0	0	0
2072	0	0	0	0	0	0
2073	0	0	0	0	0	0
2074	0	0	0	0	0	0
2075	0	0	0	0	0	0
2076	0	0	0	0	0	0
2077	0	0	0	0	0	0
2078	0	0	0	0	0	0
2079	0	0	0	0	0	0
2080	0	0	0	0	0	0
2081	0	0	0	0	0	0
2082	0	0	0	0	0	0
2083	0	0	0	0	0	0
2084	0	0	0	0	0	0
2085	0	0	0	0	0	0
2086	0	0	0	0	0	0
	26,361,270	21,217,500	426,926	0	9,003,701	57,009,396

TABLE 3.2c
SCHEDULE OF SAFSTOR EXPENDITURES
SITE RESTORATION
(2005 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2024	0	0	0	0	0	0
2025	0	0	0	0	0	0
2026	0	0	0	0	0	0
2027	0	0	0	0	0	0
2028	0	0	0	0	0	0
2029	0	0	0	0	0	0
2030	0	0	0	0	0	0
2031	0	0	0	0	0	0
2032	0	0	0	0	0	0
2033	0	0	0	0	0	0
2034	0	0	0	0	0	0
2035	0	0	0	0	0	0
2036	0	0	0	0	0	0
2037	0	0	0	0	0	0
2038	0	0	0	0	0	0
2039	0	0	0	0	0	0
2040	0	0	0	0	0	0
2041	0	0	0	0	0	0
2042	0	0	0	0	0	0
2043	0	0	0	0	0	0
2044	0	0	0	0	0	0
2045	0	0	0	0	0	0
2046	0	0	0	0	0	0
2047	0	0	0	0	0	0
2048	0	0	0	0	0	0
2049	0	0	0	0	0	0
2050	0	0	0	0	0	0
2051	0	0	0	0	0	0
2052	0	0	0	0	0	0
2053	0	0	0	0	0	0
2054	0	0	0	0	0	0
2055	0	0	0	0	0	0
2056	0	0	0	0	0	0
2057	0	0	0	0	0	0
2058	0	0	0	0	0	0
2059	0	0	0	0	0	0
2060	0	0	0	0	0	0
2061	0	0	0	0	0	0
2062	0	0	0	0	0	0

TABLE 3.2c (continued)
SCHEDULE OF SAFSTOR EXPENDITURES
SITE RESTORATION
(2005 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2063	0	0	0	0	0	0
2064	0	0	0	0	0	0
2065	0	0	0	0	0	0
2066	0	0	0	0	0	0
2067	0	0	0	0	0	0
2068	0	0	0	0	0	0
2069	0	0	0	0	0	0
2070	0	0	0	0	0	0
2071	0	0	0	0	0	0
2072	0	0	0	0	0	0
2073	0	0	0	0	0	0
2074	0	0	0	0	0	0
2075	0	0	0	0	0	0
2076	0	0	0	0	0	0
2077	0	0	0	0	0	0
2078	426,589	0	0	0	0	426,589
2079	737,104	0	0	0	0	737,104
2080	2,623,255	60,383	0	0	29,725	2,713,363
2081	1,822,747	33,174	0	0	6,505	1,862,426
2082	1,574,865	24,865	0	0	0	1,599,730
2083	1,574,865	24,865	0	0	0	1,599,730
2084	5,519,890	2,842,262	21,931	0	67,762	8,451,845
2085	26,548,491	13,827,370	106,731	0	329,776	40,812,369
2086	7,928,180	4,129,269	31,873	0	98,481	12,187,803
	48,755,985	20,942,189	160,536	0	532,249	70,390,959

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 5½ 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 2002" computer software.[26]

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 discharged 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

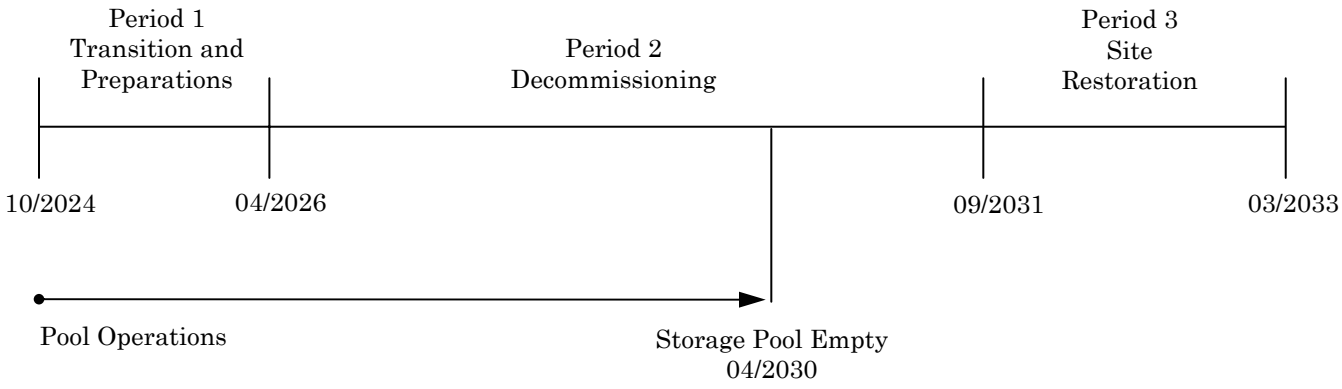
The period-dependent costs presented in the detailed cost tables are based upon the durations developed in the schedules for decommissioning. Durations are established between several milestones in each project period; these durations are used to establish a critical path for the entire project. In turn, 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 auxiliary 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 5½ years after shutdown. Deferred decommissioning in the SAFSTOR scenarios is assumed to commence so that the operating license is terminated within a 60-year period from the cessation of plant operations.

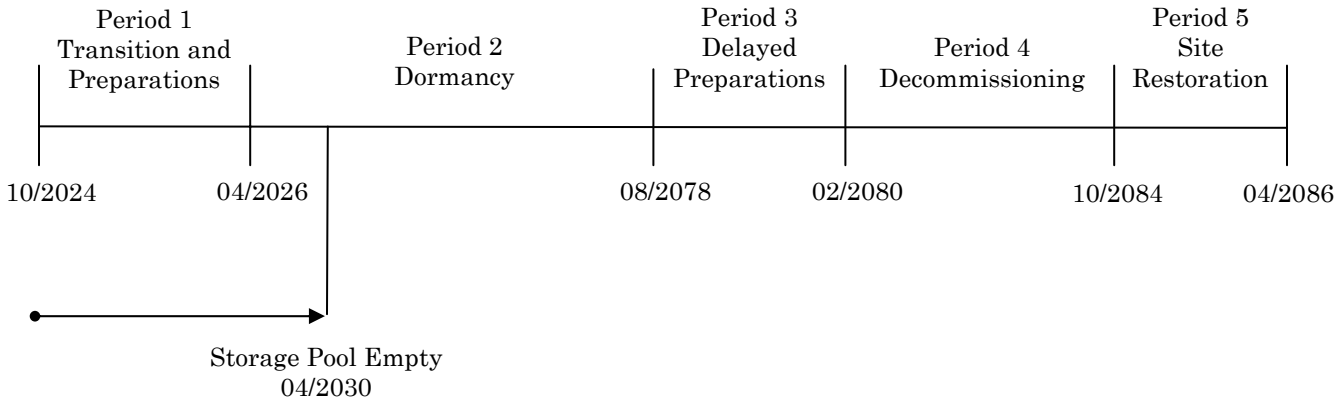
FIGURE 4.1
ACTIVITY SCHEDULE

FIGURE 4.2
DECOMMISSIONING TIMELINES
(not to scale)

DECON Alternative



SAFSTOR Alternative



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(s). This currently requires the remediation of all radioactive material at the site in excess of applicable legal limits. Under the Atomic Energy Act,[27] 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, §71 defines radioactive material as it pertains to transportation and §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 §173-178. Shipping containers are required to be Industrial Packages (IP-1, IP-2 or IP-3, as defined in subpart 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 volumes of radioactive waste generated during the various decommissioning activities at the site are shown on a line-item basis in Appendices C and D, and summarized in Tables 5.1 and 5.2. The quantified waste volume summaries shown in these tables are consistent with §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 generated in the decontamination and dismantling of the nuclear station is primarily generated during Period 2 of DECON and Period 4 of SAFSTOR. Material that is considered potentially contaminated when removed from the radiologically controlled area is sent to processing facilities in Tennessee for conditioning and disposal at a unit cost of $2.15 per pound (excluding transportation). 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 Envirocare facility was used as a proxy for future disposal facilities. A rate of $268 per cubic foot is used for containerized waste and other large components including the reactor coolant pump motors. Demolition debris including miscellaneous steel, metal siding, scaffolding, and structural steel is disposed of at a bulk rate of $36.75 per cubic foot. A unit rate of $70 per cubic foot is used for the disposal of dry active waste.

Since Envirocare 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 are based upon Barnwell rates. An average disposal rate of approximately $484 per cubic foot (based upon a waste density of 85 pounds per cubic foot) is used for this material, with additional surcharges for activity, dose rate, and/or handling added as appropriate for the particular package.

TABLE 5.1
DECOMMISSIONING WASTE SUMMARY
DECON

	Waste Class[1]	**Volume** (cubic feet)	**Weight** (pounds)
Low-Level Radioactive Waste			
	A	104,285	9,379,126
	B	12,780	1,919,878
	C	861	105,570
Geologic Repository (Greater-than Class C)			
	>C	560	116,756
Total [2]		118,486	11,521,330
Processed Waste (Off Site)			9,446,939
Scrap Metal			155,183,596

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
DECOMMISSIONING WASTE SUMMARY
SAFSTOR

	Waste Class[1]	**Volume** (cubic feet)	**Weight** (pounds)
Low-Level Radioactive Waste			
	A	98,617	7,307,834
	B	5,666	653,605
	C	845	101,865
Geologic Repository (Greater-than Class C)			
	>C	560	116,756
Total [2]		105,688	8,180,060
Processed Waste (Off Site)			10,999,060
Scrap Metal			155,512,451

[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 2002. While not an engineering study, the estimates provide AmerenUE with sufficient information to assess their 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 5½ years following the cessation of operations for continued cooling of the assemblies. Once sufficiently cooled, the assemblies will be transferred to a DOE transport cask for disposition.

The cost projected to promptly decommission (DECON) Callaway is estimated to be $586.5 million. The majority of this cost (approximately 81.7%) is associated with the physical decontamination and dismantling of the nuclear unit so that the operating license can be terminated. Another 6.3% is associated with the management and transfer of the spent fuel. The remaining 12.0% is for the demolition of the designated structures and limited restoration of the site.

The cost projected for deferred decommissioning (SAFSTOR) is estimated to be $759.1 million. The majority of this cost (approximately 83.2%) is associated with placing the unit in storage, ongoing caretaking of the unit during dormancy, and the eventual physical decontamination and dismantling of the nuclear unit so that the operating license can be terminated. Another 7.5% is associated with the management, interim storage, and eventual transfer of the spent fuel. The remaining 9.3% 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 AmerenUE 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.

As described in this report, the spent fuel pool will remain operational for a minimum of 5½ 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 5½-year period, the spent fuel will be packaged for loading into a DOE-provided transport cask.

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 Envirocare facility. Highly activated components, requiring additional isolation from the environment, 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
SUMMARY OF DECOMMISSIONING COST ELEMENTS
DECON

Cost Element	Cost 2005$ (thousands)	Percent of Total Costs
Decontamination	16,105	2.7
Removal	111,336	19.0
Packaging	12,703	2.2
Transportation	8,830	1.5
Waste Disposal	75,337	12.8
Off-site Waste Processing	23,358	4.0
Program Management [1]	258,579	44.1
Spent Fuel Pool Isolation	9,900	1.7
Spent Fuel Related	36,966	6.3
Insurance and Regulatory Fees	7,767	1.3
Energy	6,268	1.1
Characterization and Licensing Surveys	10,623	1.8
Property Taxes	2,780	0.5
Miscellaneous Equipment / Site Services	5,964	1.0
Total [2]	586,515	100.0
NRC License Termination	479,167	81.7
Spent Fuel Management [3]	36,966	6.3
Site Restoration	70,382	12.0
Total [2]	586,515	100.0

[1] Utility staffing includes engineering and security.
[2] Columns may not add due to rounding.
[3] Includes fuel loading/packaging costs

TABLE 6.2
SUMMARY OF DECOMMISSIONING COST ELEMENTS
SAFSTOR

Cost Element	Cost 2005$ (thousands)	Percent of Total Costs
Decontamination	13,305	1.8
Removal	110,883	14.6
Packaging	10,623	1.4
Transportation	6,393	0.8
Waste Disposal	48,781	6.4
Off-site Waste Processing	27,195	3.6
Program Management [1]	383,194	50.5
Spent Fuel Pool Isolation	9,900	1.3
Spent Fuel Related	36,966	4.9
Insurance and Regulatory Fees	48,390	6.4
Energy	12,936	1.7
Characterization and Licensing Surveys	12,009	1.6
Property Taxes	20,296	2.7
Miscellaneous Equipment / Site Services	18,273	2.4
Total [2]	759,143	100.0
NRC License Termination	631,743	83.2
Spent Fuel Management [3]	57,009	7.5
Site Restoration	70,391	9.3
Total [2]	759,143	100.0

[1] Utility staffing includes engineering and security.
[2] Columns may not add due to rounding.
[3] Includes fuel loading/packaging costs

7. REFERENCES

1. 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.

2. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.159, "Assuring the Availability of Funds for Decommissioning Nuclear Reactors," October 2003.

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

4. U.S. Code of Federal Regulations, Title 10, Parts 20 and 50, "Entombment Options for Power Reactors," Advanced Notice of Proposed Rulemaking, Federal Register Volume 66, Number 200, October 16, 2001.

5. 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.

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

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

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

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

10. U.S. Code of Federal Regulations, Title 10, Part 20, Subpart E, "Radiological Criteria for License Termination," Federal Register, Volume 62, Number 139 (p 39058 et seq.), July 21, 1997.

7. REFERENCES
(continued)

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

12. 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."

13. "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.

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

15. "Decommissioning Cost Analysis for the Callaway Plant," Document No. A22-1441-002, Rev. 0, TLG Services, Inc., August 2002.

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

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

18. "Building Construction Cost Data 2005," Robert Snow Means Company, Inc., Kingston, Massachusetts.

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

20. U.S. Department of Transportation, Section 49 of the Code of Federal Regulations, "Transportation," Parts 173 through 178, 1996.

21. Tri-State Motor Transit Company, published tariffs, Interstate Commerce Commission (ICC), Docket No. MC-427719 Rules Tariff, March 2004, Radioactive Materials Tariff, January 2004.

7. REFERENCES
(continued)

22. 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.

23. 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.

24. 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.

25. "Financial Protection Requirements for Permanently Shutdown Nuclear Power Reactors," 10 CFR Parts 50 and 140, Federal Register Notice, Vol. 62, No. 210, October 30, 1997.

26. "Microsoft Project Professional 2002," Microsoft Corporation, Redmond, WA.

27. "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 (40% of critical duration)	102
Adjusted work duration	485
+ Protective clothing adjustment (30% of adjusted duration)	146
Productive work duration	631
+ Work break adjustment (8.33 % of productive duration)	53
Total work duration (minutes)	684

***** Total duration = 11.400 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	11.400	$30.75	$1051.65
Craftsmen	2.00	11.400	$46.49	$1059.97
Foreman	1.00	11.400	$48.64	$554.50
General Foreman	0.25	11.400	$49.98	$142.44
Fire Watch	0.05	11.400	$30.75	$17.53
Health Physics Technician	1.00	11.400	$42.08	$479.71
Total labor cost				$3,305.80

4. EQUIPMENT & CONSUMABLES COSTS

Equipment Costs	none
Consumables/Materials Costs	
-Blotting paper 50 @ $0.48 sq ft {1}	$24.00
-Plastic sheets/bags 50 @ $0.11/sq ft {2}	$5.50
-Gas torch consumables 1 @ $8.22/hr x 1 hr {3}	$8.22
Subtotal cost of equipment and materials	$37.72
Overhead & profit on equipment and materials @ 14.23 %	$5.37
Total costs, equipment & material	$43.09

TOTAL COST:

Removal of contaminated heat exchanger <3000 pounds:	**$3,348.89**
Total labor cost:	$3305.80
Total equipment/material costs:	$43.09
Total craft labor man-hours required per unit:	83.220

APPENDIX A
(continued)

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
    2. R.S. Means (2005) Section 01540-800-0200, page 17
    3. R.S. Means (2005) Section 01590-400-6360, page 25

- 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	0.35
Removal of clean pipe 0.25 to 2 inches diameter, $/linear foot	3.69
Removal of clean pipe >2 to 4 inches diameter, $/linear foot	5.35
Removal of clean pipe >4 to 8 inches diameter, $/linear foot	10.81
Removal of clean pipe >8 to 14 inches diameter, $/linear foot	20.58
Removal of clean pipe >14 to 20 inches diameter, $/linear foot	26.72
Removal of clean pipe >20 to 36 inches diameter, $/linear foot	39.32
Removal of clean pipe >36 inches diameter, $/linear foot	46.73
Removal of clean valve >2 to 4 inches	70.87
Removal of clean valve >4 to 8 inches	108.08
Removal of clean valve >8 to 14 inches	205.80
Removal of clean valve >14 to 20 inches	267.16
Removal of clean valve >20 to 36 inches	393.17
Removal of clean valve >36 inches	467.31
Removal of clean pipe hanger for small bore piping	22.95
Removal of clean pipe hanger for large bore piping	81.67
Removal of clean pump, <300 pound	181.42
Removal of clean pump, 300-1000 pound	513.22
Removal of clean pump, 1000-10,000 pound	2,019.75
Removal of clean pump, >10,000 pound	3,902.88
Removal of clean pump motor, 300-1000 pound	215.95
Removal of clean pump motor, 1000-10,000 pound	841.37
Removal of clean pump motor, >10,000 pound	1,893.09
Removal of clean heat exchanger <3000 pound	1,083.55
Removal of clean heat exchanger >3000 pound	2,723.09

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of clean feedwater heater/deaerator	7,683.46
Removal of clean moisture separator/reheater	15,805.59
Removal of clean tank, <300 gallons	233.46
Removal of clean tank, 300-3000 gallon	737.88
Removal of clean tank, >3000 gallons, $/square foot surface area	6.28
Removal of clean electrical equipment, <300 pound	99.35
Removal of clean electrical equipment, 300-1000 pound	351.59
Removal of clean electrical equipment, 1000-10,000 pound	703.18
Removal of clean electrical equipment, >10,000 pound	1,681.79
Removal of clean electrical transformer < 30 tons	1,167.99
Removal of clean electrical transformer > 30 tons	3,363.59
Removal of clean standby diesel generator, <100 kW	1,193.00
Removal of clean standby diesel generator, 100 kW to 1 MW	2,662.84
Removal of clean standby diesel generator, >1 MW	5,512.63
Removal of clean electrical cable tray, $/linear foot	9.26
Removal of clean electrical conduit, $/linear foot	4.04
Removal of clean mechanical equipment, <300 pound	99.35
Removal of clean mechanical equipment, 300-1000 pound	351.59
Removal of clean mechanical equipment, 1000-10,000 pound	703.18
Removal of clean mechanical equipment, >10,000 pound	1,681.79
Removal of clean HVAC equipment, <300 pound	99.35
Removal of clean HVAC equipment, 300-1000 pound	351.59
Removal of clean HVAC equipment, 1000-10,000 pound	703.18
Removal of clean HVAC equipment, >10,000 pound	1,681.79
Removal of clean HVAC ductwork, $/pound	0.37

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of contaminated instrument and sampling tubing, $/linear foot	1.16
Removal of contaminated pipe 0.25 to 2 inches diameter, $/linear foot	15.65
Removal of contaminated pipe >2 to 4 inches diameter, $/linear foot	27.11
Removal of contaminated pipe >4 to 8 inches diameter, $/linear foot	43.82
Removal of contaminated pipe >8 to 14 inches diameter, $/linear foot	85.60
Removal of contaminated pipe >14 to 20 inches diameter, $/linear foot	103.49
Removal of contaminated pipe >20 to 36 inches diameter, $/linear foot	143.69
Removal of contaminated pipe >36 inches diameter, $/linear foot	169.94
Removal of contaminated valve >2 to 4 inches	341.53
Removal of contaminated valve >4 to 8 inches	406.06
Removal of contaminated valve >8 to 14 inches	822.30
Removal of contaminated valve >14 to 20 inches	1,051.07
Removal of contaminated valve >20 to 36 inches	1,403.18
Removal of contaminated valve >36 inches	1,665.70
Removal of contaminated pipe hanger for small bore piping	81.00
Removal of contaminated pipe hanger for large bore piping	259.01
Removal of contaminated pump, <300 pound	723.87
Removal of contaminated pump, 300-1000 pound	1,704.73
Removal of contaminated pump, 1000-10,000 pound	5,505.45
Removal of contaminated pump, >10,000 pound	13,393.57
Removal of contaminated pump motor, 300-1000 pound	722.20
Removal of contaminated pump motor, 1000-10,000 pound	2,231.15
Removal of contaminated pump motor, >10,000 pound	5,015.24
Removal of contaminated heat exchanger <3000 pound	3,348.89
Removal of contaminated heat exchanger >3000 pound	9,678.68

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of contaminated tank, <300 gallons	1,210.69
Removal of contaminated tank, >300 gallons, $/square foot	24.18
Removal of contaminated electrical equipment, <300 pound	566.19
Removal of contaminated electrical equipment, 300-1000 pound	1,382.83
Removal of contaminated electrical equipment, 1000-10,000 pound	2,659.81
Removal of contaminated electrical equipment, >10,000 pound	5,203.86
Removal of contaminated electrical cable tray, $/linear foot	27.24
Removal of contaminated electrical conduit, $/linear foot	12.24
Removal of contaminated mechanical equipment, <300 pound	626.34
Removal of contaminated mechanical equipment, 300-1000 pound	1,526.83
Removal of contaminated mechanical equipment, 1000-10,000 pound	2,936.22
Removal of contaminated mechanical equipment, >10,000 pound	5,203.86
Removal of contaminated HVAC equipment, <300 pound	626.34
Removal of contaminated HVAC equipment, 300-1000 pound	1,526.83
Removal of contaminated HVAC equipment, 1000-10,000 pound	2,936.22
Removal of contaminated HVAC equipment, >10,000 pound	5,203.86
Removal of contaminated HVAC ductwork, $/pound	1.67
Removal/plasma arc cut of contaminated thin metal components, $/linear in.	3.00
Additional decontamination of surface by washing, $/square foot	6.03
Additional decontamination of surfaces by hydrolasing, $/square foot	28.83
Decontamination rig hook up and flush, $/ 250 foot length	5,343.79
Chemical flush of components/systems, $/gallon	12.41
Removal of clean standard reinforced concrete, $/cubic yard	103.92
Removal of grade slab concrete, $/cubic yard	138.42
Removal of clean concrete floors, $/cubic yard	273.16

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of sections of clean concrete floors, $/cubic yard	801.73
Removal of clean heavily rein concrete w/#9 rebar, $/cubic yard	180.38
Removal of contaminated heavily rein concrete w/#9 rebar, $/cubic yard	1,622.83
Removal of clean heavily rein concrete w/#18 rebar, $/cubic yard	228.20
Removal of contaminated heavily rein concrete w/#18 rebar, $/cubic yard	2,147.52
Removal heavily rein concrete w/#18 rebar & steel embedments, $/cubic yard	343.35
Removal of below-grade suspended floors, $/cubic yard	273.16
Removal of clean monolithic concrete structures, $/cubic yard	673.75
Removal of contaminated monolithic concrete structures, $/cubic yard	1,622.04
Removal of clean foundation concrete, $/cubic yard	528.06
Removal of contaminated foundation concrete, $/cubic yard	1,509.99
Explosive demolition of bulk concrete, $/cubic yard	24.39
Removal of clean hollow masonry block wall, $/cubic yard	66.81
Removal of contaminated hollow masonry block wall, $/cubic yard	239.88
Removal of clean solid masonry block wall, $/cubic yard	66.81
Removal of contaminated solid masonry block wall, $/cubic yard	239.88
Backfill of below-grade voids, $/cubic yard	15.58
Removal of subterranean tunnels/voids, $/linear foot	81.51
Placement of concrete for below-grade voids, $/cubic yard	105.21
Excavation of clean material, $/cubic yard	2.21
Excavation of contaminated material, $/cubic yard	32.89
Removal of clean concrete rubble (tipping fee included), $/cubic yard	91.45
Removal of contaminated concrete rubble, $/cubic yard	20.64
Removal of building by volume, $/cubic foot	0.24
Removal of clean building metal siding, $/square foot	0.83

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of contaminated building metal siding, $/square foot	3.10
Removal of standard asphalt roofing, $/square foot	1.66
Removal of transite panels, $/square foot	1.84
Scarifying contaminated concrete surfaces (drill & spall), $/square foot	11.13
Scabbling contaminated concrete floors, $/square foot	6.15
Scabbling contaminated concrete walls, $/square foot	6.75
Scabbling contaminated ceilings, $/square foot	60.79
Scabbling structural steel, $/square foot	5.42
Removal of clean overhead crane/monorail < 10 ton capacity	501.47
Removal of contaminated overhead crane/monorail < 10 ton capacity	1,453.19
Removal of clean overhead crane/monorail >10-50 ton capacity	1,203.52
Removal of contaminated overhead crane/monorail >10-50 ton capacity	3,485.70
Removal of polar crane > 50 ton capacity	5,046.80
Removal of gantry crane > 50 ton capacity	21,022.46
Removal of structural steel, $/pound	0.29
Removal of clean steel floor grating, $/square foot	3.65
Removal of contaminated steel floor grating, $/square foot	10.83
Removal of clean free standing steel liner, $/square foot	9.42
Removal of contaminated free standing steel liner, $/square foot	28.04
Removal of clean concrete-anchored steel liner, $/square foot	4.71
Removal of contaminated concrete-anchored steel liner, $/square foot	32.46
Placement of scaffolding in clean areas, $/square foot	13.62
Placement of scaffolding in contaminated areas, $/square foot	21.85
Landscaping with topsoil, $/acre	18,594.84
Cost of CPC B-88 LSA box & preparation for use	1,337.59

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	1,052.75
Cost of CPC B-12V 12 gauge LSA box & preparation for use	897.00
Cost of CPC B-144 LSA box & preparation for use	5,273.00
Cost of LSA drum & preparation for use	109.90
Cost of cask liner for CNSI 14 195 cask	9,401.61
Cost of cask liner for CNSI 8 120A cask (resins)	6,319.05
Cost of cask liner for CNSI 8 120A cask (filters)	6,319.05
Decontamination of surfaces with vacuuming, $/square foot	0.52

APPENDIX C

DETAILED COST ANALYSIS

DECON

Table C
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2005 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	-	-	-	-	-	-	127	19	146	146	-	-	-	-	-	-	-	-	-	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	-	-	-	-	-	-	195	29	224	224	-	-	-	-	-	-	-	-	-	2,000
1a.1.7	Review plant dwgs & specs.	-	-	-	-	-	-	448	67	516	516	-	-	-	-	-	-	-	-	-	4,600
1a.1.8	Perform detailed rad survey									a											
1a.1.9	Estimate by-product inventory	-	-	-	-	-	-	97	15	112	112	-	-	-	-	-	-	-	-	-	1,000
1a.1.10	End product description	-	-	-	-	-	-	97	15	112	112	-	-	-	-	-	-	-	-	-	1,000
1a.1.11	Detailed by-product inventory	-	-	-	-	-	-	127	19	146	146	-	-	-	-	-	-	-	-	-	1,300
1a.1.12	Define major work sequence	-	-	-	-	-	-	731	110	841	841	-	-	-	-	-	-	-	-	-	7,500
1a.1.13	Perform SER and EA	-	-	-	-	-	-	302	45	347	347	-	-	-	-	-	-	-	-	-	3,100
1a.1.14	Perform Site-Specific Cost Study	-	-	-	-	-	-	487	73	560	560	-	-	-	-	-	-	-	-	-	5,000
1a.1.15	Prepare/submit License Termination Plan	-	-	-	-	-	-	399	60	459	459	-	-	-	-	-	-	-	-	-	4,096
1a.1.16	Receive NRC approval of termination plan									a											
Activity Specifications																					
1a.1.17.1	Plant & temporary facilities	-	-	-	-	-	-	480	72	551	496	-	55	-	-	-	-	-	-	-	4,920
1a.1.17.2	Plant systems	-	-	-	-	-	-	406	61	467	420	-	47	-	-	-	-	-	-	-	4,167
1a.1.17.3	NSSS Decontamination Flush	-	-	-	-	-	-	49	7	56	56	-	-	-	-	-	-	-	-	-	500
1a.1.17.4	Reactor internals	-	-	-	-	-	-	692	104	796	796	-	-	-	-	-	-	-	-	-	7,100
1a.1.17.5	Reactor vessel	-	-	-	-	-	-	634	95	729	729	-	-	-	-	-	-	-	-	-	6,500
1a.1.17.6	Biological shield	-	-	-	-	-	-	49	7	56	56	-	-	-	-	-	-	-	-	-	500
1a.1.17.7	Steam generators	-	-	-	-	-	-	304	46	350	350	-	-	-	-	-	-	-	-	-	3,120
1a.1.17.8	Reinforced concrete	-	-	-	-	-	-	156	23	179	90	-	90	-	-	-	-	-	-	-	1,600
1a.1.17.9	Main Turbine	-	-	-	-	-	-	39	6	45	-	-	45	-	-	-	-	-	-	-	400
1a.1.17.10	Main Condensers	-	-	-	-	-	-	39	6	45	-	-	45	-	-	-	-	-	-	-	400
1a.1.17.11	Plant structures & buildings	-	-	-	-	-	-	304	46	350	175	-	175	-	-	-	-	-	-	-	3,120
1a.1.17.12	Waste management	-	-	-	-	-	-	448	67	516	516	-	-	-	-	-	-	-	-	-	4,600
1a.1.17.13	Facility & site closeout	-	-	-	-	-	-	88	13	101	50	-	50	-	-	-	-	-	-	-	900
1a.1.17	Total	-	-	-	-	-	-	3,687	553	4,240	3,734	-	507	-	-	-	-	-	-	-	37,827
Planning & Site Preparations																					
1a.1.18	Prepare dismantling sequence	-	-	-	-	-	-	234	35	269	269	-	-	-	-	-	-	-	-	-	2,400
1a.1.19	Plant prep. & temp. svces	-	-	-	-	-	-	2,419	363	2,782	2,782	-	-	-	-	-	-	-	-	-	-
1a.1.20	Design water clean-up system	-	-	-	-	-	-	136	20	157	157	-	-	-	-	-	-	-	-	-	1,400
1a.1.21	Rigging/Cont. Cntrl Envlps/tooling/etc.	-	-	-	-	-	-	2,048	307	2,355	2,355	-	-	-	-	-	-	-	-	-	-
1a.1.22	Procure casks/liners & containers	-	-	-	-	-	-	120	18	138	138	-	-	-	-	-	-	-	-	-	1,230
1a.1	Subtotal Period 1a Activity Costs	-	-	-	-	-	-	11,656	1,748	13,404	12,897	-	507	-	-	-	-	-	-	-	73,753
Period 1a Collateral Costs																					
1a.3.1	Spent Fuel Transfer to DOE	-	-	-	-	-	-	4,500	675	5,175	-	5,175	-	-	-	-	-	-	-	-	-
1a.3	Subtotal Period 1a Collateral Costs	-	-	-	-	-	-	4,500	675	5,175	-	5,175	-	-	-	-	-	-	-	-	-
Period 1a Period-Dependent Costs																					
1a.4.1	Insurance	-	-	-	-	-	-	1,604	160	1,764	1,764	-	-	-	-	-	-	-	-	-	-
1a.4.2	Property taxes	-	-	-	-	-	-	300	30	330	330	-	-	-	-	-	-	-	-	-	-
1a.4.3	Health physics supplies	-	257	-	-	-	-	-	64	322	322	-	-	-	-	-	-	-	-	-	-
1a.4.4	Heavy equipment rental	-	334	-	-	-	-	-	50	384	384	-	-	-	-	-	-	-	-	-	-
1a.4.5	Disposal of DAW generated	-	-	6	3	-	28	-	8	45	45	-	-	-	404	-	-	-	8,103	99	-
1a.4.6	Plant energy budget	-	-	-	-	-	-	928	139	1,067	1,067	-	-	-	-	-	-	-	-	-	-
1a.4.7	NRC Fees	-	-	-	-	-	-	265	27	292	292	-	-	-	-	-	-	-	-	-	-
1a.4.8	Emergency Planning Fees	-	-	-	-	-	-	450	45	495	-	495	-	-	-	-	-	-	-	-	-

Table C
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2005 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 Period-Dependent Costs (continued)																					
1a.4.9	Spent Fuel Pool O&M	-	-	-	-	-	-	940	141	1,082	-	1,082	-	-	-	-	-	-	-	-	-
1a.4.10	Security Staff Cost	-	-	-	-	-	-	1,631	245	1,876	1,876	-	-	-	-	-	-	-	-	-	58,921
1a.4.11	Utility Staff Cost	-	-	-	-	-	-	25,393	3,809	29,202	29,202	-	-	-	-	-	-	-	-	-	438,000
1a.4	Subtotal Period 1a Period-Dependent Costs	-	592	6	3	-	28	31,511	4,718	36,858	35,282	1,576	-	-	404	-	-	-	8,103	99	496,921
1a.0	TOTAL PERIOD 1a COST	-	592	6	3	-	28	47,666	7,142	55,437	48,179	6,751	507	-	404	-	-	-	8,103	99	570,674
PERIOD 1b - Decommissioning Preparations																					
Period 1b Direct Decommissioning Activities																					
Detailed Work Procedures																					
1b.1.1.1	Plant systems	-	-	-	-	-	-	461	69	531	477	-	53	-	-	-	-	-	-	-	4,733
1b.1.1.2	NSSS Decontamination Flush	-	-	-	-	-	-	97	15	112	112	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.3	Reactor internals	-	-	-	-	-	-	244	37	280	280	-	-	-	-	-	-	-	-	-	2,500
1b.1.1.4	Remaining buildings	-	-	-	-	-	-	132	20	151	38	-	113	-	-	-	-	-	-	-	1,350
1b.1.1.5	CRD cooling assembly	-	-	-	-	-	-	97	15	112	112	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.6	CRD housings & ICI tubes	-	-	-	-	-	-	97	15	112	112	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.7	Incore instrumentation	-	-	-	-	-	-	97	15	112	112	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.8	Reactor vessel	-	-	-	-	-	-	354	53	407	407	-	-	-	-	-	-	-	-	-	3,630
1b.1.1.9	Facility closeout	-	-	-	-	-	-	117	18	135	67	-	67	-	-	-	-	-	-	-	1,200
1b.1.1.10	Missile shields	-	-	-	-	-	-	44	7	50	50	-	-	-	-	-	-	-	-	-	450
1b.1.1.11	Biological shield	-	-	-	-	-	-	117	18	135	135	-	-	-	-	-	-	-	-	-	1,200
1b.1.1.12	Steam generators	-	-	-	-	-	-	448	67	516	516	-	-	-	-	-	-	-	-	-	4,600
1b.1.1.13	Reinforced concrete	-	-	-	-	-	-	97	15	112	56	-	56	-	-	-	-	-	-	-	1,000
1b.1.1.14	Main Turbine	-	-	-	-	-	-	152	23	175	-	-	175	-	-	-	-	-	-	-	1,560
1b.1.1.15	Main Condensers	-	-	-	-	-	-	152	23	175	-	-	175	-	-	-	-	-	-	-	1,560
1b.1.1.16	Auxiliary building	-	-	-	-	-	-	266	40	306	275	-	31	-	-	-	-	-	-	-	2,730
1b.1.1.17	Reactor building	-	-	-	-	-	-	266	40	306	275	-	31	-	-	-	-	-	-	-	2,730
1b.1.1	Total	-	-	-	-	-	-	3,240	486	3,726	3,025	-	701	-	-	-	-	-	-	-	33,243
1b.1.2	Decon primary loop	1,106	-	-	-	-	-	-	553	1,659	1,659	-	-	-	-	-	-	-	-	1,067	-
1b.1	Subtotal Period 1b Activity Costs	1,106	-	-	-	-	-	3,240	1,039	5,385	4,684	-	701	-	-	-	-	-	-	1,067	33,243
Period 1b Additional Costs																					
1b.2.1	Spent Fuel Pool Isolation	-	-	-	-	-	-	8,609	1,291	9,900	9,900	-	-	-	-	-	-	-	-	-	-
1b.2.2	Site Characterization Survey	-	-	-	-	-	-	1,599	480	2,079	2,079	-	-	-	-	-	-	-	-	-	-
1b.2	Subtotal Period 1b Additional Costs	-	-	-	-	-	-	10,208	1,771	11,979	11,979	-	-	-	-	-	-	-	-	-	-
Period 1b Collateral Costs																					
1b.3.1	Decon equipment	732	-	-	-	-	-	-	110	842	842	-	-	-	-	-	-	-	-	-	-
1b.3.2	DOC staff relocation expenses	-	-	-	-	-	-	804	121	924	924	-	-	-	-	-	-	-	-	-	-
1b.3.3	Process liquid waste	57	-	461	747	-	5,131	-	1,469	7,865	7,865	-	-	-	-	5,381	-	-	890,864	197	-
1b.3.4	Small tool allowance	-	1	-	-	-	-	-	0	1	1	-	-	-	-	-	-	-	-	-	-
1b.3.5	Pipe cutting equipment	-	957	-	-	-	-	-	143	1,100	1,100	-	-	-	-	-	-	-	-	-	-
1b.3.6	Decon rig	1,243	-	-	-	-	-	-	186	1,430	1,430	-	-	-	-	-	-	-	-	-	-
1b.3.7	Spent Fuel Transfer to DOE	-	-	-	-	-	-	2,400	360	2,760	-	2,760	-	-	-	-	-	-	-	-	-
1b.3	Subtotal Period 1b Collateral Costs	2,033	957	461	747	-	5,131	3,204	2,390	14,922	12,162	2,760	-	-	-	5,381	-	-	890,864	197	-
Period 1b Period-Dependent Costs																					
1b.4.1	Decon supplies	23	-	-	-	-	-	-	6	28	28	-	-	-	-	-	-	-	-	-	-
1b.4.2	Insurance	-	-	-	-	-	-	808	81	889	889	-	-	-	-	-	-	-	-	-	-
1b.4.3	Property taxes	-	-	-	-	-	-	151	15	166	166	-	-	-	-	-	-	-	-	-	-
1b.4.4	Health physics supplies	-	134	-	-	-	-	-	34	168	168	-	-	-	-	-	-	-	-	-	-
1b.4.5	Heavy equipment rental	-	168	-	-	-	-	-	25	194	194	-	-	-	-	-	-	-	-	-	-
1b.4.6	Disposal of DAW generated	-	-	3	2	-	15	-	4	25	25	-	-	-	220	-	-	-	4,416	54	-

Table C
Callaway Plant
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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			
Period 1b Period-Dependent Costs (continued)																					
1b.4.7	Plant energy budget	-	-	-	-	-	-	936	140	1,076	1,076	-	-	-	-	-	-	-	-	-	-
1b.4.8	NRC Fees	-	-	-	-	-	-	134	13	147	147	-	-	-	-	-	-	-	-	-	-
1b.4.9	Emergency Planning Fees	-	-	-	-	-	-	227	23	249	-	249	-	-	-	-	-	-	-	-	-
1b.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	474	71	545	-	545	-	-	-	-	-	-	-	-	-
1b.4.11	Security Staff Cost	-	-	-	-	-	-	822	123	945	945	-	-	-	-	-	-	-	-	-	29,703
1b.4.12	DOC Staff Cost	-	-	-	-	-	-	4,927	739	5,666	5,666	-	-	-	-	-	-	-	-	-	64,137
1b.4.13	Utility Staff Cost	-	-	-	-	-	-	12,867	1,930	14,797	14,797	-	-	-	-	-	-	-	-	-	221,851
1b.4	Subtotal Period 1b Period-Dependent Costs	23	303	3	2	-	15	21,346	3,205	24,897	24,102	795	-	-	220	-	-	-	4,416	54	315,691
1b.0	TOTAL PERIOD 1b COST	3,161	1,260	464	749	-	5,146	37,998	8,405	57,183	52,928	3,555	701	-	220	5,381	-	-	895,280	1,317	348,934
PERIOD 1 TOTALS		3,161	1,852	470	752	-	5,174	85,665	15,546	112,620	101,107	10,306	1,207	-	625	5,381	-	-	903,383	1,417	919,609
PERIOD 2a - Large Component Removal																					
Period 2a Direct Decommissioning Activities																					
Nuclear Steam Supply System Removal																					
2a.1.1.1	Reactor Coolant Piping	152	151	14	22	-	441	-	229	1,007	1,007	-	-	-	1,157	-	-	-	139,959	6,975	-
2a.1.1.2	Pressurizer Relief Tank	26	22	4	6	-	115	-	48	220	220	-	-	-	328	-	-	-	36,395	1,093	-
2a.1.1.3	Reactor Coolant Pumps & Motors	77	74	38	4	139	2,624	-	738	3,695	3,695	-	-	198	2,556	-	-	-	897,754	3,833	-
2a.1.1.4	Pressurizer	38	46	522	374	-	650	-	301	1,932	1,932	-	-	-	2,426	-	-	-	255,229	2,462	-
2a.1.1.5	Steam Generators	323	3,350	3,151	2,182	2,595	4,716	-	3,209	19,525	19,525	-	-	16,029	17,596	-	-	-	3,344,326	35,051	-
2a.1.1.6	CRDMs/ICIs/Service Structure Removal	129	82	116	38	-	271	-	170	805	805	-	-	-	3,881	-	-	-	86,025	4,627	-
2a.1.1.7	Reactor Vessel Internals	102	2,183	3,472	933	-	6,699	200	6,169	19,758	19,758	-	-	-	1,377	412	861	-	314,544	27,523	1,233
2a.1.1.8	Vessel & Internals GTCC Disposal	-	-	-	-	-	11,361	-	1,704	13,066	13,066	-	-	-	-	-	-	560	116,756	-	-
2a.1.1.9	Reactor Vessel	72	4,677	1,239	600	-	9,006	200	8,537	24,331	24,331	-	-	-	7,750	2,128	-	-	1,069,368	27,523	1,233
2a.1.1	Totals	919	10,584	8,557	4,157	2,734	35,883	401	21,106	84,341	84,341	-	-	16,227	37,071	2,541	861	560	6,260,356	109,087	2,466
Removal of Major Equipment																					
2a.1.2	Main Turbine/Generator	-	402	219	23	861	703	-	431	2,638	2,638	-	-	4,713	2,624	-	-	-	636,083	9,617	-
2a.1.3	Main Condensers	-	1,158	118	51	745	642	-	581	3,294	3,294	-	-	7,701	2,270	-	-	-	550,231	28,153	-
Cascading Costs from Clean Building Demolition																					
2a.1.4.1	Reactor	-	738	-	-	-	-	-	111	849	849	-	-	-	-	-	-	-	-	11,134	-
2a.1.4.2	Auxiliary	-	404	-	-	-	-	-	61	464	464	-	-	-	-	-	-	-	-	6,585	-
2a.1.4.3	Hot Machine Shop	-	1	-	-	-	-	-	0	1	1	-	-	-	-	-	-	-	-	16	-
2a.1.4.4	Radwaste	-	81	-	-	-	-	-	12	94	94	-	-	-	-	-	-	-	-	1,269	-
2a.1.4.5	Fuel Building	-	185	-	-	-	-	-	28	212	212	-	-	-	-	-	-	-	-	2,642	-
2a.1.4	Totals	-	1,408	-	-	-	-	-	211	1,620	1,620	-	-	-	-	-	-	-	-	21,645	-
Disposal of Plant Systems																					
2a.1.5.1	100 Aux.Bldg Non-System Specific RCA	-	547	9	17	666	-	-	240	1,480	1,480	-	-	7,629	-	-	-	-	309,812	13,468	-
2a.1.5.2	100 Auxiliary Bldg Non-System Specific	-	92	3	4	41	56	-	44	240	240	-	-	474	199	-	-	-	37,110	2,300	-
2a.1.5.3	AB - Main Steam	-	213	-	-	-	-	-	32	245	-	-	245	-	-	-	-	-	-	5,833	-
2a.1.5.4	AB - Main Steam RCA	-	61	3	5	188	-	-	45	302	302	-	-	2,156	-	-	-	-	87,550	1,495	-
2a.1.5.5	AC - Main Turbine	-	210	-	-	-	-	-	32	242	-	-	242	-	-	-	-	-	-	5,641	-
2a.1.5.6	AD - Condensate	-	234	-	-	-	-	-	35	269	-	-	269	-	-	-	-	-	-	6,144	-
2a.1.5.7	AE - Feedwater	-	161	-	-	-	-	-	24	185	-	-	185	-	-	-	-	-	-	4,271	-
2a.1.5.8	AF - Feedwater Heater Extraction	-	196	-	-	-	-	-	29	226	-	-	226	-	-	-	-	-	-	5,352	-
2a.1.5.9	AK - Condensate Demineralizer	-	73	-	-	-	-	-	11	83	-	-	83	-	-	-	-	-	-	1,944	-
2a.1.5.10	AL - Auxiliary Feedwater	-	32	-	-	-	-	-	5	36	-	-	36	-	-	-	-	-	-	852	-
2a.1.5.11	AQ - Condensate & Feedwater Chem Addtn	-	18	-	-	-	-	-	3	20	-	-	20	-	-	-	-	-	-	468	-
2a.1.5.12	BM - Steam Generator Blowdown	-	91	3	4	78	38	-	45	259	259	-	-	892	140	-	-	-	48,310	2,258	-
2a.1.5.13	BM - Steam Generator Blowdown - RCA	-	283	5	9	359	-	-	127	783	783	-	-	4,109	-	-	-	-	166,857	6,847	-
2a.1.5.14	BN - Borated Refueling Water Storage	-	280	11	18	481	106	-	173	1,069	1,069	-	-	5,512	416	-	-	-	257,593	6,907	-
2a.1.5.15	CA - Steam Seal	-	17	-	-	-	-	-	3	19	-	-	19	-	-	-	-	-	-	455	-

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															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Disposal of Plant Systems (continued)																					
2a.1.5.16	CB - Main Turbine Lube Oil	-	48	-	-	-	-	-	7	55	-	-	55	-	-	-	-	-	-	1,207	-
2a.1.5.17	CC - Generator Hydrogen Seal & CO2	-	8	-	-	-	-	-	1	9	-	-	9	-	-	-	-	-	-	198	-
2a.1.5.18	CD - Generator Seal Oil	-	11	-	-	-	-	-	2	13	-	-	13	-	-	-	-	-	-	287	-
2a.1.5.19	CE - Stator Cooling Water	-	9	-	-	-	-	-	1	11	-	-	11	-	-	-	-	-	-	241	-
2a.1.5.20	CF - Lube Oil Storage Xfer & Prfication	-	31	-	-	-	-	-	5	35	-	-	35	-	-	-	-	-	-	812	-
2a.1.5.21	CG - Condenser Air Removal	-	25	-	-	-	-	-	4	29	-	-	29	-	-	-	-	-	-	657	-
2a.1.5.22	CH - Main Turbine Control Oil	-	49	-	-	-	-	-	7	57	-	-	57	-	-	-	-	-	-	1,219	-
2a.1.5.23	DA - Circulating Water	-	276	-	-	-	-	-	41	317	-	-	317	-	-	-	-	-	-	7,502	-
2a.1.5.24	DB - Cooling Tower Makeup & Blowdown	-	47	-	-	-	-	-	7	54	-	-	54	-	-	-	-	-	-	1,260	-
2a.1.5.25	DD - Cooling Water Chemical Control Sys	-	41	-	-	-	-	-	6	47	-	-	47	-	-	-	-	-	-	1,073	-
2a.1.5.26	DD - Cooling Wtr Chem Control RCA	-	212	4	8	310	-	-	101	636	636	-	-	3,555	-	-	-	-	144,376	4,865	-
2a.1.5.27	EJ - Residual Heat Removal	-	304	24	30	240	481	-	239	1,318	1,318	-	-	2,744	1,715	-	-	-	264,214	7,639	-
2a.1.5.28	EM - High Pressure Coolant Injection	-	237	8	9	115	129	-	111	609	609	-	-	1,315	458	-	-	-	94,439	5,881	-
2a.1.5.29	EN - Containment Spray	-	165	4	7	264	-	-	82	522	522	-	-	3,026	-	-	-	-	122,874	4,004	-
2a.1.5.30	EP - Accumulator Safety Injection	-	133	5	6	140	56	-	70	410	410	-	-	1,599	208	-	-	-	82,796	3,274	-
2a.1.5.31	FA - Auxiliary Steam Generator	-	19	-	-	-	-	-	3	22	-	-	22	-	-	-	-	-	-	521	-
2a.1.5.32	FB - Auxiliary Steam	-	77	-	-	-	-	-	12	89	-	-	89	-	-	-	-	-	-	2,106	-
2a.1.5.33	FB - Auxiliary Steam RCA	-	63	1	2	71	-	-	27	163	163	-	-	816	-	-	-	-	33,148	1,492	-
2a.1.5.34	FC - Auxiliary Turbines	-	50	-	-	-	-	-	8	58	-	-	58	-	-	-	-	-	-	1,320	-
2a.1.5.35	FE - Auxiliary Steam Chemical Addition	-	4	-	-	-	-	-	1	5	-	-	5	-	-	-	-	-	-	105	-
2a.1.5.36	GE - Turbine Building HVAC	-	134	-	-	-	-	-	20	154	-	-	154	-	-	-	-	-	-	3,792	-
2a.1.5.37	GS - Containment Hydrogen Control	-	60	2	3	57	21	-	29	172	172	-	-	658	73	-	-	-	33,309	1,484	-
2a.1.5.38	HE - Boron Recycle	318	381	18	20	227	281	-	364	1,609	1,609	-	-	2,600	1,111	-	-	-	194,922	16,116	-
2a.1.5.39	HF - Secondary Liquid Waste	585	770	41	45	540	639	-	736	3,356	3,356	-	-	6,186	2,522	-	-	-	453,942	31,196	-
2a.1.5.40	JA - Auxiliary Oil & Transfer	-	25	-	-	-	-	-	4	29	-	-	29	-	-	-	-	-	-	687	-
2a.1.5.41	KS - Bulk Chemical Storage	-	73	8	15	563	-	-	106	764	764	-	-	6,449	-	-	-	-	261,890	1,806	-
2a.1.5.42	LE - Oily Waste	-	143	-	-	-	-	-	21	165	-	-	165	-	-	-	-	-	-	3,865	-
2a.1.5.43	LE - Oily Waste RCA	-	180	3	5	197	-	-	76	460	460	-	-	2,256	-	-	-	-	91,628	4,180	-
2a.1.5.44	Turbine Bldg Non-System Specific	-	600	-	-	-	-	-	90	690	-	-	690	-	-	-	-	-	-	15,405	-
2a.1.5	Totals	903	6,682	151	207	4,538	1,808	-	3,026	17,314	14,153	-	3,160	51,976	6,842	-	-	-	2,684,769	188,430	-
2a.1.6	Scaffolding in support of decommissioning	-	1,284	15	4	119	2	-	342	1,767	1,767	-	-	1,233	62	-	-	-	61,650	36,401	-
2a.1	Subtotal Period 2a Activity Costs	1,822	21,518	9,059	4,441	8,998	39,038	401	25,696	110,973	107,813	-	3,160	81,850	48,870	2,541	861	560	10,193,090	393,334	2,466
Period 2a Additional Costs																					
2a.2.1	Curie Surcharge(Excluding RPV)	-	-	-	-	-	1,206	-	302	1,508	1,508	-	-	-	-	-	-	-	-	-	-
2a.2	Subtotal Period 2a Additional Costs	-	-	-	-	-	1,206	-	302	1,508	1,508	-	-	-	-	-	-	-	-	-	-
Period 2a Collateral Costs																					
2a.3.1	Process liquid waste	184	-	106	303	-	1,399	-	498	2,490	2,490	-	-	-	-	1,718	-	-	234,982	263	-
2a.3.2	Small tool allowance	-	262	-	-	-	-	-	39	301	271	-	30	-	-	-	-	-	-	-	-
2a.3.3	Spent Fuel Transfer to DOE	-	-	-	-	-	-	6,600	990	7,590	-	7,590	-	-	-	-	-	-	-	-	-
2a.3	Subtotal Period 2a Collateral Costs	184	262	106	303	-	1,399	6,600	1,527	10,381	2,761	7,590	30	-	-	1,718	-	-	234,982	263	-
Period 2a Period-Dependent Costs																					
2a.4.1	Decon supplies	66	-	-	-	-	-	-	17	83	83	-	-	-	-	-	-	-	-	-	-
2a.4.2	Insurance	-	-	-	-	-	-	786	79	864	864	-	-	-	-	-	-	-	-	-	-
2a.4.3	Property taxes	-	-	-	-	-	-	444	44	489	440	-	49	-	-	-	-	-	-	-	-
2a.4.4	Health physics supplies	-	1,769	-	-	-	-	-	442	2,212	2,212	-	-	-	-	-	-	-	-	-	-
2a.4.5	Heavy equipment rental	-	2,412	-	-	-	-	-	362	2,774	2,774	-	-	-	-	-	-	-	-	-	-
2a.4.6	Disposal of DAW generated	-	-	90	42	-	423	-	121	677	677	-	-	-	6,041	-	-	-	121,063	1,483	-
2a.4.7	Plant energy budget	-	-	-	-	-	-	1,307	196	1,503	1,503	-	-	-	-	-	-	-	-	-	-
2a.4.8	NRC Fees	-	-	-	-	-	-	486	49	534	534	-	-	-	-	-	-	-	-	-	-
2a.4.9	Emergency Planning Fees	-	-	-	-	-	-	667	67	733	-	733	-	-	-	-	-	-	-	-	-
2a.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	1,394	209	1,603	-	1,603	-	-	-	-	-	-	-	-	-
2a.4.11	Security Staff Cost	-	-	-	-	-	-	3,016	452	3,469	3,469	-	-	-	-	-	-	-	-	-	108,973

Table C
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2005 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 Period-Dependent Costs (continued)																					
2a.4.12	DOC Staff Cost	-	-	-	-	-	-	17,733	2,660	20,393	20,393	-	-	-	-	-	-	-	-	-	234,949
2a.4.13	Utility Staff Cost	-	-	-	-	-	-	27,183	4,077	31,260	31,260	-	-	-	-	-	-	-	-	-	459,077
2a.4	Subtotal Period 2a Period-Dependent Costs	66	4,182	90	42	-	423	53,015	8,775	66,594	64,209	2,336	49	-	6,041	-	-	-	121,063	1,483	802,999
2a.0	TOTAL PERIOD 2a COST	2,072	25,961	9,256	4,787	8,998	42,066	60,016	36,300	189,456	176,291	9,926	3,239	81,850	54,911	4,258	861	560	10,549,130	395,080	805,464
PERIOD 2b - Site Decontamination																					
Period 2b Direct Decommissioning Activities																					
Disposal of Plant Systems																					
2b.1.1.1	200 Reactor Bldg Non-System Specific	-	72	2	2	24	37	-	31	168	168	-	-	269	131	-	-	-	22,692	1,766	-
2b.1.1.2	200 Reactor Bldg Non-System Specific RCA	-	433	6	11	416	-	-	173	1,039	1,039	-	-	4,768	-	-	-	-	193,612	10,423	-
2b.1.1.3	300 Control Bldg Non-System Specific	-	140	3	5	187	-	-	64	398	398	-	-	2,139	-	-	-	-	86,849	3,413	-
2b.1.1.4	300 Control Bldg Non-System Specific Cln	-	1,147	-	-	-	-	-	172	1,320	-	-	1,320	-	-	-	-	-	-	29,076	-
2b.1.1.5	700 Radwaste Bldg Non-Sys Specific RCA	-	894	15	29	1,107	-	-	396	2,441	2,441	-	-	12,684	-	-	-	-	515,103	21,915	-
2b.1.1.6	700 Radwaste Bldg Non-System Specific	-	147	5	6	62	99	-	72	391	391	-	-	705	351	-	-	-	60,095	3,676	-
2b.1.1.7	AN - Demineralized Wtr Storage & Xfer	-	120	-	-	-	-	-	18	138	-	-	138	-	-	-	-	-	-	3,283	-
2b.1.1.8	AN - Demineralized Wtr Strg & Xfer RCA	-	30	0	1	27	-	-	12	70	70	-	-	314	-	-	-	-	12,759	711	-
2b.1.1.9	AP - Condensate Storage & Transfer	-	72	-	-	-	-	-	11	82	-	-	82	-	-	-	-	-	-	1,794	-
2b.1.1.10	BB - Reactor Coolant System	-	250	20	20	158	336	-	175	960	960	-	-	1,812	1,399	-	-	-	180,294	6,365	-
2b.1.1.11	BG - Chemical & Volume Control	605	710	51	59	431	983	-	804	3,642	3,642	-	-	4,931	3,562	-	-	-	512,267	26,550	-
2b.1.1.12	BL - Reactor Makeup Water	-	236	12	13	168	169	-	130	728	728	-	-	1,928	700	-	-	-	132,091	5,794	-
2b.1.1.13	DE - Intake & Water Treatment	-	480	-	-	-	-	-	72	552	-	-	552	-	-	-	-	-	-	12,917	-
2b.1.1.14	DE - Intake & Water Treatment RCA	-	201	14	27	1,041	-	-	212	1,496	1,496	-	-	11,923	-	-	-	-	484,206	4,989	-
2b.1.1.15	EA - Service Water	-	115	-	-	-	-	-	17	132	-	-	132	-	-	-	-	-	-	3,145	-
2b.1.1.16	EA - Service Water RCA	-	35	1	3	109	-	-	26	174	174	-	-	1,248	-	-	-	-	50,693	829	-
2b.1.1.17	EB - Closed Cooling Water	-	46	-	-	-	-	-	7	53	-	-	53	-	-	-	-	-	-	1,267	-
2b.1.1.18	EF - Essential Service Water	-	267	-	-	-	-	-	40	307	-	-	307	-	-	-	-	-	-	7,244	-
2b.1.1.19	EF - Essential Service Water RCA	-	156	6	12	465	-	-	111	750	750	-	-	5,326	-	-	-	-	216,287	3,801	-
2b.1.1.20	EG - Component Cooling Water RCA	-	195	-	-	-	-	-	29	224	-	-	224	-	-	-	-	-	-	5,335	-
2b.1.1.21	GA - Plant Heating	-	69	-	-	-	-	-	10	80	-	-	80	-	-	-	-	-	-	1,912	-
2b.1.1.22	GA - Plant Heating RCA	-	72	1	1	56	-	-	27	157	157	-	-	638	-	-	-	-	25,924	1,698	-
2b.1.1.23	GB - Central Chilled Water	-	65	-	-	-	-	-	10	75	-	-	75	-	-	-	-	-	-	1,803	-
2b.1.1.24	GB - Central Chilled Water RCA	-	20	0	0	16	-	-	7	44	44	-	-	187	-	-	-	-	7,591	463	-
2b.1.1.25	GD - Essential Serv Wtr Pumphouse HVAC	-	14	-	-	-	-	-	2	16	-	-	16	-	-	-	-	-	-	414	-
2b.1.1.26	GF - Miscellaneous Building HVAC	-	100	2	5	178	-	-	52	337	337	-	-	2,034	-	-	-	-	82,602	2,026	-
2b.1.1.27	GH - Radwaste Building HVAC	-	155	4	6	212	20	-	77	473	473	-	-	2,425	69	-	-	-	104,668	3,457	-
2b.1.1.28	GK - Control Building HVAC	-	133	-	-	-	-	-	20	153	-	-	153	-	-	-	-	-	-	3,900	-
2b.1.1.29	GL - Auxiliary Building HVAC	-	384	8	14	442	45	-	176	1,069	1,069	-	-	5,064	161	-	-	-	220,066	8,499	-
2b.1.1.30	GM - Diesel Generator Building HVAC	-	23	-	-	-	-	-	4	27	-	-	27	-	-	-	-	-	-	692	-
2b.1.1.31	GN - Containment Cooling	-	415	14	23	643	128	-	237	1,460	1,460	-	-	7,367	454	-	-	-	339,907	9,485	-
2b.1.1.32	GP - Containment Intgratd Leak Rate Test	-	31	1	1	51	-	-	16	99	99	-	-	580	-	-	-	-	23,570	737	-
2b.1.1.33	GR - Containment Atmospheric Control	-	16	2	3	95	8	-	21	145	145	-	-	1,086	29	-	-	-	46,679	397	-
2b.1.1.34	GT - Containment Purge HVAC	-	98	4	6	170	34	-	60	372	372	-	-	1,948	120	-	-	-	89,887	2,254	-
2b.1.1.35	HA - Gaseous Radwaste	-	275	11	13	243	133	-	141	816	816	-	-	2,782	486	-	-	-	155,095	6,638	-
2b.1.1.36	HB - Liquid Radwaste	641	679	38	39	485	547	-	709	3,139	3,139	-	-	5,560	2,205	-	-	-	399,479	30,414	-
2b.1.1.37	HC - Solid Radwaste	-	280	16	19	185	297	-	176	973	973	-	-	2,114	1,099	-	-	-	180,002	6,900	-
2b.1.1.38	HD - Decontamination	-	83	3	4	86	34	-	43	253	253	-	-	983	125	-	-	-	50,772	2,021	-
2b.1.1.39	JE - Emergency Fuel Oil	-	50	-	-	-	-	-	7	57	-	-	57	-	-	-	-	-	-	1,260	-
2b.1.1.40	KA - Compressed Air	-	151	-	-	-	-	-	23	174	-	-	174	-	-	-	-	-	-	4,187	-
2b.1.1.41	KA - Compressed Air RCA	-	96	1	2	70	-	-	35	204	204	-	-	801	-	-	-	-	32,538	2,242	-
2b.1.1.42	KB - Breathing Air	-	19	-	-	-	-	-	3	22	-	-	22	-	-	-	-	-	-	516	-
2b.1.1.43	KB - Breathing Air RCA	-	14	-	0	6	-	-	5	25	25	-	-	71	-	-	-	-	2,874	376	-
2b.1.1.44	KC - Fire Protection	-	300	-	-	-	-	-	45	345	-	-	345	-	-	-	-	-	-	8,376	-
2b.1.1.45	KC - Fire Protection RCA	-	309	5	10	385	-	-	137	847	847	-	-	4,411	-	-	-	-	179,151	6,951	-
2b.1.1.46	KD - Domestic Water	-	139	-	-	-	-	-	21	160	-	-	160	-	-	-	-	-	-	3,837	-

Table C
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2005 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Disposal of Plant Systems (continued)																					
2b.1.1.47	KD - Domestic Water RCA	-	20	0	1	22	-	-	8	51	51	-	-	247	-	-	-	-	10,039	448	-
2b.1.1.48	KE - Fuel Handling & Storage Rctor vssl	-	16	2	3	58	31	-	21	131	131	-	-	661	111	-	-	-	36,859	379	-
2b.1.1.49	KH - Service Gas (CO2 N2 H2 & O2)	-	44	-	-	-	-	-	7	51	-	-	51	-	-	-	-	-	-	1,226	-
2b.1.1.50	KH - Service Gas (CO2 N2 H2 & O2) RCA	-	193	3	6	212	-	-	81	495	495	-	-	2,433	-	-	-	-	98,813	4,377	-
2b.1.1.51	KJ - Standby Diesel Engine	-	264	-	-	-	-	-	40	304	-	-	304	-	-	-	-	-	-	6,749	-
2b.1.1.52	LA - Sanitary Drains	-	36	-	-	-	-	-	5	41	-	-	41	-	-	-	-	-	-	972	-
2b.1.1.53	LA - Sanitary Drains RCA	-	83	2	3	111	-	-	38	237	237	-	-	1,273	-	-	-	-	51,684	1,810	-
2b.1.1.54	LB - Roof Drains	-	47	-	-	-	-	-	7	54	-	-	54	-	-	-	-	-	-	1,276	-
2b.1.1.55	LB - Roof Drains RCA	-	110	3	5	187	-	-	57	361	361	-	-	2,139	-	-	-	-	86,858	2,627	-
2b.1.1.56	LD - Chemical & Detergent Waste	54	87	2	3	44	42	-	67	300	300	-	-	504	150	-	-	-	33,812	3,282	-
2b.1.1.57	LF - Floor & Equipment Drains	-	1,119	52	64	326	1,142	-	629	3,332	3,332	-	-	3,739	4,073	-	-	-	514,287	27,432	-
2b.1.1.58	RM - Process Sampling & Analysis	-	112	4	4	58	48	-	49	274	274	-	-	661	169	-	-	-	42,010	2,765	-
2b.1.1.59	SJ - Nuclear Sampling	-	63	3	3	37	37	-	31	173	173	-	-	423	130	-	-	-	28,862	1,564	-
2b.1.1.60	UB - Servces Stores Site Security Bldg	-	134	-	-	-	-	-	20	154	-	-	154	-	-	-	-	-	-	3,571	-
2b.1.1.61	Yard Non-System Specific	-	24	-	-	-	-	-	4	27	-	-	27	-	-	-	-	-	-	603	-
2b.1.1	Totals	1,300	12,089	313	427	8,572	4,170	-	5,700	32,571	28,022	-	4,549	98,179	15,523	-	-	-	5,310,975	324,831	-
2b.1.2	Scaffolding in support of decommissioning	-	1,605	19	5	149	3	-	427	2,209	2,209	-	-	1,541	77	-	-	-	77,062	45,501	-
Decontamination of Site Buildings																					
2b.1.3.1	Reactor	1,024	891	95	129	523	1,135	-	1,126	4,923	4,923	-	-	5,995	7,653	-	-	-	966,429	44,647	-
2b.1.3.2	Auxiliary	532	326	41	59	180	121	-	417	1,676	1,676	-	-	2,058	3,314	-	-	-	411,534	19,948	-
2b.1.3.3	Communication Corridor - Contaminated	12	6	1	1	1	3	-	8	32	32	-	-	17	72	-	-	-	7,850	406	-
2b.1.3.4	Hot Machine Shop	15	6	1	1	-	3	-	10	37	37	-	-	-	89	-	-	-	8,892	492	-
2b.1.3.5	RAM Storage Building	36	14	2	3	2	7	-	24	88	88	-	-	19	184	-	-	-	19,130	1,194	-
2b.1.3.6	Radioactive and Personnel Tunnel	5	8	1	1	-	2	-	5	21	21	-	-	-	50	-	-	-	5,022	280	-
2b.1.3.7	Radwaste	283	158	22	31	74	64	-	215	847	847	-	-	844	1,753	-	-	-	208,396	10,271	-
2b.1.3.8	Radwaste Drum Storage	32	16	2	3	6	7	-	23	90	90	-	-	66	196	-	-	-	22,226	1,122	-
2b.1.3.9	Steam Generator Replacement Bldgs	205	-	-	-	-	-	-	103	308	308	-	-	-	-	-	-	-	-	4,440	-
2b.1.3	Totals	2,144	1,424	164	229	786	1,343	-	1,932	8,022	8,022	-	-	8,999	13,312	-	-	-	1,649,479	82,800	-
2b.1	Subtotal Period 2b Activity Costs	3,443	15,119	497	661	9,507	5,516	-	8,059	42,802	38,253	-	4,549	108,720	28,912	-	-	-	7,037,517	453,132	-
Period 2b Additional Costs																					
2b.2.1	Sanitary Treatment Lagoon LLW	-	4	45	611	-	128	-	116	905	905	-	-	-	3,600	-	-	-	345,600	389	-
2b.2	Subtotal Period 2b Additional Costs	-	4	45	611	-	128	-	116	905	905	-	-	-	3,600	-	-	-	345,600	389	-
Period 2b Collateral Costs																					
2b.3.1	Process liquid waste	157	-	184	405	-	2,225	-	714	3,685	3,685	-	-	-	-	2,539	-	-	380,233	255	-
2b.3.2	Small tool allowance	-	297	-	-	-	-	-	45	341	341	-	-	-	-	-	-	-	-	-	-
2b.3.3	Spent Fuel Transfer to DOE	-	-	-	-	-	-	11,100	1,665	12,765	-	12,765	-	-	-	-	-	-	-	-	-
2b.3	Subtotal Period 2b Collateral Costs	157	297	184	405	-	2,225	11,100	2,423	16,792	4,027	12,765	-	-	-	2,539	-	-	380,233	255	-
Period 2b Period-Dependent Costs																					
2b.4.1	Decon supplies	1,005	-	-	-	-	-	-	251	1,256	1,256	-	-	-	-	-	-	-	-	-	-
2b.4.2	Insurance	-	-	-	-	-	-	1,335	133	1,468	1,468	-	-	-	-	-	-	-	-	-	-
2b.4.3	Property taxes	-	-	-	-	-	-	755	75	830	830	-	-	-	-	-	-	-	-	-	-
2b.4.4	Health physics supplies	-	2,248	-	-	-	-	-	562	2,810	2,810	-	-	-	-	-	-	-	-	-	-
2b.4.5	Heavy equipment rental	-	4,123	-	-	-	-	-	618	4,741	4,741	-	-	-	-	-	-	-	-	-	-
2b.4.6	Disposal of DAW generated	-	-	98	46	-	457	-	131	732	732	-	-	-	6,530	-	-	-	130,868	1,603	-
2b.4.7	Plant energy budget	-	-	-	-	-	-	1,753	263	2,015	2,015	-	-	-	-	-	-	-	-	-	-
2b.4.8	NRC Fees	-	-	-	-	-	-	825	82	907	907	-	-	-	-	-	-	-	-	-	-
2b.4.9	Emergency Planning Fees	-	-	-	-	-	-	1,132	113	1,245	-	1,245	-	-	-	-	-	-	-	-	-
2b.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	2,368	355	2,723	-	2,723	-	-	-	-	-	-	-	-	-
2b.4.11	Radwaste Processing Equipment/Services	-	-	-	-	-	-	466	70	536	536	-	-	-	-	-	-	-	-	-	-
2b.4.12	Security Staff Cost	-	-	-	-	-	-	4,106	616	4,722	4,722	-	-	-	-	-	-	-	-	-	148,353
2b.4.13	DOC Staff Cost	-	-	-	-	-	-	29,037	4,356	33,392	33,392	-	-	-	-	-	-	-	-	-	383,354

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Callaway Plant
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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			
Period 2b Period-Dependent Costs (continued)																					
2b.4.14	Utility Staff Cost	-	-	-	-	-	-	44,442	6,666	51,108	51,108	-	-	-	-	-	-	-	-	-	748,329
2b.4	Subtotal Period 2b Period-Dependent Costs	1,005	6,371	98	46	-	457	86,219	14,293	108,489	104,520	3,969	-	-	6,530	-	-	-	130,868	1,603	1,280,036
2b.0	TOTAL PERIOD 2b COST	4,605	21,791	824	1,723	9,507	8,326	97,319	24,892	168,987	147,704	16,734	4,549	108,720	39,042	2,539	-	-	7,894,218	455,379	1,280,036
PERIOD 2c - Decontamination Following Wet Fuel Storage																					
Period 2c Direct Decommissioning Activities																					
2c.1.1	Remove spent fuel racks	669	68	169	68	-	1,394	-	727	3,095	3,095	-	-	-	4,933	-	-	-	442,623	1,925	-
Disposal of Plant Systems																					
2c.1.2.1	600 Fuel Bldg Non-Specific Systems RCA	-	241	4	7	279	-	-	104	635	635	-	-	3,200	-	-	-	-	129,974	5,858	-
2c.1.2.2	600 Fuel Bldg Non-System Specific	-	39	1	2	15	24	-	18	98	98	-	-	170	85	-	-	-	14,545	959	-
2c.1.2.3	EC - Fuel Pool Cooling & Cleanup	-	304	12	16	227	217	-	168	945	945	-	-	2,602	770	-	-	-	174,682	7,497	-
2c.1.2.4	GA- Plant Heating Fuel Building	-	16	0	1	4	8	-	7	37	37	-	-	50	29	-	-	-	4,646	402	-
2c.1.2.5	GG - Fuel Building HVAC	-	211	6	10	326	31	-	111	695	695	-	-	3,729	109	-	-	-	161,237	4,684	-
2c.1.2.6	KC- Fire Protection Fuel Building	-	92	1	3	108	-	-	40	244	244	-	-	1,239	-	-	-	-	50,329	2,084	-
2c.1.2	Totals	-	902	25	39	960	281	-	448	2,654	2,654	-	-	10,991	994	-	-	-	535,413	21,484	-
Decontamination of Site Buildings																					
2c.1.3.1	Fuel Building	669	699	14	20	236	33	-	557	2,228	2,228	-	-	2,705	895	-	-	-	198,758	31,734	-
2c.1.3	Totals	669	699	14	20	236	33	-	557	2,228	2,228	-	-	2,705	895	-	-	-	198,758	31,734	-
2c.1.4	Scaffolding in support of decommissioning	-	321	4	1	30	1	-	85	442	442	-	-	308	15	-	-	-	15,412	9,100	-
2c.1	Subtotal Period 2c Activity Costs	1,338	1,990	211	128	1,226	1,708	-	1,818	8,419	8,419	-	-	14,004	6,837	-	-	-	1,192,206	64,243	-
Period 2c Collateral Costs																					
2c.3.1	Process liquid waste	83	-	32	115	-	493	-	185	907	907	-	-	-	-	601	-	-	75,801	118	-
2c.3.2	Small tool allowance	-	55	-	-	-	-	-	8	63	63	-	-	-	-	-	-	-	-	-	-
2c.3.3	Decommissioning Equipment Disposition	-	-	75	24	581	106	-	124	909	909	-	-	6,000	373	-	-	-	303,507	739	-
2c.3	Subtotal Period 2c Collateral Costs	83	55	107	138	581	598	-	318	1,879	1,879	-	-	6,000	373	601	-	-	379,307	858	-
Period 2c Period-Dependent Costs																					
2c.4.1	Decon supplies	145	-	-	-	-	-	-	36	181	181	-	-	-	-	-	-	-	-	-	-
2c.4.2	Insurance	-	-	-	-	-	-	353	35	388	388	-	-	-	-	-	-	-	-	-	-
2c.4.3	Property taxes	-	-	-	-	-	-	200	20	220	220	-	-	-	-	-	-	-	-	-	-
2c.4.4	Health physics supplies	-	401	-	-	-	-	-	100	501	501	-	-	-	-	-	-	-	-	-	-
2c.4.5	Heavy equipment rental	-	1,090	-	-	-	-	-	164	1,254	1,254	-	-	-	-	-	-	-	-	-	-
2c.4.6	Disposal of DAW generated	-	-	33	15	-	153	-	44	245	245	-	-	-	2,190	-	-	-	43,893	538	-
2c.4.7	Plant energy budget	-	-	-	-	-	-	247	37	284	284	-	-	-	-	-	-	-	-	-	-
2c.4.8	NRC Fees	-	-	-	-	-	-	218	22	240	240	-	-	-	-	-	-	-	-	-	-
2c.4.9	Radwaste Processing Equipment/Services	-	-	-	-	-	-	247	37	284	284	-	-	-	-	-	-	-	-	-	-
2c.4.10	Security Staff Cost	-	-	-	-	-	-	1,086	163	1,249	1,249	-	-	-	-	-	-	-	-	-	39,227
2c.4.11	DOC Staff Cost	-	-	-	-	-	-	5,264	790	6,054	6,054	-	-	-	-	-	-	-	-	-	69,429
2c.4.12	Utility Staff Cost	-	-	-	-	-	-	8,628	1,294	9,922	9,922	-	-	-	-	-	-	-	-	-	140,940
2c.4	Subtotal Period 2c Period-Dependent Costs	145	1,491	33	15	-	153	16,243	2,742	20,822	20,822	-	-	-	2,190	-	-	-	43,893	538	249,596
2c.0	TOTAL PERIOD 2c COST	1,566	3,536	351	281	1,806	2,460	16,243	4,877	31,121	31,121	-	-	20,004	9,401	601	-	-	1,615,407	65,638	249,596
PERIOD 2e - License Termination																					
Period 2e Direct Decommissioning Activities																					
2e.1.1	ORISE confirmatory survey	-	-	-	-	-	-	119	36	155	155	-	-	-	-	-	-	-	-	-	-
2e.1.2	Terminate license									a											
2e.1	Subtotal Period 2e Activity Costs	-	-	-	-	-	-	119	36	155	155	-	-	-	-	-	-	-	-	-	-

Table C
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2005 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 2e Additional Costs																					
2e.2.1	Final Site Survey	-	-	-	-	-	-	6,453	1,936	8,389	8,389	-	-	-	-	-	-	-	-	150,988	-
2e.2	Subtotal Period 2e Additional Costs	-	-	-	-	-	-	6,453	1,936	8,389	8,389	-	-	-	-	-	-	-	-	150,988	-
Period 2e Collateral Costs																					
2e.3.1	DOC staff relocation expenses	-	-	-	-	-	-	804	121	924	924	-	-	-	-	-	-	-	-	-	-
2e.3	Subtotal Period 2e Collateral Costs	-	-	-	-	-	-	804	121	924	924	-	-	-	-	-	-	-	-	-	-
Period 2e Period-Dependent Costs																					
2e.4.1	Insurance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2e.4.2	Property taxes	-	-	-	-	-	-	227	23	249	249	-	-	-	-	-	-	-	-	-	-
2e.4.3	Health physics supplies	-	727	-	-	-	-	-	182	909	909	-	-	-	-	-	-	-	-	-	-
2e.4.4	Disposal of DAW generated	-	-	5	2	-	21	-	6	34	34	-	-	-	306	-	-	-	6,127	75	-
2e.4.5	Plant energy budget	-	-	-	-	-	-	140	21	161	161	-	-	-	-	-	-	-	-	-	-
2e.4.6	NRC Fees	-	-	-	-	-	-	248	25	272	272	-	-	-	-	-	-	-	-	-	-
2e.4.7	Security Staff Cost	-	-	-	-	-	-	393	59	452	452	-	-	-	-	-	-	-	-	-	14,194
2e.4.8	DOC Staff Cost	-	-	-	-	-	-	4,430	665	5,095	5,095	-	-	-	-	-	-	-	-	-	57,566
2e.4.9	Utility Staff Cost	-	-	-	-	-	-	5,330	799	6,129	6,129	-	-	-	-	-	-	-	-	-	79,646
2e.4	Subtotal Period 2e Period-Dependent Costs	-	727	5	2	-	21	10,768	1,779	13,302	13,302	-	-	-	306	-	-	-	6,127	75	151,406
2e.0	TOTAL PERIOD 2e COST	-	727	5	2	-	21	18,143	3,871	22,770	22,770	-	-	-	306	-	-	-	6,127	151,063	151,406
PERIOD 2 TOTALS		8,243	52,016	10,436	6,793	20,311	52,873	191,721	69,941	412,334	377,885	26,660	7,789	210,574	103,660	7,399	861	560	20,064,890	1,067,160	2,486,502
PERIOD 3b - Site Restoration																					
Period 3b Direct Decommissioning Activities																					
Demolition of Remaining Site Buildings																					
3b.1.1.1	Reactor	-	4,188	-	-	-	-	-	628	4,817	-	-	4,817	-	-	-	-	-	-	63,214	-
3b.1.1.2	Auxiliary	-	3,634	-	-	-	-	-	545	4,179	-	-	4,179	-	-	-	-	-	-	59,266	-
3b.1.1.3	Auxiliary Boiler	-	29	-	-	-	-	-	4	33	-	-	33	-	-	-	-	-	-	619	-
3b.1.1.4	Barge Facility	-	1,238	-	-	-	-	-	186	1,424	-	-	1,424	-	-	-	-	-	-	18,771	-
3b.1.1.5	Circulating & Service Water Pumphouse	-	245	-	-	-	-	-	37	282	-	-	282	-	-	-	-	-	-	4,345	-
3b.1.1.6	Communication Corridor - Clean	-	1,244	-	-	-	-	-	187	1,431	-	-	1,431	-	-	-	-	-	-	21,919	-
3b.1.1.7	Communication Corridor - Contaminated	-	45	-	-	-	-	-	7	52	-	-	52	-	-	-	-	-	-	674	-
3b.1.1.8	Cooling Tower	-	945	-	-	-	-	-	142	1,087	-	-	1,087	-	-	-	-	-	-	17,975	-
3b.1.1.9	Diesel Generator	-	420	-	-	-	-	-	63	483	-	-	483	-	-	-	-	-	-	6,314	-
3b.1.1.10	Essential Service Water Pumphouse	-	232	-	-	-	-	-	35	267	-	-	267	-	-	-	-	-	-	3,938	-
3b.1.1.11	Fire Water Pumphouse	-	22	-	-	-	-	-	3	25	-	-	25	-	-	-	-	-	-	382	-
3b.1.1.12	Hot Machine Shop	-	19	-	-	-	-	-	3	22	-	-	22	-	-	-	-	-	-	417	-
3b.1.1.13	Intake	-	291	-	-	-	-	-	44	335	-	-	335	-	-	-	-	-	-	4,224	-
3b.1.1.14	Misc. Structures	-	1,930	-	-	-	-	-	289	2,219	-	-	2,219	-	-	-	-	-	-	28,089	-
3b.1.1.15	Miscellaneous Site Foundations	-	293	-	-	-	-	-	44	337	-	-	337	-	-	-	-	-	-	5,478	-
3b.1.1.16	Outage Maintenance	-	144	-	-	-	-	-	22	166	-	-	166	-	-	-	-	-	-	3,190	-
3b.1.1.17	RAM Storage Building	-	54	-	-	-	-	-	8	62	-	-	62	-	-	-	-	-	-	1,081	-
3b.1.1.18	Radioactive and Personnel Tunnel	-	21	-	-	-	-	-	3	24	-	-	24	-	-	-	-	-	-	383	-
3b.1.1.19	Radwaste	-	1,572	-	-	-	-	-	236	1,808	-	-	1,808	-	-	-	-	-	-	24,859	-
3b.1.1.20	Radwaste Drum Storage	-	215	-	-	-	-	-	32	247	-	-	247	-	-	-	-	-	-	3,840	-
3b.1.1.21	Security Additions	-	1,911	-	-	-	-	-	287	2,197	-	-	2,197	-	-	-	-	-	-	21,829	-
3b.1.1.22	Service	-	405	-	-	-	-	-	61	466	-	-	466	-	-	-	-	-	-	6,045	-
3b.1.1.23	Sludge Pump Station & Lagoon	-	20	-	-	-	-	-	3	23	-	-	23	-	-	-	-	-	-	313	-
3b.1.1.24	Steam Generator Replacement Bldgs	-	938	-	-	-	-	-	141	1,078	-	-	1,078	-	-	-	-	-	-	15,693	-
3b.1.1.25	Turbine Building	-	4,376	-	-	-	-	-	656	5,033	-	-	5,033	-	-	-	-	-	-	89,690	-
3b.1.1.26	Turbine Pedestal	-	830	-	-	-	-	-	125	955	-	-	955	-	-	-	-	-	-	10,928	-
3b.1.1.27	U.H.S. Cooling Tower	-	503	-	-	-	-	-	76	579	-	-	579	-	-	-	-	-	-	6,681	-
3b.1.1.28	Water Treatment Plant	-	1	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	9	-
3b.1.1.29	Fuel Building	-	1,703	-	-	-	-	-	256	1,959	-	-	1,959	-	-	-	-	-	-	24,799	-

Table C
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2005 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
3b.1.1	Totals	-	27,469	-	-	-	-	-	4,120	31,589	-	-	31,589	-	-	-	-	-	-	444,963	-
Site Closeout Activities																					
3b.1.2	BackFill Site	-	2,638	-	-	-	-	-	396	3,033	-	-	3,033	-	-	-	-	-	-	10,158	-
3b.1.3	Grade & landscape site	-	2,064	-	-	-	-	-	310	2,374	-	-	2,374	-	-	-	-	-	-	5,839	-
3b.1.4	Final report to NRC	-	-	-	-	-	-	152	23	175	175	-	-	-	-	-	-	-	-	-	1,560
3b.1	Subtotal Period 3b Activity Costs	-	32,171	-	-	-	-	152	4,848	37,171	175	-	36,996	-	-	-	-	-	-	460,959	1,560
Period 3b Additional Costs																					
3b.2.1	Concrete Crushing	-	953	-	-	-	-	6	144	1,103	-	-	1,103	-	-	-	-	-	-	5,830	-
3b.2	Subtotal Period 3b Additional Costs	-	953	-	-	-	-	6	144	1,103	-	-	1,103	-	-	-	-	-	-	5,830	-
Period 3b Collateral Costs																					
3b.3.1	Small tool allowance	-	326	-	-	-	-	-	49	375	-	-	375	-	-	-	-	-	-	-	-
3b.3	Subtotal Period 3b Collateral Costs	-	326	-	-	-	-	-	49	375	-	-	375	-	-	-	-	-	-	-	-
Period 3b Period-Dependent Costs																					
3b.4.1	Insurance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3b.4.2	Property taxes	-	-	-	-	-	-	451	45	496	-	-	496	-	-	-	-	-	-	-	-
3b.4.3	Heavy equipment rental	-	3,379	-	-	-	-	-	507	3,885	-	-	3,885	-	-	-	-	-	-	-	-
3b.4.4	Plant energy budget	-	-	-	-	-	-	140	21	161	-	-	161	-	-	-	-	-	-	-	-
3b.4.5	Security Staff Cost	-	-	-	-	-	-	782	117	899	-	-	899	-	-	-	-	-	-	-	28,234
3b.4.6	DOC Staff Cost	-	-	-	-	-	-	9,833	1,475	11,307	-	-	11,307	-	-	-	-	-	-	-	123,917
3b.4.7	Utility Staff Cost	-	-	-	-	-	-	5,360	804	6,164	-	-	6,164	-	-	-	-	-	-	-	79,997
3b.4	Subtotal Period 3b Period-Dependent Costs	-	3,379	-	-	-	-	16,565	2,969	22,912	-	-	22,912	-	-	-	-	-	-	-	232,149
3b.0	TOTAL PERIOD 3b COST	-	36,829	-	-	-	-	16,722	8,010	61,561	175	-	61,386	-	-	-	-	-	-	466,789	233,709
PERIOD 3 TOTALS		-	36,829	-	-	-	-	16,722	8,010	61,561	175	-	61,386	-	-	-	-	-	-	466,789	233,709
TOTAL COST TO DECOMMISSION		11,404	90,696	10,906	7,545	20,311	58,048	294,108	93,498	586,515	479,167	36,966	70,382	210,574	104,285	12,780	861	560	20,968,270	1,535,366	3,639,819

TOTAL COST TO DECOMMISSION WITH 18.96% CONTINGENCY:	**$586,515**	**thousands of 2005 dollars**
TOTAL NRC LICENSE TERMINATION COST IS 81.7% OR:	**$479,167**	**thousands of 2005 dollars**
SPENT FUEL MANAGEMENT COST IS 6.3% OR:	**$36,966**	**thousands of 2005 dollars**
NON-NUCLEAR DEMOLITION COST IS 12% OR:	**$70,382**	**thousands of 2005 dollars**
TOTAL RADWASTE VOLUME BURIED (EXCLUDING GTCC):	**117,926**	**cubic feet**
TOTAL GREATER THAN CLASS C RADWASTE VOLUME GENERATED:	**560**	**cubic feet**
TOTAL SCRAP METAL REMOVED:	**77,592**	**tons**
TOTAL CRAFT LABOR REQUIREMENTS:	**1,535,366**	**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

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2005 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	-	-	-	-	-	-	333	100	433	433	-	-	-	-	-	-	-	-	-	-
1a.1.2	Prepare preliminary decommissioning cost	-	-	-	-	-	-	127	19	146	146	-	-	-	-	-	-	-	-	-	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	-	-	-	-	-	-	195	29	224	224	-	-	-	-	-	-	-	-	-	2,000
1a.1.8	Review plant dwgs & specs.	-	-	-	-	-	-	127	19	146	146	-	-	-	-	-	-	-	-	-	1,300
1a.1.9	Perform detailed rad survey									a											
1a.1.10	Estimate by-product inventory	-	-	-	-	-	-	97	15	112	112	-	-	-	-	-	-	-	-	-	1,000
1a.1.11	End product description	-	-	-	-	-	-	97	15	112	112	-	-	-	-	-	-	-	-	-	1,000
1a.1.12	Detailed by-product inventory	-	-	-	-	-	-	146	22	168	168	-	-	-	-	-	-	-	-	-	1,500
1a.1.13	Define major work sequence	-	-	-	-	-	-	97	15	112	112	-	-	-	-	-	-	-	-	-	1,000
1a.1.14	Perform SER and EA	-	-	-	-	-	-	302	45	347	347	-	-	-	-	-	-	-	-	-	3,100
1a.1.15	Perform Site-Specific Cost Study	-	-	-	-	-	-	487	73	560	560	-	-	-	-	-	-	-	-	-	5,000
Activity Specifications																					
1a.1.16.1	Prepare plant and facilities for SAFSTOR	-	-	-	-	-	-	480	72	551	551	-	-	-	-	-	-	-	-	-	4,920
1a.1.16.2	Plant systems	-	-	-	-	-	-	406	61	467	467	-	-	-	-	-	-	-	-	-	4,167
1a.1.16.3	Plant structures and buildings	-	-	-	-	-	-	304	46	350	350	-	-	-	-	-	-	-	-	-	3,120
1a.1.16.4	Waste management	-	-	-	-	-	-	195	29	224	224	-	-	-	-	-	-	-	-	-	2,000
1a.1.16.5	Facility and site dormancy	-	-	-	-	-	-	195	29	224	224	-	-	-	-	-	-	-	-	-	2,000
1a.1.16	Total	-	-	-	-	-	-	1,580	237	1,817	1,817	-	-	-	-	-	-	-	-	-	16,207
Detailed Work Procedures																					
1a.1.17.1	Plant systems	-	-	-	-	-	-	115	17	133	133	-	-	-	-	-	-	-	-	-	1,183
1a.1.17.2	Facility closeout & dormancy	-	-	-	-	-	-	117	18	135	135	-	-	-	-	-	-	-	-	-	1,200
1a.1.17	Total	-	-	-	-	-	-	232	35	267	267	-	-	-	-	-	-	-	-	-	2,383
1a.1.18	Procure vacuum drying system	-	-	-	-	-	-	10	1	11	11	-	-	-	-	-	-	-	-	-	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	-	-	-	-	-	-	3,832	625	4,456	4,456	-	-	-	-	-	-	-	-	-	35,890
Period 1a Collateral Costs																					
1a.3.1	Spent Fuel Transfer to DOE	-	-	-	-	-	-	4,500	675	5,175	-	5,175	-	-	-	-	-	-	-	-	-
1a.3	Subtotal Period 1a Collateral Costs	-	-	-	-	-	-	4,500	675	5,175	-	5,175	-	-	-	-	-	-	-	-	-
Period 1a Period-Dependent Costs																					
1a.4.1	Insurance	-	-	-	-	-	-	1,604	160	1,764	1,764	-	-	-	-	-	-	-	-	-	-
1a.4.2	Property taxes	-	-	-	-	-	-	300	30	330	330	-	-	-	-	-	-	-	-	-	-
1a.4.3	Health physics supplies	-	257	-	-	-	-	-	64	322	322	-	-	-	-	-	-	-	-	-	-
1a.4.4	Heavy equipment rental	-	334	-	-	-	-	-	50	384	384	-	-	-	-	-	-	-	-	-	-
1a.4.5	Disposal of DAW generated	-	-	6	3	-	28	-	8	45	45	-	-	-	404	-	-	-	8,103	99	-
1a.4.6	Plant energy budget	-	-	-	-	-	-	928	139	1,067	1,067	-	-	-	-	-	-	-	-	-	-
1a.4.7	NRC Fees	-	-	-	-	-	-	265	27	292	292	-	-	-	-	-	-	-	-	-	-
1a.4.8	Emergency Planning Fees	-	-	-	-	-	-	450	45	495	-	495	-	-	-	-	-	-	-	-	-
1a.4.9	Spent Fuel Pool O&M	-	-	-	-	-	-	940	141	1,082	-	1,082	-	-	-	-	-	-	-	-	-
1a.4.10	Security Staff Cost	-	-	-	-	-	-	1,631	245	1,876	1,876	-	-	-	-	-	-	-	-	-	58,921
1a.4.11	Utility Staff Cost	-	-	-	-	-	-	25,261	3,789	29,050	29,050	-	-	-	-	-	-	-	-	-	435,914
1a.4	Subtotal Period 1a Period-Dependent Costs	-	592	6	3	-	28	31,379	4,699	36,706	35,130	1,576	-	-	404	-	-	-	8,103	99	494,836

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2005 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
1a.0	TOTAL PERIOD 1a COST	-	592	6	3	-	28	39,711	5,998	46,338	39,586	6,751	-	-	404	-	-	-	8,103	99	530,726
PERIOD 1b - SAFSTOR Limited DECON Activities																					
Period 1b Direct Decommissioning Activities																					
Decontamination of Site Buildings																					
1b.1.1.1	Reactor	1,009	-	-	-	-	-	-	505	1,514	1,514	-	-	-	-	-	-	-	-	24,718	-
1b.1.1.2	Auxiliary	500	-	-	-	-	-	-	250	750	750	-	-	-	-	-	-	-	-	12,859	-
1b.1.1.3	Communication Corridor - Contaminated	11	-	-	-	-	-	-	6	17	17	-	-	-	-	-	-	-	-	284	-
1b.1.1.4	Fuel Building	660	-	-	-	-	-	-	330	990	990	-	-	-	-	-	-	-	-	14,711	-
1b.1.1.5	Hot Machine Shop	14	-	-	-	-	-	-	7	21	21	-	-	-	-	-	-	-	-	353	-
1b.1.1.6	RAM Storage Building	35	-	-	-	-	-	-	17	52	52	-	-	-	-	-	-	-	-	888	-
1b.1.1.7	Radioactive and Personnel Tunnel	4	-	-	-	-	-	-	2	6	6	-	-	-	-	-	-	-	-	104	-
1b.1.1.8	Radwaste	266	-	-	-	-	-	-	133	400	400	-	-	-	-	-	-	-	-	6,847	-
1b.1.1.9	Radwaste Drum Storage	30	-	-	-	-	-	-	15	45	45	-	-	-	-	-	-	-	-	770	-
1b.1.1	Totals	2,529	-	-	-	-	-	-	1,265	3,794	3,794	-	-	-	-	-	-	-	-	61,535	-
1b.1	Subtotal Period 1b Activity Costs	2,529	-	-	-	-	-	-	1,265	3,794	3,794	-	-	-	-	-	-	-	-	61,535	-
Period 1b Collateral Costs																					
1b.3.1	Decon equipment	732	-	-	-	-	-	-	110	842	842	-	-	-	-	-	-	-	-	-	-
1b.3.2	Process liquid waste	158	-	58	207	-	839	-	325	1,587	1,587	-	-	-	-	1,084	-	-	136,673	213	-
1b.3.3	Small tool allowance	-	42	-	-	-	-	-	6	48	48	-	-	-	-	-	-	-	-	-	-
1b.3.4	Spent Fuel Transfer to DOE	-	-	-	-	-	-	1,200	180	1,380	-	1,380	-	-	-	-	-	-	-	-	-
1b.3	Subtotal Period 1b Collateral Costs	890	42	58	207	-	839	1,200	622	3,857	2,477	1,380	-	-	-	1,084	-	-	136,673	213	-
Period 1b Period-Dependent Costs																					
1b.4.1	Decon supplies	932	-	-	-	-	-	-	233	1,165	1,165	-	-	-	-	-	-	-	-	-	-
1b.4.2	Insurance	-	-	-	-	-	-	404	40	445	445	-	-	-	-	-	-	-	-	-	-
1b.4.3	Property taxes	-	-	-	-	-	-	76	8	83	83	-	-	-	-	-	-	-	-	-	-
1b.4.4	Health physics supplies	-	283	-	-	-	-	-	71	353	353	-	-	-	-	-	-	-	-	-	-
1b.4.5	Heavy equipment rental	-	84	-	-	-	-	-	13	97	97	-	-	-	-	-	-	-	-	-	-
1b.4.6	Disposal of DAW generated	-	-	12	5	-	54	-	15	86	86	-	-	-	772	-	-	-	15,461	189	-
1b.4.7	Plant energy budget	-	-	-	-	-	-	234	35	269	269	-	-	-	-	-	-	-	-	-	-
1b.4.8	NRC Fees	-	-	-	-	-	-	67	7	74	74	-	-	-	-	-	-	-	-	-	-
1b.4.9	Emergency Planning Fees	-	-	-	-	-	-	113	11	125	-	125	-	-	-	-	-	-	-	-	-
1b.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	237	36	273	-	273	-	-	-	-	-	-	-	-	-
1b.4.11	Security Staff Cost	-	-	-	-	-	-	411	62	473	473	-	-	-	-	-	-	-	-	-	14,851
1b.4.12	Utility Staff Cost	-	-	-	-	-	-	6,367	955	7,322	7,322	-	-	-	-	-	-	-	-	-	109,874
1b.4	Subtotal Period 1b Period-Dependent Costs	932	367	12	5	-	54	7,909	1,485	10,764	10,367	397	-	-	772	-	-	-	15,461	189	124,726
1b.0	TOTAL PERIOD 1b COST	4,351	409	69	212	-	893	9,109	3,371	18,415	16,638	1,777	-	-	772	1,084	-	-	152,134	61,938	124,726
PERIOD 1c - Preparations for SAFSTOR Dormancy																					
Period 1c Direct Decommissioning Activities																					
1c.1.1	Prepare support equipment for storage	-	392	-	-	-	-	-	59	451	451	-	-	-	-	-	-	-	-	3,000	-
1c.1.2	Install containment pressure equal. lines	-	33	-	-	-	-	-	5	37	37	-	-	-	-	-	-	-	-	700	-
1c.1.3	Interim survey prior to dormancy	-	-	-	-	-	-	733	220	953	953	-	-	-	-	-	-	-	-	16,393	-
1c.1.4	Secure building accesses									a											
1c.1.5	Prepare & submit interim report	-	-	-	-	-	-	57	9	65	65	-	-	-	-	-	-	-	-	-	583
1c.1	Subtotal Period 1c Activity Costs	-	425	-	-	-	-	790	292	1,507	1,507	-	-	-	-	-	-	-	-	20,093	583

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2005 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 1c Additional Costs																					
1c.2.1	Spent Fuel Pool Isolation	-	-	-	-	-	-	8,609	1,291	9,900	9,900	-	-	-	-	-	-	-	-	-	-
1c.2	Subtotal Period 1c Additional Costs	-	-	-	-	-	-	8,609	1,291	9,900	9,900	-	-	-	-	-	-	-	-	-	-
Period 1c Collateral Costs																					
1c.3.1	Process liquid waste	172	-	63	226	-	911	-	354	1,726	1,726	-	-	-	-	1,185	-	-	149,335	233	-
1c.3.2	Small tool allowance	-	3	-	-	-	-	-	0	3	3	-	-	-	-	-	-	-	-	-	-
1c.3.3	Spent Fuel Transfer to DOE	-	-	-	-	-	-	1,200	180	1,380	-	1,380	-	-	-	-	-	-	-	-	-
1c.3	Subtotal Period 1c Collateral Costs	172	3	63	226	-	911	1,200	534	3,110	1,730	1,380	-	-	-	1,185	-	-	149,335	233	-
Period 1c Period-Dependent Costs																					
1c.4.1	Insurance	-	-	-	-	-	-	404	40	445	445	-	-	-	-	-	-	-	-	-	-
1c.4.2	Property taxes	-	-	-	-	-	-	76	8	83	83	-	-	-	-	-	-	-	-	-	-
1c.4.3	Health physics supplies	-	137	-	-	-	-	-	34	171	171	-	-	-	-	-	-	-	-	-	-
1c.4.4	Heavy equipment rental	-	84	-	-	-	-	-	13	97	97	-	-	-	-	-	-	-	-	-	-
1c.4.5	Disposal of DAW generated	-	-	2	1	-	7	-	2	11	11	-	-	-	102	-	-	-	2,042	25	-
1c.4.6	Plant energy budget	-	-	-	-	-	-	234	35	269	269	-	-	-	-	-	-	-	-	-	-
1c.4.7	NRC Fees	-	-	-	-	-	-	67	7	74	74	-	-	-	-	-	-	-	-	-	-
1c.4.8	Emergency Planning Fees	-	-	-	-	-	-	113	11	125	-	125	-	-	-	-	-	-	-	-	-
1c.4.9	Spent Fuel Pool O&M	-	-	-	-	-	-	237	36	273	-	273	-	-	-	-	-	-	-	-	-
1c.4.10	Security Staff Cost	-	-	-	-	-	-	411	62	473	473	-	-	-	-	-	-	-	-	-	14,851
1c.4.11	Utility Staff Cost	-	-	-	-	-	-	6,231	935	7,165	7,165	-	-	-	-	-	-	-	-	-	107,771
1c.4	Subtotal Period 1c Period-Dependent Costs	-	221	2	1	-	7	7,773	1,182	9,184	8,787	397	-	-	102	-	-	-	2,042	25	122,623
1c.0	TOTAL PERIOD 1c COST	172	648	64	227	-	918	18,371	3,300	23,701	21,924	1,777	-	-	102	1,185	-	-	151,377	20,351	123,206
PERIOD 1 TOTALS		4,523	1,649	140	442	-	1,840	67,191	12,669	88,454	78,148	10,306	-	-	1,278	2,269	-	-	311,614	82,388	778,658
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	-	-	-	-	-	-	214	32	247	247	-	-	-	-	-	-	-	-	-	-
2a.1.5	Maintenance supplies	-	-	-	-	-	-	503	126	629	629	-	-	-	-	-	-	-	-	-	-
2a.1	Subtotal Period 2a Activity Costs	-	-	-	-	-	-	717	158	875	875	-	-	-	-	-	-	-	-	-	-
Period 2a Collateral Costs																					
2a.3.1	Spent Fuel Transfer to DOE	-	-	-	-	-	-	17,700	2,655	20,355	-	20,355	-	-	-	-	-	-	-	-	-
2a.3	Subtotal Period 2a Collateral Costs	-	-	-	-	-	-	17,700	2,655	20,355	-	20,355	-	-	-	-	-	-	-	-	-
Period 2a Period-Dependent Costs																					
2a.4.1	Insurance	-	-	-	-	-	-	2,121	212	2,333	2,005	328	-	-	-	-	-	-	-	-	-
2a.4.2	Property taxes	-	-	-	-	-	-	1,199	120	1,319	1,319	-	-	-	-	-	-	-	-	-	-
2a.4.3	Health physics supplies	-	257	-	-	-	-	-	64	322	322	-	-	-	-	-	-	-	-	-	-
2a.4.4	Disposal of DAW generated	-	-	24	11	-	113	-	32	181	181	-	-	-	1,617	-	-	-	32,412	397	-
2a.4.5	Plant energy budget	-	-	-	-	-	-	742	111	854	427	427	-	-	-	-	-	-	-	-	-
2a.4.6	NRC Fees	-	-	-	-	-	-	936	94	1,030	1,030	-	-	-	-	-	-	-	-	-	-
2a.4.7	Emergency Planning Fees	-	-	-	-	-	-	1,799	180	1,979	-	1,979	-	-	-	-	-	-	-	-	-
2a.4.8	Spent Fuel Pool O&M	-	-	-	-	-	-	3,762	564	4,326	-	4,326	-	-	-	-	-	-	-	-	-
2a.4.9	Security Staff Cost	-	-	-	-	-	-	3,579	537	4,116	1,394	2,722	-	-	-	-	-	-	-	-	129,314
2a.4.10	Utility Staff Cost	-	-	-	-	-	-	20,272	3,041	23,313	6,746	16,567	-	-	-	-	-	-	-	-	342,057
2a.4	Subtotal Period 2a Period-Dependent Costs	-	257	24	11	-	113	34,411	4,956	39,773	13,424	26,349	-	-	1,617	-	-	-	32,412	397	471,371
2a.0	TOTAL PERIOD 2a COST	-	257	24	11	-	113	52,828	7,769	61,003	14,299	46,704	-	-	1,617	-	-	-	32,412	397	471,371

Table D
Callaway Plant
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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			
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	-	-	-	-	-	-	2,591	389	2,980	2,980	-	-	-	-	-	-	-	-	-	-
2c.1.5	Maintenance supplies	-	-	-	-	-	-	6,076	1,519	7,595	7,595	-	-	-	-	-	-	-	-	-	-
2c.1	Subtotal Period 2c Activity Costs	-	-	-	-	-	-	8,667	1,908	10,575	10,575	-	-	-	-	-	-	-	-	-	-
Period 2c Period-Dependent Costs																					
2c.4.1	Insurance	-	-	-	-	-	-	22,023	2,202	24,225	24,225	-	-	-	-	-	-	-	-	-	-
2c.4.2	Property taxes	-	-	-	-	-	-	14,490	1,449	15,939	15,939	-	-	-	-	-	-	-	-	-	-
2c.4.3	Health physics supplies	-	3,110	-	-	-	-	-	778	3,888	3,888	-	-	-	-	-	-	-	-	-	-
2c.4.4	Disposal of DAW generated	-	-	293	137	-	1,368	-	392	2,190	2,190	-	-	-	19,544	-	-	-	391,652	4,799	-
2c.4.5	Plant energy budget	-	-	-	-	-	-	4,486	673	5,159	5,159	-	-	-	-	-	-	-	-	-	-
2c.4.6	NRC Fees	-	-	-	-	-	-	11,312	1,131	12,443	12,443	-	-	-	-	-	-	-	-	-	-
2c.4.7	Security Staff Cost	-	-	-	-	-	-	14,650	2,197	16,847	16,847	-	-	-	-	-	-	-	-	-	529,260
2c.4.8	Utility Staff Cost	-	-	-	-	-	-	70,886	10,633	81,518	81,518	-	-	-	-	-	-	-	-	-	1,285,346
2c.4	Subtotal Period 2c Period-Dependent Costs	-	3,110	293	137	-	1,368	137,847	19,455	162,210	162,210	-	-	-	19,544	-	-	-	391,652	4,799	1,814,606
2c.0	TOTAL PERIOD 2c COST	-	3,110	293	137	-	1,368	146,514	21,363	172,785	172,785	-	-	-	19,544	-	-	-	391,652	4,799	1,814,606
PERIOD 2 TOTALS		-	3,368	317	149	-	1,481	199,342	29,131	233,787	187,084	46,704	-	-	21,161	-	-	-	424,064	5,196	2,285,977
PERIOD 3a - Reactivate Site Following SAFSTOR Dormancy																					
Period 3a Direct Decommissioning Activities																					
3a.1.1	Prepare preliminary decommissioning cost	-	-	-	-	-	-	127	19	146	146	-	-	-	-	-	-	-	-	-	1,300
3a.1.2	Review plant dwgs & specs.	-	-	-	-	-	-	448	67	516	516	-	-	-	-	-	-	-	-	-	4,600
3a.1.3	Perform detailed rad survey									a											
3a.1.4	End product description	-	-	-	-	-	-	97	15	112	112	-	-	-	-	-	-	-	-	-	1,000
3a.1.5	Detailed by-product inventory	-	-	-	-	-	-	127	19	146	146	-	-	-	-	-	-	-	-	-	1,300
3a.1.6	Define major work sequence	-	-	-	-	-	-	731	110	841	841	-	-	-	-	-	-	-	-	-	7,500
3a.1.7	Perform SER and EA	-	-	-	-	-	-	302	45	347	347	-	-	-	-	-	-	-	-	-	3,100
3a.1.8	Perform Site-Specific Cost Study	-	-	-	-	-	-	487	73	560	560	-	-	-	-	-	-	-	-	-	5,000
3a.1.9	Prepare/submit License Termination Plan	-	-	-	-	-	-	399	60	459	459	-	-	-	-	-	-	-	-	-	4,096
3a.1.10	Receive NRC approval of termination plan									a											
Activity Specifications																					
3a.1.11.1	Re-activate plant & temporary facilities	-	-	-	-	-	-	718	108	826	743	-	83	-	-	-	-	-	-	-	7,370
3a.1.11.2	Plant systems	-	-	-	-	-	-	406	61	467	420	-	47	-	-	-	-	-	-	-	4,167
3a.1.11.3	Reactor internals	-	-	-	-	-	-	692	104	796	796	-	-	-	-	-	-	-	-	-	7,100
3a.1.11.4	Reactor vessel	-	-	-	-	-	-	634	95	729	729	-	-	-	-	-	-	-	-	-	6,500
3a.1.11.5	Biological shield	-	-	-	-	-	-	49	7	56	56	-	-	-	-	-	-	-	-	-	500
3a.1.11.6	Steam generators	-	-	-	-	-	-	304	46	350	350	-	-	-	-	-	-	-	-	-	3,120
3a.1.11.7	Reinforced concrete	-	-	-	-	-	-	156	23	179	90	-	90	-	-	-	-	-	-	-	1,600
3a.1.11.8	Main Turbine	-	-	-	-	-	-	39	6	45	-	-	45	-	-	-	-	-	-	-	400
3a.1.11.9	Main Condensers	-	-	-	-	-	-	39	6	45	-	-	45	-	-	-	-	-	-	-	400
3a.1.11.10	Plant structures & buildings	-	-	-	-	-	-	304	46	350	175	-	175	-	-	-	-	-	-	-	3,120
3a.1.11.11	Waste management	-	-	-	-	-	-	448	67	516	516	-	-	-	-	-	-	-	-	-	4,600
3a.1.11.12	Facility & site closeout	-	-	-	-	-	-	88	13	101	50	-	50	-	-	-	-	-	-	-	900
3a.1.11	Total	-	-	-	-	-	-	3,877	582	4,459	3,925	-	534	-	-	-	-	-	-	-	39,777

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2005 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
Planning & Site Preparations																					
3a.1.12	Prepare dismantling sequence	-	-	-	-	-	-	234	35	269	269	-	-	-	-	-	-	-	-	-	2,400
3a.1.13	Plant prep. & temp. svces	-	-	-	-	-	-	2,419	363	2,782	2,782	-	-	-	-	-	-	-	-	-	-
3a.1.14	Design water clean-up system	-	-	-	-	-	-	136	20	157	157	-	-	-	-	-	-	-	-	-	1,400
3a.1.15	Rigging/Cont. Cntrl Envlps/tooling/etc.	-	-	-	-	-	-	2,048	307	2,355	2,355	-	-	-	-	-	-	-	-	-	-
3a.1.16	Procure casks/liners & containers	-	-	-	-	-	-	120	18	138	138	-	-	-	-	-	-	-	-	-	1,230
3a.1	Subtotal Period 3a Activity Costs	-	-	-	-	-	-	11,553	1,733	13,286	12,752	-	534	-	-	-	-	-	-	-	72,703
Period 3a Period-Dependent Costs																					
3a.4.1	Insurance	-	-	-	-	-	-	230	23	253	253	-	-	-	-	-	-	-	-	-	-
3a.4.2	Property taxes	-	-	-	-	-	-	151	15	166	166	-	-	-	-	-	-	-	-	-	-
3a.4.3	Health physics supplies	-	130	-	-	-	-	-	32	162	162	-	-	-	-	-	-	-	-	-	-
3a.4.4	Heavy equipment rental	-	168	-	-	-	-	-	25	194	194	-	-	-	-	-	-	-	-	-	-
3a.4.5	Disposal of DAW generated	-	-	3	1	-	14	-	4	23	23	-	-	-	204	-	-	-	4,085	50	-
3a.4.6	Plant energy budget	-	-	-	-	-	-	468	70	538	538	-	-	-	-	-	-	-	-	-	-
3a.4.7	NRC Fees	-	-	-	-	-	-	134	13	147	147	-	-	-	-	-	-	-	-	-	-
3a.4.8	Security Staff Cost	-	-	-	-	-	-	226	34	259	259	-	-	-	-	-	-	-	-	-	8,149
3a.4.9	Utility Staff Cost	-	-	-	-	-	-	8,088	1,213	9,302	9,302	-	-	-	-	-	-	-	-	-	135,897
3a.4	Subtotal Period 3a Period-Dependent Costs	-	298	3	1	-	14	9,296	1,431	11,044	11,044	-	-	-	204	-	-	-	4,085	50	144,046
3a.0	TOTAL PERIOD 3a COST	-	298	3	1	-	14	20,850	3,164	24,330	23,796	-	534	-	204	-	-	-	4,085	50	216,748
PERIOD 3b - Decommissioning Preparations																					
Period 3b Direct Decommissioning Activities																					
Detailed Work Procedures																					
3b.1.1.1	Plant systems	-	-	-	-	-	-	461	69	531	477	-	53	-	-	-	-	-	-	-	4,733
3b.1.1.2	Reactor internals	-	-	-	-	-	-	244	37	280	280	-	-	-	-	-	-	-	-	-	2,500
3b.1.1.3	Remaining buildings	-	-	-	-	-	-	132	20	151	38	-	113	-	-	-	-	-	-	-	1,350
3b.1.1.4	CRD cooling assembly	-	-	-	-	-	-	97	15	112	112	-	-	-	-	-	-	-	-	-	1,000
3b.1.1.5	CRD housings & ICI tubes	-	-	-	-	-	-	97	15	112	112	-	-	-	-	-	-	-	-	-	1,000
3b.1.1.6	Incore instrumentation	-	-	-	-	-	-	97	15	112	112	-	-	-	-	-	-	-	-	-	1,000
3b.1.1.7	Reactor vessel	-	-	-	-	-	-	354	53	407	407	-	-	-	-	-	-	-	-	-	3,630
3b.1.1.8	Facility closeout	-	-	-	-	-	-	117	18	135	67	-	67	-	-	-	-	-	-	-	1,200
3b.1.1.9	Missile shields	-	-	-	-	-	-	44	7	50	50	-	-	-	-	-	-	-	-	-	450
3b.1.1.10	Biological shield	-	-	-	-	-	-	117	18	135	135	-	-	-	-	-	-	-	-	-	1,200
3b.1.1.11	Steam generators	-	-	-	-	-	-	448	67	516	516	-	-	-	-	-	-	-	-	-	4,600
3b.1.1.12	Reinforced concrete	-	-	-	-	-	-	97	15	112	56	-	56	-	-	-	-	-	-	-	1,000
3b.1.1.13	Main Turbine	-	-	-	-	-	-	152	23	175	-	-	175	-	-	-	-	-	-	-	1,560
3b.1.1.14	Main Condensers	-	-	-	-	-	-	152	23	175	-	-	175	-	-	-	-	-	-	-	1,560
3b.1.1.15	Auxiliary building	-	-	-	-	-	-	266	40	306	275	-	31	-	-	-	-	-	-	-	2,730
3b.1.1.16	Reactor building	-	-	-	-	-	-	266	40	306	275	-	31	-	-	-	-	-	-	-	2,730
3b.1.1	Total	-	-	-	-	-	-	3,143	471	3,614	2,913	-	701	-	-	-	-	-	-	-	32,243
3b.1	Subtotal Period 3b Activity Costs	-	-	-	-	-	-	3,143	471	3,614	2,913	-	701	-	-	-	-	-	-	-	32,243
Period 3b Additional Costs																					
3b.2.1	Site Characterization Survey	-	-	-	-	-	-	1,599	480	2,079	2,079	-	-	-	-	-	-	-	-	-	-
3b.2	Subtotal Period 3b Additional Costs	-	-	-	-	-	-	1,599	480	2,079	2,079	-	-	-	-	-	-	-	-	-	-
Period 3b Collateral Costs																					
3b.3.1	Decon equipment	732	-	-	-	-	-	-	110	842	842	-	-	-	-	-	-	-	-	-	-
3b.3.2	DOC staff relocation expenses	-	-	-	-	-	-	804	121	924	924	-	-	-	-	-	-	-	-	-	-
3b.3.3	Pipe cutting equipment	-	957	-	-	-	-	-	143	1,100	1,100	-	-	-	-	-	-	-	-	-	-
3b.3	Subtotal Period 3b Collateral Costs	732	957	-	-	-	-	804	374	2,866	2,866	-	-	-	-	-	-	-	-	-	-

Table D
Callaway Plant
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Period 3b Period-Dependent Costs																					
3b.4.1	Decon supplies	45	-	-	-	-	-	-	11	56	56	-	-	-	-	-	-	-	-	-	-
3b.4.2	Insurance	-	-	-	-	-	-	530	53	583	583	-	-	-	-	-	-	-	-	-	-
3b.4.3	Property taxes	-	-	-	-	-	-	300	30	330	330	-	-	-	-	-	-	-	-	-	-
3b.4.4	Health physics supplies	-	257	-	-	-	-	-	64	322	322	-	-	-	-	-	-	-	-	-	-
3b.4.5	Heavy equipment rental	-	334	-	-	-	-	-	50	384	384	-	-	-	-	-	-	-	-	-	-
3b.4.6	Disposal of DAW generated	-	-	6	3	-	28	-	8	45	45	-	-	-	404	-	-	-	8,103	99	-
3b.4.7	Plant energy budget	-	-	-	-	-	-	928	139	1,067	1,067	-	-	-	-	-	-	-	-	-	-
3b.4.8	NRC Fees	-	-	-	-	-	-	265	27	292	292	-	-	-	-	-	-	-	-	-	-
3b.4.9	Security Staff Cost	-	-	-	-	-	-	447	67	515	515	-	-	-	-	-	-	-	-	-	16,164
3b.4.10	DOC Staff Cost	-	-	-	-	-	-	8,829	1,324	10,153	10,153	-	-	-	-	-	-	-	-	-	114,714
3b.4.11	Utility Staff Cost	-	-	-	-	-	-	16,255	2,438	18,693	18,693	-	-	-	-	-	-	-	-	-	273,750
3b.4	Subtotal Period 3b Period-Dependent Costs	45	592	6	3	-	28	27,554	4,212	32,440	32,440	-	-	-	404	-	-	-	8,103	99	404,629
3b.0	TOTAL PERIOD 3b COST	777	1,548	6	3	-	28	33,100	5,537	40,999	40,298	-	701	-	404	-	-	-	8,103	99	436,872
PERIOD 3 TOTALS		777	1,846	9	4	-	43	53,949	8,701	65,329	64,094	-	1,235	-	608	-	-	-	12,188	149	653,620
PERIOD 4a - Large Component Removal																					
Period 4a Direct Decommissioning Activities																					
Nuclear Steam Supply System Removal																					
4a.1.1.1	Reactor Coolant Piping	28	132	14	11	138	220	-	125	668	668	-	-	579	579	-	-	-	134,210	3,867	-
4a.1.1.2	Pressurizer Relief Tank	5	19	4	3	39	57	-	28	155	155	-	-	164	164	-	-	-	36,395	581	-
4a.1.1.3	Reactor Coolant Pumps & Motors	14	63	38	29	1,035	1,312	-	514	3,005	3,005	-	-	1,476	1,278	-	-	-	897,754	2,252	-
4a.1.1.4	Pressurizer	7	46	522	374	-	650	-	286	1,886	1,886	-	-	-	2,426	-	-	-	255,229	1,814	-
4a.1.1.5	Steam Generators	67	3,350	3,151	2,182	2,595	4,716	-	3,082	19,143	19,143	-	-	16,029	17,596	-	-	-	3,344,326	29,813	-
4a.1.1.6	CRDMs/ICIs/Service Structure Removal	23	78	114	26	60	169	-	98	568	568	-	-	753	2,947	-	-	-	81,666	2,337	-
4a.1.1.7	Reactor Vessel Internals	38	1,791	2,903	399	-	3,466	136	3,941	12,673	12,673	-	-	-	1,841	250	845	-	311,424	17,640	838
4a.1.1.8	Vessel & Internals GTCC Disposal	-	-	-	-	-	11,361	-	1,704	13,066	13,066	-	-	-	-	-	-	560	116,756	-	-
4a.1.1.9	Reactor Vessel	-	4,285	717	248	-	5,825	136	6,388	17,599	17,599	-	-	-	7,720	2,859	-	-	1,075,513	17,640	838
4a.1.1	Totals	182	9,764	7,463	3,271	3,867	27,777	272	16,166	68,761	68,761	-	-	19,001	34,550	3,110	845	560	6,253,273	75,944	1,675
Removal of Major Equipment																					
4a.1.2	Main Turbine/Generator	-	339	148	24	907	-	-	239	1,656	1,656	-	-	4,961	-	-	-	-	421,681	8,099	-
4a.1.3	Main Condensers	-	996	95	21	784	-	-	379	2,275	2,275	-	-	8,106	-	-	-	-	364,767	24,132	-
Cascading Costs from Clean Building Demolition																					
4a.1.4.1	Reactor	-	738	-	-	-	-	-	111	849	849	-	-	-	-	-	-	-	-	11,134	-
4a.1.4.2	Auxiliary	-	404	-	-	-	-	-	61	464	464	-	-	-	-	-	-	-	-	6,585	-
4a.1.4.3	Fuel Building	-	185	-	-	-	-	-	28	212	212	-	-	-	-	-	-	-	-	2,642	-
4a.1.4.4	Hot Machine Shop	-	1	-	-	-	-	-	0	1	1	-	-	-	-	-	-	-	-	16	-
4a.1.4.5	Radwaste	-	81	-	-	-	-	-	12	94	94	-	-	-	-	-	-	-	-	1,269	-
4a.1.4	Totals	-	1,408	-	-	-	-	-	211	1,620	1,620	-	-	-	-	-	-	-	-	21,645	-
Disposal of Plant Systems																					
4a.1.5.1	100 Aux.Bldg Non-System Specific RCA	-	547	9	17	666	-	-	240	1,480	1,480	-	-	7,629	-	-	-	-	309,812	13,468	-
4a.1.5.2	100 Auxiliary Bldg Non-System Specific	-	79	1	2	72	6	-	33	194	194	-	-	824	22	-	-	-	35,448	1,969	-
4a.1.5.3	AB - Main Steam	-	213	-	-	-	-	-	32	245	-	-	245	-	-	-	-	-	-	5,833	-
4a.1.5.4	AB - Main Steam RCA	-	61	3	5	188	-	-	45	302	302	-	-	2,156	-	-	-	-	87,550	1,495	-
4a.1.5.5	AC - Main Turbine	-	210	-	-	-	-	-	32	242	-	-	242	-	-	-	-	-	-	5,641	-
4a.1.5.6	AD - Condensate	-	234	-	-	-	-	-	35	269	-	-	269	-	-	-	-	-	-	6,144	-
4a.1.5.7	AE - Feedwater	-	161	-	-	-	-	-	24	185	-	-	185	-	-	-	-	-	-	4,271	-
4a.1.5.8	AF - Feedwater Heater Extraction	-	196	-	-	-	-	-	29	226	-	-	226	-	-	-	-	-	-	5,352	-
4a.1.5.9	AK - Condensate Demineralizer	-	73	-	-	-	-	-	11	83	-	-	83	-	-	-	-	-	-	1,944	-
4a.1.5.10	AL - Auxiliary Feedwater	-	32	-	-	-	-	-	5	36	-	-	36	-	-	-	-	-	-	852	-

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Disposal of Plant Systems (continued)																					
4a.1.5.11	AQ - Condensate & Feedwater Chem Addtn	-	18	-	-	-	-	-	3	20	-	-	20	-	-	-	-	-	-	468	-
4a.1.5.12	BM - Steam Generator Blowdown	-	78	1	3	101	-	-	35	219	219	-	-	1,157	-	-	-	-	46,993	1,915	-
4a.1.5.13	BM - Steam Generator Blowdown - RCA	-	283	5	9	359	-	-	127	783	783	-	-	4,109	-	-	-	-	166,857	6,847	-
4a.1.5.14	BN - Borated Refueling Water Storage	-	241	7	14	546	-	-	145	953	953	-	-	6,255	-	-	-	-	254,024	5,897	-
4a.1.5.15	CA - Steam Seal	-	17	-	-	-	-	-	3	19	-	-	19	-	-	-	-	-	-	455	-
4a.1.5.16	CB - Main Turbine Lube Oil	-	48	-	-	-	-	-	7	55	-	-	55	-	-	-	-	-	-	1,207	-
4a.1.5.17	CC - Generator Hydrogen Seal & CO2	-	8	-	-	-	-	-	1	9	-	-	9	-	-	-	-	-	-	198	-
4a.1.5.18	CD - Generator Seal Oil	-	11	-	-	-	-	-	2	13	-	-	13	-	-	-	-	-	-	287	-
4a.1.5.19	CE - Stator Cooling Water	-	9	-	-	-	-	-	1	11	-	-	11	-	-	-	-	-	-	241	-
4a.1.5.20	CF - Lube Oil Storage Xfer & Prfication	-	31	-	-	-	-	-	5	35	-	-	35	-	-	-	-	-	-	812	-
4a.1.5.21	CG - Condenser Air Removal	-	25	-	-	-	-	-	4	29	-	-	29	-	-	-	-	-	-	657	-
4a.1.5.22	CH - Main Turbine Control Oil	-	49	-	-	-	-	-	7	57	-	-	57	-	-	-	-	-	-	1,219	-
4a.1.5.23	DA - Circulating Water	-	276	-	-	-	-	-	41	317	-	-	317	-	-	-	-	-	-	7,502	-
4a.1.5.24	DB - Cooling Tower Makeup & Blowdown	-	47	-	-	-	-	-	7	54	-	-	54	-	-	-	-	-	-	1,260	-
4a.1.5.25	DD - Cooling Water Chemical Control Sys	-	41	-	-	-	-	-	6	47	-	-	47	-	-	-	-	-	-	1,073	-
4a.1.5.26	DD - Cooling Wtr Chem Control RCA	-	212	4	8	310	-	-	101	636	636	-	-	3,555	-	-	-	-	144,376	4,865	-
4a.1.5.27	EJ - Residual Heat Removal	-	263	15	22	391	233	-	187	1,111	1,111	-	-	4,481	825	-	-	-	255,781	6,505	-
4a.1.5.28	EM - High Pressure Coolant Injection	-	203	3	5	193	-	-	81	485	485	-	-	2,214	-	-	-	-	89,903	4,932	-
4a.1.5.29	EN - Containment Spray	-	165	4	7	264	-	-	82	522	522	-	-	3,026	-	-	-	-	122,874	4,004	-
4a.1.5.30	EP - Accumulator Safety Injection	-	115	2	5	174	-	-	56	351	351	-	-	1,989	-	-	-	-	80,762	2,774	-
4a.1.5.31	FA - Auxiliary Steam Generator	-	19	-	-	-	-	-	3	22	-	-	22	-	-	-	-	-	-	521	-
4a.1.5.32	FB - Auxiliary Steam	-	77	-	-	-	-	-	12	89	-	-	89	-	-	-	-	-	-	2,106	-
4a.1.5.33	FB - Auxiliary Steam RCA	-	63	1	2	71	-	-	27	163	163	-	-	816	-	-	-	-	33,148	1,492	-
4a.1.5.34	FC - Auxiliary Turbines	-	50	-	-	-	-	-	8	58	-	-	58	-	-	-	-	-	-	1,320	-
4a.1.5.35	FE - Auxiliary Steam Chemical Addition	-	4	-	-	-	-	-	1	5	-	-	5	-	-	-	-	-	-	105	-
4a.1.5.36	GE - Turbine Building HVAC	-	134	-	-	-	-	-	20	154	-	-	154	-	-	-	-	-	-	3,792	-
4a.1.5.37	GS - Containment Hydrogen Control	-	52	1	2	70	-	-	24	148	148	-	-	801	-	-	-	-	32,539	1,265	-
4a.1.5.38	HE - Boron Recycle	-	329	12	16	302	158	-	171	987	987	-	-	3,460	583	-	-	-	190,724	7,930	-
4a.1.5.39	HF - Secondary Liquid Waste	-	663	25	35	736	317	-	363	2,139	2,139	-	-	8,431	1,173	-	-	-	442,934	16,162	-
4a.1.5.40	JA - Auxiliary Oil & Transfer	-	25	-	-	-	-	-	4	29	-	-	29	-	-	-	-	-	-	687	-
4a.1.5.41	KS - Bulk Chemical Storage	-	73	8	15	563	-	-	106	764	764	-	-	6,449	-	-	-	-	261,890	1,806	-
4a.1.5.42	LE - Oily Waste	-	143	-	-	-	-	-	21	165	-	-	165	-	-	-	-	-	-	3,865	-
4a.1.5.43	LE - Oily Waste RCA	-	180	3	5	197	-	-	76	460	460	-	-	2,256	-	-	-	-	91,628	4,180	-
4a.1.5.44	Turbine Bldg Non-System Specific	-	600	-	-	-	-	-	90	690	-	-	690	-	-	-	-	-	-	15,405	-
4a.1.5	Totals	-	6,356	104	171	5,204	714	-	2,309	14,857	11,697	-	3,160	59,608	2,604	-	-	-	2,647,241	160,723	-
4a.1.6	Scaffolding in support of decommissioning	-	1,121	15	4	119	2	-	301	1,563	1,563	-	-	1,233	62	-	-	-	61,650	31,913	-
4a.1	Subtotal Period 4a Activity Costs	182	19,984	7,824	3,491	10,881	28,493	272	19,605	90,732	87,571	-	3,160	92,909	37,216	3,110	845	560	9,748,611	322,456	1,675
Period 4a Additional Costs																					
4a.2.1	Curie Surcharge(Excluding RPV)	-	-	-	-	-	172	-	43	215	215	-	-	-	-	-	-	-	-	-	-
4a.2	Subtotal Period 4a Additional Costs	-	-	-	-	-	172	-	43	215	215	-	-	-	-	-	-	-	-	-	-
Period 4a Collateral Costs																					
4a.3.1	Process liquid waste	4	-	4	14	-	116	-	34	172	172	-	-	-	-	76	-	-	9,565	15	-
4a.3.2	Small tool allowance	-	208	-	-	-	-	-	31	239	215	-	24	-	-	-	-	-	-	-	-
4a.3	Subtotal Period 4a Collateral Costs	4	208	4	14	-	116	-	65	411	387	-	24	-	-	76	-	-	9,565	15	-
Period 4a Period-Dependent Costs																					
4a.4.1	Decon supplies	49	-	-	-	-	-	-	12	62	62	-	-	-	-	-	-	-	-	-	-
4a.4.2	Insurance	-	-	-	-	-	-	583	58	641	641	-	-	-	-	-	-	-	-	-	-
4a.4.3	Property taxes	-	-	-	-	-	-	329	33	362	326	-	36	-	-	-	-	-	-	-	-
4a.4.4	Health physics supplies	-	1,420	-	-	-	-	-	355	1,775	1,775	-	-	-	-	-	-	-	-	-	-
4a.4.5	Heavy equipment rental	-	1,788	-	-	-	-	-	268	2,056	2,056	-	-	-	-	-	-	-	-	-	-
4a.4.6	Disposal of DAW generated	-	-	69	32	-	321	-	92	514	514	-	-	-	4,584	-	-	-	91,867	1,126	-

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2005 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 (continued)																					
4a.4.7	Plant energy budget	-	-	-	-	-	-	969	145	1,114	1,114	-	-	-	-	-	-	-	-	-	-
4a.4.8	NRC Fees	-	-	-	-	-	-	360	36	396	396	-	-	-	-	-	-	-	-	-	-
4a.4.9	Radwaste Processing Equipment/Services	-	-	-	-	-	-	407	61	468	468	-	-	-	-	-	-	-	-	-	-
4a.4.10	Security Staff Cost	-	-	-	-	-	-	1,903	285	2,188	2,188	-	-	-	-	-	-	-	-	-	68,743
4a.4.11	DOC Staff Cost	-	-	-	-	-	-	13,159	1,974	15,133	15,133	-	-	-	-	-	-	-	-	-	174,149
4a.4.12	Utility Staff Cost	-	-	-	-	-	-	18,060	2,709	20,769	20,769	-	-	-	-	-	-	-	-	-	308,197
4a.4	Subtotal Period 4a Period-Dependent Costs	49	3,208	69	32	-	321	35,769	6,029	45,477	45,441	-	36	-	4,584	-	-	-	91,867	1,126	551,089
4a.0	TOTAL PERIOD 4a COST	235	23,399	7,897	3,537	10,881	29,102	36,041	25,742	136,835	133,615	-	3,221	92,909	41,800	3,186	845	560	9,850,044	323,596	552,764
PERIOD 4b - Site Decontamination																					
Period 4b Direct Decommissioning Activities																					
4b.1.1	Remove spent fuel racks	578	68	169	68	-	1,394	-	682	2,959	2,959	-	-	-	4,933	-	-	-	442,623	1,925	-
Disposal of Plant Systems																					
4b.1.2.1	200 Reactor Bldg Non-System Specific	-	62	1	1	44	4	-	23	135	135	-	-	502	13	-	-	-	21,587	1,521	-
4b.1.2.2	200 Reactor Bldg Non-System Specific RCA	-	433	6	11	416	-	-	173	1,039	1,039	-	-	4,768	-	-	-	-	193,612	10,423	-
4b.1.2.3	300 Control Bldg Non-System Specific	-	140	3	5	187	-	-	64	398	398	-	-	2,139	-	-	-	-	86,849	3,413	-
4b.1.2.4	300 Control Bldg Non-System Specific Cln	-	1,147	-	-	-	-	-	172	1,320	-	-	1,320	-	-	-	-	-	-	29,076	-
4b.1.2.5	600 Fuel Bldg Non-Specific Systems RCA	-	241	4	7	279	-	-	104	635	635	-	-	3,200	-	-	-	-	129,974	5,858	-
4b.1.2.6	600 Fuel Bldg Non-System Specific	-	34	0	1	28	2	-	13	79	79	-	-	322	9	-	-	-	13,827	825	-
4b.1.2.7	700 Radwaste Bldg Non-Sys Specific RCA	-	894	15	29	1,107	-	-	396	2,441	2,441	-	-	12,684	-	-	-	-	515,103	21,915	-
4b.1.2.8	700 Radwaste Bldg Non-System Specific	-	128	2	4	116	10	-	53	312	312	-	-	1,329	35	-	-	-	57,135	3,158	-
4b.1.2.9	AN - Demineralized Wtr Storage & Xfer	-	120	-	-	-	-	-	18	138	-	-	138	-	-	-	-	-	-	3,283	-
4b.1.2.10	AN - Demineralized Wtr Strg & Xfer RCA	-	30	0	1	27	-	-	12	70	70	-	-	314	-	-	-	-	12,759	711	-
4b.1.2.11	AP - Condensate Storage & Transfer	-	72	-	-	-	-	-	11	82	-	-	82	-	-	-	-	-	-	1,794	-
4b.1.2.12	BB - Reactor Coolant System	-	212	14	17	226	225	-	147	842	842	-	-	2,586	903	-	-	-	176,605	5,350	-
4b.1.2.13	BG - Chemical & Volume Control	-	609	33	44	715	516	-	398	2,315	2,315	-	-	8,192	1,842	-	-	-	496,399	14,846	-
4b.1.2.14	BL - Reactor Makeup Water	-	203	7	10	221	83	-	107	631	631	-	-	2,529	315	-	-	-	129,173	4,917	-
4b.1.2.15	DE - Intake & Water Treatment	-	480	-	-	-	-	-	72	552	-	-	552	-	-	-	-	-	-	12,917	-
4b.1.2.16	DE - Intake & Water Treatment RCA	-	201	14	27	1,041	-	-	212	1,496	1,496	-	-	11,923	-	-	-	-	484,206	4,989	-
4b.1.2.17	EA - Service Water	-	115	-	-	-	-	-	17	132	-	-	132	-	-	-	-	-	-	3,145	-
4b.1.2.18	EA - Service Water RCA	-	35	1	3	109	-	-	26	174	174	-	-	1,248	-	-	-	-	50,693	829	-
4b.1.2.19	EB - Closed Cooling Water	-	46	-	-	-	-	-	7	53	-	-	53	-	-	-	-	-	-	1,267	-
4b.1.2.20	EC - Fuel Pool Cooling & Cleanup	-	261	5	9	360	-	-	121	756	756	-	-	4,119	-	-	-	-	167,293	6,330	-
4b.1.2.21	EF - Essential Service Water	-	267	-	-	-	-	-	40	307	-	-	307	-	-	-	-	-	-	7,244	-
4b.1.2.22	EF - Essential Service Water RCA	-	156	6	12	465	-	-	111	750	750	-	-	5,326	-	-	-	-	216,287	3,801	-
4b.1.2.23	EG - Component Cooling Water RCA	-	195	-	-	-	-	-	29	224	-	-	224	-	-	-	-	-	-	5,335	-
4b.1.2.24	GA - Plant Heating	-	69	-	-	-	-	-	10	80	-	-	80	-	-	-	-	-	-	1,912	-
4b.1.2.25	GA - Plant Heating RCA	-	72	1	1	56	-	-	27	157	157	-	-	638	-	-	-	-	25,924	1,698	-
4b.1.2.26	GA- Plant Heating Fuel Building	-	14	0	0	9	-	-	5	29	29	-	-	107	-	-	-	-	4,351	338	-
4b.1.2.27	GB - Central Chilled Water	-	65	-	-	-	-	-	10	75	-	-	75	-	-	-	-	-	-	1,803	-
4b.1.2.28	GB - Central Chilled Water RCA	-	20	0	0	16	-	-	7	44	44	-	-	187	-	-	-	-	7,591	463	-
4b.1.2.29	GD - Essential Serv Wtr Pumphouse HVAC	-	14	-	-	-	-	-	2	16	-	-	16	-	-	-	-	-	-	414	-
4b.1.2.30	GF - Miscellaneous Building HVAC	-	100	2	5	178	-	-	52	337	337	-	-	2,034	-	-	-	-	82,602	2,026	-
4b.1.2.31	GG - Fuel Building HVAC	-	184	5	9	344	-	-	100	642	642	-	-	3,945	-	-	-	-	160,195	4,030	-
4b.1.2.32	GH - Radwaste Building HVAC	-	135	3	6	224	-	-	68	435	435	-	-	2,561	-	-	-	-	104,012	2,973	-
4b.1.2.33	GK - Control Building HVAC	-	133	-	-	-	-	-	20	153	-	-	153	-	-	-	-	-	-	3,900	-
4b.1.2.34	GL - Auxiliary Building HVAC	-	334	6	12	470	-	-	157	979	979	-	-	5,381	-	-	-	-	218,514	7,310	-
4b.1.2.35	GM - Diesel Generator Building HVAC	-	23	-	-	-	-	-	4	27	-	-	27	-	-	-	-	-	-	692	-
4b.1.2.36	GN - Containment Cooling	-	360	9	19	722	-	-	202	1,312	1,312	-	-	8,264	-	-	-	-	335,602	8,117	-
4b.1.2.37	GP - Containment Intgratd Leak Rate Test	-	31	1	1	51	-	-	16	99	99	-	-	580	-	-	-	-	23,570	737	-
4b.1.2.38	GR - Containment Atmospheric Control	-	14	1	3	100	-	-	19	137	137	-	-	1,143	-	-	-	-	46,407	340	-
4b.1.2.39	GT - Containment Purge HVAC	-	86	2	5	191	-	-	51	335	335	-	-	2,185	-	-	-	-	88,746	1,932	-
4b.1.2.40	HA - Gaseous Radwaste	-	238	4	8	323	-	-	110	684	684	-	-	3,699	-	-	-	-	150,219	5,632	-

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2005 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
Disposal of Plant Systems (continued)																					
4b.1.2.41	HB - Liquid Radwaste	-	587	25	31	643	289	-	322	1,897	1,897	-	-	7,362	1,077	-	-	-	390,669	14,094	-
4b.1.2.42	HC - Solid Radwaste	-	241	11	15	261	172	-	146	845	845	-	-	2,985	618	-	-	-	175,776	5,830	-
4b.1.2.43	HD - Decontamination	-	72	3	4	86	34	-	40	239	239	-	-	983	125	-	-	-	50,772	1,722	-
4b.1.2.44	JE - Emergency Fuel Oil	-	50	-	-	-	-	-	7	57	-	-	57	-	-	-	-	-	-	1,260	-
4b.1.2.45	KA - Compressed Air	-	151	-	-	-	-	-	23	174	-	-	174	-	-	-	-	-	-	4,187	-
4b.1.2.46	KA - Compressed Air RCA	-	96	1	2	70	-	-	35	204	204	-	-	801	-	-	-	-	32,538	2,242	-
4b.1.2.47	KB - Breathing Air	-	19	-	-	-	-	-	3	22	-	-	22	-	-	-	-	-	-	516	-
4b.1.2.48	KB - Breathing Air RCA	-	14	-	0	6	-	-	5	25	25	-	-	71	-	-	-	-	2,874	376	-
4b.1.2.49	KC - Fire Protection	-	300	-	-	-	-	-	45	345	-	-	345	-	-	-	-	-	-	8,376	-
4b.1.2.50	KC - Fire Protection RCA	-	309	5	10	385	-	-	137	847	847	-	-	4,411	-	-	-	-	179,151	6,951	-
4b.1.2.51	KC- Fire Protection Fuel Building	-	92	1	3	108	-	-	40	244	244	-	-	1,239	-	-	-	-	50,329	2,084	-
4b.1.2.52	KD - Domestic Water	-	139	-	-	-	-	-	21	160	-	-	160	-	-	-	-	-	-	3,837	-
4b.1.2.53	KD - Domestic Water RCA	-	20	0	1	22	-	-	8	51	51	-	-	247	-	-	-	-	10,039	448	-
4b.1.2.54	KE - Fuel Handling & Storage Rctor vssl	-	13	1	2	77	-	-	15	109	109	-	-	882	-	-	-	-	35,813	323	-
4b.1.2.55	KH - Service Gas (CO2 N2 H2 & O2)	-	44	-	-	-	-	-	7	51	-	-	51	-	-	-	-	-	-	1,226	-
4b.1.2.56	KH - Service Gas (CO2 N2 H2 & O2) RCA	-	193	3	6	212	-	-	81	495	495	-	-	2,433	-	-	-	-	98,813	4,377	-
4b.1.2.57	KJ - Standby Diesel Engine	-	264	-	-	-	-	-	40	304	-	-	304	-	-	-	-	-	-	6,749	-
4b.1.2.58	LA - Sanitary Drains	-	36	-	-	-	-	-	5	41	-	-	41	-	-	-	-	-	-	972	-
4b.1.2.59	LA - Sanitary Drains RCA	-	83	2	3	111	-	-	38	237	237	-	-	1,273	-	-	-	-	51,684	1,810	-
4b.1.2.60	LB - Roof Drains	-	47	-	-	-	-	-	7	54	-	-	54	-	-	-	-	-	-	1,276	-
4b.1.2.61	LB - Roof Drains RCA	-	110	3	5	187	-	-	57	361	361	-	-	2,139	-	-	-	-	86,858	2,627	-
4b.1.2.62	LD - Chemical & Detergent Waste	-	75	1	2	70	-	-	30	177	177	-	-	797	-	-	-	-	32,369	1,828	-
4b.1.2.63	LF - Floor & Equipment Drains	-	966	37	50	581	723	-	521	2,879	2,879	-	-	6,660	2,567	-	-	-	500,138	23,235	-
4b.1.2.64	RM - Process Sampling & Analysis	-	96	1	2	86	-	-	37	223	223	-	-	990	-	-	-	-	40,200	2,335	-
4b.1.2.65	SJ - Nuclear Sampling	-	53	1	2	59	-	-	22	137	137	-	-	677	-	-	-	-	27,501	1,312	-
4b.1.2.66	UB - Servces Stores Site Security Bldg	-	134	-	-	-	-	-	20	154	-	-	154	-	-	-	-	-	-	3,571	-
4b.1.2.67	Yard Non-System Specific	-	24	-	-	-	-	-	4	27	-	-	27	-	-	-	-	-	-	603	-
4b.1.2	Totals	-	12,202	242	388	10,989	2,059	-	4,900	30,780	26,231	-	4,549	125,856	7,504	-	-	-	5,764,757	301,431	-
4b.1.3	Scaffolding in support of decommissioning	-	1,682	23	6	179	3	-	451	2,344	2,344	-	-	1,849	92	-	-	-	92,475	47,869	-
Decontamination of Site Buildings																					
4b.1.4.1	Reactor	875	717	88	119	520	1,113	-	1,000	4,432	4,432	-	-	5,955	7,058	-	-	-	905,431	37,131	-
4b.1.4.2	Auxiliary	446	184	22	32	180	61	-	318	1,244	1,244	-	-	2,058	1,696	-	-	-	249,762	14,927	-
4b.1.4.3	Communication Corridor - Contaminated	10	3	0	1	1	1	-	6	23	23	-	-	17	36	-	-	-	4,292	300	-
4b.1.4.4	Fuel Building	568	579	9	13	236	18	-	472	1,895	1,895	-	-	2,705	479	-	-	-	157,196	26,693	-
4b.1.4.5	Hot Machine Shop	12	3	1	1	-	2	-	7	25	25	-	-	-	44	-	-	-	4,446	360	-
4b.1.4.6	RAM Storage Building	31	7	1	2	2	3	-	18	63	63	-	-	19	93	-	-	-	9,968	901	-
4b.1.4.7	Radioactive and Personnel Tunnel	4	3	0	0	-	1	-	3	12	12	-	-	-	25	-	-	-	2,532	164	-
4b.1.4.8	Radwaste	237	85	11	16	74	33	-	163	619	619	-	-	844	892	-	-	-	122,248	7,650	-
4b.1.4.9	Radwaste Drum Storage	27	8	1	2	6	4	-	18	65	65	-	-	66	99	-	-	-	12,548	833	-
4b.1.4.10	Steam Generator Replacement Bldgs	175	-	-	-	-	-	-	87	262	262	-	-	-	-	-	-	-	-	3,780	-
4b.1.4	Totals	2,385	1,589	134	186	1,018	1,236	-	2,093	8,641	8,641	-	-	11,664	10,424	-	-	-	1,468,423	92,740	-
4b.1	Subtotal Period 4b Activity Costs	2,963	15,542	568	647	12,186	4,693	-	8,126	44,725	40,175	-	4,549	139,370	22,953	-	-	-	7,768,277	443,964	-
Period 4b Additional Costs																					
4b.2.1	Sanitary Treatment Lagoon LLW	-	4	45	611	-	128	-	116	905	905	-	-	-	3,600	-	-	-	345,600	389	-
4b.2	Subtotal Period 4b Additional Costs	-	4	45	611	-	128	-	116	905	905	-	-	-	3,600	-	-	-	345,600	389	-
Period 4b Collateral Costs																					
4b.3.1	Process liquid waste	11	-	11	40	-	214	-	66	343	343	-	-	-	-	213	-	-	26,830	42	-
4b.3.2	Small tool allowance	-	300	-	-	-	-	-	45	345	345	-	-	-	-	-	-	-	-	-	-
4b.3.3	Decommissioning Equipment Disposition	-	-	75	24	581	106	-	124	909	909	-	-	6,000	373	-	-	-	303,507	739	-
4b.3	Subtotal Period 4b Collateral Costs	11	300	86	64	581	320	-	236	1,597	1,597	-	-	6,000	373	213	-	-	330,337	781	-

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2005 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 4b Period-Dependent Costs																					
4b.4.1	Decon supplies	1,048	-	-	-	-	-	-	262	1,310	1,310	-	-	-	-	-	-	-	-	-	-
4b.4.2	Insurance	-	-	-	-	-	-	1,508	151	1,659	1,659	-	-	-	-	-	-	-	-	-	-
4b.4.3	Property taxes	-	-	-	-	-	-	853	85	938	938	-	-	-	-	-	-	-	-	-	-
4b.4.4	Health physics supplies	-	2,301	-	-	-	-	-	575	2,877	2,877	-	-	-	-	-	-	-	-	-	-
4b.4.5	Heavy equipment rental	-	4,657	-	-	-	-	-	699	5,355	5,355	-	-	-	-	-	-	-	-	-	-
4b.4.6	Disposal of DAW generated	-	-	98	46	-	458	-	131	733	733	-	-	-	6,537	-	-	-	130,994	1,605	-
4b.4.7	Plant energy budget	-	-	-	-	-	-	1,980	297	2,276	2,276	-	-	-	-	-	-	-	-	-	-
4b.4.8	NRC Fees	-	-	-	-	-	-	932	93	1,025	1,025	-	-	-	-	-	-	-	-	-	-
4b.4.9	Radwaste Processing Equipment/Services	-	-	-	-	-	-	1,054	158	1,212	1,212	-	-	-	-	-	-	-	-	-	-
4b.4.10	Security Staff Cost	-	-	-	-	-	-	3,776	566	4,343	4,343	-	-	-	-	-	-	-	-	-	136,423
4b.4.11	DOC Staff Cost	-	-	-	-	-	-	30,205	4,531	34,735	34,735	-	-	-	-	-	-	-	-	-	403,337
4b.4.12	Utility Staff Cost	-	-	-	-	-	-	41,281	6,192	47,473	47,473	-	-	-	-	-	-	-	-	-	686,563
4b.4	Subtotal Period 4b Period-Dependent Costs	1,048	6,958	98	46	-	458	81,587	13,741	103,936	103,936	-	-	-	6,537	-	-	-	130,994	1,605	1,226,323
4b.0	TOTAL PERIOD 4b COST	4,022	22,804	797	1,368	12,767	5,598	81,587	22,219	151,163	146,613	-	4,549	145,370	33,464	213	-	-	8,575,207	446,739	1,226,323
PERIOD 4e - License Termination																					
Period 4e Direct Decommissioning Activities																					
4e.1.1	ORISE confirmatory survey	-	-	-	-	-	-	119	36	155	155	-	-	-	-	-	-	-	-	-	-
4e.1.2	Terminate license									a											
4e.1	Subtotal Period 4e Activity Costs	-	-	-	-	-	-	119	36	155	155	-	-	-	-	-	-	-	-	-	-
Period 4e Additional Costs																					
4e.2.1	Final Site Survey	-	-	-	-	-	-	6,453	1,936	8,389	8,389	-	-	-	-	-	-	-	-	150,988	-
4e.2	Subtotal Period 4e Additional Costs	-	-	-	-	-	-	6,453	1,936	8,389	8,389	-	-	-	-	-	-	-	-	150,988	-
Period 4e Collateral Costs																					
4e.3.1	DOC staff relocation expenses	-	-	-	-	-	-	804	121	924	924	-	-	-	-	-	-	-	-	-	-
4e.3	Subtotal Period 4e Collateral Costs	-	-	-	-	-	-	804	121	924	924	-	-	-	-	-	-	-	-	-	-
Period 4e Period-Dependent Costs																					
4e.4.1	Insurance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4e.4.2	Property taxes	-	-	-	-	-	-	227	23	249	249	-	-	-	-	-	-	-	-	-	-
4e.4.3	Health physics supplies	-	727	-	-	-	-	-	182	909	909	-	-	-	-	-	-	-	-	-	-
4e.4.4	Disposal of DAW generated	-	-	5	2	-	21	-	6	34	34	-	-	-	306	-	-	-	6,127	75	-
4e.4.5	Plant energy budget	-	-	-	-	-	-	140	21	161	161	-	-	-	-	-	-	-	-	-	-
4e.4.6	NRC Fees	-	-	-	-	-	-	248	25	272	272	-	-	-	-	-	-	-	-	-	-
4e.4.7	Security Staff Cost	-	-	-	-	-	-	393	59	452	452	-	-	-	-	-	-	-	-	-	14,194
4e.4.8	DOC Staff Cost	-	-	-	-	-	-	4,430	665	5,095	5,095	-	-	-	-	-	-	-	-	-	57,566
4e.4.9	Utility Staff Cost	-	-	-	-	-	-	4,672	701	5,373	5,373	-	-	-	-	-	-	-	-	-	72,943
4e.4	Subtotal Period 4e Period-Dependent Costs	-	727	5	2	-	21	10,110	1,681	12,546	12,546	-	-	-	306	-	-	-	6,127	75	144,703
4e.0	TOTAL PERIOD 4e COST	-	727	5	2	-	21	17,486	3,773	22,014	22,014	-	-	-	306	-	-	-	6,127	151,063	144,703
PERIOD 4 TOTALS		4,257	46,931	8,698	4,908	23,648	34,722	135,114	51,734	310,012	302,242	-	7,770	238,278	75,569	3,398	845	560	18,431,380	921,399	1,923,789
PERIOD 5b - Site Restoration																					
Period 5b Direct Decommissioning Activities																					
Demolition of Remaining Site Buildings																					
5b.1.1.1	Reactor	-	4,188	-	-	-	-	-	628	4,817	-	-	4,817	-	-	-	-	-	-	63,214	-
5b.1.1.2	Auxiliary	-	3,634	-	-	-	-	-	545	4,179	-	-	4,179	-	-	-	-	-	-	59,266	-
5b.1.1.3	Auxiliary Boiler	-	29	-	-	-	-	-	4	33	-	-	33	-	-	-	-	-	-	619	-
5b.1.1.4	Barge Facility	-	1,238	-	-	-	-	-	186	1,424	-	-	1,424	-	-	-	-	-	-	18,771	-

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2005 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.1.1.5	Circulating & Service Water Pumphouse	-	245	-	-	-	-	-	37	282	-	-	282	-	-	-	-	-	-	4,345	-
5b.1.1.6	Communication Corridor - Clean	-	1,244	-	-	-	-	-	187	1,431	-	-	1,431	-	-	-	-	-	-	21,919	-
5b.1.1.7	Communication Corridor - Contaminated	-	45	-	-	-	-	-	7	52	-	-	52	-	-	-	-	-	-	674	-
5b.1.1.8	Cooling Tower	-	945	-	-	-	-	-	142	1,087	-	-	1,087	-	-	-	-	-	-	17,975	-
5b.1.1.9	Diesel Generator	-	420	-	-	-	-	-	63	483	-	-	483	-	-	-	-	-	-	6,314	-
5b.1.1.10	Essential Service Water Pumphouse	-	232	-	-	-	-	-	35	267	-	-	267	-	-	-	-	-	-	3,938	-
5b.1.1.11	Fire Water Pumphouse	-	22	-	-	-	-	-	3	25	-	-	25	-	-	-	-	-	-	382	-
5b.1.1.12	Fuel Building	-	1,703	-	-	-	-	-	256	1,959	-	-	1,959	-	-	-	-	-	-	24,799	-
5b.1.1.13	Hot Machine Shop	-	19	-	-	-	-	-	3	22	-	-	22	-	-	-	-	-	-	417	-
5b.1.1.14	Intake	-	291	-	-	-	-	-	44	335	-	-	335	-	-	-	-	-	-	4,224	-
5b.1.1.15	Misc. Structures	-	1,930	-	-	-	-	-	289	2,219	-	-	2,219	-	-	-	-	-	-	28,089	-
5b.1.1.16	Miscellaneous Site Foundations	-	293	-	-	-	-	-	44	337	-	-	337	-	-	-	-	-	-	5,478	-
5b.1.1.17	Outage Maintenance	-	144	-	-	-	-	-	22	166	-	-	166	-	-	-	-	-	-	3,190	-
5b.1.1.18	RAM Storage Building	-	54	-	-	-	-	-	8	62	-	-	62	-	-	-	-	-	-	1,081	-
5b.1.1.19	Radioactive and Personnel Tunnel	-	21	-	-	-	-	-	3	24	-	-	24	-	-	-	-	-	-	383	-
5b.1.1.20	Radwaste	-	1,572	-	-	-	-	-	236	1,808	-	-	1,808	-	-	-	-	-	-	24,859	-
5b.1.1.21	Radwaste Drum Storage	-	215	-	-	-	-	-	32	247	-	-	247	-	-	-	-	-	-	3,840	-
5b.1.1.22	Security Additions	-	1,911	-	-	-	-	-	287	2,197	-	-	2,197	-	-	-	-	-	-	21,829	-
5b.1.1.23	Service	-	405	-	-	-	-	-	61	466	-	-	466	-	-	-	-	-	-	6,045	-
5b.1.1.24	Sludge Pump Station & Lagoon	-	20	-	-	-	-	-	3	23	-	-	23	-	-	-	-	-	-	313	-
5b.1.1.25	Steam Generator Replacement Bldgs	-	938	-	-	-	-	-	141	1,078	-	-	1,078	-	-	-	-	-	-	15,693	-
5b.1.1.26	Turbine Building	-	4,376	-	-	-	-	-	656	5,033	-	-	5,033	-	-	-	-	-	-	89,690	-
5b.1.1.27	Turbine Pedestal	-	830	-	-	-	-	-	125	955	-	-	955	-	-	-	-	-	-	10,928	-
5b.1.1.28	U.H.S. Cooling Tower	-	503	-	-	-	-	-	76	579	-	-	579	-	-	-	-	-	-	6,681	-
5b.1.1.29	Water Treatment Plant	-	1	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	9	-
5b.1.1	Totals	-	27,469	-	-	-	-	-	4,120	31,589	-	-	31,589	-	-	-	-	-	-	444,963	-
Site Closeout Activities																					
5b.1.2	BackFill Site	-	2,638	-	-	-	-	-	396	3,033	-	-	3,033	-	-	-	-	-	-	10,158	-
5b.1.3	Grade & landscape site	-	2,064	-	-	-	-	-	310	2,374	-	-	2,374	-	-	-	-	-	-	5,839	-
5b.1.4	Final report to NRC	-	-	-	-	-	-	152	23	175	175	-	-	-	-	-	-	-	-	-	1,560
5b.1	Subtotal Period 5b Activity Costs	-	32,171	-	-	-	-	152	4,848	37,171	175	-	36,996	-	-	-	-	-	-	460,959	1,560
Period 5b Additional Costs																					
5b.2.1	Concrete Crushing	-	953	-	-	-	-	6	144	1,103	-	-	1,103	-	-	-	-	-	-	5,830	-
5b.2	Subtotal Period 5b Additional Costs	-	953	-	-	-	-	6	144	1,103	-	-	1,103	-	-	-	-	-	-	5,830	-
Period 5b Collateral Costs																					
5b.3.1	Small tool allowance	-	326	-	-	-	-	-	49	375	-	-	375	-	-	-	-	-	-	-	-
5b.3	Subtotal Period 5b Collateral Costs	-	326	-	-	-	-	-	49	375	-	-	375	-	-	-	-	-	-	-	-
Period 5b Period-Dependent Costs																					
5b.4.1	Insurance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5b.4.2	Property taxes	-	-	-	-	-	-	451	45	496	-	-	496	-	-	-	-	-	-	-	-
5b.4.3	Heavy equipment rental	-	3,379	-	-	-	-	-	507	3,885	-	-	3,885	-	-	-	-	-	-	-	-
5b.4.4	Plant energy budget	-	-	-	-	-	-	140	21	161	-	-	161	-	-	-	-	-	-	-	-
5b.4.5	Security Staff Cost	-	-	-	-	-	-	782	117	899	-	-	899	-	-	-	-	-	-	-	28,234
5b.4.6	DOC Staff Cost	-	-	-	-	-	-	9,833	1,475	11,307	-	-	11,307	-	-	-	-	-	-	-	123,917
5b.4.7	Utility Staff Cost	-	-	-	-	-	-	5,360	804	6,164	-	-	6,164	-	-	-	-	-	-	-	79,997
5b.4	Subtotal Period 5b Period-Dependent Costs	-	3,379	-	-	-	-	16,565	2,969	22,912	-	-	22,912	-	-	-	-	-	-	-	232,149
5b.0	TOTAL PERIOD 5b COST	-	36,829	-	-	-	-	16,722	8,010	61,561	175	-	61,386	-	-	-	-	-	-	466,789	233,709
PERIOD 5 TOTALS		-	36,829	-	-	-	-	16,722	8,010	61,561	175	-	61,386	-	-	-	-	-	-	466,789	233,709
TOTAL COST TO DECOMMISSION		9,557	90,622	9,163	5,502	23,648	38,086	472,319	110,246	759,143	631,743	57,009	70,391	238,278	98,617	5,667	845	560	19,179,240	1,475,922	5,875,752

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Callaway Plant
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															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			

TOTAL COST TO DECOMMISSION WITH 16.99% CONTINGENCY:	$759,143	thousands of 2005 dollars
TOTAL NRC LICENSE TERMINATION COST IS 83.22% OR:	$631,743	thousands of 2005 dollars
SPENT FUEL MANAGEMENT COST IS 7.51% OR:	$57,009	thousands of 2005 dollars
NON-NUCLEAR DEMOLITION COST IS 9.27% OR:	$70,391	thousands of 2005 dollars
TOTAL RADWASTE VOLUME BURIED (EXCLUDING GTCC):	105,130	cubic feet
TOTAL GREATER THAN CLASS C RADWASTE VOLUME GENERATED:	560	cubic feet
TOTAL SCRAP METAL REMOVED:	77,756	tons
TOTAL CRAFT LABOR REQUIREMENTS:	1,475,922	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