2014.09.02 13:43:14
Kansas Corporation Commission

WOLF CREEK
Nuclear Operating Corporation

August 28, 2014
GC 14-0016
File 50.027-01

15-WCNE-093-GIE

Mr. Thomas A. Day
Acting Executive Director
Kansas Corporation Commission
1500 SW Arrowhead Rd.
Topeka, KS 66604-4027

By Hand Delivery

Received
on
AUG 2 9 2014
by
State Corporation Commission
of Kansas

Subject: 2014 Wolf Creek Decommissioning Cost Analysis

Dear Mr. Day:

In accordance with the Commission's December 9, 1992, Order in Docket No. 163,561-U (directing the filing of a Wolf Creek decommissioning cost study update every three years after September 1, 1993), I am enclosing on behalf of Kansas Gas and Electric Company, Kansas City Power & Light Company and Kansas Electric Power Cooperative, Inc., the original and seven copies of the 2014 Decommissioning Cost Analysis for the Wolf Creek Generating Station.

As with our previous submission, we have included Appendix E to the enclosed cost analysis that provides details on spent fuel removal from the Wolf Creek Generating Station. A new Appendix F is also enclosed in accordance with the Order dated June 13, 2013 in Docket 13-WCNE-204-GIE that imposed an additional requirement to "continue to update [our] estimates of total capital costs for the ISFSI project through [our] decommissioning financing plans pursuant to K.S.A. 66-128o." The Wolf Creek owners are not proposing that these items be reflected in the current cost analysis.

Also enclosed is a copy of this letter. Please stamp it "Filed," and return it to me in the enclosed envelope.

Sincerely,

D. Hendell

Debbie L. Hendell

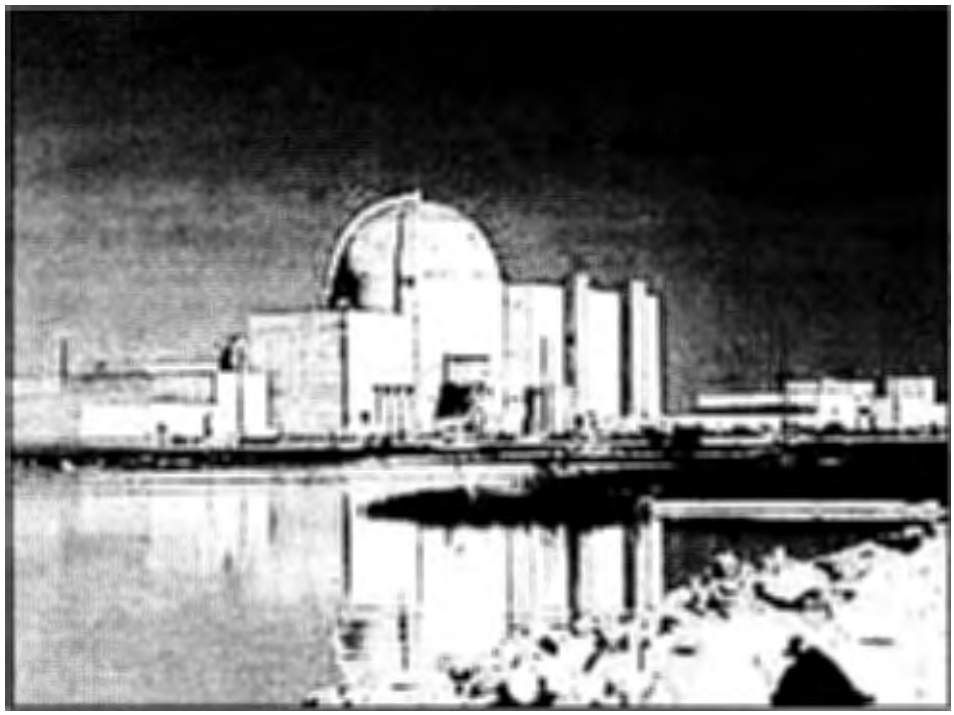
Enclosures

cc w/encl.: Cindy Wilson (Westar Energy)
Cathy Dinges (Westar Energy)
Heather Humphrey (KCP&L)
Roger Steiner (KCPL)
Mary Turner (KCPL)
William Riggins (KEPCo)
David Springe (CURB)
Records Management (CC-DS)

DECOMMISSIONING COST ANALYSIS

for the

WOLF CREEK GENERATING STATION



prepared for the

Wolf Creek Nuclear Operating Corporation

prepared by

TLG Services, Inc.
Bridgewater, Connecticut

August 2014

APPROVALS

Project Manager	William A. Cloutier, Jr.	28 Aug 2014 Date
Project Engineer	Timothy A. Arnold	8/28/2014 Date
Project Engineer	Thomas J. Garrett	8/28/2014 Date
Technical Manager	Francis W. Seymore	8/20/14 Date

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

SECTION **PAGE**

TABLES

TABLE OF CONTENTS
(continued)

SECTION **PAGE**

FIGURES

APPENDICES

REVISION LOG

No.	Date	Item Revised	Reason for Revision
0	08-28-2014		Original Issue

EXECUTIVE SUMMARY

This report presents estimates of the cost to decommission the Wolf Creek Generating Station (Wolf Creek) for the selected decommissioning scenarios following the scheduled cessation of plant operations. The estimates are designed to provide the Wolf Creek Nuclear Operating Corporation (WCNOC), the plant's operator, and its owners: Kansas Gas and Electric Company, a wholly owned subsidiary of Westar Energy, Inc., Kansas City Power & Light Company, a wholly owned subsidiary of Great Plains Energy Incorporated, and Kansas Electric Power Cooperative, Inc., with sufficient information to assess their financial obligations, as they pertain to the eventual decommissioning of the nuclear station.

The analysis relies upon site-specific, technical information from an evaluation prepared in 2011,[1] updated to reflect current assumptions pertaining to the disposition of the nuclear station and relevant industry experience in undertaking such projects. The analysis is not a comprehensive engineering evaluation, but estimates prepared in advance of the detailed planning required to execute the decommissioning of the nuclear station. It may also not reflect the actual plan to decommission Wolf Creek; the plan may differ from the assumptions made in this analysis based on facts that exist at the time of decommissioning.

The costs to decommission Wolf Creek are presented at the end of this section. Costs are reported in 2014 dollars and include monies anticipated to be spent for radiological remediation and operating license termination, spent fuel management, and site restoration activities.

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

Consistent with the 2011 analysis, the current cost estimates assume that the shutdown of the nuclear station is a scheduled and pre-planned event (e.g., there is no delay in transitioning the plant and workforce from operations or in obtaining regulatory relief from operating requirements, etc.). The estimates include the continued operation of the fuel handling building as an interim wet fuel storage facility for approximately five and one-half years after operations cease (years 2045

1 "Decommissioning Cost Analysis for the Wolf Creek Generating Station," Document No. W11-1642-001, Rev. 0, TLG Services, Inc., August 2011

through 2050). During this time period, it is assumed that the Department of Energy (DOE) will complete the transfer of the spent fuel from the site to a federal facility.

Alternatives and Regulations

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

> DECON is defined as "the alternative in which the equipment, structures, and portions of a facility and site containing radioactive contaminants are removed or decontaminated to a level that permits the property to be released for unrestricted use shortly after cessation of operations."[3]
>
> SAFSTOR is defined as "the alternative in which the nuclear facility is placed and maintained in a condition that allows the nuclear facility to be safely stored and subsequently decontaminated (deferred decontamination) to levels that permit release for unrestricted use."[4] Decommissioning is to be completed within 60 years, although longer time periods will be considered when necessary to protect public health and safety.
>
> ENTOMB is defined as "the alternative in which radioactive contaminants are encased in a structurally long-lived material, such as concrete; the entombed structure is appropriately maintained and continued surveillance is carried out until the radioactive material decays to a level permitting unrestricted release of the property."[5] As

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

3 Ibid. Page FR24022, Column 3

4 Ibid.

5 Ibid. Page FR24023, Column 2

> with the SAFSTOR alternative, decommissioning is currently required to be completed within 60 years, although longer time periods will also be considered when necessary to protect public health and safety.
>
> The 60-year restriction has limited the practicality for the ENTOMB alternative at commercial reactors that generate significant amounts of long-lived radioactive material. In 1997, the Commission directed its staff to re-evaluate this alternative and identify the technical requirements and regulatory actions that would be necessary for entombment to become a viable option. The resulting evaluation provided several recommendations; however, rulemaking has been deferred pending the completion of additional research studies, for example, on engineered barriers.

In 1996, the NRC published revisions to the general requirements for decommissioning nuclear power plants to clarify ambiguities and codify procedures and terminology as a means of enhancing efficiency and uniformity in the decommissioning process.[6] The amendments allow for greater public participation and better define the transition process from operations to decommissioning. Regulatory Guide 1.184,[7] issued in July 2000, further described the methods and procedures acceptable to the NRC staff for implementing the requirements of the 1996 revised rule relating to the initial activities and major phases of the decommissioning process. The costs and schedules presented in this analysis follow the general guidance and processes described in the amended regulations. The format and content of the estimates is also consistent with the recommendations of Regulatory Guide 1.202,[8] issued in February 2005.

Methodology

The methodology used to develop the estimates described within this document follows the basic approach originally presented in the cost estimating guidelines[9] developed by the Atomic Industrial Forum (now Nuclear Energy Institute). This reference describes a unit factor method for determining decommissioning activity costs. The

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

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

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

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

unit factors used in this analysis incorporate site-specific costs and the latest available information on worker productivity in decommissioning.

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

Contingency

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

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

Low-Level Radioactive Waste Disposal

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

With the exception of Texas, no new compact facilities have been successfully sited, licensed, and constructed. The Texas Compact disposal facility is now operational and

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

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

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

waste is being accepted from generators within the Compact by the operator, Waste Control Specialists (WCS). The facility is also able to accept limited quantities of non-Compact waste.

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

The WCS facility is able to receive the Class B and C waste. As such, for this analysis, Class B and C waste was assumed to be shipped to the WCS facility for disposal. Disposal costs were based upon preliminary and indicative information for the WCS site.

The dismantling of the components residing closest to the reactor core generates radioactive waste that may be considered unsuitable for shallow-land disposal (i.e., low-level radioactive waste with concentrations of radionuclides that exceed the limits established by the NRC for Class C radioactive waste (GTCC)). The Low-Level Radioactive Waste Policy Amendments Act of 1985 assigned the federal government the responsibility for the disposal of this material. The Act also stated that the beneficiaries of the activities resulting in the generation of such radioactive waste bear all reasonable costs of disposing of such waste. However, to date, the federal government has not identified a cost for disposing of GTCC or a schedule for acceptance.

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

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

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

disposal as radioactive waste, compaction, incineration or metal melt. The estimates reflect the savings from waste recovery/volume reduction.

High-Level Radioactive Waste Management

Congress passed the "Nuclear Waste Policy Act"[14] (NWPA) in 1982, assigning the federal government's long-standing responsibility for disposal of the spent nuclear fuel created by the commercial nuclear generating plants to the DOE. The DOE was to begin accepting spent fuel by January 31, 1998; however, to date no progress in the removal of spent fuel from commercial generating sites has been made.

Today, the country is at an impasse on high-level waste disposal, even with the License Application for a geologic repository submitted by the DOE to the NRC in 2008. The current administration has eliminated the budget for the repository program while promising to "conduct a comprehensive review of policies for managing the back end of the nuclear fuel cycle ... and make recommendations for a new plan."[15] Towards this goal, the administration appointed a Blue Ribbon Commission on America's Nuclear Future (Blue Ribbon Commission) to make recommendations for a new plan for nuclear waste disposal. The Blue Ribbon Commission's charter includes a requirement that it consider "[o]ptions for safe storage of used nuclear fuel while final disposition pathways are selected and deployed."[16]

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

- "[T]he United States [should] establish a program that leads to the timely development of one or more consolidated storage facilities"[17]
- "[T]he United States should undertake an integrated nuclear waste management program that leads to the timely development of one or more

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

15 Charter of the Blue Ribbon Commission on America's Nuclear Future, "Objectives and Scope of Activities," http://www.brc.gov/index.php?q=page/charter

16 Ibid.

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

permanent deep geological facilities for the safe disposal of spent fuel and high-level nuclear waste."[18]

In January 2013, the DOE issued the "Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste," in response to the recommendations made by the Blue Ribbon Commission and as "a framework for moving toward a sustainable program to deploy an integrated system capable of transporting, storing, and disposing of used nuclear fuel..."[19] This document states:

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

- Sites, designs and licenses, constructs and begins operations of a pilot interim storage facility by 2021 with an initial focus on accepting used nuclear fuel from shut-down reactor sites;
- Advances toward the siting and licensing of a larger interim storage facility to be available by 2025 that will have sufficient capacity to provide flexibility in the waste management system and allows for acceptance of enough used nuclear fuel to reduce expected government liabilities; and
- Makes demonstrable progress on the siting and characterization of repository sites to facilitate the availability of a geologic repository by 2048."[20]

The NRC's review of DOE's license application to construct a geologic repository at Yucca Mountain was suspended in 2011 when the Administration slashed the budget for completing that work. However, the US Court of Appeals for the District of Columbia Circuit recently issued a writ of mandamus (in August 2013) ordering NRC to comply with federal law and restart its review of DOE's Yucca Mountain repository license application to the extent of previously appropriated funding for the review.

Completion of the decommissioning process is dependent upon the DOE's ability to remove spent fuel from the site in a timely manner. DOE's repository program assumed that spent fuel allocations would be accepted for disposal from the nation's commercial nuclear plants, with limited exceptions, in the order (the "queue") in which it was discharged from the reactor. The current spent fuel management plan for the Wolf Creek spent fuel is based in general upon: 1) a 2025 start date for DOE initiating

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18 Ibid., p.27

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

20 Ibid., p.2

transfer of commercial spent fuel to a federal facility, and 2) a 2032 start date for the transfer of spent fuel from the Wolf Creek site based on an oldest fuel first priority, and the DOE achieving an annual rate of transfer (3,000 metric tons of uranium per year) as reflected in DOE's latest Acceptance Priority Ranking and Annual Capacity Report.[21]

The estimates also assume that the DOE would give priority to fuel at shutdown sites, i.e., it is assumed that Congress would "(1)...direct the Department to take spent nuclear fuel from decommissioned commercial nuclear power reactors as soon as possible; (2) to establish an expedited siting process; and (3) to authorize the Department to construct and operate the facility under its regulatory authority, or, if the facility were to be constructed and operated under a U.S. Nuclear Regulatory Commission license, to provide for an expedited siting and licensing process."[22]

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

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

Interim storage of the fuel, until the DOE has completed the transfer, will be in the wet storage pool located in the fuel building (as well as on the ISFSI). The pool will be isolated, allowing WCNOC to proceed with decommissioning (or safe-storage preparations) in the shortest time possible.

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21 "Acceptance Priority Ranking and Annual Capacity Report," U.S. DOE, Office of Civilian Radioactive Waste Management, DOE/RW-0567, July 2004

22 "Report to Congress on the Demonstration of the Interim Storage of Spent Nuclear Fuel from Decommissioned Nuclear Power Reactor Sites" DOE/RW-0596, December 2008

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

Sensitivity of Spent Fuel Management Assumptions

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

If DOE is unable to remove the spent fuel from the Wolf Creek site within this time period, wet storage pool operations would need to be extended (potentially delaying decommissioning) and/or the ISFSI would be used for the interim storage of the fuel so that decommissioning could proceed. Appendix E evaluates such a scenario (i.e., where spent fuel is accepted from generators in the order in which it was generated or oldest fuel first and the ISFSI is used for interim storage, similar to what has occurred at recently decommissioned reactor sites).

The resulting costs for long-term spent fuel management (summarized in Table E) are illustrative only and based upon current regulations and associated constraints that may change as a result of actions taken on the Blue Ribbon Commission's recommendations. It should also be noted that the costs, while incurred by the licensee, may also be recoverable as a result of DOE's breech of its contract to take possession of the spent fuel in a timely manner. However, the analysis described in Appendix E may prove useful as a planning basis should delays continue in the development of a national solution for the disposition of spent fuel and high-level waste.

Site Restoration

Prompt dismantling of site structures (once the facilities are decontaminated) is clearly the most appropriate and cost-effective option. It is unreasonable to anticipate that these structures would be repaired and preserved after the radiological contamination is removed. The cost to dismantle site structures with a work force already mobilized on site is more efficient than if the process is deferred. Site facilities quickly degrade without maintenance, adding additional expense and creating potential hazards to the public and the demolition work force.
Consequently, this study assumes that site structures are removed to a nominal depth of three feet below the local grade level wherever possible. The site is then to be graded and stabilized.

Summary

The costs to decommission Wolf Creek assume the removal of all contaminated and activated plant components and structural materials such that the owners may then have unrestricted use of the site with no further requirements for an operating license. Low-level radioactive waste, other than GTCC waste, is sent to a commercial processor for treatment/conditioning or to a controlled disposal facility.

Decommissioning is accomplished within the 60-year period required by current NRC regulations.

The decommissioning scenarios 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. The major cost components are also identified in the cost summary provided at the end of this section.

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

The "Spent Fuel Management" subcategory contains costs associated with the transfer of the spent fuel to the DOE as well as the operation of the spent fuel pool until such time that the transfer is complete.

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

It should be noted that the costs assigned to these subcategories are allocations. Delegation of cost elements is for the purposes of comparison (e.g., with NRC financial guidelines) or to permit specific financial treatment (e.g., Asset Retirement Obligations determinations). In reality, there can be considerable interaction between the activities in the three subcategories. For example, an owner may decide to remove non-contaminated structures early in the project to improve access to highly contaminated facilities or plant components. In these instances, the non-contaminated removal costs

could be reassigned from Site Restoration to an NRC License Termination support activity. However, in general, the allocations represent a reasonable accounting of those costs that can be expected to be incurred for the specific subcomponents of the total estimated program cost, if executed as described.

As noted within this document, the estimates were developed and costs are presented in 2014 dollars. As such, the estimates do not reflect the escalation of costs (due to inflationary and market forces) over the remaining operating life of the reactor or during the decommissioning period.

DECON COST SUMMARY
DECOMMISSIONING COST ELEMENTS
(thousands of 2014 dollars)

Cost Element	Cost
Decontamination	14,843
Removal	115,134
Packaging	23,258
Transportation	11,795
Waste Disposal	88,460
Off-site Waste Processing	23,328
Program Management [1]	265,653
Security	94,167
Corporate Allocations	1,972
Spent Fuel Pool Isolation	12,434
Spent Fuel Management - Direct Costs [2]	46,016
Insurance and Regulatory Fees	14,647
Energy	14,220
Characterization and Licensing Surveys	21,182
Property Taxes	10,994
Miscellaneous Equipment	6,956
Total [3]	765,060

Cost Element	Cost
License Termination	656,060
Spent Fuel Management	46,016
Site Restoration	62,985
Total [3]	765,060

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

SAFSTOR COST SUMMARY
DECOMMISSIONING COST ELEMENTS
(thousands of 2014 dollars)

Cost Element	Cost
Decontamination	13,083
Removal	118,585
Packaging	18,474
Transportation	9,453
Waste Disposal	66,933
Off-site Waste Processing	26,084
Program Management [1]	356,987
Security	188,070
Corporate Allocations	3,217
Spent Fuel Pool Isolation	12,434
Spent Fuel Management - Direct Costs [2]	46,016
Insurance and Regulatory Fees	78,163
Energy	29,260
Characterization and Licensing Surveys	21,630
Property Taxes	22,877
Miscellaneous Equipment	23,234
Total [3]	1,034,501

Cost Element	Cost
License Termination	852,539
Spent Fuel Management	119,221
Site Restoration	62,740
Total [3]	1,034,501

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

1. INTRODUCTION

This report presents estimates of the cost to decommission the Wolf Creek Generating Station (Wolf Creek) for the selected decommissioning scenarios following the scheduled cessation of plant operations. The estimates are designed to provide the Wolf Creek Nuclear Operating Corporation (WCNOC), the plant's operator, and its owners: Kansas Gas and Electric Company, a wholly owned subsidiary of Westar Energy, Inc., Kansas City Power & Light Company, a wholly owned subsidiary of Great Plains Energy Incorporated, and Kansas Electric Power Cooperative, Inc., with sufficient information to assess their financial obligations, as they pertain to the eventual decommissioning of the nuclear station.

The analysis relies upon site-specific, technical information from an earlier evaluation prepared in 2011,[1]* updated to reflect current assumptions pertaining to the disposition of the nuclear station and relevant industry experience in undertaking such projects. The analysis is not a comprehensive engineering evaluation, but estimates prepared in advance of the detailed planning required to execute the decommissioning of the nuclear station. It may also not reflect the actual plan to decommission Wolf Creek; the plan may differ from the assumptions made in this analysis based on facts that exist at the time of decommissioning.

1.1 OBJECTIVES OF STUDY

The objectives of this study were to prepare comprehensive estimates of the costs to decommission Wolf Creek, 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 originally issued for Wolf Creek in June of 1985. A license renewal application was filed for the nuclear station in October 2006. The NRC approved the application and a renewed licensed was issued in November 2008. As such, this analysis is based upon a 60-year operating life, with a final shutdown date (license expiration) in March of 2045. This date was used as input to scheduling the decommissioning activities.

1.2 SITE DESCRIPTION

The Wolf Creek site is located approximately 3.5 miles northeast of the town of Burlington, in Coffey County, Kansas, approximately 75 miles southwest of Kansas City, Kansas. The site is on the east side of a man-made lake formed

* References provided in Section 7 of the document

by impounding Wolf Creek. The station is an 1,170 MWe (nominal) pressurized water reactor with supporting facilities.

Westinghouse Electric Company designed the Nuclear Steam Supply System (NSSS). The system consists of a pressurized water reactor with four independent primary coolant loops, each of which contains a reactor coolant pump and a steam generator. An electrically heated pressurizer and connecting piping complete the system. The NSSS is rated at a thermal power level of 3,579 MWt (3,565 MWt reactor core plus 14 MWt for reactor coolant pumps), with a corresponding turbine-generator gross output of 1,267 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 four turbine elements were replaced in 2010 with very similar equipment.) 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. A large cooling lake provides the heat sink required for removal of waste heat in the power plant's thermal cycle.

1.3 REGULATORY GUIDANCE

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

provided additional guidance to the licensees of nuclear facilities on the financial methods acceptable to the NRC staff for complying with the requirements of the rule. The regulatory guide addressed the funding requirements and provided guidance on the content and form of the financial assurance mechanisms indicated in the rule.

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

The ENTOMB alternative has not been viewed as a viable option for power reactors due to the significant time required to isolate the long-lived radionuclides for decay to permissible levels. However, with rulemaking permitting the controlled release of a site,[4] the NRC has re-evaluated this alternative. The resulting feasibility study, based upon an assessment by Pacific Northwest National Laboratory, concluded that the method did have conditional merit for some, if not most reactors. However, the staff also found that additional rulemaking would be needed before this option could be treated as a generic alternative. The NRC had considered rulemaking to alter the 60-year time for completing decommissioning and to clarify the use of engineered barriers for reactor entombments.[5]

The NRC's staff has recommended that rulemaking be deferred, based upon several factors, e.g., no licensee has committed to pursuing the entombment option, and the NRC's current priorities, at least until after the additional research studies are complete. The NRC concurred with the staff's recommendation.

In 1996, the NRC published revisions to the general requirements for decommissioning nuclear power plants.[6] When the decommissioning regulations were adopted in 1988, it was assumed that the majority of

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

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

1.3.1 High-Level Radioactive Waste Management

Congress passed the "Nuclear Waste Policy Act"[7] (NWPA) in 1982, assigning the federal government's long-standing responsibility for disposal of the spent nuclear fuel created by the commercial nuclear generating plants to the DOE. The DOE was to begin accepting spent fuel by January 31, 1998; however, to date no progress in the removal of spent fuel from commercial generating sites has been made.

Today, the country is at an impasse on high-level waste disposal, even with the License Application for a geologic repository submitted by the DOE to the NRC in 2008. The current administration has eliminated the budget for the repository program while promising to "conduct a comprehensive review of policies for managing the back end of the nuclear fuel cycle ... and make recommendations for a new plan." Towards this goal, the administration appointed a Blue Ribbon Commission on America's Nuclear Future (Blue Ribbon Commission) to make recommendations for a new plan for nuclear waste disposal. The Blue Ribbon Commission's charter includes a requirement that it

consider "[o]ptions for safe storage of used nuclear fuel while final disposition pathways are selected and deployed."[8]

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

- "[T]he United States [should] establish a program that leads to the timely development of one or more consolidated storage facilities"
- "[T]he United States should undertake an integrated nuclear waste management program that leads to the timely development of one or more permanent deep geological facilities for the safe disposal of spent fuel and high-level nuclear waste."[9]

In January 2013, the DOE issued the "Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste," in response to the recommendations made by the Blue Ribbon Commission and as "a framework for moving toward a sustainable program to deploy an integrated system capable of transporting, storing, and disposing of used nuclear fuel..."[10] This document states:

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

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

The NRC's review of DOE's license application to construct a geologic repository at Yucca Mountain was suspended in 2011 when the Administration slashed the budget for completing that work. However,

the US Court of Appeals for the District of Columbia Circuit recently issued a writ of mandamus (in August 2013) ordering NRC to comply with federal law and restart its review of DOE's Yucca Mountain repository license application to the extent of previously appropriated funding for the review.

Completion of the decommissioning process is dependent upon the DOE's ability to remove spent fuel from the site in a timely manner. DOE's repository program assumed that spent fuel allocations would be accepted for disposal from the nation's commercial nuclear plants, with limited exceptions, in the order (the "queue") in which it was discharged from the reactor. The current spent fuel management plan for the Wolf Creek spent fuel is based in general upon: 1) a 2025 start date for DOE initiating transfer of commercial spent fuel to a federal facility, and 2) a 2032 start date for the transfer of spent fuel from the Wolf Creek site based on an oldest fuel first priority, and the DOE achieving an annual rate of transfer (3,000 metric tons of uranium per year) as reflected in DOE's latest Acceptance Priority Ranking and Annual Capacity Report.[11]

The estimates also assume that the DOE would give priority to fuel at shutdown sites, i.e., it is assumed that Congress would "(1)...direct the Department to take spent nuclear fuel from decommissioned commercial nuclear power reactors as soon as possible; (2) to establish an expedited siting process; and (3) to authorize the Department to construct and operate the facility under its regulatory authority, or, if the facility were to be constructed and operated under a U.S. Nuclear Regulatory Commission license, to provide for an expedited siting and licensing process."[12]

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

At shutdown, the spent fuel pool is expected to contain freshly discharged assemblies (from the most recent refueling cycles) as well as

the final reactor core. Over the following five and one-half years the assemblies are packaged into multipurpose canisters for transfer to the DOE. It is assumed that this period provides the necessary cooling for the final core to meet the transportation system requirements for decay heat.

Interim storage of the fuel, until the DOE has completed the transfer, will be in the wet storage pool located in the fuel building (as well as on the ISFSI). The pool will be isolated, allowing WCNOC to proceed with decommissioning (or safe-storage preparations) in the shortest time possible.

1.3.2 Low-Level Radioactive Waste Management

The contaminated and activated material generated in the decontamination and dismantling of a commercial nuclear reactor is classified as low-level (radioactive) waste, although not all of the material is suitable for "shallow-land" disposal. With the passage of the "Low-Level Radioactive Waste Policy Act" in 1980,[14] and its Amendments of 1985,[15] the states became ultimately responsible for the disposition of low-level radioactive waste generated within their own borders. With the exception of Texas (which has issued a license to Waste Control Specialists for the construction of a new facility in Andrews, Texas), no new compact facilities have been successfully sited, licensed, and constructed.

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

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

The WCS facility is able to receive the Class B and C waste. As such, for this analysis, Class B and C waste was assumed to be shipped to the WCS facility for disposal. Disposal costs were based upon preliminary and indicative information for the WCS site.

The dismantling of the components residing closest to the reactor core generates radioactive waste that may be considered unsuitable for shallow-land disposal (i.e., low-level radioactive waste with concentrations of radionuclides that exceed the limits established by the NRC for Class C radioactive waste (GTCC)). The Low-Level Radioactive Waste Policy Amendments Act of 1985 assigned the federal government the responsibility for the disposal of this material. The Act also stated that the beneficiaries of the activities resulting in the generation of such radioactive waste bear all reasonable costs of disposing of such waste. However, to date, the federal government has not identified a cost for disposing of GTCC or a schedule for acceptance.

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

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

1.3.3 Radiological Criteria for License Termination

In 1997, the NRC published Subpart E, "Radiological Criteria for License Termination,"[17] 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 Wolf Creek 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).[18] An additional and separate limit of 4 millirem per year, as defined in 40 CFR §141.16, is applied to drinking water.[19]

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)[20] 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 Wolf Creek 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 Wolf Creek 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.

2.1.1 Period 1 - Preparations

In anticipation of the cessation of plant operations, detailed preparations are undertaken to provide a smooth transition from plant

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

Engineering and Planning

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

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

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

In this instance, the licensee would have to submit a license amendment for the specific activity and update the environmental report.

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

Site Preparations

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

- Characterization of the site and surrounding environs. This includes radiation surveys of work areas, major components (including the reactor vessel and its internals), internal piping, and primary shield cores.
- Isolation of the spent fuel storage pool and fuel handling systems, such that decommissioning operations can commence on the balance of the plant. The pool will remain operational for approximately five and one-half years following the cessation of operations before the inventory resident at shutdown can be transferred to the 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 fuel building and any other contaminated facility. Radiation and contamination controls will be utilized until residual levels indicate that the structures and equipment can be released for unrestricted access and conventional demolition. This activity may necessitate the dismantling and disposition of most of the systems and components (both clean and contaminated) located within these buildings. This activity facilitates surface decontamination and subsequent verification surveys required prior to obtaining release for demolition.
- Routing of material removed in the decontamination and dismantling to a central processing area. Material certified to be free of contamination is released for unrestricted disposition, e.g., as scrap, recycle, or general disposal. Contaminated material is characterized and segregated for additional off-site processing (disassembly, chemical cleaning, volume reduction, and waste treatment), and/or packaged for controlled disposal at a low-level radioactive waste disposal facility.

Incorporated into the LTP is the Final Survey Plan. This plan identifies the radiological surveys to be performed once the decontamination activities are completed and is developed using the guidance provided in the "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)."[21] 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, fuel handling, radioactive waste, solidification facility and condensate polishing buildings. Under certain circumstances, verifying that subsurface radionuclide concentrations meet NRC site release requirements will require removal of grade slabs and lower floors, potentially weakening footings and structural supports. This removal activity will be necessary for those facilities and plant areas where historical records, when available, indicate the potential for radionuclides having been present in the soil, where system failures have been recorded, or where it is required to confirm that subsurface process and drain lines were not breached over the operating life of the station.

Immediate dismantling of site structures is clearly the most appropriate and cost-effective option. It is unreasonable to anticipate that these structures would be repaired and preserved after the radiological contamination is removed. The cost to dismantle site structures with a work force already mobilized on site is more efficient than if the process were deferred. Site facilities quickly degrade without maintenance, adding additional expense and creating potential hazards to the public as well as to future workers. Abandonment creates a breeding ground for vermin infestation as well as other biological hazards.

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

Non-contaminated concrete rubble produced by demolition activities is processed to remove reinforcing steel and miscellaneous embedments. The processed material is then used on site to backfill foundation voids.

Excess non-contaminated materials are trucked to an off-site area for disposal as construction debris.

2.2 SAFSTOR

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

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

2.2.1 Period 1 - Preparations

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

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

- Isolation of the spent fuel storage services and fuel handling systems so that safe-storage operations may commence on the balance of the plant. This activity may be carried out by plant personnel in accordance with existing operating technical specifications. Activities are scheduled around the fuel handling systems to the greatest extent possible.
- Transfer of the spent fuel from the storage pool to the DOE 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 five and one-half years of the cessation of operations. The pool is secured for storage and decommissioned along with the power block structures in Period 4.

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

2.2.3 Periods 3 and 4 - Delayed Decommissioning

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

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

Variations in the length of the dormancy period are expected to have little effect upon the quantities of radioactive wastes generated from system and structure removal operations. Given the levels of

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

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

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

2.2.4 Period 5 - Site Restoration

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

3. COST ESTIMATE

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

3.1 BASIS OF ESTIMATE

The estimates were developed using the site-specific, technical information from the 2011 analysis. This information was reviewed for the current analysis and updated as deemed appropriate. The site-specific considerations and assumptions used in the previous evaluation were also revisited. Modifications were incorporated where new information was available or experience from previously completed decommissioning programs provided viable alternatives or improved processes.

3.2 METHODOLOGY

The methodology used to develop the estimates follows the basic approach originally presented in the AIF/NESP-036 study report, "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates,"[22] and the DOE "Decommissioning Handbook."[23] 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.[24]

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

This analysis reflects lessons learned from TLG's involvement in the Shippingport Station Decommissioning Project, completed in 1989, as well as the decommissioning of the Cintichem reactor, hot cells, and associated facilities, completed in 1997. In addition, the planning and engineering for the Pathfinder, Shoreham, Rancho Seco, Trojan, Yankee Rowe, Big Rock Point, Maine Yankee, Humboldt Bay-3, Oyster Creek, Connecticut Yankee, and San Onofre-1 nuclear units have provided additional insight into the process, the regulatory aspects, and the technical challenges of decommissioning commercial nuclear units.

Work Difficulty Factors

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

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

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

Scheduling Program Durations

The unit factors, adjusted by the WDFs as described above, are applied against the inventory of materials to be removed in the radiological controlled areas. The resulting man-hours, or crew-hours, are used in the development of the decommissioning program schedule, using resource loading and event sequencing considerations. The scheduling of conventional removal and dismantling activities is based upon productivity information available from the "Building Construction Cost Data" publication.

An activity duration critical path is used to determine the total decommissioning program schedule. The schedule is relied upon in calculating the carrying costs, which include program management, administration, field

engineering, equipment rental, and support services such as quality control and security. This systematic approach for assembling decommissioning estimates ensures a high degree of confidence in the reliability of the resulting costs.

3.3 FINANCIAL COMPONENTS OF THE COST MODEL

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

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

3.3.1 Contingency

The activity- and period-dependent costs are combined to develop the total decommissioning cost. A contingency is then applied on a line-item basis, using one or more of the contingency types listed in the AIF/NESP-036 study. "Contingencies" are defined in the American Association of Cost Engineers "Project and Cost Engineers' Handbook"[25] as "specific provision for unforeseeable elements of cost within the defined project scope; particularly important where previous experience relating estimates and actual costs has shown that unforeseeable events which will increase costs are likely to occur." The cost elements in this analysis are based upon ideal conditions and maximum efficiency; therefore, consistent with industry practice, contingency is included. In the AIF/NESP-036 study, the types of unforeseeable events that are likely to occur in decommissioning are discussed and guidelines are provided for percentage contingency in each category. It should be noted that contingency, as used in this analysis, does not account for price escalation and inflation in the cost of decommissioning over the remaining operating life of the station.

Contingency funds are an integral part of the total cost to complete the decommissioning process. Exclusion of this component puts at risk a

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

• Decontamination	50%
• Contaminated Component Removal	25%
• Contaminated Component Packaging	10%
• Contaminated Component Transport	15%
• Low-Level Radioactive Waste Disposal	25%
• 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 18.96%.

3.3.2 Financial Risk

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

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

This cost study 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 Wolf Creek. 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, until recently, the disposal cost was being financed by a 1 mill/kWhr surcharge on nuclear generated energy delivered to customers, the fee being paid into the DOE's waste fund during operations. The D.C. Circuit ruling on November 19, 2013, ordered the DOE to submit a proposal to Congress to suspend the Nuclear Waste Fund fee "until such time as either the Secretary chooses to comply with the Act as it is currently written, or until Congress enacts an alternative waste management plan". The fee was reduced to 0.0 mill/kWh as of May 16, 2014. The fee is expected to be reinstated in the future.

Nonetheless, the NRC does 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, WCNOC has assumed that all spent fuel will be removed to a DOE facility within five and one-half 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 (as well as on the ISFSI). The spent fuel storage pool and fuel handling systems will be isolated (i.e., a spent fuel island created). This will allow WCNOC to proceed with decommissioning (or safe-storage) operations in the shortest time possible. A delay in the start of fuel pickup, or a decrease in the spent fuel acceptance rate, will correspondingly prolong

the transfer process and result in the fuel remaining at the Wolf Creek site longer.

It is assumed that the five and one-half 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 to transfer the spent fuel to the DOE.

Supplemental Storage

It is likely that supplemental spent fuel storage will be required to support continued plant operations (i.e., maintain full core off-load capability). This analysis assumes that an Independent Spent Fuel Storage Installation (ISFSI) is constructed during operations and that 592 spent fuel assemblies (16 equivalent dry storage system modules) are transferred to the ISFSI during plant operations. The fuel will remain in storage until it is off-loaded into a DOE-provided transport cask. The transfer is assumed to occur once the spent fuel pool has been emptied. The estimates include the cost for the transfer only.

Canister Loading and Transfer

The estimates include the cost to load the spent fuel in the wet storage pool into a DOE-provided multi-purpose canister (e.g., Transport, Aging and Disposal or TAD canister), seal the canisters and place the canister into the DOE transport vehicle. The estimates also include the cost to transfer each canister stored at the ISFSI into the DOE transport vehicle.

Operations and Maintenance

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

GTCC

The dismantling of the reactor internals is expected to generate radioactive waste considered unsuitable for shallow land disposal (i.e., low-level radioactive waste with concentrations of radionuclides that

exceed the limits established by the NRC for Class C radioactive waste (GTCC)). The Low-Level Radioactive Waste Policy Amendments Act of 1985 assigned the federal government the responsibility for the disposal of this material. The Act also stated that the beneficiaries of the activities resulting in the generation of such radioactive waste bear all reasonable costs of disposing of such waste. Although the DOE is responsible for disposing of GTCC waste, any costs for that service have not been determined.

For purposes of this study, GTCC is packaged in the same canisters used to transport spent fuel. 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 reactor pressure vessel and internal components are segmented for disposal in shielded, reusable transportation casks. Segmentation is performed in the refueling canal, where a turntable and remote cutter are installed. The vessel is segmented in place, using a mast-mounted cutter supported off the lower head and directed from a shielded work platform installed overhead in the reactor cavity. Transportation cask specifications and transportation regulations dictate the segmentation and packaging methodology.

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

- the reactor package could be secured to the transport vehicle for the entire journey, i.e., the package was not lifted during transport,
- there were no man-made or natural terrain features between the plant site and the disposal location that could produce a large drop, and

- transport speeds were very low, limited by the overland transport vehicle and the river barge.

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

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

3.4.3 Primary System Components

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

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

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

The generators are rigged for removal, disconnected from the surrounding piping and supports, and maneuvered into the open area

where they are lowered onto a dolly. Each generator is rotated into the horizontal position for extraction from the containment and placed onto a multi-wheeled vehicle for transport to an on-site processing and storage area.

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

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

3.4.4 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.[26] The contaminated material will be packaged in Industrial Packages (IP-1, IP-2, or IP-3, as defined in subpart 173.411) for transport unless demonstrated to qualify as their own shipping containers. The reactor vessel and internal components are expected to be transported in accordance with Part 71, as Type B. It is conceivable that the reactor, due to its limited specific activity, could qualify as LSA II or III. However, the high radiation levels on the outer surface would

require that additional shielding be incorporated within the packaging so as to attenuate the dose to levels acceptable for transport.

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

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

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

Transportation costs for Class A radioactive material requiring controlled disposal are based upon the mileage to the EnergySolutions facility in Clive, Utah. Transportation costs for the higher activity Class B and C radioactive material are based upon the mileage to the WCS facility in Andrews County, Texas. The transportation cost for the GTCC material is assumed to be contained within the disposal cost. Transportation costs for off-site waste processing are based upon the mileage to Oak Ridge, Tennessee. Truck transport costs are estimated using published tariffs from Tri-State Motor Transit.[27]

3.4.6 Low-Level Radioactive Waste Disposal

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

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

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

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

3.4.7 Site Conditions Following Decommissioning

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

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

The existing electrical switchyard and access roads will remain in support of the electrical transmission and distribution system. Other structures that will remain are the main dam, cooling lake, makeup water discharge structure (west side of lake), makeup water screen house (located below the John Redmond Dam) and associated underground piping, the Eisenhower Learning Center, and a railroad spur running about 11.5 miles from the plant southeast to near Aliceville, Kansas, where it connects to a Union Pacific Railroad line.

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

3.5 ASSUMPTIONS

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

3.5.1 Estimating Basis

Decommissioning costs are reported in the year of projected expenditure; however, the values are provided in 2014 dollars. Costs are not inflated, escalated, or discounted over the periods of performance.

The estimates rely upon the physical plant inventory that was the basis for the 2011 analysis.

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

3.5.2 Labor Costs

WCNOC, as the operator, will continue to provide site operations support, including decommissioning program management, licensing, radiological protection, and site security. A Decommissioning Operations

Contractor (DOC) will provide the supervisory staff needed to oversee the labor subcontractors, consultants, and specialty contractors needed to perform the work required for the decontamination and dismantling effort. The DOC will also provide the engineering services needed to develop activity specifications, detailed procedures, detailed activation analyses, and support field activities such as structural modifications.

Personnel costs are based upon average salary information provided by WCNOC. Overhead costs are included for site and corporate support, reduced commensurate with the staffing of the project.

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

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

3.5.3 Design Conditions

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

The curie contents of the vessel and internals at final shutdown are derived from those listed in NUREG/CR-3474.[28] Actual estimates are derived from the curie/gram values contained therein and adjusted for the different mass of the Wolf Creek components, projected operating life, and different periods of decay. Additional short-lived isotopes were derived from CR-0130[29] and CR-0672,[30] and benchmarked to the long-lived values from CR-3474.

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

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

3.5.4 General

Transition Activities

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

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

Scrap and Salvage

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

It is assumed, for purposes of this analysis, that any value received from the sale of scrap generated in the dismantling process would be more than offset by the on-site processing costs. The dismantling techniques assumed in the decommissioning estimates do not include the additional cost for size reduction and preparation to meet "furnace ready" conditions. For example, the recovery of copper from electrical cabling may require the removal and disposition of any contaminated insulation, an added expense. With a volatile market, the potential profit margin in

scrap recovery is highly speculative, regardless of the ability to free release this material. This assumption is an implicit recognition of scrap value in the disposal of clean metallic waste at no additional cost to the project.

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

Energy

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

Insurance

Costs for continuing coverage (nuclear liability and property insurance) following cessation of plant operations and during decommissioning are included and based upon current operating premiums. Reductions in premiums, throughout the decommissioning process, are based upon the guidance provided in SECY-00-0145, "Integrated Rulemaking Plan for Nuclear Power Plant Decommissioning"[31] The NRC's financial protection requirements are based on various reactor (and spent fuel) configurations.

Taxes

Property tax payments are included for the land and those facilities that will continue to be used to support the decommissioning project. When the facilities are no longer needed, the taxes are reduced accordingly.

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 in Tables 3.1 and 3.2. The tables delineate the cost contributors by year of expenditures as well as cost contributor (e.g., labor, materials, and waste disposal).

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

The "Spent Fuel Management" subcategory contains costs associated with the five and one-half years of post-shutdown pool operations, and the management of the spent fuel until such time that the transfer of all fuel from this facility to an off-site location is complete. These costs are identified in Tables 3.1b and 3.2b.

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

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

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

The estimates were developed and costs are presented in 2014 dollars. As such, the estimates do not reflect the escalation of costs (due to inflationary and market forces) over the remaining operating life of the reactor or during the decommissioning period. The schedules are based upon the detailed activity costs reported in Appendices C and D, along with the timeline presented in Section 4.

TABLE 3.1
DECON ALTERNATIVE
TOTAL ANNUAL EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2045	53,028	2,343	1,950	32	7,042	64,396
2046	73,415	20,182	3,580	16,739	24,695	138,612
2047	72,126	29,817	2,285	40,310	20,523	165,060
2048	65,594	19,275	1,979	20,158	12,577	119,582
2049	61,762	13,455	1,804	9,103	8,199	94,323
2050	53,339	11,258	1,543	8,674	7,169	81,983
2051	31,298	3,441	656	2,832	2,568	40,794
2052	21,438	13,675	274	4	1,595	36,986
2053	12,504	9,649	150	0	1,023	23,326
Total	444,503	123,095	14,220	97,853	85,389	765,060

Note: Columns may not add due to rounding

TABLE 3.1a
DECON ALTERNATIVE
LICENSE TERMINATION EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2045	52,289	1,550	1,950	32	5,116	60,938
2046	70,590	15,771	3,580	16,739	22,464	129,144
2047	68,949	24,547	2,285	40,310	18,614	154,705
2048	62,311	13,349	1,979	20,158	10,780	108,577
2049	58,435	7,198	1,804	9,103	6,471	83,011
2050	51,042	6,939	1,543	8,674	5,976	74,174
2051	31,298	3,441	656	2,832	2,568	40,794
2052	4,149	242	66	4	171	4,632
2053	84	0	0	0	0	84
Total	399,147	73,037	13,862	97,853	72,161	656,060

Note: Columns may not add due to rounding

TABLE 3.1b
DECON ALTERNATIVE
SPENT FUEL MANAGEMENT EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2045	264	793	0	0	1,925	2,983
2046	1,460	4,381	0	0	2,176	8,017
2047	1,724	5,172	0	0	1,727	8,623
2048	1,949	5,846	0	0	1,732	9,526
2049	2,063	6,188	0	0	1,727	9,978
2050	1,424	4,272	0	0	1,193	6,889
2051	0	0	0	0	0	0
2052	0	0	0	0	0	0
2053	0	0	0	0	0	0
Total	8,884	26,651	0	0	10,481	46,016

Note: Columns may not add due to rounding

TABLE 3.1c
DECON ALTERNATIVE
SITE RESTORATION EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2045	474	0	0	0	0	474
2046	1,365	30	0	0	55	1,451
2047	1,453	98	0	0	181	1,732
2048	1,335	80	0	0	64	1,478
2049	1,264	69	0	0	0	1,334
2050	873	48	0	0	0	921
2051	0	0	0	0	0	0
2052	17,288	13,432	208	0	1,424	32,353
2053	12,419	9,649	150	0	1,023	23,241
Total	36,473	23,407	358	0	2,748	62,985

Note: Columns may not add due to rounding

TABLE 3.2
SAFSTOR ALTERNATIVE
TOTAL ANNUAL EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2045	44,926	1,929	1,950	32	7,042	55,880
2046	45,802	10,322	1,814	1,348	20,203	79,490
2047	22,940	6,229	481	15	5,083	34,747
2048	23,002	6,246	482	15	5,097	34,842
2049	22,940	6,229	481	15	5,083	34,747
2050	16,845	4,399	407	12	3,955	25,619
2051	3,253	320	240	7	1,442	5,261
2052	3,262	320	241	7	1,446	5,276
2053	3,253	320	240	7	1,442	5,261
2054	3,253	320	240	7	1,442	5,261
2055	3,253	320	240	7	1,442	5,261
2056	3,262	320	241	7	1,446	5,276
2057	3,253	320	240	7	1,442	5,261
2058	3,253	320	240	7	1,442	5,261
2059	3,253	320	240	7	1,442	5,261
2060	3,262	320	241	7	1,446	5,276
2061	3,253	320	240	7	1,442	5,261
2062	3,253	320	240	7	1,442	5,261
2063	3,253	320	240	7	1,442	5,261
2064	3,262	320	241	7	1,446	5,276
2065	3,253	320	240	7	1,442	5,261
2066	3,253	320	240	7	1,442	5,261
2067	3,253	320	240	7	1,442	5,261
2068	3,262	320	241	7	1,446	5,276
2069	3,253	320	240	7	1,442	5,261
2070	3,253	320	240	7	1,442	5,261
2071	3,253	320	240	7	1,442	5,261
2072	3,262	320	241	7	1,446	5,276
2073	3,253	320	240	7	1,442	5,261
2074	3,253	320	240	7	1,442	5,261
2075	3,253	320	240	7	1,442	5,261
2076	3,262	320	241	7	1,446	5,276
2077	3,253	320	240	7	1,442	5,261

TABLE 3.2 (continued)
SAFSTOR ALTERNATIVE
TOTAL ANNUAL EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2078	3,253	320	240	7	1,442	5,261
2079	3,253	320	240	7	1,442	5,261
2080	3,262	320	241	7	1,446	5,276
2081	3,253	320	240	7	1,442	5,261
2082	3,253	320	240	7	1,442	5,261
2083	3,253	320	240	7	1,442	5,261
2084	3,262	320	241	7	1,446	5,276
2085	3,253	320	240	7	1,442	5,261
2086	3,253	320	240	7	1,442	5,261
2087	3,253	320	240	7	1,442	5,261
2088	3,262	320	241	7	1,446	5,276
2089	3,253	320	240	7	1,442	5,261
2090	3,253	320	240	7	1,442	5,261
2091	3,253	320	240	7	1,442	5,261
2092	3,262	320	241	7	1,446	5,276
2093	3,253	320	240	7	1,442	5,261
2094	3,253	320	240	7	1,442	5,261
2095	3,253	320	240	7	1,442	5,261
2096	3,262	320	241	7	1,446	5,276
2097	3,253	320	240	7	1,442	5,261
2098	3,253	320	240	7	1,442	5,261
2099	46,550	4,019	2,399	36	1,911	54,915
2100	46,415	15,315	2,345	19,371	10,352	93,798
2101	51,415	23,967	2,252	37,140	17,930	132,704
2102	41,756	6,768	1,804	8,569	4,685	63,581
2103	41,756	6,768	1,804	8,569	4,685	63,581
2104	34,711	3,882	1,040	3,633	2,554	45,820
2105	21,892	12,877	287	6	1,520	36,582
2106	13,659	10,540	163	0	1,118	25,481
Total	630,864	134,836	29,260	79,082	160,459	1,034,501

TABLE 3.2a
SAFSTOR ALTERNATIVE
LICENSE TERMINATION EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2045	44,662	1,136	1,950	32	5,116	52,897
2046	38,830	5,759	1,741	1,348	17,937	65,614
2047	3,253	463	240	15	3,059	7,030
2048	3,262	464	241	15	3,067	7,049
2049	3,253	463	240	15	3,059	7,030
2050	3,253	418	240	12	2,558	6,482
2051	3,253	320	240	7	1,442	5,261
2052	3,262	320	241	7	1,446	5,276
2053	3,253	320	240	7	1,442	5,261
2054	3,253	320	240	7	1,442	5,261
2055	3,253	320	240	7	1,442	5,261
2056	3,262	320	241	7	1,446	5,276
2057	3,253	320	240	7	1,442	5,261
2058	3,253	320	240	7	1,442	5,261
2059	3,253	320	240	7	1,442	5,261
2060	3,262	320	241	7	1,446	5,276
2061	3,253	320	240	7	1,442	5,261
2062	3,253	320	240	7	1,442	5,261
2063	3,253	320	240	7	1,442	5,261
2064	3,262	320	241	7	1,446	5,276
2065	3,253	320	240	7	1,442	5,261
2066	3,253	320	240	7	1,442	5,261
2067	3,253	320	240	7	1,442	5,261
2068	3,262	320	241	7	1,446	5,276
2069	3,253	320	240	7	1,442	5,261
2070	3,253	320	240	7	1,442	5,261
2071	3,253	320	240	7	1,442	5,261
2072	3,262	320	241	7	1,446	5,276
2073	3,253	320	240	7	1,442	5,261
2074	3,253	320	240	7	1,442	5,261
2075	3,253	320	240	7	1,442	5,261
2076	3,262	320	241	7	1,446	5,276
2077	3,253	320	240	7	1,442	5,261

TABLE 3.2a (continued)
SAFSTOR ALTERNATIVE
LICENSE TERMINATION EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2078	3,253	320	240	7	1,442	5,261
2079	3,253	320	240	7	1,442	5,261
2080	3,262	320	241	7	1,446	5,276
2081	3,253	320	240	7	1,442	5,261
2082	3,253	320	240	7	1,442	5,261
2083	3,253	320	240	7	1,442	5,261
2084	3,262	320	241	7	1,446	5,276
2085	3,253	320	240	7	1,442	5,261
2086	3,253	320	240	7	1,442	5,261
2087	3,253	320	240	7	1,442	5,261
2088	3,262	320	241	7	1,446	5,276
2089	3,253	320	240	7	1,442	5,261
2090	3,253	320	240	7	1,442	5,261
2091	3,253	320	240	7	1,442	5,261
2092	3,262	320	241	7	1,446	5,276
2093	3,253	320	240	7	1,442	5,261
2094	3,253	320	240	7	1,442	5,261
2095	3,253	320	240	7	1,442	5,261
2096	3,262	320	241	7	1,446	5,276
2097	3,253	320	240	7	1,442	5,261
2098	3,253	320	240	7	1,442	5,261
2099	45,535	4,019	2,399	36	1,911	53,900
2100	45,169	15,260	2,345	19,371	10,341	92,486
2101	49,755	23,858	2,252	37,140	17,909	130,915
2102	40,568	6,703	1,804	8,569	4,685	62,328
2103	40,568	6,703	1,804	8,569	4,685	62,328
2104	34,210	3,855	1,040	3,633	2,554	45,292
2105	5,754	339	92	6	191	6,381
2106	92	0	0	0	0	92
Total	514,419	84,786	27,940	79,082	146,312	852,539

TABLE 3.2b
SAFSTOR ALTERNATIVE
SPENT FUEL MANAGEMENT EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2045	264	793	0	0	1,925	2,983
2046	6,972	4,563	74	0	2,267	13,875
2047	19,686	5,766	240	0	2,024	27,717
2048	19,740	5,782	241	0	2,030	27,793
2049	19,686	5,766	240	0	2,024	27,717
2050	13,592	3,981	166	0	1,397	19,136
2051-2106	0	0	0	0	0	0
Total	79,942	26,651	962	0	11,667	119,221

TABLE 3.2c
SAFSTOR ALTERNATIVE
SITE RESTORATION EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2045-98	0	0	0	0	0	0
2099	1,015	0	0	0	0	1,015
2100	1,245	55	0	0	11	1,312
2101	1,659	108	0	0	21	1,789
2102	1,188	65	0	0	0	1,253
2103	1,188	65	0	0	0	1,253
2104	501	27	0	0	0	529
2105	16,138	12,538	194	0	1,330	30,200
2106	13,567	10,540	163	0	1,118	25,389
Total	36,503	23,400	358	0	2,480	62,740

4. SCHEDULE ESTIMATE

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

A schedule or sequence of activities for the DECON alternative is presented in Figure 4.1. The scheduling sequence assumes that fuel is removed from the spent fuel pool within five and one-half years. The key activities listed in the schedule do not reflect a one-to-one correspondence with those activities in the cost tables, but reflect dividing some activities for clarity and combining others for convenience. The schedule was prepared using the "Microsoft Project Professional 2010" computer software.[32]

4.1 SCHEDULE ESTIMATE ASSUMPTIONS

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

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

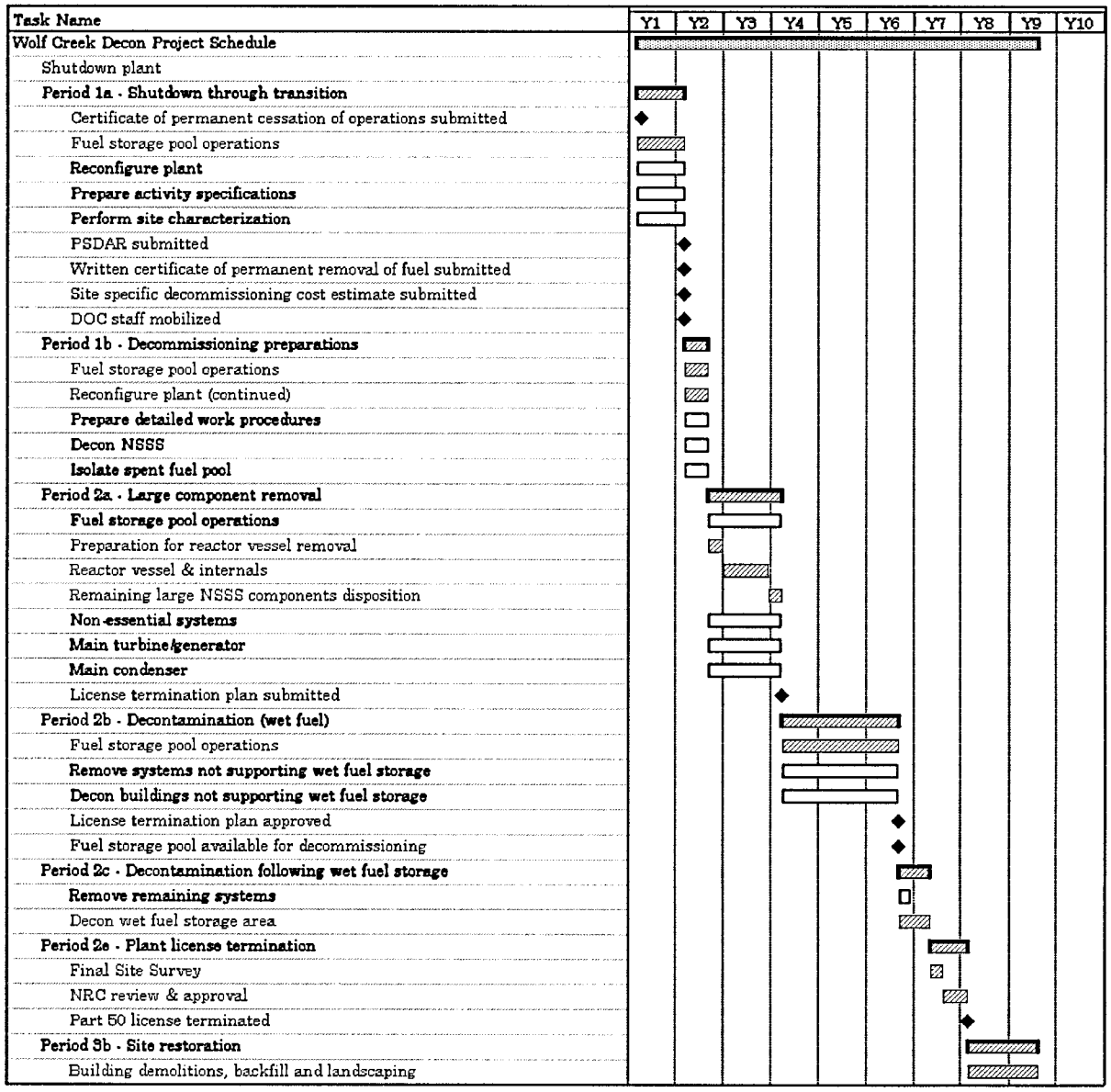
- For plant systems removal, the systems with the longest removal durations in areas on the critical path are considered to determine the duration of the activity.

4.2 PROJECT SCHEDULE

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

Project timelines are provided in Figures 4.2 and 4.3 with milestone dates based on a 2045 shutdown date. The fuel pool is emptied approximately five and one-half years after shutdown. Deferred decommissioning in the SAFSTOR scenarios is assumed to commence so that the operating license is terminated within a 60-year period from the cessation of plant operations.

FIGURE 4.1
ACTIVITY SCHEDULE



Red text indicates critical path activities
Blue text indicates milestones

FIGURE 4.2
DECOMMISSIONING TIMELINE
DECON ALTERNATIVE
(not to scale)

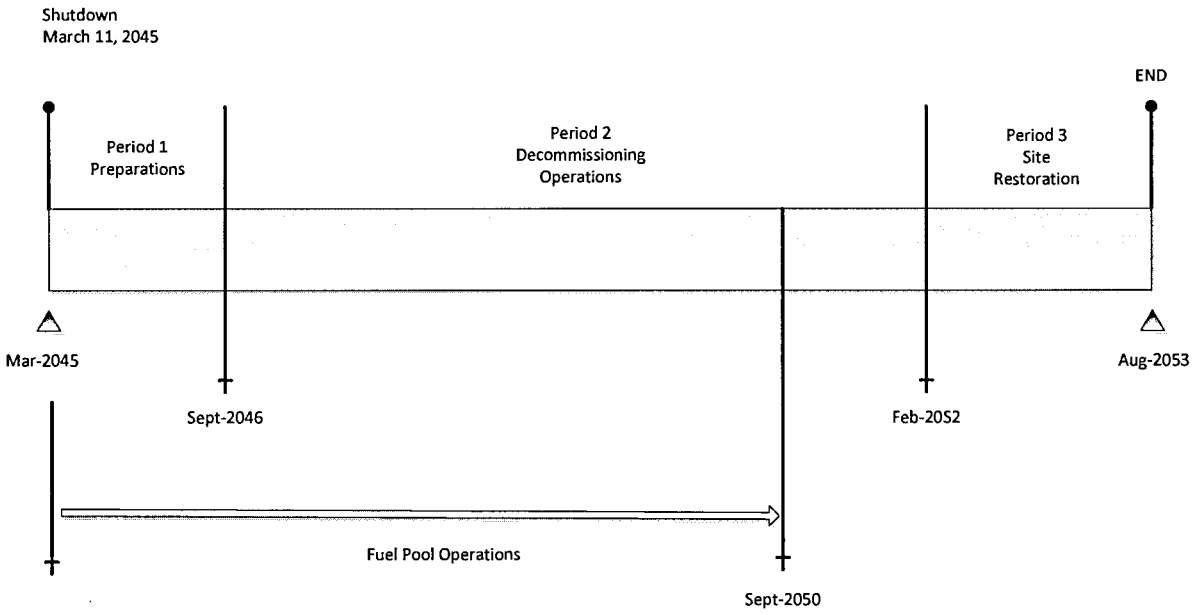
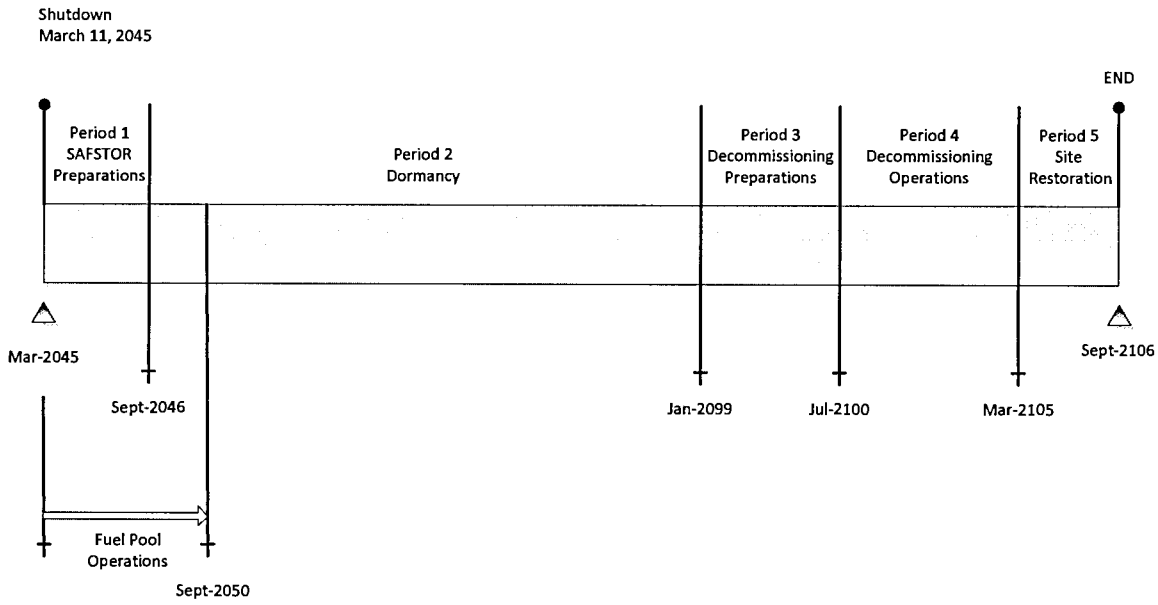


FIGURE 4.3
DECOMMISSIONING TIMELINE
SAFSTOR ALTERNATIVE
(not to scale)



5. RADIOACTIVE WASTES

The objectives of the decommissioning process are the removal of all radioactive material from the site that would restrict its future use and the termination of the NRC license. This currently requires the remediation of all radioactive material at the site in excess of applicable legal limits. Under the Atomic Energy Act,[33] the NRC is responsible for protecting the public from sources of ionizing radiation. Title 10 of the Code of Federal Regulations delineates the production, utilization, and disposal of radioactive materials and processes. In particular, Part 71 defines radioactive material as it pertains to transportation and Part 61 specifies its disposition.

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

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

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

No process system containing/handling radioactive substances at shutdown is presumed to meet material release criteria by decay alone (i.e., systems radioactive at shutdown will still be radioactive over the time period during which the decommissioning is accomplished, due to the presence of long-lived radionuclides).

While the dose rates decrease with time, radionuclides such as ^{137}Cs will still control the disposition requirements.

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

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

Since Energy*Solutions* is not currently able to receive the more highly radioactive components generated in the decontamination and dismantling of the reactor, disposal costs for the Class B and C material were based preliminary and indicative rates for WCS's Andrews County disposal facility.

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

FIGURE 5.1
RADIOACTIVE WASTE DISPOSITION

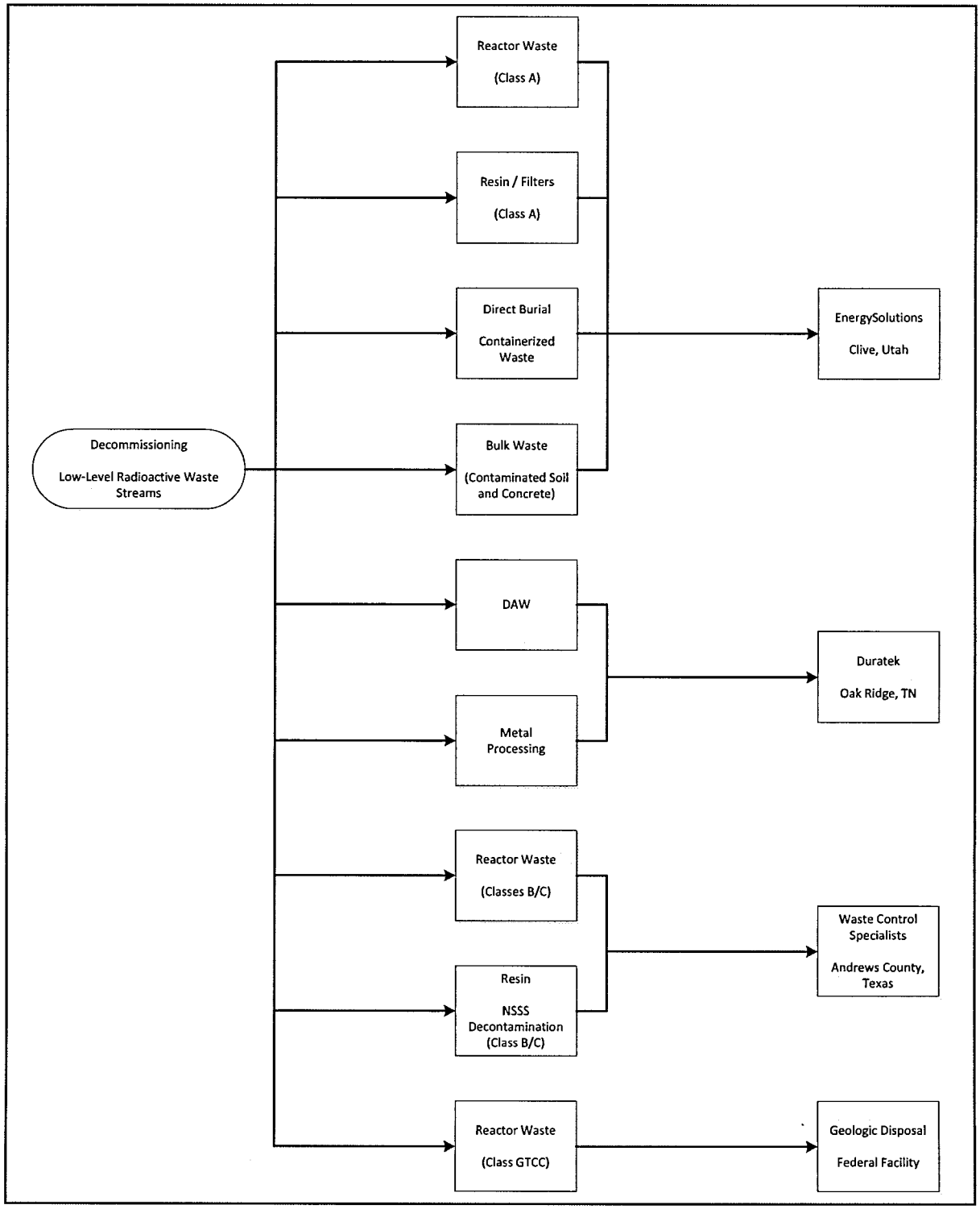


FIGURE 5.2
DECOMMISSIONING WASTE DESTINATIONS
RADIOLOGICAL

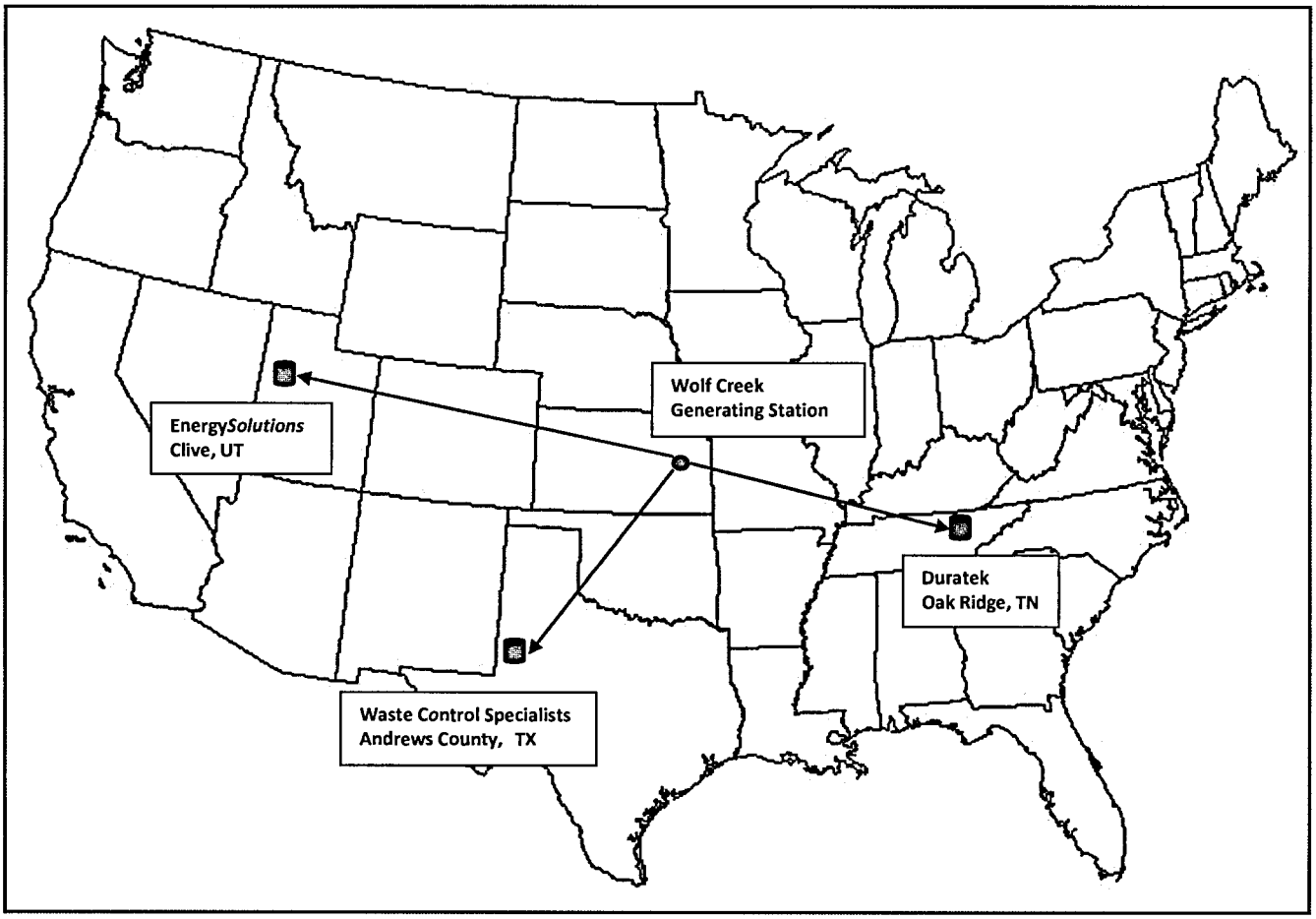


TABLE 5.1
DECON ALTERNATIVE
DECOMMISSIONING WASTE SUMMARY

Waste	Cost Basis	Class [1]	Waste Volume (cubic feet)	Mass (pounds)
Low-Level Radioactive Waste (near-surface disposal)	Energy*Solutions*	A	129,335	9,925,727
	WCS	B	1,750	191,469
	WCS	C	393	47,411
Greater than Class C (geologic repository)	Spent Fuel Equivalent	GTCC	2,217	433,180
Processed/Conditioned (off-site recycling center)	Recycling Vendors	A	254,605	9,935,532
Totals [2]			388,299	20,533,320

[1] Waste is classified according to the requirements as delineated in Title 10 CFR, Part 61.55

[2] Columns may not add due to rounding.

TABLE 5.2
SAFSTOR ALTERNATIVE
DECOMMISSIONING WASTE SUMMARY

Waste	Cost Basis	Class [1]	Waste Volume (cubic feet)	Mass (pounds)
Low-Level Radioactive Waste (near-surface disposal)	Energy*Solutions*	A	100,034	7,432,405
	WCS	B	501	50,254
	WCS	C	393	47,411
Greater than Class C (geologic repository)	Spent Fuel Equivalent	GTCC	2,217	433,180
Processed/Conditioned (off-site recycling center)	Recycling Vendors	A	281,907	11,099,010
Totals [2]			385,051	19,062,260

[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 Wolf Creek relied upon the site-specific, technical information developed for a previous analysis prepared in 2011. While not an engineering study, the estimates provide the operator and the plant owners with sufficient information to assess their financial obligations, as they pertain to the eventual decommissioning of the nuclear station.

The estimates are based on numerous fundamental assumptions that consider current regulations, low-level radioactive waste disposal options, spent fuel management requirements, site restoration practices, and project contingencies. The estimates incorporate a minimum cooling period of approximately five and one-half years for the spent fuel that resides in the plant's wet storage pool when operations cease. During this period, it is assumed that the DOE will complete the transfer of the spent fuel from the site to a federal facility.

The cost projected to promptly decommission (DECON) Wolf Creek is estimated to be $765.1 million. The majority of this cost (approximately 85.8%) is associated with the physical decontamination and dismantling of the nuclear station so that the operating license can be terminated. Another 6.0% is associated with the management, interim storage, and eventual transfer of the spent fuel. The remaining 8.2% 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 $1,034.5 million. The majority of this cost (approximately 82.4%) is associated with placing the station in storage, ongoing caretaking of the station during dormancy, and the eventual physical decontamination and dismantling of the nuclear station so that the operating license can be terminated. Another 11.5% is associated with the management, interim storage, and eventual transfer of the spent fuel. The remaining 6.1% is for the demolition of the designated structures and limited restoration of the site.

The primary cost contributors, identified in Tables 6.1 and 6.2, are either labor-related or associated with the management and disposition of the radioactive waste. Program management is the largest single contributor to the overall cost. The magnitude of the expense is a function of both the size of the organization required to manage the decommissioning, as well as the duration of the program. It is assumed, for purposes of this analysis, that WCNOC will oversee the decommissioning program, using a DOC to manage the decommissioning labor force and the associated subcontractors. The size and composition of the management organization varies with the decommissioning phase and associated site activities.

However, once the operating license is terminated, the staff is substantially reduced for the conventional demolition and restoration of the site (for the DECON alternative).

As described in this report, the spent fuel pool will remain operational for a minimum of five and one-half years following the cessation of operations. The pool will be isolated and an independent spent fuel island created. This will allow decommissioning operations to proceed in and around the pool area. Over the five and one-half year period, the spent fuel will be packaged into transportable canisters 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 requiring controlled disposal is at licensed facility (e.g., Energy*Solutions*' or equivalent). Highly activated components, requiring additional isolation from the environment (GTCC), are packaged for geologic disposal. The cost of geologic disposal is based upon a cost equivalent for spent fuel.

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

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

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

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

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

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

TABLE 6.1
DECON ALTERNATIVE
DECOMMISSIONING COST ELEMENTS
(thousands of 2014 dollars)

Cost Element	Total	Percentage
Decontamination	14,843	1.9
Removal	115,134	15.0
Packaging	23,258	3.0
Transportation	11,795	1.5
Waste Disposal	88,460	11.6
Off-site Waste Processing	23,328	3.0
Program Management [1]	265,653	34.7
Security	94,167	12.3
Corporate Allocations	1,972	0.3
Spent Fuel Pool Isolation	12,434	1.6
Spent Fuel Management - Direct Costs [2]	46,016	6.0
Insurance and Regulatory Fees	14,647	1.9
Energy	14,220	1.9
Characterization and Licensing Surveys	21,182	2.8
Property Taxes	10,994	1.4
Miscellaneous Equipment	6,956	0.9
Total [3]	765,060	100

Cost Element	Total	Percentage
License Termination	656,060	85.8
Spent Fuel Management	46,016	6.0
Site Restoration	62,985	8.2
Total [3]	765,060	100

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

TABLE 6.2
SAFSTOR ALTERNATIVE
DECOMMISSIONING COST ELEMENTS
(thousands of 2014 dollars)

Cost Element	Total	Percentage
Decontamination	13,083	1.3
Removal	118,585	11.5
Packaging	18,474	1.8
Transportation	9,453	0.9
Waste Disposal	66,933	6.5
Off-site Waste Processing	26,084	2.5
Program Management [1]	356,987	34.5
Security	188,070	18.2
Corporate Allocations	3,217	0.3
Spent Fuel Pool Isolation	12,434	1.2
Spent Fuel Management - Direct Costs [2]	46,016	4.4
Insurance and Regulatory Fees	78,163	7.6
Energy	29,260	2.8
Characterization and Licensing Surveys	21,630	2.1
Property Taxes	22,877	2.2
Miscellaneous Equipment	23,234	2.2
Total [3]	1,034,501	100

Cost Element	Total	Percentage
License Termination	852,539	82.4
Spent Fuel Management	119,221	11.5
Site Restoration	62,740	6.1
Total [3]	1,034,501	100

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

7. REFERENCES

1. "Decommissioning Cost Analysis for the Wolf Creek Generating Station," Document No. W11-1642-001, Rev. 0, TLG Services, Inc., August 2011

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

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

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

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

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

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

8. Charter of the Blue Ribbon Commission on America's Nuclear Future, "Objectives and Scope of Activities," http://www.brc.gov/index.php?q=page/charter

9. "Blue Ribbon Commission on America's Nuclear Future, Report to the Secretary of Energy," http://www.brc.gov/, p. 32, January 2012

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

11. "Acceptance Priority Ranking & Annual Capacity Report," DOE/RW-0567, July 2004

7. REFERENCES
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12. "Report to Congress on the Demonstration of the Interim Storage of Spent Nuclear Fuel from Decommissioned Nuclear Power Reactor Sites" DOE/RW-0596, December 2008

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

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

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

19. 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"

20. "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

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

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

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

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

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

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

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

28. 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

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APPENDIX A

UNIT COST FACTOR DEVELOPMENT

APPENDIX A
UNIT COST FACTOR DEVELOPMENT

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

1. SCOPE

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

2. CALCULATIONS

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

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

***** Total duration = 11.217 hr *****

* alpha designators indicate activities that can be performed in parallel

APPENDIX A
(continued)

3. LABOR REQUIRED

Crew	Number	Duration (hours)	Rate ($/hr)	Cost
Laborers	3.00	11.217	$17.35	$583.84
Craftsmen	2.00	11.217	$36.09	$809.64
Foreman	1.00	11.217	$39.73	$445.65
General Foreman	0.25	11.217	$44.51	$124.82
Fire Watch	0.05	11.217	$17.35	$9.73
Health Physics Technician	1.00	11.217	$44.00	$547.84
Total Labor Cost				$2,521.52

4. EQUIPMENT & CONSUMABLES COSTS

Equipment Costs	none
Consumables/Materials Costs	
• Universal Polypropylene Sorbent 50 @ $0.62/sq ft [1]	$31.00
• Tarpaulin, oil resistant, fire retardant 50 @ $0.28/sq ft [2]	$14.00
• Gas torch consumables 1 @ $19.53 x 1 /hr [3]	$19.53
Subtotal cost of equipment and materials	$64.53
Overhead & profit on equipment and materials @ 15.30 %	$11.71
Total costs, equipment & material	$76.24

TOTAL COST:

Removal of contaminated **heat exchanger <3000 pounds:**	**$2,597.76**
Total labor cost:	$2,521.52
Total equipment/material costs:	$76.24
Total craft labor man-hours required per unit:	81.88

5. NOTES AND REFERENCES

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

- References for equipment & consumables costs:

    1. www.mcmaster.com online catalog, McMaster Carr Spill Control (7193T88)
    2. R.S. Means (2014) Division 01 56, Section 13.60-0600, page 23
    3. R.S. Means (2014) Division 01 54 33, Section 40-6360, page 698

- Material and consumable costs were adjusted using the regional indices for Emporia, Kansas.

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	0.23
Removal of clean pipe 0.25 to 2 inches diameter, $/linear foot	2.33
Removal of clean pipe >2 to 4 inches diameter, $/linear foot	3.57
Removal of clean pipe >4 to 8 inches diameter, $/linear foot	7.60
Removal of clean pipe >8 to 14 inches diameter, $/linear foot	13.92
Removal of clean pipe >14 to 20 inches diameter, $/linear foot	18.31
Removal of clean pipe >20 to 36 inches diameter, $/linear foot	26.89
Removal of clean pipe >36 inches diameter, $/linear foot	31.86
Removal of clean valve >2 to 4 inches	50.16
Removal of clean valve >4 to 8 inches	76.02
Removal of clean valve >8 to 14 inches	139.24
Removal of clean valve >14 to 20 inches	183.14
Removal of clean valve >20 to 36 inches	268.93
Removal of clean valve >36 inches	318.61
Removal of clean pipe hanger for small bore piping	19.16
Removal of clean pipe hanger for large bore piping	58.99
Removal of clean pump, <300 pound	132.63
Removal of clean pump, 300-1000 pound	377.23
Removal of clean pump, 1000-10,000 pound	1,441.41
Removal of clean pump, >10,000 pound	2,802.92
Removal of clean pump motor, 300-1000 pound	154.39
Removal of clean pump motor, 1000-10,000 pound	594.17
Removal of clean pump motor, >10,000 pound	1,336.89
Removal of clean heat exchanger <3000 pound	785.49
Removal of clean heat exchanger >3000 pound	1,998.43
Removal of clean feedwater heater/deaerator	5,552.44
Removal of clean moisture separator/reheater	11,307.46
Removal of clean tank, <300 gallons	170.09
Removal of clean tank, 300-3000 gallon	527.92
Removal of clean tank, >3000 gallons, $/square foot surface area	4.69
Removal of clean electrical equipment, <300 pound	68.99

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of clean electrical equipment, 300-1000 pound	251.38
Removal of clean electrical equipment, 1000-10,000 pound	502.77
Removal of clean electrical equipment, >10,000 pound	1,230.34
Removal of clean electrical transformer < 30 tons	854.47
Removal of clean electrical transformer > 30 tons	2,460.71
Removal of clean standby diesel generator, <100 kW	872.77
Removal of clean standby diesel generator, 100 kW to 1 MW	1,948.06
Removal of clean standby diesel generator, >1 MW	4,032.88
Removal of clean electrical cable tray, $/linear foot	6.70
Removal of clean electrical conduit, $/linear foot	2.94
Removal of clean mechanical equipment, <300 pound	68.99
Removal of clean mechanical equipment, 300-1000 pound	251.38
Removal of clean mechanical equipment, 1000-10,000 pound	502.77
Removal of clean mechanical equipment, >10,000 pound	1,230.34
Removal of clean HVAC equipment, <300 pound	83.41
Removal of clean HVAC equipment, 300-1000 pound	302.06
Removal of clean HVAC equipment, 1000-10,000 pound	602.02
Removal of clean HVAC equipment, >10,000 pound	1,230.34
Removal of clean HVAC ductwork, $/pound	0.24
Removal of contaminated instrument and sampling tubing, $/linear foot	0.94
Removal of contaminated pipe 0.25 to 2 inches diameter, $/linear foot	14.12
Removal of contaminated pipe >2 to 4 inches diameter, $/linear foot	22.80
Removal of contaminated pipe >4 to 8 inches diameter, $/linear foot	38.15
Removal of contaminated pipe >8 to 14 inches diameter, $/linear foot	70.70
Removal of contaminated pipe >14 to 20 inches diameter, $/linear foot	84.15
Removal of contaminated pipe >20 to 36 inches diameter, $/linear foot	114.54
Removal of contaminated pipe >36 inches diameter, $/linear foot	134.40
Removal of contaminated valve >2 to 4 inches	284.75
Removal of contaminated valve >4 to 8 inches	337.05
Removal of contaminated valve >8 to 14 inches	653.81
Removal of contaminated valve >14 to 20 inches	826.33

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of contaminated valve >20 to 36 inches	1,092.27
Removal of contaminated valve >36 inches	1,290.80
Removal of contaminated pipe hanger for small bore piping	92.25
Removal of contaminated pipe hanger for large bore piping	273.64
Removal of contaminated pump, <300 pound	607.53
Removal of contaminated pump, 300-1000 pound	1,398.94
Removal of contaminated pump, 1000-10,000 pound	4,182.46
Removal of contaminated pump, >10,000 pound	10,185.83
Removal of contaminated pump motor, 300-1000 pound	619.54
Removal of contaminated pump motor, 1000-10,000 pound	1,728.94
Removal of contaminated pump motor, >10,000 pound	3,881.92
Removal of contaminated heat exchanger <3000 pound	2,597.76
Removal of contaminated heat exchanger >3000 pound	7,619.81
Removal of contaminated tank, <300 gallons	1,015.34
Removal of contaminated tank, >300 gallons, $/square foot	19.19
Removal of contaminated electrical equipment, <300 pound	453.16
Removal of contaminated electrical equipment, 300-1000 pound	1,107.84
Removal of contaminated electrical equipment, 1000-10,000 pound	2,134.34
Removal of contaminated electrical equipment, >10,000 pound	4,228.16
Removal of contaminated electrical cable tray, $/linear foot	22.02
Removal of contaminated electrical conduit, $/linear foot	11.08
Removal of contaminated mechanical equipment, <300 pound	503.94
Removal of contaminated mechanical equipment, 300-1000 pound	1,222.68
Removal of contaminated mechanical equipment, 1000-10,000 pound	2,351.72
Removal of contaminated mechanical equipment, >10,000 pound	4,228.16
Removal of contaminated HVAC equipment, <300 pound	503.94
Removal of contaminated HVAC equipment, 300-1000 pound	1,222.68
Removal of contaminated HVAC equipment, 1000-10,000 pound	2,351.72
Removal of contaminated HVAC equipment, >10,000 pound	4,228.16
Removal of contaminated HVAC ductwork, $/pound	1.52
Removal/plasma arc cut of contaminated thin metal components, $/linear in.	2.34

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Additional decontamination of surface by washing, $/square foot	4.91
Additional decontamination of surfaces by hydrolasing, $/square foot	23.78
Decontamination rig hook up and flush, $/ 250 foot length	4,233.25
Chemical flush of components/systems, $/gallon	20.14
Removal of clean standard reinforced concrete, $/cubic yard	106.89
Removal of grade slab concrete, $/cubic yard	131.22
Removal of clean concrete floors, $/cubic yard	296.88
Removal of sections of clean concrete floors, $/cubic yard	830.62
Removal of clean heavily rein concrete w/#9 rebar, $/cubic yard	199.70
Removal of contaminated heavily rein concrete w/#9 rebar, $/cubic yard	1,568.31
Removal of clean heavily rein concrete w/#18 rebar, $/cubic yard	252.57
Removal of contaminated heavily rein concrete w/#18 rebar, $/cubic yard	2,072.91
Removal heavily rein concrete w/#18 rebar & steel embedments, $/cubic yard	349.40
Removal of below-grade suspended floors, $/cubic yard	296.88
Removal of clean monolithic concrete structures, $/cubic yard	660.44
Removal of contaminated monolithic concrete structures, $/cubic yard	1,557.24
Removal of clean foundation concrete, $/cubic yard	524.47
Removal of contaminated foundation concrete, $/cubic yard	1,452.16
Explosive demolition of bulk concrete, $/cubic yard	24.57
Removal of clean hollow masonry block wall, $/cubic yard	67.38
Removal of contaminated hollow masonry block wall, $/cubic yard	249.24
Removal of clean solid masonry block wall, $/cubic yard	67.38
Removal of contaminated solid masonry block wall, $/cubic yard	249.24
Backfill of below-grade voids, $/cubic yard	33.64
Removal of subterranean tunnels/voids, $/linear foot	80.79
Placement of concrete for below-grade voids, $/cubic yard	124.80
Excavation of clean material, $/cubic yard	2.97
Excavation of contaminated material, $/cubic yard	36.20
Removal of clean concrete rubble (tipping fee included), $/cubic yard	23.26
Removal of contaminated concrete rubble, $/cubic yard	22.85
Removal of building by volume, $/cubic foot	0.26

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of clean building metal siding, $/square foot	0.83
Removal of contaminated building metal siding, $/square foot	3.20
Removal of standard asphalt roofing, $/square foot	1.08
Removal of transite panels, $/square foot	1.45
Scarifying contaminated concrete surfaces (drill & spall), $/square foot	10.01
Scabbling contaminated concrete floors, $/square foot	5.48
Scabbling contaminated concrete walls, $/square foot	13.89
Scabbling contaminated ceilings, $/square foot	47.11
Scabbling structural steel, $/square foot	4.50
Removal of clean overhead crane/monorail < 10 ton capacity	373.62
Removal of contaminated overhead crane/monorail < 10 ton capacity	1,195.73
Removal of clean overhead crane/monorail >10-50 ton capacity	896.68
Removal of contaminated overhead crane/monorail >10-50 ton capacity	2,869.27
Removal of polar crane > 50 ton capacity	3,832.57
Removal of gantry crane > 50 ton capacity	15,379.40
Removal of structural steel, $/pound	0.14
Removal of clean steel floor grating, $/square foot	3.17
Removal of contaminated steel floor grating, $/square foot	9.77
Removal of clean free standing steel liner, $/square foot	7.03
Removal of contaminated free standing steel liner, $/square foot	22.26
Removal of clean concrete-anchored steel liner, $/square foot	3.52
Removal of contaminated concrete-anchored steel liner, $/square foot	25.99
Placement of scaffolding in clean areas, $/square foot	13.34
Placement of scaffolding in contaminated areas, $/square foot	19.71
Landscaping with topsoil, $/acre	24,509.59
Cost of CPC B-88 LSA box & preparation for use	2,072.95
Cost of CPC B-25 LSA box & preparation for use	1,888.34
Cost of CPC B-12V 12 gauge LSA box & preparation for use	1,521.99
Cost of CPC B-144 LSA box & preparation for use	10,950.90
Cost of LSA drum & preparation for use	173.50
Cost of cask liner for CNSI 8 120A cask (resins)	12,218.74

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Cost of cask liner for CNSI 8 120A cask (filters)	8,590.78
Decontamination of surfaces with vacuuming, $/square foot	0.56

APPENDIX C

DETAILED COST ANALYSIS

DECON

Table C
Wolf Creek Generating Station
DECON Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Llc. 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 1a - Shutdown through Transition																					
Period 1a Direct Decommissioning Activities																					
1a.1.1	Prepare preliminary decommissioning cost	-	-	-	-	-	-	146	22	168	168	-	-	-	-	-	-	-	-	-	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	-	-	-	-	-	-	225	34	259	259	-	-	-	-	-	-	-	-	-	2,000
1a.1.7	Review plant dwgs & specs.	-	-	-	-	-	-	518	78	595	595	-	-	-	-	-	-	-	-	-	4,600
1a.1.8	Perform detailed rad survey									a											
1a.1.9	Estimate by-product inventory	-	-	-	-	-	-	113	17	129	129	-	-	-	-	-	-	-	-	-	1,000
1a.1.10	End product description	-	-	-	-	-	-	113	17	129	129	-	-	-	-	-	-	-	-	-	1,000
1a.1.11	Detailed by-product inventory	-	-	-	-	-	-	146	22	168	168	-	-	-	-	-	-	-	-	-	1,300
1a.1.12	Define major work sequence	-	-	-	-	-	-	844	127	971	971	-	-	-	-	-	-	-	-	-	7,500
1a.1.13	Perform SER and EA	-	-	-	-	-	-	349	52	401	401	-	-	-	-	-	-	-	-	-	3,100
1a.1.14	Perform Site-Specific Cost Study	-	-	-	-	-	-	563	84	647	647	-	-	-	-	-	-	-	-	-	5,000
1a.1.15	Prepare/submit License Termination Plan	-	-	-	-	-	-	461	69	530	530	-	-	-	-	-	-	-	-	-	4,096
1a.1.16	Receive NRC approval of termination plan									a											
Activity Specifications																					
1a.1.17.1	Plant & temporary facilities	-	-	-	-	-	-	554	83	637	573	-	64	-	-	-	-	-	-	-	4,920
1a.1.17.2	Plant systems	-	-	-	-	-	-	469	70	539	485	-	54	-	-	-	-	-	-	-	4,167
1a.1.17.3	NSSS Decontamination Flush	-	-	-	-	-	-	56	8	65	65	-	-	-	-	-	-	-	-	-	500
1a.1.17.4	Reactor internals	-	-	-	-	-	-	799	120	919	919	-	-	-	-	-	-	-	-	-	7,100
1a.1.17.5	Reactor vessel	-	-	-	-	-	-	731	110	841	841	-	-	-	-	-	-	-	-	-	6,500
1a.1.17.6	Biological shield	-	-	-	-	-	-	56	8	65	65	-	-	-	-	-	-	-	-	-	500
1a.1.17.7	Steam generators	-	-	-	-	-	-	351	53	404	404	-	-	-	-	-	-	-	-	-	3,120
1a.1.17.8	Reinforced concrete	-	-	-	-	-	-	180	27	207	104	-	104	-	-	-	-	-	-	-	1,600
1a.1.17.9	Main Turbine	-	-	-	-	-	-	45	7	52	-	-	52	-	-	-	-	-	-	-	400
1a.1.17.10	Main Condensers	-	-	-	-	-	-	45	7	52	-	-	52	-	-	-	-	-	-	-	400
1a.1.17.11	Plant structures & buildings	-	-	-	-	-	-	351	53	404	202	-	202	-	-	-	-	-	-	-	3,120
1a.1.17.12	Waste management	-	-	-	-	-	-	518	78	595	595	-	-	-	-	-	-	-	-	-	4,600
1a.1.17.13	Facility & site closeout	-	-	-	-	-	-	101	15	116	58	-	58	-	-	-	-	-	-	-	900
1a.1.17	Total	-	-	-	-	-	-	4,267	638	4,895	4,310	-	585	-	-	-	-	-	-	-	37,827
Planning & Site Preparations																					
1a.1.18	Prepare dismantling sequence	-	-	-	-	-	-	270	41	311	311	-	-	-	-	-	-	-	-	-	2,400
1a.1.19	Plant prep. & temp. svces	-	-	-	-	-	-	3,000	450	3,450	3,450	-	-	-	-	-	-	-	-	-	-
1a.1.20	Design water clean-up system	-	-	-	-	-	-	158	24	181	181	-	-	-	-	-	-	-	-	-	1,400
1a.1.21	Rigging/Cont. Cntrl Envlps/cooling/etc.	-	-	-	-	-	-	2,300	345	2,645	2,645	-	-	-	-	-	-	-	-	-	-
1a.1.22	Procure casks/liners & containers	-	-	-	-	-	-	138	21	159	159	-	-	-	-	-	-	-	-	-	1,230
1a.1	Subtotal Period 1a Activity Costs	-	-	-	-	-	-	13,599	2,040	15,639	15,055	-	585	-	-	-	-	-	-	-	73,753
Period 1a Collateral Costs																					
1a.3.1	Spent Fuel Capital and Transfer	-	-	-	-	-	-	1,134	170	1,304	-	1,304	-	-	-	-	-	-	-	-	-
1a.3	Subtotal Period 1a Collateral Costs	-	-	-	-	-	-	1,134	170	1,304	-	1,304	-	-	-	-	-	-	-	-	-
Period 1a Period-Dependent Costs																					
1a.4.1	Insurance	-	-	-	-	-	-	2,187	219	2,406	2,406	-	-	-	-	-	-	-	-	-	-
1a.4.2	Property taxes	-	-	-	-	-	-	1,643	164	1,808	1,808	-	-	-	-	-	-	-	-	-	-
1a.4.3	Health physics supplies	-	515	-	-	-	-	-	129	643	643	-	-	-	-	-	-	-	-	-	-
1a.4.4	Heavy equipment rental	-	661	-	-	-	-	-	84	645	645	-	-	-	-	-	-	-	-	-	-
1a.4.5	Disposal of DAW generated	-	-	13	4	-	32	-	10	58	58	-	-	-	610	-	-	-	12,190	20	-
1a.4.6	Plant energy budget	-	-	-	-	-	-	2,091	314	2,405	2,405	-	-	-	-	-	-	-	-	-	-
1a.4.7	NRC Fees	-	-	-	-	-	-	1,181	118	1,299	1,299	-	-	-	-	-	-	-	-	-	-
1a.4.8	Emergency Planning Fees	-	-	-	-	-	-	1,231	123	1,354	-	1,354	-	-	-	-	-	-	-	-	-
1a.4.9	INPO Fees	-	-	-	-	-	-	336	50	386	386	-	-	-	-	-	-	-	-	-	-
1a.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	791	119	910	-	910	-	-	-	-	-	-	-	-	-
1a.4.11	ISFSI Operating Costs	-	-	-	-	-	-	96	14	110	-	110	-	-	-	-	-	-	-	-	-
1a.4.12	Corporate Allocations	-	-	-	-	-	-	353	53	406	406	-	-	-	-	-	-	-	-	-	-
1a.4.13	Security Staff Cost	-	-	-	-	-	-	15,454	2,318	17,773	17,773	-	-	-	-	-	-	-	-	-	312,857
1a.4.14	Utility Staff Cost	-	-	-	-	-	-	28,052	4,208	32,260	32,260	-	-	-	-	-	-	-	-	-	423,400
1a.4	Subtotal Period 1a Period-Dependent Costs	-	1,075	13	4	-	32	53,416	7,923	62,463	60,089	2,374	-	-	610	-	-	-	12,190	20	736,257
1a.0	TOTAL PERIOD 1a COST	-	1,075	13	4	-	32	68,150	10,133	79,407	75,144	3,678	585	-	610	-	-	-	12,190	20	810,010

Table C
Wolf Creek Generating Station
DECON Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes: Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
PERIOD 1b - Decommissioning Preparations																					
Period 1b Direct Decommissioning Activities																					
Detailed Work Procedures																					
1b.1.1.1	Plant systems	-	-	-	-	-	-	533	80	612	551	-	61	-	-	-	-	-	-	-	4,733
1b.1.1.2	NSSS Decontamination Flush	-	-	-	-	-	-	113	17	129	129	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.3	Reactor internals	-	-	-	-	-	-	281	42	324	324	-	-	-	-	-	-	-	-	-	2,500
1b.1.1.4	Remaining buildings	-	-	-	-	-	-	152	23	175	44	-	131	-	-	-	-	-	-	-	1,350
1b.1.1.5	CRD cooling assembly	-	-	-	-	-	-	113	17	129	129	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.6	CRD housings & ICI tubes	-	-	-	-	-	-	113	17	129	129	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.7	Incore instrumentation	-	-	-	-	-	-	113	17	129	129	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.8	Reactor vessel	-	-	-	-	-	-	408	61	470	470	-	-	-	-	-	-	-	-	-	3,630
1b.1.1.9	Facility closeout	-	-	-	-	-	-	135	20	155	78	-	78	-	-	-	-	-	-	-	1,200
1b.1.1.10	Missile shields	-	-	-	-	-	-	51	8	58	58	-	-	-	-	-	-	-	-	-	450
1b.1.1.11	Biological shield	-	-	-	-	-	-	135	20	155	155	-	-	-	-	-	-	-	-	-	1,200
1b.1.1.12	Steam generators	-	-	-	-	-	-	518	78	595	595	-	-	-	-	-	-	-	-	-	4,600
1b.1.1.13	Reinforced concrete	-	-	-	-	-	-	113	17	129	65	-	65	-	-	-	-	-	-	-	1,000
1b.1.1.14	Main Turbine	-	-	-	-	-	-	176	26	202	-	-	202	-	-	-	-	-	-	-	1,560
1b.1.1.15	Main Condensers	-	-	-	-	-	-	176	26	202	-	-	202	-	-	-	-	-	-	-	1,560
1b.1.1.16	Auxiliary building	-	-	-	-	-	-	307	46	353	318	-	35	-	-	-	-	-	-	-	2,730
1b.1.1.17	Reactor building	-	-	-	-	-	-	307	46	353	318	-	35	-	-	-	-	-	-	-	2,730
1b.1.1	Total	-	-	-	-	-	-	3,741	561	4,302	3,493	-	809	-	-	-	-	-	-	-	33,243
1b.1.2	Decon primary loop	675	-	-	-	-	-	-	338	1,013	1,013	-	-	-	-	-	-	-	-	1,067	-
1b.1	Subtotal Period 1b Activity Costs	675	-	-	-	-	-	3,741	899	5,315	4,506	-	809	-	-	-	-	-	-	1,067	33,243
Period 1b Additional Costs																					
1b.2.1	Spent fuel pool isolation	-	-	-	-	-	-	10,813	1,622	12,434	12,434	-	-	-	-	-	-	-	-	-	-
1b.2.2	Site Characterization	-	-	-	-	-	-	2,890	867	3,758	3,758	-	-	-	-	-	-	-	-	19,100	7,852
1b.2.3	Misc/Hazardous Waste	-	-	68	21	15	-	-	12	116	116	-	-	2,151	-	-	-	-	137,800	740	-
1b.2	Subtotal Period 1b Additional Costs	-	-	68	21	15	-	13,703	2,501	16,308	16,308	-	-	2,151	-	-	-	-	137,800	19,840	7,852
Period 1b Collateral Costs																					
1b.3.1	Decon equipment	925	-	-	-	-	-	-	139	1,064	1,064	-	-	-	-	-	-	-	-	-	-
1b.3.2	DOC staff relocation expenses	-	-	-	-	-	-	1,239	186	1,425	1,425	-	-	-	-	-	-	-	-	-	-
1b.3.3	Process decommissioning water waste	45	-	29	68	-	126	-	67	335	335	-	-	-	283	-	-	-	16,989	55	-
1b.3.4	Process decommissioning chemical flush waste	2	-	77	267	-	3,332	-	882	4,559	4,559	-	-	-	-	788	-	-	83,917	147	-
1b.3.5	Small tool allowance	-	2	-	-	-	-	-	0	2	2	-	-	-	-	-	-	-	-	-	-
1b.3.6	Pipe cutting equipment	-	1,100	-	-	-	-	-	165	1,265	1,265	-	-	-	-	-	-	-	-	-	-
1b.3.7	Decon rig	1,500	-	-	-	-	-	-	225	1,725	1,725	-	-	-	-	-	-	-	-	-	-
1b.3.8	Spent Fuel Capital and Transfer	-	-	-	-	-	-	3,025	454	3,478	-	3,478	-	-	-	-	-	-	-	-	-
1b.3	Subtotal Period 1b Collateral Costs	2,472	1,102	106	336	-	3,457	4,263	2,117	13,853	10,374	3,478	-	-	283	788	-	-	100,906	203	-
Period 1b Period-Dependent Costs																					
1b.4.1	Decon supplies	28	-	-	-	-	-	-	7	36	36	-	-	-	-	-	-	-	-	-	-
1b.4.2	Insurance	-	-	-	-	-	-	1,103	110	1,213	1,213	-	-	-	-	-	-	-	-	-	-
1b.4.3	Property taxes	-	-	-	-	-	-	828	83	911	911	-	-	-	-	-	-	-	-	-	-
1b.4.4	Health physics supplies	-	295	-	-	-	-	-	74	368	368	-	-	-	-	-	-	-	-	-	-
1b.4.5	Heavy equipment rental	-	283	-	-	-	-	-	42	325	325	-	-	-	-	-	-	-	-	-	-
1b.4.6	Disposal of DAW generated	-	-	8	2	-	19	-	6	34	34	-	-	-	360	-	-	-	7,197	12	-
1b.4.7	Plant energy budget	-	-	-	-	-	-	2,108	316	2,425	2,425	-	-	-	-	-	-	-	-	-	-
1b.4.8	NRC Fees	-	-	-	-	-	-	348	35	383	383	-	-	-	-	-	-	-	-	-	-
1b.4.9	Emergency Planning Fees	-	-	-	-	-	-	621	62	683	-	683	-	-	-	-	-	-	-	-	-
1b.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	399	60	459	-	459	-	-	-	-	-	-	-	-	-
1b.4.11	ISFSI Operating Costs	-	-	-	-	-	-	48	7	55	-	55	-	-	-	-	-	-	-	-	-
1b.4.12	Corporate Allocations	-	-	-	-	-	-	179	27	205	205	-	-	-	-	-	-	-	-	-	-
1b.4.13	Security Staff Cost	-	-	-	-	-	-	7,048	1,057	8,106	8,106	-	-	-	-	-	-	-	-	-	141,943
1b.4.14	DOC Staff Cost	-	-	-	-	-	-	5,154	773	5,928	5,928	-	-	-	-	-	-	-	-	-	64,137
1b.4.15	Utility Staff Cost	-	-	-	-	-	-	14,214	2,132	16,346	16,346	-	-	-	-	-	-	-	-	-	214,491
1b.4	Subtotal Period 1b Period-Dependent Costs	28	577	8	2	-	19	32,050	4,792	37,476	36,280	1,197	-	-	360	-	-	-	7,197	12	420,571
1b.0	TOTAL PERIOD 1b COST	3,175	1,679	181	358	15	3,476	53,758	10,309	72,952	67,468	4,675	809	2,151	643	788	-	-	245,903	21,120	461,666
PERIOD 1 TOTALS		3,175	2,755	194	362	15	3,508	121,908	20,441	152,359	142,611	8,353	1,394	2,151	1,253	788	-	-	258,093	21,140	1,271,678

Table C
Wolf Creek Generating Station
DECON Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
PERIOD 2a - Large Component Removal																					
Period 2a Direct Decommissioning Activities																					
Nuclear Steam Supply System Removal																					
2a.1.1.1	Reactor Coolant Piping	126	127	24	29	-	519	-	231	1,056	1,056	-	-	-	1,227	-	-	-	140,300	6,838	-
2a.1.1.2	Pressurizer Relief Tank	21	17	7	8	-	135	-	50	239	239	-	-	-	328	-	-	-	36,395	1,068	-
2a.1.1.3	Reactor Coolant Pumps & Motors	64	61	123	220	-	1,031	-	350	1,849	1,849	-	-	-	3,386	-	-	-	816,140	4,188	100
2a.1.1.4	Pressurizer	34	36	594	158	-	1,138	-	394	2,353	2,353	-	-	-	3,739	-	-	-	293,734	2,534	1,875
2a.1.1.5	Steam Generators	267	5,187	3,817	3,235	2,599	7,066	-	4,454	26,625	26,625	-	-	40,845	23,217	-	-	-	3,577,181	23,234	8,750
2a.1.1.6	CRDMs/ICIs/Service Structure Removal	106	71	258	54	-	402	-	205	1,095	1,095	-	-	-	4,534	-	-	-	108,572	4,446	-
2a.1.1.7	Reactor Vessel Internals	95	3,643	9,143	1,439	-	22,277	335	16,614	53,546	53,546	-	-	-	1,878	963	393	-	329,968	31,550	1,394
2a.1.1.8	Vessel & Internals GTCC Disposal	-	-	-	-	-	12,118	-	1,818	13,935	13,935	-	-	-	-	-	-	2,217	433,180	-	-
2a.1.1.9	Reactor Vessel	79	6,571	2,459	1,064	-	3,107	335	7,452	21,067	21,067	-	-	-	9,391	-	-	-	961,214	31,550	1,394
2a.1.1	Totals	792	15,713	16,425	6,207	2,599	47,792	669	31,568	121,765	121,765	-	-	40,845	47,700	963	393	2,217	6,696,685	105,408	10,513
Removal of Major Equipment																					
2a.1.2	Main Turbine/Generator	-	319	404	81	599	599	-	372	2,373	2,373	-	-	4,844	2,698	-	-	-	468,962	9,734	-
2a.1.3	Main Condensers	-	870	236	90	714	787	-	558	3,255	3,255	-	-	7,701	3,216	-	-	-	559,114	27,762	-
Cascading Costs from Clean Building Demolition																					
2a.1.4.1	Reactor	-	754	-	-	-	-	-	113	867	867	-	-	-	-	-	-	-	-	10,579	-
2a.1.4.2	Auxiliary	-	374	-	-	-	-	-	56	430	430	-	-	-	-	-	-	-	-	5,551	-
2a.1.4.3	Hot Machine Shop	-	1	-	-	-	-	-	0	1	1	-	-	-	-	-	-	-	-	16	-
2a.1.4.4	Radwaste	-	79	-	-	-	-	-	12	91	91	-	-	-	-	-	-	-	-	1,108	-
2a.1.4.5	Fuel Building	-	189	-	-	-	-	-	28	217	217	-	-	-	-	-	-	-	-	2,395	-
2a.1.4	Totals	-	1,397	-	-	-	-	-	209	1,606	1,606	-	-	-	-	-	-	-	-	19,649	-
Disposal of Plant Systems																					
2a.1.5.1	AB - Main Steam	-	147	-	-	-	-	-	22	169	-	-	169	-	-	-	-	-	-	5,833	-
2a.1.5.2	AB - Main Steam RCA	-	53	3	11	180	-	-	42	291	291	-	-	2,156	-	-	-	-	87,550	1,515	-
2a.1.5.3	AC - Main Turbine	-	148	-	-	-	-	-	22	170	-	-	170	-	-	-	-	-	-	5,641	-
2a.1.5.4	AD - Condensate	-	166	-	-	-	-	-	25	190	-	-	190	-	-	-	-	-	-	6,144	-
2a.1.5.5	AE - Feedwater	-	113	-	-	-	-	-	17	129	-	-	129	-	-	-	-	-	-	4,271	-
2a.1.5.6	AF - Feedwater Hter Extrction, Drn & Vnt	-	137	-	-	-	-	-	21	158	-	-	158	-	-	-	-	-	-	5,352	-
2a.1.5.7	AK - Condensate Demineralizer	-	51	-	-	-	-	-	8	59	-	-	59	-	-	-	-	-	-	1,944	-
2a.1.5.8	AL - Auxiliary Feedwater	-	31	-	-	-	-	-	5	36	-	-	36	-	-	-	-	-	-	1,174	-
2a.1.5.9	AL-Auxiliary Feedwater Surge Tanks	-	2	-	-	-	-	-	0	2	-	-	2	-	-	-	-	-	-	72	-
2a.1.5.10	AQ - Condensate & Feedwater Chem Additn	-	13	-	-	-	-	-	2	15	-	-	15	-	-	-	-	-	-	468	-
2a.1.5.11	AX - Acid Feed	-	19	-	-	-	-	-	3	22	-	-	22	-	-	-	-	-	-	754	-
2a.1.5.12	Auxiliary Bldg Non-System Specific	-	78	6	6	40	69	-	44	243	243	-	-	474	282	-	-	-	37,889	2,282	-
2a.1.5.13	Auxiliary Bldg Non-System Specific RCA	-	478	12	40	638	-	-	223	1,392	1,392	-	-	7,629	-	-	-	-	309,812	13,471	-
2a.1.5.14	BL - Reactor Makeup Water	-	202	23	22	161	204	-	131	744	744	-	-	1,928	850	-	-	-	133,562	5,872	-
2a.1.5.15	BM - Steam Generator Blowdown	-	407	8	27	432	-	-	171	1,045	1,045	-	-	5,160	-	-	-	-	209,560	11,982	-
2a.1.5.16	CA - Steam Seal	-	12	-	-	-	-	-	2	14	-	-	14	-	-	-	-	-	-	455	-
2a.1.5.17	CB - Main Turbine Lube Oil	-	35	-	-	-	-	-	5	40	-	-	40	-	-	-	-	-	-	1,207	-
2a.1.5.18	CC - Generator Hydrogen & CO2	-	6	-	-	-	-	-	1	6	-	-	6	-	-	-	-	-	-	198	-
2a.1.5.19	CD - Generator Seal Oil	-	8	-	-	-	-	-	1	9	-	-	9	-	-	-	-	-	-	287	-
2a.1.5.20	CE - Stator Cooling Water	-	7	-	-	-	-	-	1	8	-	-	8	-	-	-	-	-	-	241	-
2a.1.5.21	CF - Lube Oil Strg, Xfer & Purification	-	22	-	-	-	-	-	3	25	-	-	25	-	-	-	-	-	-	812	-
2a.1.5.22	CG - Condenser Air Removal	-	18	-	-	-	-	-	3	20	-	-	20	-	-	-	-	-	-	657	-
2a.1.5.23	CH - Main Turbine Control Oil	-	36	-	-	-	-	-	5	42	-	-	42	-	-	-	-	-	-	1,219	-
2a.1.5.24	CL - Chlorination	-	15	-	-	-	-	-	2	17	-	-	17	-	-	-	-	-	-	569	-
2a.1.5.25	CO - Carbon Dioxide	-	3	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	121	-
2a.1.5.26	CW - Circulating Water	-	199	-	-	-	-	-	30	229	-	-	229	-	-	-	-	-	-	7,858	-
2a.1.5.27	CZ - Caustic Acid	-	3	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	111	-
2a.1.5.28	DA - Circulating Water System	-	202	-	-	-	-	-	30	233	-	-	233	-	-	-	-	-	-	7,953	-
2a.1.5.29	DM - Equipment Drains	-	33	-	-	-	-	-	5	38	-	-	38	-	-	-	-	-	-	1,223	-
2a.1.5.30	DM - Equipment Drains RCA	-	101	24	82	1,292	-	-	234	1,733	1,733	-	-	15,445	-	-	-	-	627,223	2,840	-
2a.1.5.31	EC - Component Cooling Water RCA	-	492	22	75	1,185	-	-	314	2,088	2,088	-	-	14,161	-	-	-	-	575,071	13,646	-
2a.1.5.32	EJ - Residual Heat Removal	-	260	56	48	228	590	-	259	1,440	1,440	-	-	2,727	2,411	-	-	-	270,084	7,897	-
2a.1.5.33	EM - High Pressure Coolant Injection	-	214	17	16	105	159	-	113	624	624	-	-	1,260	648	-	-	-	94,082	6,201	-
2a.1.5.34	EN - Containment Spray	-	149	5	16	253	-	-	78	501	501	-	-	3,026	-	-	-	-	122,874	4,134	-
2a.1.5.35	FB - Auxiliary Steam	-	54	-	-	-	-	-	8	62	-	-	62	-	-	-	-	-	-	2,106	-
2a.1.5.36	FB - Auxiliary Steam RCA	-	58	1	4	68	-	-	25	157	157	-	-	816	-	-	-	-	33,148	1,537	-
2a.1.5.37	FC - Auxiliary Turbines	-	36	-	-	-	-	-	5	41	-	-	41	-	-	-	-	-	-	1,301	-
2a.1.5.38	FE - Auxiliary Steam Chemical Addition	-	3	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	105	-
2a.1.5.39	GE - Turbine Bldg HVAC	-	78	-	-	-	-	-	12	90	-	-	90	-	-	-	-	-	-	3,189	-
2a.1.5.40	GF - Miscellaneous Building HVAC	-	23	-	-	-	-	-	4	27	-	-	27	-	-	-	-	-	-	987	-

Table C
Wolf Creek Generating Station
DECON Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Disposal of Plant Systems (continued)																					
2a.1.5.41	GS - Containment Hydrogen Control	-	53	4	5	55	26	-	29	172	172	-	-	658	104	-	-	-	33,630	1,559	-
2a.1.5.42	HF - Secondary Liquid Waste	523	673	83	77	517	775	-	721	3,370	3,370	-	-	6,186	3,203	-	-	-	460,585	31,896	-
2a.1.5.43	HY - Hydrogen	-	6	-	-	-	-	-	1	6	-	-	6	-	-	-	-	-	-	223	-
2a.1.5.44	KH - Service Gas	-	18	-	-	-	-	-	3	20	-	-	20	-	-	-	-	-	-	644	-
2a.1.5.45	LE - Oily Waste	-	66	-	-	-	-	-	10	76	-	-	76	-	-	-	-	-	-	2,575	-
2a.1.5.46	LE - Oily Waste RCA	-	133	3	9	144	-	-	57	345	345	-	-	1,718	-	-	-	-	69,785	3,518	-
2a.1.5.47	NT - Nitrogen	-	4	-	-	-	-	-	1	4	-	-	4	-	-	-	-	-	-	149	-
2a.1.5.48	OX - Oxygen	-	5	-	-	-	-	-	1	5	-	-	5	-	-	-	-	-	-	171	-
2a.1.5.49	SW - Screen Wash	-	18	-	-	-	-	-	3	21	-	-	21	-	-	-	-	-	-	635	-
2a.1.5.50	Turbine Bldg Non-System Specific	-	434	-	-	-	-	-	65	499	-	-	499	-	-	-	-	-	-	15,405	-
2a.1.5.51	VH - Circ Water & Makeup Water Scrnhs	-	8	-	-	-	-	-	1	9	-	-	9	-	-	-	-	-	-	272	-
2a.1.5.52	VV - Misc Bldg HVAC	-	4	-	-	-	-	-	1	5	-	-	5	-	-	-	-	-	-	148	-
2a.1.5.53	WG - Gland Water & Motor Cooling Water	-	14	-	-	-	-	-	2	16	-	-	16	-	-	-	-	-	-	593	-
2a.1.5.54	WL - Cooling Lake Makeup & Blowdown	-	20	-	-	-	-	-	3	23	-	-	23	-	-	-	-	-	-	745	-
2a.1.5	Totals	523	5,664	267	440	5,299	1,822	-	2,774	16,089	14,144	-	2,546	63,344	7,498	-	-	-	3,064,853	192,162	-
2a.1.6	Scaffolding in support of decommissioning	-	947	28	9	112	26	-	264	1,385	1,385	-	-	1,206	106	-	-	-	61,306	36,964	-
2a.1	Subtotal Period 2a Activity Costs	1,316	24,810	17,359	6,826	9,323	51,025	669	35,746	147,074	144,528	-	2,546	117,940	61,218	963	393	2,217	10,850,920	391,677	10,513
Period 2a Additional Costs																					
2a.2.1	Remedial Action Surveys	-	-	-	-	-	-	1,686	506	2,191	2,191	-	-	-	-	-	-	-	-	34,511	-
2a.2	Subtotal Period 2a Additional Costs	-	-	-	-	-	-	1,686	506	2,191	2,191	-	-	-	-	-	-	-	-	34,511	-
Period 2a Collateral Costs																					
2a.3.1	Process decommissioning water waste	164	-	107	254	-	467	-	247	1,238	1,238	-	-	-	1,052	-	-	-	63,099	205	-
2a.3.2	Process decommissioning chemical flush waste	1	-	26	90	-	219	-	69	396	396	-	-	-	266	-	-	-	28,388	50	-
2a.3.3	Small tool allowance	-	269	-	-	-	-	-	39	309	270	-	39	-	-	-	-	-	-	-	-
2a.3.4	Spent Fuel Capital and Transfer	-	-	-	-	-	-	9,956	1,493	11,449	-	11,449	-	-	-	-	-	-	-	-	-
2a.3.5	On-site survey and release of 115.8 tons clean metallic waste	-	-	-	-	-	-	160	16	176	176	-	-	-	-	-	-	-	-	-	-
2a.3	Subtotal Period 2a Collateral Costs	164	269	133	344	-	677	10,116	1,865	13,559	2,080	11,449	39	-	1,318	-	-	-	91,487	255	-
Period 2a Period-Dependent Costs																					
2a.4.1	Decon supplies	94	-	-	-	-	-	-	23	117	117	-	-	-	-	-	-	-	-	-	-
2a.4.2	Insurance	-	-	-	-	-	-	1,710	171	1,881	1,881	-	-	-	-	-	-	-	-	-	-
2a.4.3	Property taxes	-	-	-	-	-	-	2,728	273	3,001	2,701	-	300	-	-	-	-	-	-	-	-
2a.4.4	Health physics supplies	-	2,907	-	-	-	-	-	727	3,634	3,634	-	-	-	-	-	-	-	-	-	-
2a.4.5	Heavy equipment rental	-	3,579	-	-	-	-	-	537	4,116	4,116	-	-	-	-	-	-	-	-	-	-
2a.4.6	Disposal of DAW generated	-	-	121	33	-	303	-	93	550	550	-	-	-	5,779	-	-	-	115,578	188	-
2a.4.7	Plant energy budget	-	-	-	-	-	-	3,298	495	3,793	3,793	-	-	-	-	-	-	-	-	-	-
2a.4.8	NRC Fees	-	-	-	-	-	-	1,040	104	1,144	1,144	-	-	-	-	-	-	-	-	-	-
2a.4.9	Emergency Planning Fees	-	-	-	-	-	-	1,069	107	1,175	-	1,175	-	-	-	-	-	-	-	-	-
2a.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	1,313	197	1,510	-	1,510	-	-	-	-	-	-	-	-	-
2a.4.11	ISFSI Operating Costs	-	-	-	-	-	-	159	24	182	-	182	-	-	-	-	-	-	-	-	-
2a.4.12	Corporate Allocations	-	-	-	-	-	-	408	61	469	469	-	-	-	-	-	-	-	-	-	-
2a.4.13	Security Staff Cost	-	-	-	-	-	-	23,214	3,482	26,696	26,696	-	-	-	-	-	-	-	-	-	467,486
2a.4.14	DOC Staff Cost	-	-	-	-	-	-	20,617	3,093	23,709	23,709	-	-	-	-	-	-	-	-	-	263,177
2a.4.15	Utility Staff Cost	-	-	-	-	-	-	34,124	5,119	39,243	39,243	-	-	-	-	-	-	-	-	-	489,994
2a.4	Subtotal Period 2a Period-Dependent Costs	94	6,486	121	33	-	303	89,680	14,504	111,221	108,053	2,868	300	-	5,779	-	-	-	115,578	188	1,220,657
2a.0	TOTAL PERIOD 2a COST	1,573	31,556	17,613	7,204	9,323	52,005	102,150	52,621	274,046	256,852	14,317	2,876	117,940	68,315	963	393	2,217	11,057,980	426,632	1,231,170
PERIOD 2b - Site Decontamination																					
Period 2b Direct Decommissioning Activities																					
Disposal of Plant Systems																					
2b.1.1.1	AN - Demineralized Wtr Storage & xfer	-	40	-	-	-	-	-	6	46	-	-	46	-	-	-	-	-	-	1,548	-
2b.1.1.2	AN - Demineralized Wtr Strg & xfer RCA	-	13	0	1	10	-	-	5	29	29	-	-	120	-	-	-	-	4,855	334	-
2b.1.1.3	AP - Condensate Storage & Transfer	-	49	-	-	-	-	-	7	57	-	-	57	-	-	-	-	-	-	1,660	-
2b.1.1.4	BB - Reactor Coolant	-	207	37	32	146	401	-	182	1,005	1,005	-	-	1,746	1,669	-	-	-	179,209	6,412	-
2b.1.1.5	BG - Chemical & Volume Control	683	645	117	95	410	1,202	-	891	4,043	4,043	-	-	4,899	4,925	-	-	-	523,957	27,846	-
2b.1.1.6	BN - Borated Refueling Water Storage	-	230	10	37	461	129	-	166	1,042	1,042	-	-	5,512	533	-	-	-	258,692	6,939	-
2b.1.1.7	Control Bldg Non-System Specific	-	123	3	11	179	-	-	60	376	376	-	-	2,139	-	-	-	-	86,849	3,413	-
2b.1.1.8	Control Bldg Non-System Specific Cln	-	934	-	-	-	-	-	140	1,074	-	-	1,074	-	-	-	-	-	-	29,076	-
2b.1.1.9	DO - Diesel Oil	-	1	-	-	-	-	-	0	1	-	-	1	-	-	-	-	-	-	48	-
2b.1.1.10	EA - Service Water	-	67	-	-	-	-	-	10	77	-	-	77	-	-	-	-	-	-	2,592	-
2b.1.1.11	EB - Closed Cooling Water	-	33	-	-	-	-	-	5	38	-	-	38	-	-	-	-	-	-	1,267	-

Table C
Wolf Creek Generating Station
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Disposal of Plant Systems (continued)																					
2b.1.1.12	EF - Essential Service Water	-	76	-	-	-	-	-	11	87	-	-	87	-	-	-	-	-	-	2,951	-
2b.1.1.13	EF - Essential Service Water RCA	-	61	2	8	119	-	-	35	225	225	-	-	1,427	-	-	-	-	57,959	1,734	-
2b.1.1.14	EP - Accumulator Safety Injection	-	112	10	12	131	69	-	68	402	402	-	-	1,568	283	-	-	-	82,302	3,246	-
2b.1.1.15	FA - Auxiliary Steam Generator	-	13	-	-	-	-	-	2	15	-	-	15	-	-	-	-	-	-	521	-
2b.1.1.16	FO - Fuel Oil	-	12	-	-	-	-	-	2	14	-	-	14	-	-	-	-	-	-	486	-
2b.1.1.17	FP - Fire Protection	-	97	-	-	-	-	-	15	112	-	-	112	-	-	-	-	-	-	3,826	-
2b.1.1.18	FP - Fire Protection RCA	-	135	7	24	376	-	-	94	636	636	-	-	4,492	-	-	-	-	182,411	3,541	-
2b.1.1.19	GA - Plant Heating	-	49	-	-	-	-	-	7	56	-	-	56	-	-	-	-	-	-	1,912	-
2b.1.1.20	GA - Plant Heating RCA	-	80	1	4	62	-	-	30	177	177	-	-	746	-	-	-	-	30,275	2,072	-
2b.1.1.21	GB - Central Chilled Water	-	46	-	-	-	-	-	7	53	-	-	53	-	-	-	-	-	-	1,803	-
2b.1.1.22	GB - Central Chilled Water RCA	-	18	0	1	16	-	-	7	43	43	-	-	187	-	-	-	-	7,591	482	-
2b.1.1.23	GD - Esstl Srve Wtr Pumphs Bldg HVAC	-	7	-	-	-	-	-	1	8	-	-	8	-	-	-	-	-	-	284	-
2b.1.1.24	GH - Radwaste Building HVAC	-	137	6	14	203	24	-	73	457	457	-	-	2,425	98	-	-	-	104,941	3,455	-
2b.1.1.25	GK - Control Building HVAC	-	89	-	-	-	-	-	13	102	-	-	102	-	-	-	-	-	-	3,959	-
2b.1.1.26	GL - Auxiliary Building HVAC	-	343	13	30	424	58	-	169	1,034	1,034	-	-	5,064	228	-	-	-	220,713	8,491	-
2b.1.1.27	GM - Diesel Generator Building HVAC	-	15	-	-	-	-	-	2	18	-	-	18	-	-	-	-	-	-	695	-
2b.1.1.28	GN - Containment Cooling	-	365	24	48	615	157	-	232	1,442	1,442	-	-	7,354	643	-	-	-	341,151	9,502	-
2b.1.1.29	GP - Containmnt Integratd Leak Rate Test	-	27	1	3	49	-	-	15	94	94	-	-	580	-	-	-	-	23,570	750	-
2b.1.1.30	GR - Containment Atmospheric Control	-	13	2	6	91	10	-	21	143	143	-	-	1,086	41	-	-	-	46,792	392	-
2b.1.1.31	GT - Containment Purge HVAC	-	86	6	13	163	42	-	59	369	369	-	-	1,948	170	-	-	-	90,362	2,359	-
2b.1.1.32	HA - Gaseous Radwaste	-	252	23	24	233	163	-	144	838	838	-	-	2,782	666	-	-	-	156,977	7,037	-
2b.1.1.33	HB - Liquid Radwaste	559	596	75	67	464	662	-	681	3,104	3,104	-	-	5,544	2,742	-	-	-	404,086	30,762	-
2b.1.1.34	HC - Solid Radwaste	-	331	51	44	233	507	-	256	1,420	1,420	-	-	2,781	2,076	-	-	-	249,843	9,589	-
2b.1.1.35	HD - Decontamination	-	71	6	8	82	42	-	42	251	251	-	-	983	171	-	-	-	51,237	2,051	-
2b.1.1.36	HE - Boron Recycle	283	345	37	33	218	341	-	355	1,612	1,612	-	-	2,600	1,411	-	-	-	197,879	16,660	-
2b.1.1.37	JE - Emergency Fuel Oil	-	37	-	-	-	-	-	6	42	-	-	42	-	-	-	-	-	-	1,260	-
2b.1.1.38	KA - Compressed Air and Instrument	-	160	-	-	-	-	-	24	184	-	-	184	-	-	-	-	-	-	6,089	-
2b.1.1.39	KB - Breathing Air	-	28	-	-	-	-	-	4	32	-	-	32	-	-	-	-	-	-	1,075	-
2b.1.1.40	KC - Fire Protection	-	192	-	-	-	-	-	29	220	-	-	220	-	-	-	-	-	-	7,516	-
2b.1.1.41	KC - Fire Protection RCA	-	240	9	32	497	-	-	140	918	918	-	-	5,944	-	-	-	-	241,384	6,383	-
2b.1.1.42	KD - Domestic Water	-	44	-	-	-	-	-	7	51	-	-	51	-	-	-	-	-	-	1,708	-
2b.1.1.43	KE - Fuel Hndlg & Strg Reactor Vsel Serv	-	13	4	6	55	39	-	22	139	139	-	-	661	158	-	-	-	37,295	375	-
2b.1.1.44	KJ - Standby Diesel Engine	-	192	-	-	-	-	-	29	221	-	-	221	-	-	-	-	-	-	6,749	-
2b.1.1.45	LA - Sanitary Drains	-	7	-	-	-	-	-	1	8	-	-	8	-	-	-	-	-	-	290	-
2b.1.1.46	LA - Sanitary Drains RCA	-	18	0	1	23	-	-	8	51	51	-	-	272	-	-	-	-	11,053	422	-
2b.1.1.47	LB - Roof Drains	-	33	-	-	-	-	-	5	38	-	-	38	-	-	-	-	-	-	1,276	-
2b.1.1.48	LB - Roof Drains RCA	-	100	3	11	179	-	-	54	348	348	-	-	2,139	-	-	-	-	86,858	2,694	-
2b.1.1.49	LC - Yard Drains	-	3	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	96	-
2b.1.1.50	LD - Chemical & Detergent Waste	51	81	5	6	42	52	-	66	302	302	-	-	504	211	-	-	-	34,402	3,490	-
2b.1.1.51	LF - Floor & Equipment Drains	-	1,097	125	100	313	1,399	-	676	3,620	3,620	-	-	3,739	5,724	-	-	-	529,989	29,320	-
2b.1.1.52	RM - Process Sampling & Analysis	-	93	8	7	55	59	-	18	270	270	-	-	661	210	-	-	-	42,764	2,774	-
2b.1.1.53	Radwaste Bldg Non-System Specific	-	125	11	11	59	121	-	73	401	401	-	-	705	497	-	-	-	61,467	3,653	-
2b.1.1.54	Radwaste Bldg Non-System Specific RCA	-	791	20	67	1,061	-	-	369	2,308	2,308	-	-	12,684	-	-	-	-	515,103	21,919	-
2b.1.1.55	Reactor Bldg Non-System Specific	-	63	4	4	23	45	-	31	170	170	-	-	269	186	-	-	-	23,204	1,760	-
2b.1.1.56	Reactor Bldg Non-System Specific RCA	-	397	7	25	399	-	-	164	992	992	-	-	4,788	-	-	-	-	193,612	10,425	-
2b.1.1.57	SBO Diesel Generator	-	104	-	-	-	-	-	16	119	-	-	119	-	-	-	-	-	-	3,610	-
2b.1.1.58	SJ - Nuclear Sampling	-	53	6	5	35	45	-	31	175	175	-	-	423	184	-	-	-	29,429	1,620	-
2b.1.1.59	ST - Sewage Treatment	-	62	-	-	-	-	-	9	71	-	-	71	-	-	-	-	-	-	2,316	-
2b.1.1.60	SZ - Service Air	-	49	-	-	-	-	-	7	56	-	-	56	-	-	-	-	-	-	1,892	-
2b.1.1.61	VA - I&C Shop HVAC	-	4	-	-	-	-	-	1	5	-	-	5	-	-	-	-	-	-	155	-
2b.1.1.62	VB - I&C Shop Computer Room HVAC	-	3	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	106	-
2b.1.1.63	VC - Health Physics Computer Room HVAC	-	6	-	-	-	-	-	1	7	-	-	7	-	-	-	-	-	-	208	-
2b.1.1.64	VJ - Shop Bldg Machine Shop Area Vent	-	2	-	-	-	-	-	0	2	-	-	2	-	-	-	-	-	-	57	-
2b.1.1.65	VL - Shop Building HVAC	-	3	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	101	-
2b.1.1.66	VS - Admin Bldg HVAC	-	7	-	-	-	-	-	1	9	-	-	9	-	-	-	-	-	-	262	-
2b.1.1.67	VT - Tech Support Building HVAC	-	2	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	87	-
2b.1.1.68	VW - Waste Water Treatment Ventilation	-	1	-	-	-	-	-	0	2	-	-	2	-	-	-	-	-	-	52	-
2b.1.1.69	WD - Domestic Water	-	22	-	-	-	-	-	3	25	-	-	25	-	-	-	-	-	-	870	-
2b.1.1.70	WM - Makeup Demineralizer	-	103	-	-	-	-	-	15	118	-	-	118	-	-	-	-	-	-	3,929	-
2b.1.1.71	WS - Plant Services Water	-	84	-	-	-	-	-	13	97	-	-	97	-	-	-	-	-	-	3,297	-
2b.1.1.72	WS - Plant Services Water RCA	-	26	3	10	154	-	-	31	224	224	-	-	1,838	-	-	-	-	74,625	782	-
2b.1.1.73	WT - Waste Water Treatment	-	20	-	-	-	-	-	3	23	-	-	23	-	-	-	-	-	-	769	-
2b.1.1.74	WZ - Radioactive Liquid Waste	-	32	5	4	10	63	-	27	142	142	-	-	120	258	-	-	-	21,938	879	-
2b.1.1.75	Yard Non-System Specific	-	17	-	-	-	-	-	3	19	-	-	19	-	-	-	-	-	-	603	-
2b.1.1	Totals	1,576	9,944	653	804	7,588	6,628	-	5,734	31,927	28,806	-	3,121	90,709	23,114	-	-	-	5,204,775	330,463	-
2b.1.2	Scaffolding in support of decommissioning	-	1,184	35	11	140	33	-	330	1,732	1,732	-	-	1,508	133	-	-	-	76,632	46,205	-

Table C
Wolf Creek Generating Station
DECON Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes: Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Decontamination of Site Buildings																					
2b.1.3.1	Reactor	837	806	34	192	498	521	-	857	3,746	3,746	-	-	5,955	8,050	-	-	-	933,810	44,323	-
2b.1.3.2	Auxiliary	433	290	14	88	172	242	-	390	1,628	1,628	-	-	2,058	3,823	-	-	-	412,089	19,424	-
2b.1.3.3	Communication Corridor - Contaminated	19	5	0	2	1	5	-	8	31	31	-	-	17	83	-	-	-	7,854	395	-
2b.1.3.4	Hot Machine Shop	12	10	0	2	-	6	-	10	41	41	-	-	-	103	-	-	-	8,802	597	-
2b.1.3.5	RWST Foundation Decon	-	7	0	4	-	11	-	5	27	27	-	-	-	183	-	-	-	15,840	108	-
2b.1.3.6	Radwaste	230	141	7	45	71	126	-	200	821	821	-	-	844	2,022	-	-	-	208,617	9,997	-
2b.1.3.7	Radwaste Drum Storage	26	15	1	5	6	14	-	22	87	87	-	-	66	226	-	-	-	22,243	1,092	-
2b.1.3.8	Radwaste Storage Building	66	31	1	12	-	36	-	52	199	199	-	-	-	594	-	-	-	51,480	2,632	-
2b.1.3	Totals	1,614	1,306	58	350	748	961	-	1,544	6,581	6,581	-	-	8,941	15,084	-	-	-	1,660,826	78,567	-
2b.1	Subtotal Period 2b Activity Costs	3,190	12,433	746	1,165	8,476	6,621	-	7,608	40,239	37,119	-	3,121	101,157	38,330	-	-	-	6,942,233	455,235	-
Period 2b Additional Costs																					
2b.2.1	Remedial Action Surveys	-	-	-	-	-	-	2,375	713	3,088	3,088	-	-	-	-	-	-	-	-	48,627	-
2b.2.2	Operational Equipment	-	-	17	52	603	-	-	100	772	772	-	-	11,710	-	-	-	-	292,750	32	-
2b.2	Subtotal Period 2b Additional Costs	-	-	17	52	603	-	2,375	813	3,860	3,860	-	-	11,710	-	-	-	-	292,750	48,659	-
Period 2b Collateral Costs																					
2b.3.1	Process decommissioning water waste	190	-	128	303	-	558	-	293	1,473	1,473	-	-	-	1,258	-	-	-	75,469	245	-
2b.3.2	Process decommissioning chemical flush waste	4	-	145	603	-	1,168	-	384	2,203	2,203	-	-	-	1,481	-	-	-	157,863	277	-
2b.3.3	Small tool allowance	-	239	-	-	-	-	-	36	275	275	-	-	-	-	-	-	-	-	-	-
2b.3.4	Spent Fuel Capital and Transfer	-	-	-	-	-	-	16,785	2,518	19,303	-	19,303	-	-	-	-	-	-	-	-	-
2b.3.5	On-site survey and release of 44.30 tons clean metallic waste	-	-	-	-	-	-	61	6	67	67	-	-	-	-	-	-	-	-	-	-
2b.3	Subtotal Period 2b Collateral Costs	194	239	273	906	-	1,727	16,846	3,237	23,321	4,018	19,303	-	-	2,739	-	-	-	233,332	523	-
Period 2b Period-Dependent Costs																					
2b.4.1	Decon supplies	1,288	-	-	-	-	-	-	322	1,609	1,609	-	-	-	-	-	-	-	-	-	-
2b.4.2	Insurance	-	-	-	-	-	-	2,410	241	2,651	2,651	-	-	-	-	-	-	-	-	-	-
2b.4.3	Property taxes	-	-	-	-	-	-	3,845	384	4,229	4,229	-	-	-	-	-	-	-	-	-	-
2b.4.4	Health physics supplies	-	3,619	-	-	-	-	-	905	4,524	4,524	-	-	-	-	-	-	-	-	-	-
2b.4.5	Heavy equipment rental	-	4,993	-	-	-	-	-	749	5,742	5,742	-	-	-	-	-	-	-	-	-	-
2b.4.6	Disposal of DAW generated	-	-	136	37	-	339	-	104	616	616	-	-	-	6,468	-	-	-	129,362	211	-
2b.4.7	Plant energy budget	-	-	-	-	-	-	3,669	550	4,220	4,220	-	-	-	-	-	-	-	-	-	-
2b.4.8	NRC Fees	-	-	-	-	-	-	1,465	147	1,612	1,612	-	-	-	-	-	-	-	-	-	-
2b.4.9	Emergency Planning Fees	-	-	-	-	-	-	1,506	151	1,656	-	1,656	-	-	-	-	-	-	-	-	-
2b.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	1,851	278	2,128	-	2,128	-	-	-	-	-	-	-	-	-
2b.4.11	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	469	70	539	539	-	-	-	-	-	-	-	-	-	-
2b.4.12	ISFSI Operating Costs	-	-	-	-	-	-	223	34	257	-	257	-	-	-	-	-	-	-	-	-
2b.4.13	Corporate Allocations	-	-	-	-	-	-	551	83	633	633	-	-	-	-	-	-	-	-	-	-
2b.4.14	Security Staff Cost	-	-	-	-	-	-	32,713	4,907	37,620	37,620	-	-	-	-	-	-	-	-	-	658,800
2b.4.15	DOC Staff Cost	-	-	-	-	-	-	27,941	4,191	32,132	32,132	-	-	-	-	-	-	-	-	-	356,240
2b.4.16	Utility Staff Cost	-	-	-	-	-	-	46,172	6,926	53,098	53,098	-	-	-	-	-	-	-	-	-	661,240
2b.4	Subtotal Period 2b Period-Dependent Costs	1,288	8,612	136	37	-	339	122,817	20,041	153,269	149,227	4,042	-	-	6,468	-	-	-	129,362	211	1,676,280
2b.0	TOTAL PERIOD 2b COST	4,672	21,284	1,171	2,061	9,079	8,687	142,038	31,698	220,689	194,224	23,345	3,121	112,867	47,538	-	-	-	7,597,677	504,627	1,676,280
PERIOD 2d - Decontamination Following Wet Fuel Storage																					
Period 2d Direct Decommissioning Activities																					
2d.1.1	Remove spent fuel racks	487	47	271	88	-	1,529	-	678	3,099	3,099	-	-	-	6,250	-	-	-	413,145	1,722	-
Disposal of Plant Systems																					
2d.1.2.1	EC - Fuel Pool Cooling & Cleanup	-	273	27	29	218	266	-	175	988	988	-	-	2,690	1,088	-	-	-	177,571	8,041	-
2d.1.2.2	Fuel Bldg Non-System Specific	-	33	3	3	14	29	-	18	101	101	-	-	170	120	-	-	-	14,877	954	-
2d.1.2.3	Fuel Bldg Non-System Specific RCA	-	215	5	17	268	-	-	97	602	602	-	-	3,200	-	-	-	-	129,974	5,859	-
2d.1.2.4	Fuel Building Fire Protection	-	106	5	16	246	-	-	66	438	438	-	-	2,941	-	-	-	-	119,444	2,802	-
2d.1.2.5	GG - Fuel Building HVAC	-	189	9	22	312	38	-	108	677	677	-	-	3,729	155	-	-	-	161,671	4,673	-
2d.1.2	Totals	-	816	48	86	1,057	334	-	464	2,806	2,806	-	-	12,641	1,364	-	-	-	603,537	22,329	-
Decontamination of Site Buildings																					
2d.1.3.1	Fuel Building	550	580	10	34	226	83	-	481	1,964	1,964	-	-	2,705	1,064	-	-	-	199,826	31,501	-
2d.1.3	Totals	550	580	10	34	226	83	-	481	1,964	1,964	-	-	2,705	1,064	-	-	-	199,826	31,561	-
2d.1.4	Scaffolding in support of decommissioning	-	237	7	2	28	7	-	66	346	346	-	-	302	27	-	-	-	15,326	9,241	-
2d.1	Subtotal Period 2d Activity Costs	1,038	1,681	336	210	1,312	1,952	-	1,689	8,216	8,216	-	-	15,647	8,705	-	-	-	1,231,834	64,852	-

Table C
Wolf Creek Generating Station
DECON Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes: Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Period 2d Additional Costs																					
2d.2.1	License Termination Survey Planning	-	-	-	-	-	-	1,307	392	1,699	1,699	-	-	-	-	-	-	-	-	-	12,480
2d.2.2	Remedial Action Surveys	-	-	-	-	-	-	684	205	890	890	-	-	-	-	-	-	-	-	14,009	-
2d.2	Subtotal Period 2d Additional Costs	-	-	-	-	-	-	1,991	597	2,588	2,588	-	-	-	-	-	-	-	-	14,009	12,480
Period 2d Collateral Costs																					
2d.3.1	Process decommissioning water waste	86	-	58	138	-	254	-	133	668	668	-	-	-	571	-	-	-	34,257	111	-
2d.3.3	Small tool allowance	-	44	-	-	-	-	-	7	51	51	-	-	-	-	-	-	-	-	-	-
2d.3.4	Decommissioning Equipment Disposition	-	-	138	50	556	129	-	137	1,011	1,011	-	-	6,000	529	-	-	-	304,968	88	-
2d.3	Subtotal Period 2d Collateral Costs	86	44	196	188	556	383	-	276	1,730	1,730	-	-	6,000	1,100	-	-	-	339,225	199	-
Period 2d Period-Dependent Costs																					
2d.4.1	Decon supplies	183	-	-	-	-	-	-	46	229	229	-	-	-	-	-	-	-	-	-	-
2d.4.2	Insurance	-	-	-	-	-	-	694	69	764	764	-	-	-	-	-	-	-	-	-	-
2d.4.3	Property taxes	-	-	-	-	-	-	297	30	326	326	-	-	-	-	-	-	-	-	-	-
2d.4.4	Health physics supplies	-	691	-	-	-	-	-	173	864	864	-	-	-	-	-	-	-	-	-	-
2d.4.5	Heavy equipment rental	-	1,438	-	-	-	-	-	216	1,654	1,654	-	-	-	-	-	-	-	-	-	-
2d.4.6	Disposal of DAW generated	-	-	43	12	-	108	-	33	197	197	-	-	-	2,065	-	-	-	41,306	67	-
2d.4.7	Plant energy budget	-	-	-	-	-	-	564	85	648	648	-	-	-	-	-	-	-	-	-	-
2d.4.8	NRC Fees	-	-	-	-	-	-	359	36	395	395	-	-	-	-	-	-	-	-	-	-
2d.4.9	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	270	41	311	311	-	-	-	-	-	-	-	-	-	-
2d.4.10	Corporate Allocations	-	-	-	-	-	-	111	17	127	127	-	-	-	-	-	-	-	-	-	-
2d.4.11	Security Staff Cost	-	-	-	-	-	-	1,084	163	1,247	1,247	-	-	-	-	-	-	-	-	-	21,086
2d.4.12	DOC Staff Cost	-	-	-	-	-	-	5,580	837	6,416	6,416	-	-	-	-	-	-	-	-	-	70,286
2d.4.13	Utility Staff Cost	-	-	-	-	-	-	9,562	1,434	10,996	10,996	-	-	-	-	-	-	-	-	-	132,840
2d.4	Subtotal Period 2d Period-Dependent Costs	183	2,130	43	12	-	108	16,520	3,178	24,174	24,174	-	-	-	2,065	-	-	-	41,306	67	224,211
2d.0	TOTAL PERIOD 2d COST	1,307	3,854	575	410	1,868	2,443	20,511	5,741	36,708	36,708	-	-	21,647	11,870	-	-	-	1,612,365	79,128	236,691
PERIOD 2f - License Termination																					
Period 2f Direct Decommissioning Activities																					
2f.1.1	ORISE confirmatory survey	-	-	-	-	-	-	163	49	212	212	-	-	-	-	-	-	-	-	-	-
2f.1.2	Terminate license									a											
2f.1	Subtotal Period 2f Activity Costs	-	-	-	-	-	-	163	49	212	212	-	-	-	-	-	-	-	-	-	-
Period 2f Additional Costs																					
2f.2.1	License Termination Survey	-	-	-	-	-	-	6,238	1,871	8,109	8,109	-	-	-	-	-	-	-	-	152,819	6,240
2f.2	Subtotal Period 2f Additional Costs	-	-	-	-	-	-	6,238	1,871	8,109	8,109	-	-	-	-	-	-	-	-	152,819	6,240
Period 2f Collateral Costs																					
2f.3.1	DOC staff relocation expenses	-	-	-	-	-	-	1,239	186	1,425	1,425	-	-	-	-	-	-	-	-	-	-
2f.3	Subtotal Period 2f Collateral Costs	-	-	-	-	-	-	1,239	186	1,425	1,425	-	-	-	-	-	-	-	-	-	-
Period 2f Period-Dependent Costs																					
2f.4.2	Property taxes	-	-	-	-	-	-	340	34	374	374	-	-	-	-	-	-	-	-	-	-
2f.4.3	Health physics supplies	-	767	-	-	-	-	-	192	958	958	-	-	-	-	-	-	-	-	-	-
2f.4.4	Disposal of DAW generated	-	-	8	2	-	19	-	6	34	34	-	-	-	360	-	-	-	7,203	12	-
2f.4.5	Plant energy budget	-	-	-	-	-	-	323	48	372	372	-	-	-	-	-	-	-	-	-	-
2f.4.6	NRC Fees	-	-	-	-	-	-	407	47	514	514	-	-	-	-	-	-	-	-	-	-
2f.4.7	Corporate Allocations	-	-	-	-	-	-	64	10	73	73	-	-	-	-	-	-	-	-	-	-
2f.4.8	Security Staff Cost	-	-	-	-	-	-	810	122	932	932	-	-	-	-	-	-	-	-	-	19,337
2f.4.9	DOC Staff Cost	-	-	-	-	-	-	4,849	727	5,577	5,577	-	-	-	-	-	-	-	-	-	58,817
2f.4.10	Utility Staff Cost	-	-	-	-	-	-	5,985	898	6,883	6,883	-	-	-	-	-	-	-	-	-	76,543
2f.4	Subtotal Period 2f Period-Dependent Costs	-	767	8	2	-	19	12,839	2,083	15,717	15,717	-	-	-	360	-	-	-	7,203	12	154,697
2f.0	TOTAL PERIOD 2f COST	-	767	8	2	-	19	20,478	4,189	25,462	25,462	-	-	-	360	-	-	-	7,203	152,831	160,937
PERIOD 2 TOTALS		7,552	57,461	19,367	9,676	20,270	63,153	285,178	94,248	556,905	513,247	37,662	5,996	252,454	128,083	963	393	2,217	20,275,230	1,163,218	3,305,079
PERIOD 3b - Site Restoration																					
Period 3b Direct Decommissioning Activities																					
Demolition of Remaining Site Buildings																					
3b.1.1.1	Reactor	-	4,279	-	-	-	-	-	642	4,920	-	-	4,920	-	-	-	-	-	-	60,067	-
3b.1.1.2	Access Vaults	-	15	-	-	-	-	-	2	18	-	-	18	-	-	-	-	-	-	251	-
3b.1.1.3	Administration	-	197	-	-	-	-	-	30	227	-	-	227	-	-	-	-	-	-	4,467	-

Table C
Wolf Creek Generating Station
DECON Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Demolition of Remaining Site Buildings (continued)																					
3b.1.1.4	Auxiliary	-	3,368	-	-	-	-	-	505	3,873	-	-	3,873	-	-	-	-	-	-	49,968	-
3b.1.1.5	Auxiliary Boiler	-	27	-	-	-	-	-	4	31	-	-	31	-	-	-	-	-	-	619	-
3b.1.1.6	Chemical Addition Structure	-	39	-	-	-	-	-	6	44	-	-	44	-	-	-	-	-	-	735	-
3b.1.1.7	Circ Water Pump Enclosure	-	5	-	-	-	-	-	1	5	-	-	5	-	-	-	-	-	-	164	-
3b.1.1.8	Circ Water Travel Screen Enclosure	-	4	-	-	-	-	-	1	5	-	-	5	-	-	-	-	-	-	160	-
3b.1.1.9	Circulating Water Discharge Structure	-	145	-	-	-	-	-	22	167	-	-	167	-	-	-	-	-	-	2,373	-
3b.1.1.10	Circulating Water Intake & Screenhouse	-	139	-	-	-	-	-	21	160	-	-	160	-	-	-	-	-	-	2,059	-
3b.1.1.11	Communication Corridor - Clean	-	1,054	-	-	-	-	-	158	1,212	-	-	1,212	-	-	-	-	-	-	17,215	-
3b.1.1.12	Communication Corridor - Contaminated	-	49	-	-	-	-	-	7	56	-	-	56	-	-	-	-	-	-	674	-
3b.1.1.13	Covered Walkways	-	10	-	-	-	-	-	1	11	-	-	11	-	-	-	-	-	-	242	-
3b.1.1.14	Diesel Generator	-	411	-	-	-	-	-	62	472	-	-	472	-	-	-	-	-	-	5,492	-
3b.1.1.15	E.S.W.S. Pumphouse	-	229	-	-	-	-	-	34	263	-	-	263	-	-	-	-	-	-	3,019	-
3b.1.1.16	ESWS Valve House	-	12	-	-	-	-	-	2	14	-	-	14	-	-	-	-	-	-	243	-
3b.1.1.17	FLEX Building No. 1 & 2	-	550	-	-	-	-	-	83	633	-	-	633	-	-	-	-	-	-	10,361	-
3b.1.1.18	GOB - Administration Building	-	265	-	-	-	-	-	40	305	-	-	305	-	-	-	-	-	-	5,819	-
3b.1.1.19	Hot Machine Shop	-	17	-	-	-	-	-	3	19	-	-	19	-	-	-	-	-	-	417	-
3b.1.1.20	M.M.O. Building	-	253	-	-	-	-	-	38	291	-	-	291	-	-	-	-	-	-	3,483	-
3b.1.1.21	Material Center West	-	98	-	-	-	-	-	15	112	-	-	112	-	-	-	-	-	-	2,512	-
3b.1.1.22	Misc Structures and Additions	-	72	-	-	-	-	-	11	83	-	-	83	-	-	-	-	-	-	1,523	-
3b.1.1.23	Miscellaneous Site Foundations	-	354	-	-	-	-	-	53	407	-	-	407	-	-	-	-	-	-	7,074	-
3b.1.1.24	Miscellaneous Site Structures	-	1,445	-	-	-	-	-	217	1,662	-	-	1,662	-	-	-	-	-	-	20,147	-
3b.1.1.25	New Covered Walkway	-	8	-	-	-	-	-	1	9	-	-	9	-	-	-	-	-	-	160	-
3b.1.1.26	Oil Separator and Waste Tank	-	2	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	48	-
3b.1.1.27	Radwaste	-	1,513	-	-	-	-	-	227	1,740	-	-	1,740	-	-	-	-	-	-	21,798	-
3b.1.1.28	Radwaste Drum Storage	-	210	-	-	-	-	-	32	242	-	-	242	-	-	-	-	-	-	3,840	-
3b.1.1.29	Radwaste Storage Building	-	97	-	-	-	-	-	15	112	-	-	112	-	-	-	-	-	-	2,323	-
3b.1.1.30	SHO Diesel Generator	-	336	-	-	-	-	-	50	387	-	-	387	-	-	-	-	-	-	6,705	-
3b.1.1.31	Security Main Gate North	-	85	-	-	-	-	-	13	98	-	-	98	-	-	-	-	-	-	1,720	-
3b.1.1.32	Security Additions 2010	-	31	-	-	-	-	-	5	36	-	-	36	-	-	-	-	-	-	544	-
3b.1.1.33	Security/Guardhouse	-	45	-	-	-	-	-	7	51	-	-	51	-	-	-	-	-	-	845	-
3b.1.1.34	Site Diesel Generator	-	3	-	-	-	-	-	1	4	-	-	4	-	-	-	-	-	-	61	-
3b.1.1.35	Support Complex	-	28	-	-	-	-	-	4	33	-	-	33	-	-	-	-	-	-	697	-
3b.1.1.36	Turbine Building	-	2,613	-	-	-	-	-	392	3,005	-	-	3,005	-	-	-	-	-	-	55,694	-
3b.1.1.37	Turbine Pedestal	-	922	-	-	-	-	-	138	1,060	-	-	1,060	-	-	-	-	-	-	10,928	-
3b.1.1.38	Waste Water Treatment	-	19	-	-	-	-	-	3	22	-	-	22	-	-	-	-	-	-	407	-
3b.1.1.39	Water Treatment Building North (Z110)	-	55	-	-	-	-	-	8	63	-	-	63	-	-	-	-	-	-	911	-
3b.1.1.40	Fuel Building	-	1,731	-	-	-	-	-	260	1,991	-	-	1,991	-	-	-	-	-	-	22,580	-
3b.1.1	Totals	-	20,738	-	-	-	-	-	3,110	23,847	-	-	23,847	-	-	-	-	-	-	328,340	-
Site Closeout Activities																					
3b.1.2	Remove Rubble	-	914	-	-	-	-	-	137	1,051	-	-	1,051	-	-	-	-	-	-	5,383	-
3b.1.3	Grade & landscape site	-	111	-	-	-	-	-	17	128	-	-	128	-	-	-	-	-	-	512	-
3b.1.4	Final report to NRC	-	-	-	-	-	-	176	26	202	202	-	-	-	-	-	-	-	-	-	1,560
3b.1	Subtotal Period 3b Activity Costs	-	21,761	-	-	-	-	176	3,291	25,227	202	-	25,025	-	-	-	-	-	-	334,234	1,560
Period 3b Additional Costs																					
3b.2.1	Concrete Crushing	-	877	-	-	-	-	9	133	1,019	-	-	1,019	-	-	-	-	-	-	4,585	-
3b.2.2	Circulating Water Intake Cofferdam	-	279	-	-	-	-	-	42	321	-	-	321	-	-	-	-	-	-	2,540	-
3b.2.3	E.S.W.S. Pumphouse Cofferdam	-	372	-	-	-	-	-	56	428	-	-	428	-	-	-	-	-	-	3,386	-
3b.2.4	Excavation of Underground Services	-	2,100	-	-	-	-	864	445	3,409	-	-	3,409	-	-	-	-	-	-	15,949	-
3b.2.5	Construction Debris	-	-	-	-	-	-	1,770	266	2,036	-	-	2,036	-	-	-	-	-	-	-	-
3b.2	Subtotal Period 3b Additional Costs	-	3,627	-	-	-	-	2,644	941	7,212	-	-	7,212	-	-	-	-	-	-	20,460	-
Period 3b Collateral Costs																					
3b.3.1	Small tool allowance	-	192	-	-	-	-	-	29	221	-	-	221	-	-	-	-	-	-	-	-
3b.3.2	Corporate Allocations	-	-	-	-	-	-	50	8	58	-	-	58	-	-	-	-	-	-	-	-
3b.3	Subtotal Period 3b Collateral Costs	-	192	-	-	-	-	50	36	279	-	-	279	-	-	-	-	-	-	-	-
Period 3b Period-Dependent Costs																					
3b.4.2	Property taxes	-	-	-	-	-	-	312	31	343	-	-	343	-	-	-	-	-	-	-	-
3b.4.3	Heavy equipment rental	-	4,510	-	-	-	-	-	676	5,186	-	-	5,186	-	-	-	-	-	-	-	-
3b.4.4	Plant energy budget	-	-	-	-	-	-	311	47	358	-	-	358	-	-	-	-	-	-	-	-
3b.4.5	Security Staff Cost	-	-	-	-	-	-	1,560	234	1,794	-	-	1,794	-	-	-	-	-	-	-	37,234
3b.4.6	DOC Staff Cost	-	-	-	-	-	-	8,866	1,330	10,195	-	-	10,195	-	-	-	-	-	-	-	105,497
3b.4.7	Utility Staff Cost	-	-	-	-	-	-	4,523	678	5,202	-	-	5,202	-	-	-	-	-	-	-	60,506
3b.4	Subtotal Period 3b Period-Dependent Costs	-	4,510	-	-	-	-	15,572	2,997	23,079	-	-	23,079	-	-	-	-	-	-	-	203,237
3b.0	TOTAL PERIOD 3b COST	-	30,091	-	-	-	-	18,442	7,264	55,797	202	-	55,595	-	-	-	-	-	-	360,695	204,797

Table C
Wolf Creek Generating Station
DECON Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
PERIOD 3 TOTALS		-	30,091	-	-	-	-	18,442	7,264	55,797	202	-	55,595	-	-	-	-	-	-	360,695	204,797
TOTAL COST TO DECOMMISSION		10,727	90,306	19,562	10,038	20,285	66,661	425,527	121,954	765,060	656,060	46,016	62,985	254,605	129,335	1,750	393	2,217	20,533,320	1,545,053	4,781,552

TOTAL COST TO DECOMMISSION WITH 18.96% CONTINGENCY:	$765,060	thousands of 2014 dollars
TOTAL NRC LICENSE TERMINATION COST IS 85.75% OR:	$656,060	thousands of 2014 dollars
SPENT FUEL MANAGEMENT COST IS 6.01% OR:	$46,016	thousands of 2014 dollars
NON-NUCLEAR DEMOLITION COST IS 8.23% OR:	$62,985	thousands of 2014 dollars
TOTAL LOW-LEVEL RADIOACTIVE WASTE VOLUME BURIED (EXCLUDING GTCC):	131,478	cubic feet
TOTAL GREATER THAN CLASS C RADWASTE VOLUME GENERATED:	2,217	cubic feet
TOTAL SCRAP METAL REMOVED:	69,023	tons
TOTAL CRAFT LABOR REQUIREMENTS:	1,545,053	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
Wolf Creek Generating Station
SAFSTOR Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
PERIOD 1a - Shutdown through Transition																					
Period 1a Direct Decommissioning Activities																					
1a.1.1	SAFSTOR site characterization survey	-	-	-	-	-	-	380	114	494	494	-	-	-	-	-	-	-	-	-	-
1a.1.2	Prepare preliminary decommissioning cost	-	-	-	-	-	-	146	22	168	168	-	-	-	-	-	-	-	-	-	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	-	-	-	-	-	-	225	34	259	259	-	-	-	-	-	-	-	-	-	2,000
1a.1.8	Review plant dwgs & specs.	-	-	-	-	-	-	146	22	168	168	-	-	-	-	-	-	-	-	-	1,300
1a.1.9	Perform detailed rad survey									a											
1a.1.10	Estimate by-product inventory	-	-	-	-	-	-	113	17	129	129	-	-	-	-	-	-	-	-	-	1,000
1a.1.11	End product description	-	-	-	-	-	-	113	17	129	129	-	-	-	-	-	-	-	-	-	1,000
1a.1.12	Detailed by-product inventory	-	-	-	-	-	-	169	25	194	194	-	-	-	-	-	-	-	-	-	1,500
1a.1.13	Define major work sequence	-	-	-	-	-	-	113	17	129	129	-	-	-	-	-	-	-	-	-	1,000
1a.1.14	Perform SER and EA	-	-	-	-	-	-	349	52	401	401	-	-	-	-	-	-	-	-	-	3,100
1a.1.15	Perform Site-Specific Cost Study	-	-	-	-	-	-	563	84	647	647	-	-	-	-	-	-	-	-	-	5,000
Activity Specifications																					
1a.1.16.1	Prepare plant and facilities for SAFSTOR	-	-	-	-	-	-	554	83	637	637	-	-	-	-	-	-	-	-	-	4,920
1a.1.16.2	Plant systems	-	-	-	-	-	-	469	70	539	539	-	-	-	-	-	-	-	-	-	4,167
1a.1.16.3	Plant structures and buildings	-	-	-	-	-	-	351	53	404	404	-	-	-	-	-	-	-	-	-	3,120
1a.1.16.4	Waste management	-	-	-	-	-	-	225	34	259	259	-	-	-	-	-	-	-	-	-	2,000
1a.1.16.5	Facility and site dormancy	-	-	-	-	-	-	225	34	259	259	-	-	-	-	-	-	-	-	-	2,000
1a.1.16	Total	-	-	-	-	-	-	1,824	274	2,097	2,097	-	-	-	-	-	-	-	-	-	16,207
Detailed Work Procedures																					
1a.1.17.1	Plant systems	-	-	-	-	-	-	133	20	153	153	-	-	-	-	-	-	-	-	-	1,183
1a.1.17.2	Facility closeout & dormancy	-	-	-	-	-	-	135	20	155	155	-	-	-	-	-	-	-	-	-	1,200
1a.1.17	Total	-	-	-	-	-	-	268	40	308	308	-	-	-	-	-	-	-	-	-	2,383
1a.1.18	Procure vacuum drying system	-	-	-	-	-	-	11	2	13	13	-	-	-	-	-	-	-	-	-	100
1a.1.19	Drain/de-energize non-cont. systems									a											
1a.1.20	Drain & dry NSSS									a											
1a.1.21	Drain/de-energize contaminated systems									a											
1a.1.22	Decon/secure contaminated systems									a											
1a.1	Subtotal Period 1a Activity Costs	-	-	-	-	-	-	4,419	720	5,138	5,138	-	-	-	-	-	-	-	-	-	35,890
Period 1a Collateral Costs																					
1a.3.1	Spent Fuel Capital and Transfer	-	-	-	-	-	-	1,134	170	1,304	-	1,304	-	-	-	-	-	-	-	-	-
1a.3	Subtotal Period 1a Collateral Costs	-	-	-	-	-	-	1,134	170	1,304	-	1,304	-	-	-	-	-	-	-	-	-
Period 1a Period-Dependent Costs																					
1a.4.1	Insurance	-	-	-	-	-	-	2,187	219	2,406	2,406	-	-	-	-	-	-	-	-	-	-
1a.4.2	Property taxes	-	-	-	-	-	-	1,643	164	1,808	1,808	-	-	-	-	-	-	-	-	-	-
1a.4.3	Health physics supplies	-	515	-	-	-	-	-	129	643	643	-	-	-	-	-	-	-	-	-	-
1a.4.4	Heavy equipment rental	-	561	-	-	-	-	-	84	645	645	-	-	-	-	-	-	-	-	-	-
1a.4.5	Disposal of DAW generated	-	-	13	4	-	32	-	10	58	58	-	-	-	610	-	-	-	12,190	20	-
1a.4.6	Plant energy budget	-	-	-	-	-	-	2,091	314	2,405	2,405	-	-	-	-	-	-	-	-	-	-
1a.4.7	NRC Fees	-	-	-	-	-	-	1,181	118	1,299	1,299	-	-	-	-	-	-	-	-	-	-
1a.4.8	Emergency Planning Fees	-	-	-	-	-	-	1,231	123	1,354	-	1,354	-	-	-	-	-	-	-	-	-
1a.4.9	INPO Fees	-	-	-	-	-	-	336	50	386	386	-	-	-	-	-	-	-	-	-	-
1a.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	791	119	910	-	910	-	-	-	-	-	-	-	-	-
1a.4.11	ISFSI Operating Costs	-	-	-	-	-	-	95	14	110	-	110	-	-	-	-	-	-	-	-	-
1a.4.12	Corporate Allocations	-	-	-	-	-	-	353	53	406	406	-	-	-	-	-	-	-	-	-	-
1a.4.13	Security Staff Cost	-	-	-	-	-	-	15,464	2,318	17,773	17,773	-	-	-	-	-	-	-	-	-	312,857
1a.4.14	Utility Staff Cost	-	-	-	-	-	-	28,052	4,208	32,260	32,260	-	-	-	-	-	-	-	-	-	423,400
1a.4	Subtotal Period 1a Period-Dependent Costs	-	1,075	13	4	-	32	53,416	7,923	62,463	60,089	2,374	-	-	610	-	-	-	12,190	20	736,257
1a.0	TOTAL PERIOD 1a COST	-	1,075	13	4	-	32	58,969	8,813	68,906	65,228	3,678	-	-	610	-	-	-	12,190	20	772,147

Table D
Wolf Creek Generating Station
SAFSTOR Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
PERIOD 1b - SAFSTOR Limited DECON Activities																					
Period 1b Direct Decommissioning Activities																					
Decontamination of Site Buildings																					
1b.1.1.1	Reactor	825	-	-	-	-	-	-	413	1,238	1,238	-	-	-	-	-	-	-	-	24,102	-
1b.1.1.2	Auxiliary	407	-	-	-	-	-	-	204	611	611	-	-	-	-	-	-	-	-	12,527	-
1b.1.1.3	Communication Corridor - Contaminated	9	-	-	-	-	-	-	4	13	13	-	-	-	-	-	-	-	-	276	-
1b.1.1.4	Fuel Building	543	-	-	-	-	-	-	272	815	815	-	-	-	-	-	-	-	-	14,371	-
1b.1.1.5	Hot Machine Shop	11	-	-	-	-	-	-	6	17	17	-	-	-	-	-	-	-	-	344	-
1b.1.1.6	Radwaste	217	-	-	-	-	-	-	108	325	325	-	-	-	-	-	-	-	-	6,671	-
1b.1.1.7	Radwaste Drum Storage	24	-	-	-	-	-	-	12	37	37	-	-	-	-	-	-	-	-	750	-
1b.1.1.8	Radwaste Storage Building	57	-	-	-	-	-	-	28	85	85	-	-	-	-	-	-	-	-	1,690	-
1b.1.1	Totals	2,094	-	-	-	-	-	-	1,047	3,141	3,141	-	-	-	-	-	-	-	-	60,731	-
1b.1	Subtotal Period 1b Activity Costs	2,094	-	-	-	-	-	-	1,047	3,141	3,141	-	-	-	-	-	-	-	-	60,731	-
Period 1b Collateral Costs																					
1b.3.1	Decon equipment	925	-	-	-	-	-	-	139	1,064	1,064	-	-	-	-	-	-	-	-	-	-
1b.3.2	Process decommissioning water waste	172	-	111	262	-	482	-	257	1,284	1,284	-	-	-	1,086	-	-	-	65,189	212	-
1b.3.4	Small tool allowance	-	34	-	-	-	-	-	5	39	39	-	-	-	-	-	-	-	-	-	-
1b.3.5	Spent Fuel Capital and Transfer	-	-	-	-	-	-	1,512	227	1,739	-	1,739	-	-	-	-	-	-	-	-	-
1b.3	Subtotal Period 1b Collateral Costs	1,097	34	111	262	-	482	1,512	628	4,126	2,387	1,739	-	-	1,086	-	-	-	65,189	212	-
Period 1b Period-Dependent Costs																					
1b.4.1	Decon supplies	1,196	-	-	-	-	-	-	299	1,495	1,495	-	-	-	-	-	-	-	-	-	-
1b.4.2	Insurance	-	-	-	-	-	-	551	55	607	607	-	-	-	-	-	-	-	-	-	-
1b.4.3	Property taxes	-	-	-	-	-	-	414	41	456	456	-	-	-	-	-	-	-	-	-	-
1b.4.4	Health physics supplies	-	420	-	-	-	-	-	105	525	525	-	-	-	-	-	-	-	-	-	-
1b.4.5	Heavy equipment rental	-	141	-	-	-	-	-	21	163	163	-	-	-	-	-	-	-	-	-	-
1b.4.6	Disposal of DAW generated	-	-	16	4	-	39	-	12	72	72	-	-	-	753	-	-	-	15,052	25	-
1b.4.7	Plant energy budget	-	-	-	-	-	-	527	79	606	606	-	-	-	-	-	-	-	-	-	-
1b.4.8	NRC Fees	-	-	-	-	-	-	174	17	191	191	-	-	-	-	-	-	-	-	-	-
1b.4.9	Emergency Planning Fees	-	-	-	-	-	-	310	31	341	-	341	-	-	-	-	-	-	-	-	-
1b.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	190	30	229	-	229	-	-	-	-	-	-	-	-	-
1b.4.11	ISFSI Operating Costs	-	-	-	-	-	-	24	4	28	-	28	-	-	-	-	-	-	-	-	-
1b.4.12	Corporate Allocations	-	-	-	-	-	-	89	13	102	102	-	-	-	-	-	-	-	-	-	-
1b.4.13	Security Staff Cost	-	-	-	-	-	-	3,153	473	3,626	3,626	-	-	-	-	-	-	-	-	-	63,086
1b.4.14	Utility Staff Cost	-	-	-	-	-	-	7,071	1,061	8,131	8,131	-	-	-	-	-	-	-	-	-	106,720
1b.4	Subtotal Period 1b Period-Dependent Costs	1,196	562	16	4	-	39	12,513	2,242	16,572	15,974	598	-	-	753	-	-	-	15,052	25	169,806
1b.0	TOTAL PERIOD 1b COST	4,387	595	128	266	-	522	14,025	3,916	23,839	21,502	2,338	-	-	1,839	-	-	-	80,241	60,968	169,806
PERIOD 1c - Preparations for SAFSTOR Dormancy																					
Period 1c Direct Decommissioning Activities																					
1c.1.1	Prepare support equipment for storage	-	388	-	-	-	-	-	58	447	447	-	-	-	-	-	-	-	-	3,000	-
1c.1.2	Install containment pressure equal. lines	-	25	-	-	-	-	-	4	29	29	-	-	-	-	-	-	-	-	700	-
1c.1.3	Interim survey prior to dormancy	-	-	-	-	-	-	733	220	953	953	-	-	-	-	-	-	-	-	14,124	-
1c.1.4	Secure building accesses									a											
1c.1.5	Prepare & submit interim report	-	-	-	-	-	-	66	10	75	75	-	-	-	-	-	-	-	-	-	583
1c.1	Subtotal Period 1c Activity Costs	-	414	-	-	-	-	799	292	1,504	1,504	-	-	-	-	-	-	-	-	17,824	583
Period 1c Additional Costs																					
1c.2.1	Spent fuel pool isolation	-	-	-	-	-	-	10,813	1,622	12,434	12,434	-	-	-	-	-	-	-	-	-	-
1c.2.2	Misc/Hazardous Waste	-	-	68	21	15	-	-	12	116	116	-	-	2,151	-	-	-	-	137,800	740	-
1c.2	Subtotal Period 1c Additional Costs	-	-	68	21	15	-	10,813	1,634	12,551	12,551	-	-	2,151	-	-	-	-	137,800	740	-
Period 1c Collateral Costs																					
1c.3.1	Process decommissioning water waste	187	-	120	285	-	525	-	280	1,397	1,397	-	-	-	1,183	-	-	-	70,966	231	-
1c.3.3	Small tool allowance	-	2	-	-	-	-	-	0	3	3	-	-	-	-	-	-	-	-	-	-
1c.3.4	Spent Fuel Capital and Transfer	-	-	-	-	-	-	1,512	227	1,739	-	1,739	-	-	-	-	-	-	-	-	-
1c.3	Subtotal Period 1c Collateral Costs	187	2	120	285	-	525	1,512	507	3,139	1,400	1,739	-	-	1,183	-	-	-	70,966	231	-
Period 1c Period-Dependent Costs																					
1c.4.1	Insurance	-	-	-	-	-	-	551	55	607	607	-	-	-	-	-	-	-	-	-	-
1c.4.2	Property taxes	-	-	-	-	-	-	414	41	456	456	-	-	-	-	-	-	-	-	-	-
1c.4.3	Health physics supplies	-	219	-	-	-	-	-	55	274	274	-	-	-	-	-	-	-	-	-	-

Table D
Wolf Creek Generating Station
SAFSTOR Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Llc. 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 Period-Dependent Costs (continued)																					
1c.4.4	Heavy equipment rental	-	141	-	-	-	-	-	21	163	163	-	-	-	-	-	-	-	-	-	-
1c.4.5	Disposal of DAW generated	-	-	3	1	-	8	-	2	15	15	-	-	-	154	-	-	-	3,073	5	-
1c.4.6	Plant energy budget	-	-	-	-	-	-	527	79	606	606	-	-	-	-	-	-	-	-	-	-
1c.4.7	NRC Fees	-	-	-	-	-	-	174	17	191	191	-	-	-	-	-	-	-	-	-	-
1c.4.8	Emergency Planning Fees	-	-	-	-	-	-	310	31	341	-	341	-	-	-	-	-	-	-	-	-
1c.4.9	Spent Fuel Pool O&M	-	-	-	-	-	-	199	30	229	-	229	-	-	-	-	-	-	-	-	-
1c.4.10	ISFSI Operating Costs	-	-	-	-	-	-	24	4	28	-	28	-	-	-	-	-	-	-	-	-
1c.4.11	Corporate Allocations	-	-	-	-	-	-	89	13	102	102	-	-	-	-	-	-	-	-	-	-
1c.4.12	Security Staff Cost	-	-	-	-	-	-	3,153	473	3,626	3,626	-	-	-	-	-	-	-	-	-	63,086
1c.4.13	Utility Staff Cost	-	-	-	-	-	-	7,071	1,061	8,131	8,131	-	-	-	-	-	-	-	-	-	106,720
1c.4	Subtotal Period 1c Period-Dependent Costs	-	361	3	1	-	8	12,513	1,883	14,769	14,170	598	-	-	154	-	-	-	3,073	5	169,806
1c.0	TOTAL PERIOD 1c COST	187	777	192	307	15	533	25,636	4,316	31,963	29,625	2,338	-	2,151	1,336	-	-	-	211,838	18,799	170,389
PERIOD 1 TOTALS		4,574	2,448	331	577	15	1,087	98,631	17,045	124,708	116,354	8,353	-	2,151	3,785	-	-	-	304,269	79,787	1,112,342
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	-	-	-	-	-	-	414	62	476	476	-	-	-	-	-	-	-	-	-	-
2a.1.5	Maintenance supplies	-	-	-	-	-	-	556	139	695	695	-	-	-	-	-	-	-	-	-	-
2a.1	Subtotal Period 2a Activity Costs	-	-	-	-	-	-	970	201	1,171	1,171	-	-	-	-	-	-	-	-	-	-
Period 2a Collateral Costs																					
2a.3.1	Spent Fuel Capital and Transfer	-	-	-	-	-	-	26,741	4,011	30,752	-	30,752	-	-	-	-	-	-	-	-	-
2a.3	Subtotal Period 2a Collateral Costs	-	-	-	-	-	-	26,741	4,011	30,752	-	30,752	-	-	-	-	-	-	-	-	-
Period 2a Period-Dependent Costs																					
2a.4.1	Insurance	-	-	-	-	-	-	4,121	412	4,533	3,592	940	-	-	-	-	-	-	-	-	-
2a.4.2	Property taxes	-	-	-	-	-	-	6,573	657	7,231	7,231	-	-	-	-	-	-	-	-	-	-
2a.4.3	Health physics supplies	-	626	-	-	-	-	-	206	1,032	1,032	-	-	-	-	-	-	-	-	-	-
2a.4.4	Disposal of DAW generated	-	-	19	5	-	46	-	15	86	86	-	-	-	920	-	-	-	18,406	30	-
2a.4.5	Plant energy budget	-	-	-	-	-	-	1,673	251	1,924	962	962	-	-	-	-	-	-	-	-	-
2a.4.6	NRC Fees	-	-	-	-	-	-	1,157	116	1,273	1,273	-	-	-	-	-	-	-	-	-	-
2a.4.7	Emergency Planning Fees	-	-	-	-	-	-	2,574	257	2,832	-	2,832	-	-	-	-	-	-	-	-	-
2a.4.8	Spent Fuel Pool O&M	-	-	-	-	-	-	3,164	475	3,639	-	3,639	-	-	-	-	-	-	-	-	-
2a.4.9	ISFSI Operating Costs	-	-	-	-	-	-	382	57	439	-	439	-	-	-	-	-	-	-	-	-
2a.4.10	Corporate Allocations	-	-	-	-	-	-	274	41	316	70	246	-	-	-	-	-	-	-	-	-
2a.4.11	Security Staff Cost	-	-	-	-	-	-	50,036	7,505	57,541	7,399	50,143	-	-	-	-	-	-	-	-	1,001,143
2a.4.12	Utility Staff Cost	-	-	-	-	-	-	22,798	3,420	26,218	5,302	20,915	-	-	-	-	-	-	-	-	329,543
2a.4	Subtotal Period 2a Period-Dependent Costs	-	826	19	5	-	48	92,753	13,413	107,065	26,949	80,116	-	-	920	-	-	-	18,406	30	1,330,686
2a.0	TOTAL PERIOD 2a COST	-	826	19	5	-	48	120,464	17,625	138,988	28,120	110,868	-	-	920	-	-	-	18,406	30	1,330,686
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	-	-	-	-	-	-	5,007	751	5,758	5,758	-	-	-	-	-	-	-	-	-	-
2c.1.5	Maintenance supplies	-	-	-	-	-	-	6,715	1,679	8,394	8,394	-	-	-	-	-	-	-	-	-	-
2c.1	Subtotal Period 2c Activity Costs	-	-	-	-	-	-	11,723	2,430	14,152	14,152	-	-	-	-	-	-	-	-	-	-
Period 2c Period-Dependent Costs																					
2c.4.1	Insurance	-	-	-	-	-	-	39,471	3,947	43,418	43,418	-	-	-	-	-	-	-	-	-	-
2c.4.2	Property taxes	-	-	-	-	-	-	10,141	1,014	11,155	11,155	-	-	-	-	-	-	-	-	-	-
2c.4.3	Health physics supplies	-	4,553	-	-	-	-	-	1,138	5,692	5,692	-	-	-	-	-	-	-	-	-	-
2c.4.4	Disposal of DAW generated	-	-	103	29	-	258	-	79	469	469	-	-	-	4,921	-	-	-	98,421	161	-
2c.4.5	Plant energy budget	-	-	-	-	-	-	10,110	1,516	11,626	11,626	-	-	-	-	-	-	-	-	-	-
2c.4.6	NRC Fees	-	-	-	-	-	-	12,264	1,226	13,491	13,491	-	-	-	-	-	-	-	-	-	-
2c.4.7	Corporate Allocations	-	-	-	-	-	-	735	110	845	845	-	-	-	-	-	-	-	-	-	-
2c.4.8	Security Staff Cost	-	-	-	-	-	-	77,761	11,664	89,426	89,426	-	-	-	-	-	-	-	-	-	1,512,514
2c.4.9	Utility Staff Cost	-	-	-	-	-	-	55,726	8,359	64,085	64,085	-	-	-	-	-	-	-	-	-	882,300
2c.4	Subtotal Period 2c Period-Dependent Costs	-	4,553	103	29	-	258	206,208	29,055	240,206	240,206	-	-	-	4,921	-	-	-	98,421	161	2,394,814

Table D
Wolf Creek Generating Station
SAFSTOR Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes: Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
2c.0	TOTAL PERIOD 2c COST	-	4,553	103	29	-	258	217,931	31,485	254,358	254,358	-	-	-	4,921	-	-	-	98,421	161	2,394,814
PERIOD 2 TOTALS		-	5,379	122	34	-	306	338,395	49,110	393,346	282,478	110,868	-	-	5,841	-	-	-	116,827	191	3,725,500
PERIOD 3a - Reactivate Site Following SAFSTOR Dormancy																					
Period 3a Direct Decommissioning Activities																					
3a.1.1	Prepare preliminary decommissioning cost	-	-	-	-	-	-	146	22	168	168	-	-	-	-	-	-	-	-	-	1,300
3a.1.2	Review plant dwgs & specs.	-	-	-	-	-	-	518	78	595	595	-	-	-	-	-	-	-	-	-	4,600
3a.1.3	Perform detailed rad survey									a											
3a.1.4	End product description	-	-	-	-	-	-	113	17	129	129	-	-	-	-	-	-	-	-	-	1,000
3a.1.5	Detailed by-product inventory	-	-	-	-	-	-	146	22	168	168	-	-	-	-	-	-	-	-	-	1,300
3a.1.6	Define major work sequence	-	-	-	-	-	-	844	127	971	971	-	-	-	-	-	-	-	-	-	7,500
3a.1.7	Perform SER and EA	-	-	-	-	-	-	349	52	401	401	-	-	-	-	-	-	-	-	-	3,100
3a.1.8	Perform Site-Specific Cost Study	-	-	-	-	-	-	563	84	647	647	-	-	-	-	-	-	-	-	-	5,000
3a.1.9	Prepare/submit License Termination Plan	-	-	-	-	-	-	461	69	530	530	-	-	-	-	-	-	-	-	-	4,096
3a.1.10	Receive NRC approval of termination plan									a											
Activity Specifications																					
3a.1.11.1	Re-activate plant & temporary facilities	-	-	-	-	-	-	829	124	954	858	-	95	-	-	-	-	-	-	-	7,370
3a.1.11.2	Plant systems	-	-	-	-	-	-	469	70	539	485	-	54	-	-	-	-	-	-	-	4,167
3a.1.11.3	Reactor internals	-	-	-	-	-	-	799	120	919	919	-	-	-	-	-	-	-	-	-	7,100
3a.1.11.4	Reactor vessel	-	-	-	-	-	-	731	110	841	841	-	-	-	-	-	-	-	-	-	6,500
3a.1.11.5	Biological shield	-	-	-	-	-	-	56	8	65	65	-	-	-	-	-	-	-	-	-	500
3a.1.11.6	Steam generators	-	-	-	-	-	-	351	53	404	404	-	-	-	-	-	-	-	-	-	3,120
3a.1.11.7	Reinforced concrete	-	-	-	-	-	-	180	27	207	104	-	104	-	-	-	-	-	-	-	1,600
3a.1.11.8	Main Turbine	-	-	-	-	-	-	45	7	52	-	-	52	-	-	-	-	-	-	-	400
3a.1.11.9	Main Condensers	-	-	-	-	-	-	45	7	52	-	-	52	-	-	-	-	-	-	-	400
3a.1.11.10	Plant structures & buildings	-	-	-	-	-	-	351	53	404	202	-	202	-	-	-	-	-	-	-	3,120
3a.1.11.11	Waste management	-	-	-	-	-	-	518	78	595	595	-	-	-	-	-	-	-	-	-	4,600
3a.1.11.12	Facility & site closeout	-	-	-	-	-	-	101	15	116	58	-	58	-	-	-	-	-	-	-	900
3a.1.11	Total	-	-	-	-	-	-	4,476	671	5,147	4,531	-	616	-	-	-	-	-	-	-	39,777
Planning & Site Preparations																					
3a.1.12	Prepare dismantling sequence	-	-	-	-	-	-	270	41	311	311	-	-	-	-	-	-	-	-	-	2,400
3a.1.13	Plant prep. & temp. svces	-	-	-	-	-	-	3,000	450	3,450	3,450	-	-	-	-	-	-	-	-	-	-
3a.1.14	Design water clean-up system	-	-	-	-	-	-	158	24	181	181	-	-	-	-	-	-	-	-	-	1,400
3a.1.15	Rigging/Cont. Cntrl Envlps/tooling/etc.	-	-	-	-	-	-	2,300	345	2,645	2,645	-	-	-	-	-	-	-	-	-	-
3a.1.16	Procure casks/liners & containers	-	-	-	-	-	-	138	21	159	159	-	-	-	-	-	-	-	-	-	1,230
3a.1	Subtotal Period 3a Activity Costs	-	-	-	-	-	-	13,481	2,022	15,503	14,887	-	616	-	-	-	-	-	-	-	72,703
Period 3a Period-Dependent Costs																					
3a.4.1	Insurance	-	-	-	-	-	-	412	41	453	453	-	-	-	-	-	-	-	-	-	-
3a.4.2	Property taxes	-	-	-	-	-	-	106	11	116	116	-	-	-	-	-	-	-	-	-	-
3a.4.3	Health physics supplies	-	227	-	-	-	-	-	57	283	283	-	-	-	-	-	-	-	-	-	-
3a.4.4	Heavy equipment rental	-	283	-	-	-	-	-	42	325	325	-	-	-	-	-	-	-	-	-	-
3a.4.5	Disposal of DAW generated	-	-	5	2	-	14	-	4	25	25	-	-	-	259	-	-	-	5,186	8	-
3a.4.6	Plant energy budget	-	-	-	-	-	-	1,054	158	1,212	1,212	-	-	-	-	-	-	-	-	-	-
3a.4.7	NRC Fees	-	-	-	-	-	-	191	19	210	210	-	-	-	-	-	-	-	-	-	-
3a.4.8	Corporate Allocations	-	-	-	-	-	-	109	16	125	125	-	-	-	-	-	-	-	-	-	-
3a.4.9	Security Staff Cost	-	-	-	-	-	-	1,080	162	1,242	1,242	-	-	-	-	-	-	-	-	-	32,857
3a.4.10	Utility Staff Cost	-	-	-	-	-	-	8,918	1,338	10,256	10,256	-	-	-	-	-	-	-	-	-	130,377
3a.4	Subtotal Period 3a Period-Dependent Costs	-	509	5	2	-	14	11,869	1,848	14,247	14,247	-	-	-	259	-	-	-	5,186	8	163,234
3a.0	TOTAL PERIOD 3a COST	-	509	5	2	-	14	25,350	3,870	29,750	29,134	-	616	-	259	-	-	-	5,186	8	235,937
PERIOD 3b - Decommissioning Preparations																					
Period 3b Direct Decommissioning Activities																					
Detailed Work Procedures																					
3b.1.1.1	Plant systems	-	-	-	-	-	-	533	80	612	551	-	61	-	-	-	-	-	-	-	4,733
3b.1.1.2	Reactor internals	-	-	-	-	-	-	281	42	324	324	-	-	-	-	-	-	-	-	-	2,500
3b.1.1.3	Remaining buildings	-	-	-	-	-	-	152	23	175	44	-	131	-	-	-	-	-	-	-	1,350
3b.1.1.4	CRD cooling assembly	-	-	-	-	-	-	113	17	129	129	-	-	-	-	-	-	-	-	-	1,000
3b.1.1.5	CRD housings & ICI tubes	-	-	-	-	-	-	113	17	129	129	-	-	-	-	-	-	-	-	-	1,000
3b.1.1.6	Incore instrumentation	-	-	-	-	-	-	113	17	129	129	-	-	-	-	-	-	-	-	-	1,000
3b.1.1.7	Reactor vessel	-	-	-	-	-	-	408	61	470	470	-	-	-	-	-	-	-	-	-	3,630
3b.1.1.8	Facility closeout	-	-	-	-	-	-	135	20	155	78	-	78	-	-	-	-	-	-	-	1,200

Table D
Wolf Creek Generating Station
SAFSTOR Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Llc. 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
Detailed Work Procedures (continued)																					
3b.1.1.9	Missile shields	-	-	-	-	-	-	51	8	58	58	-	-	-	-	-	-	-	-	-	450
3b.1.1.10	Biological shield	-	-	-	-	-	-	135	20	155	155	-	-	-	-	-	-	-	-	-	1,200
3b.1.1.11	Steam generators	-	-	-	-	-	-	518	78	595	595	-	-	-	-	-	-	-	-	-	4,600
3b.1.1.12	Reinforced concrete	-	-	-	-	-	-	113	17	129	65	-	65	-	-	-	-	-	-	-	1,000
3b.1.1.13	Main Turbine	-	-	-	-	-	-	176	26	202	-	-	202	-	-	-	-	-	-	-	1,560
3b.1.1.14	Main Condensers	-	-	-	-	-	-	176	26	202	-	-	202	-	-	-	-	-	-	-	1,560
3b.1.1.15	Auxiliary building	-	-	-	-	-	-	307	46	353	318	-	35	-	-	-	-	-	-	-	2,730
3b.1.1.16	Reactor building	-	-	-	-	-	-	307	46	353	318	-	35	-	-	-	-	-	-	-	2,730
3b.1.1	Total	-	-	-	-	-	-	3,628	544	4,173	3,364	-	809	-	-	-	-	-	-	-	32,243
3b.1	Subtotal Period 3b Activity Costs	-	-	-	-	-	-	3,628	544	4,173	3,364	-	809	-	-	-	-	-	-	-	32,243
Period 3b Additional Costs																					
3b.2.1	Site Characterization	-	-	-	-	-	-	2,890	867	3,758	3,758	-	-	-	-	-	-	-	-	19,100	7,852
3b.2	Subtotal Period 3b Additional Costs	-	-	-	-	-	-	2,890	867	3,758	3,758	-	-	-	-	-	-	-	-	19,100	7,852
Period 3b Collateral Costs																					
3b.3.1	Decon equipment	925	-	-	-	-	-	-	139	1,064	1,064	-	-	-	-	-	-	-	-	-	-
3b.3.2	DOC staff relocation expenses	-	-	-	-	-	-	1,239	186	1,425	1,425	-	-	-	-	-	-	-	-	-	-
3b.3.3	Pipe cutting equipment	-	1,100	-	-	-	-	-	165	1,265	1,265	-	-	-	-	-	-	-	-	-	-
3b.3	Subtotal Period 3b Collateral Costs	925	1,100	-	-	-	-	1,239	490	3,753	3,753	-	-	-	-	-	-	-	-	-	-
Period 3b Period-Dependent Costs																					
3b.4.1	Decon supplies	56	-	-	-	-	-	-	14	71	71	-	-	-	-	-	-	-	-	-	-
3b.4.2	Insurance	-	-	-	-	-	-	1,030	103	1,133	1,133	-	-	-	-	-	-	-	-	-	-
3b.4.3	Property taxes	-	-	-	-	-	-	210	21	231	231	-	-	-	-	-	-	-	-	-	-
3b.4.4	Health physics supplies	-	496	-	-	-	-	-	124	620	620	-	-	-	-	-	-	-	-	-	-
3b.4.5	Heavy equipment rental	-	561	-	-	-	-	-	84	645	645	-	-	-	-	-	-	-	-	-	-
3b.4.6	Disposal of DAW generated	-	-	12	3	-	30	-	9	55	55	-	-	-	582	-	-	-	11,636	19	-
3b.4.7	Plant energy budget	-	-	-	-	-	-	2,091	314	2,405	2,405	-	-	-	-	-	-	-	-	-	-
3b.4.8	NRC Fees	-	-	-	-	-	-	378	38	416	416	-	-	-	-	-	-	-	-	-	-
3b.4.9	Corporate Allocations	-	-	-	-	-	-	215	32	248	248	-	-	-	-	-	-	-	-	-	-
3b.4.10	Security Staff Cost	-	-	-	-	-	-	2,143	321	2,464	2,464	-	-	-	-	-	-	-	-	-	65,179
3b.4.11	DOC Staff Cost	-	-	-	-	-	-	9,291	1,394	10,684	10,684	-	-	-	-	-	-	-	-	-	116,800
3b.4.12	Utility Staff Cost	-	-	-	-	-	-	17,691	2,654	20,344	20,344	-	-	-	-	-	-	-	-	-	258,629
3b.4	Subtotal Period 3b Period-Dependent Costs	56	1,057	12	3	-	30	33,049	5,108	39,316	39,316	-	-	-	582	-	-	-	11,636	19	440,607
3b.0	TOTAL PERIOD 3b COST	981	2,157	12	3	-	30	40,806	7,009	50,999	50,190	-	809	-	582	-	-	-	11,636	19,119	480,702
PERIOD 3 TOTALS		981	2,666	18	5	-	44	66,156	10,879	80,750	79,324	-	1,426	-	841	-	-	-	16,822	19,127	716,639
PERIOD 4a - Large Component Removal																					
Period 4a Direct Decommissioning Activities																					
Nuclear Steam Supply System Removal																					
4a.1.1.1	Reactor Coolant Piping	24	116	24	18	133	269	-	131	705	705	-	-	580	614	-	-	-	134,538	3,957	-
4a.1.1.2	Pressurizer Relief Tank	4	15	7	5	37	67	-	30	166	166	-	-	164	164	-	-	-	36,395	594	-
4a.1.1.3	Reactor Coolant Pumps & Motors	13	54	62	205	-	1,031	-	315	1,680	1,680	-	-	-	3,386	-	-	-	816,140	2,700	80
4a.1.1.4	Pressurizer	6	36	412	145	-	1,138	-	360	2,098	2,098	-	-	-	3,739	-	-	-	240,915	1,539	1,500
4a.1.1.5	Steam Generators	50	5,187	2,854	3,184	2,599	6,862	-	4,190	24,927	24,927	-	-	40,845	22,546	-	-	-	3,356,336	20,508	4,500
4a.1.1.6	CRDMs/ICIs/Service Structure Removal	20	68	250	38	94	207	-	124	802	802	-	-	1,227	3,012	-	-	-	101,470	2,274	-
4a.1.1.7	Reactor Vessel Internals	53	3,374	7,381	883	-	17,515	297	13,424	42,927	42,927	-	-	-	2,461	501	393	-	328,507	27,633	1,237
4a.1.1.8	Vessel & Internals GTCC Disposal	-	-	-	-	-	12,118	-	1,818	13,935	13,935	-	-	-	-	-	-	2,217	433,180	-	-
4a.1.1.9	Reactor Vessel	68	6,301	2,155	1,032	-	3,087	297	7,145	20,085	20,085	-	-	-	9,361	-	-	-	960,909	27,633	1,237
4a.1.1	Totals	238	15,152	13,146	5,511	2,863	42,285	594	27,536	107,324	107,324	-	-	42,816	45,283	501	393	2,217	6,408,391	86,838	8,555
Removal of Major Equipment																					
4a.1.2	Main Turbine/Generator	-	282	273	40	630	-	-	198	1,423	1,423	-	-	5,099	-	-	-	-	305,952	8,585	-
4a.1.3	Main Condensers	-	782	170	48	751	-	-	332	2,083	2,083	-	-	8,106	-	-	-	-	364,767	24,802	-
Cascading Costs from Clean Building Demolition																					
4a.1.4.1	Reactor	-	754	-	-	-	-	-	113	867	867	-	-	-	-	-	-	-	-	10,579	-
4a.1.4.2	Auxiliary	-	374	-	-	-	-	-	56	430	430	-	-	-	-	-	-	-	-	5,551	-
4a.1.4.3	Fuel Building	-	189	-	-	-	-	-	28	217	217	-	-	-	-	-	-	-	-	2,395	-
4a.1.4.4	Hot Machine Shop	-	1	-	-	-	-	-	0	1	1	-	-	-	-	-	-	-	-	16	-
4a.1.4.5	Radwaste	-	79	-	-	-	-	-	12	91	91	-	-	-	-	-	-	-	-	1,108	-
4a.1.4	Totals	-	1,397	-	-	-	-	-	209	1,606	1,606	-	-	-	-	-	-	-	-	19,649	-

Table D
Wolf Creek Generating Station
SAFSTOR Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Llc. 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																					
4a.1.5.1	AB - Main Steam	-	147	-	-	-	-	-	22	169	-	-	169	-	-	-	-	-	-	5,833	-
4a.1.5.2	AB - Main Steam RCA	-	53	3	11	189	-	-	42	291	291	-	-	2,156	-	-	-	-	87,550	1,515	-
4a.1.5.3	AC - Main Turbine	-	148	-	-	-	-	-	22	170	-	-	170	-	-	-	-	-	-	5,641	-
4a.1.5.4	AD - Condensate	-	166	-	-	-	-	-	25	190	-	-	190	-	-	-	-	-	-	6,144	-
4a.1.5.5	AE - Feedwater	-	113	-	-	-	-	-	17	129	-	-	129	-	-	-	-	-	-	4,271	-
4a.1.5.6	AF - Feedwater Hter Extrction, Drn & Vnt	-	137	-	-	-	-	-	21	158	-	-	158	-	-	-	-	-	-	5,352	-
4a.1.5.7	AK - Condensate Demineralizer	-	51	-	-	-	-	-	8	59	-	-	59	-	-	-	-	-	-	1,944	-
4a.1.5.8	AL - Auxiliary Feedwater	-	31	-	-	-	-	-	5	36	-	-	36	-	-	-	-	-	-	1,174	-
4a.1.5.9	AL-Auxiliary Feedwater Surge Tanks	-	2	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	87	-
4a.1.5.10	AQ - Condensate & Feedwater Chem Additn	-	13	-	-	-	-	-	2	15	-	-	15	-	-	-	-	-	-	468	-
4a.1.5.11	AX - Acid Feed	-	19	-	-	-	-	-	3	22	-	-	22	-	-	-	-	-	-	754	-
4a.1.5.12	Auxiliary Bldg Non-System Specific	-	70	2	5	69	8	-	31	184	184	-	-	824	31	-	-	-	35,534	2,031	-
4a.1.5.13	Auxiliary Bldg Non-System Specific RCA	-	478	12	40	638	-	-	223	1,392	1,392	-	-	7,629	-	-	-	-	309,812	13,471	-
4a.1.5.14	BL - Reactor Makeup Water	-	183	14	19	212	102	-	107	637	637	-	-	2,529	418	-	-	-	130,204	5,227	-
4a.1.5.15	BM - Steam Generator Blowdown	-	370	8	27	432	-	-	162	999	999	-	-	5,160	-	-	-	-	209,560	10,703	-
4a.1.5.16	CA - Steam Seal	-	12	-	-	-	-	-	2	14	-	-	14	-	-	-	-	-	-	455	-
4a.1.5.17	CB - Main Turbine Lube Oil	-	35	-	-	-	-	-	5	40	-	-	40	-	-	-	-	-	-	1,207	-
4a.1.5.18	CC - Generator Hydrogen & CO2	-	6	-	-	-	-	-	1	6	-	-	6	-	-	-	-	-	-	198	-
4a.1.5.19	CD - Generator Seal Oil	-	8	-	-	-	-	-	1	9	-	-	9	-	-	-	-	-	-	287	-
4a.1.5.20	CE - Stator Cooling Water	-	7	-	-	-	-	-	1	8	-	-	8	-	-	-	-	-	-	241	-
4a.1.5.21	CF - Lube Oil Strg, Xfer & Purification	-	22	-	-	-	-	-	3	25	-	-	25	-	-	-	-	-	-	812	-
4a.1.5.22	CG - Condenser Air Removal	-	18	-	-	-	-	-	3	20	-	-	20	-	-	-	-	-	-	657	-
4a.1.5.23	CH - Main Turbine Control Oil	-	36	-	-	-	-	-	5	42	-	-	42	-	-	-	-	-	-	1,219	-
4a.1.5.24	CL - Chlorination	-	15	-	-	-	-	-	2	17	-	-	17	-	-	-	-	-	-	569	-
4a.1.5.25	CO - Carbon Dioxide	-	3	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	121	-
4a.1.5.26	CW - Circulating Water	-	199	-	-	-	-	-	30	229	-	-	229	-	-	-	-	-	-	7,858	-
4a.1.5.27	CZ - Caustic Acid	-	3	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	111	-
4a.1.5.28	DA - Circulating Water System	-	202	-	-	-	-	-	30	233	-	-	233	-	-	-	-	-	-	7,953	-
4a.1.5.29	DM - Equipment Drains	-	33	-	-	-	-	-	5	38	-	-	38	-	-	-	-	-	-	1,223	-
4a.1.5.30	DM - Equipment Drains RCA	-	101	24	82	1,292	-	-	234	1,733	1,733	-	-	15,445	-	-	-	-	627,223	2,849	-
4a.1.5.31	EG - Component Cooling Water RCA	-	492	22	75	1,185	-	-	314	2,088	2,088	-	-	14,161	-	-	-	-	575,071	13,646	-
4a.1.5.32	EJ - Residual Heat Removal	-	236	32	40	373	285	-	195	1,161	1,161	-	-	4,461	1,166	-	-	-	258,247	7,018	-
4a.1.5.33	EM - High Pressure Coolant Injection	-	195	3	11	181	-	-	78	469	469	-	-	2,159	-	-	-	-	87,663	5,527	-
4a.1.5.34	EN - Containment Spray	-	149	5	16	253	-	-	78	501	501	-	-	3,026	-	-	-	-	122,874	4,134	-
4a.1.5.35	FB - Auxiliary Steam	-	54	-	-	-	-	-	8	62	-	-	62	-	-	-	-	-	-	2,106	-
4a.1.5.36	FB - Auxiliary Steam RCA	-	58	1	4	68	-	-	25	157	157	-	-	816	-	-	-	-	33,148	1,537	-
4a.1.5.37	FC - Auxiliary Turbines	-	36	-	-	-	-	-	5	41	-	-	41	-	-	-	-	-	-	1,301	-
4a.1.5.38	FE - Auxiliary Steam Chemical Addition	-	3	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	105	-
4a.1.5.39	GE - Turbine Bldg HVAC	-	78	-	-	-	-	-	12	90	-	-	90	-	-	-	-	-	-	3,189	-
4a.1.5.40	GF - Miscellaneous Building HVAC	-	23	-	-	-	-	-	4	27	-	-	27	-	-	-	-	-	-	987	-
4a.1.5.41	GS - Containment Hydrogen Control	-	48	1	4	67	-	-	23	144	144	-	-	801	-	-	-	-	32,539	1,395	-
4a.1.5.42	HF - Secondary Liquid Waste	-	613	50	67	705	387	-	371	2,192	2,192	-	-	8,431	1,588	-	-	-	447,007	17,832	-
4a.1.5.43	HY - Hydrogen	-	6	-	-	-	-	-	1	6	-	-	6	-	-	-	-	-	-	223	-
4a.1.5.44	KH - Service Gas	-	18	-	-	-	-	-	3	20	-	-	20	-	-	-	-	-	-	644	-
4a.1.5.45	LE - Oily Waste	-	66	-	-	-	-	-	10	76	-	-	76	-	-	-	-	-	-	2,575	-
4a.1.5.46	LE - Oily Waste RCA	-	133	3	9	144	-	-	57	345	345	-	-	1,718	-	-	-	-	69,785	3,518	-
4a.1.5.47	NT - Nitrogen	-	4	-	-	-	-	-	1	4	-	-	4	-	-	-	-	-	-	149	-
4a.1.5.48	OX - Oxygen	-	5	-	-	-	-	-	1	5	-	-	5	-	-	-	-	-	-	171	-
4a.1.5.49	SW - Screen Wash	-	18	-	-	-	-	-	3	21	-	-	21	-	-	-	-	-	-	635	-
4a.1.5.50	Turbine Bldg Non-System Specific	-	434	-	-	-	-	-	65	499	-	-	499	-	-	-	-	-	-	15,405	-
4a.1.5.51	VH - Circ Water & Makeup Water Scrnhs	-	8	-	-	-	-	-	1	9	-	-	9	-	-	-	-	-	-	272	-
4a.1.5.52	VV - Misc Bldg HVAC	-	4	-	-	-	-	-	1	5	-	-	5	-	-	-	-	-	-	148	-
4a.1.5.53	WG - Gland Water & Motor Cooling Water	-	14	-	-	-	-	-	2	16	-	-	16	-	-	-	-	-	-	593	-
4a.1.5.54	WL - Cooling Lake Makeup & Blowdown	-	20	-	-	-	-	-	3	23	-	-	23	-	-	-	-	-	-	745	-
4a.1.5	Totals	-	5,394	180	412	5,799	782	-	2,272	14,838	12,292	-	2,546	69,317	3,203	-	-	-	3,026,216	174,218	-
4a.1.6	Scaffolding in support of decommissioning	-	865	28	9	112	26	-	244	1,283	1,283	-	-	1,200	106	-	-	-	61,306	33,925	-
4a.1	Subtotal Period 4a Activity Costs	238	23,872	13,795	6,019	10,156	43,092	594	30,792	128,557	126,011	-	2,546	126,544	48,593	501	393	2,217	10,166,630	348,016	8,555
Period 4a Additional Costs																					
4a.2.1	Remedial Action Surveys	-	-	-	-	-	-	1,446	434	1,880	1,880	-	-	-	-	-	-	-	-	29,613	-
4a.2	Subtotal Period 4a Additional Costs	-	-	-	-	-	-	1,446	434	1,880	1,880	-	-	-	-	-	-	-	-	29,613	-
Period 4a Collateral Costs																					
4a.3.1	Process decommissioning water waste	5	-	8	19	-	35	-	15	82	82	-	-	-	79	-	-	-	4,725	15	-
4a.3.3	Small tool allowance	-	225	-	-	-	-	-	34	259	233	-	26	-	-	-	-	-	-	-	-
4a.3.4	On-site survey and release of 116.8 tons clean metallic waste	-	-	-	-	-	-	161	16	177	177	-	-	-	-	-	-	-	-	-	-
4a.3	Subtotal Period 4a Collateral Costs	5	225	8	19	-	35	161	65	518	492	-	26	-	79	-	-	-	4,725	15	-

Table D
Wolf Creek Generating Station
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Period 4a Period-Dependent Costs																					
4a.4.1	Decon supplies	80	-	-	-	-	-	-	20	101	101	-	-	-	-	-	-	-	-	-	-
4a.4.2	Insurance	-	-	-	-	-	-	1,468	147	1,614	1,614	-	-	-	-	-	-	-	-	-	-
4a.4.3	Property taxes	-	-	-	-	-	-	299	30	329	296	-	33	-	-	-	-	-	-	-	-
4a.4.4	Health physics supplies	-	2,523	-	-	-	-	-	631	3,154	3,154	-	-	-	-	-	-	-	-	-	-
4a.4.5	Heavy equipment rental	-	3,071	-	-	-	-	-	461	3,532	3,532	-	-	-	-	-	-	-	-	-	-
4a.4.6	Disposal of DAW generated	-	-	101	28	-	251	-	77	457	457	-	-	-	4,798	-	-	-	95,952	156	-
4a.4.7	Plant energy budget	-	-	-	-	-	-	2,830	425	3,255	3,255	-	-	-	-	-	-	-	-	-	-
4a.4.8	NRC Fees	-	-	-	-	-	-	860	86	946	946	-	-	-	-	-	-	-	-	-	-
4a.4.9	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	571	86	657	657	-	-	-	-	-	-	-	-	-	-
4a.4.10	Corporate Allocations	-	-	-	-	-	-	309	46	356	356	-	-	-	-	-	-	-	-	-	-
4a.4.11	Security Staff Cost	-	-	-	-	-	-	3,052	458	3,510	3,510	-	-	-	-	-	-	-	-	-	92,857
4a.4.12	DOC Staff Cost	-	-	-	-	-	-	15,742	2,361	18,103	18,103	-	-	-	-	-	-	-	-	-	205,029
4a.4.13	Utility Staff Cost	-	-	-	-	-	-	25,505	3,826	29,331	29,331	-	-	-	-	-	-	-	-	-	371,429
4a.4	Subtotal Period 4a Period-Dependent Costs	80	5,594	101	28	-	251	50,636	8,653	65,343	65,310	-	33	-	4,798	-	-	-	95,952	156	669,314
4a.0	TOTAL PERIOD 4a COST	324	29,690	13,904	6,066	10,156	43,378	52,838	39,943	196,298	193,693	-	2,605	126,544	53,469	501	393	2,217	10,267,310	377,801	677,869
PERIOD 4b - Site Decontamination																					
Period 4b Direct Decommissioning Activities																					
4b.1.1	Remove spent fuel racks	446	47	271	88	-	1,529	-	657	3,037	3,037	-	-	-	6,250	-	-	-	413,145	1,722	-
Disposal of Plant Systems																					
4b.1.2.1	AN - Demineralized Wtr Storage & xfer	-	40	-	-	-	-	-	6	46	-	-	46	-	-	-	-	-	-	1,548	-
4b.1.2.2	AN - Demineralized Wtr Strg & xfer RCA	-	13	0	1	10	-	-	5	29	29	-	-	120	-	-	-	-	4,855	334	-
4b.1.2.3	AP - Condensate Storage & Transfer	-	49	-	-	-	-	-	7	57	-	-	57	-	-	-	-	-	-	1,660	-
4b.1.2.4	BB - Reactor Coolant	-	187	27	29	210	270	-	153	876	876	-	-	2,511	1,121	-	-	-	175,064	5,731	-
4b.1.2.5	BG - Chemical & Volume Control	-	589	71	80	682	633	-	427	2,482	2,482	-	-	8,155	2,586	-	-	-	502,157	17,005	-
4b.1.2.6	BN - Borated Refueling Water Storage	-	296	9	33	523	-	-	136	908	908	-	-	6,255	-	-	-	-	254,024	6,161	-
4b.1.2.7	Control Bldg Non-System Specific	-	123	3	11	179	-	-	60	376	376	-	-	2,139	-	-	-	-	85,849	3,413	-
4b.1.2.8	Control Bldg Non-System Specific Cln	-	934	-	-	-	-	-	140	1,074	-	-	1,074	-	-	-	-	-	-	29,076	-
4b.1.2.9	DO - Diesel Oil	-	1	-	-	-	-	-	0	1	-	-	1	-	-	-	-	-	-	48	-
4b.1.2.10	EA - Service Water	-	67	-	-	-	-	-	10	77	-	-	77	-	-	-	-	-	-	2,592	-
4b.1.2.11	EB - Closed Cooling Water	-	33	-	-	-	-	-	5	38	-	-	38	-	-	-	-	-	-	1,267	-
4b.1.2.12	EC - Fuel Pool Cooling & Cleanup	-	249	6	22	344	-	-	118	739	739	-	-	4,115	-	-	-	-	167,129	7,154	-
4b.1.2.13	EF - Essential Service Water	-	76	-	-	-	-	-	11	87	-	-	87	-	-	-	-	-	-	2,951	-
4b.1.2.14	EF - Essential Service Water RCA	-	61	2	8	119	-	-	35	225	225	-	-	1,427	-	-	-	-	57,959	1,734	-
4b.1.2.15	EP - Accumulator Safety Injection	-	103	3	10	164	-	-	52	332	332	-	-	1,958	-	-	-	-	79,502	2,904	-
4b.1.2.16	FA - Auxiliary Steam Generator	-	13	-	-	-	-	-	2	15	-	-	15	-	-	-	-	-	-	521	-
4b.1.2.17	FO - Fuel Oil	-	12	-	-	-	-	-	2	14	-	-	14	-	-	-	-	-	-	486	-
4b.1.2.18	FP - Fire Protection	-	97	-	-	-	-	-	15	112	-	-	112	-	-	-	-	-	-	3,828	-
4b.1.2.19	FP - Fire Protection RCA	-	135	7	24	376	-	-	94	636	636	-	-	4,492	-	-	-	-	182,411	3,541	-
4b.1.2.20	Fuel Bldg Non-System Specific	-	30	1	2	27	3	-	13	75	75	-	-	322	12	-	-	-	13,860	850	-
4b.1.2.21	Fuel Bldg Non-System Specific RCA	-	215	5	17	268	-	-	97	602	602	-	-	3,200	-	-	-	-	129,974	5,859	-
4b.1.2.22	Fuel Building Fire Protection	-	106	5	16	246	-	-	66	438	438	-	-	2,941	-	-	-	-	119,444	2,802	-
4b.1.2.23	GA - Plant Heating	-	49	-	-	-	-	-	7	56	-	-	56	-	-	-	-	-	-	1,912	-
4b.1.2.24	GA - Plant Heating RCA	-	80	1	4	62	-	-	30	177	177	-	-	746	-	-	-	-	30,275	2,072	-
4b.1.2.25	GB - Central Chilled Water	-	46	-	-	-	-	-	7	53	-	-	53	-	-	-	-	-	-	1,803	-
4b.1.2.26	GB - Central Chilled Water RCA	-	18	0	1	16	-	-	7	43	43	-	-	187	-	-	-	-	7,591	482	-
4b.1.2.27	GD - Essti Srvc Wtr Pumphs Bldg HVAC	-	7	-	-	-	-	-	1	8	-	-	8	-	-	-	-	-	-	284	-
4b.1.2.28	GG - Fuel Building HVAC	-	172	6	21	330	-	-	96	625	625	-	-	3,945	-	-	-	-	160,195	4,052	-
4b.1.2.29	GH - Radwaste Building HVAC	-	125	4	14	214	-	-	66	423	423	-	-	2,561	-	-	-	-	104,012	3,004	-
4b.1.2.30	GK - Control Building HVAC	-	89	-	-	-	-	-	13	102	-	-	102	-	-	-	-	-	-	3,959	-
4b.1.2.31	GL - Auxiliary Building HVAC	-	313	8	29	450	-	-	151	951	951	-	-	6,381	-	-	-	-	218,514	7,264	-
4b.1.2.32	GM - Diesel Generator Building HVAC	-	15	-	-	-	-	-	2	18	-	-	18	-	-	-	-	-	-	695	-
4b.1.2.33	GN - Containment Cooling	-	333	12	44	690	-	-	195	1,274	1,274	-	-	8,250	-	-	-	-	335,052	8,317	-
4b.1.2.34	GP - Containmnt Integratd Leak Rate Test	-	27	1	3	49	-	-	15	94	94	-	-	580	-	-	-	-	23,570	750	-
4b.1.2.35	GR - Containment Atmospheric Control	-	12	2	6	96	-	-	18	134	134	-	-	1,143	-	-	-	-	46,407	350	-
4b.1.2.36	GT - Containment Purge HVAC	-	79	3	12	183	-	-	49	326	326	-	-	2,185	-	-	-	-	88,746	1,973	-
4b.1.2.37	HA - Gaseous Radwaste	-	231	6	20	309	-	-	108	673	673	-	-	3,699	-	-	-	-	150,219	6,296	-
4b.1.2.38	HB - Liquid Radwaste	-	544	48	59	614	353	-	330	1,950	1,950	-	-	7,343	1,450	-	-	-	393,695	15,380	-
4b.1.2.39	HC - Solid Radwaste	-	302	34	38	333	296	-	209	1,213	1,213	-	-	3,986	1,211	-	-	-	241,918	8,570	-
4b.1.2.40	HD - Decontamination	-	65	2	6	102	-	-	33	208	208	-	-	1,220	-	-	-	-	49,558	1,828	-
4b.1.2.41	HE - Boron Recycle	-	315	24	29	289	194	-	177	1,030	1,030	-	-	3,460	784	-	-	-	192,819	8,970	-
4b.1.2.42	JE - Emergency Fuel Oil	-	37	-	-	-	-	-	6	42	-	-	42	-	-	-	-	-	-	1,260	-
4b.1.2.43	KA - Compressed Air and Instrument	-	160	-	-	-	-	-	24	184	-	-	184	-	-	-	-	-	-	6,089	-
4b.1.2.44	KB - Breathing Air	-	28	-	-	-	-	-	4	32	-	-	32	-	-	-	-	-	-	1,075	-
4b.1.2.45	KC - Fire Protection	-	192	-	-	-	-	-	29	220	-	-	220	-	-	-	-	-	-	7,516	-
4b.1.2.46	KC - Fire Protection RCA	-	240	9	32	497	-	-	140	918	918	-	-	5,944	-	-	-	-	241,384	6,383	-

Table D
Wolf Creek Generating Station
SAFSTOR Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Disposal of Plant Systems (continued)																					
4b.1.2.47	KD - Domestic Water	-	44	-	-	-	-	-	7	51	-	-	51	-	-	-	-	-	-	1,708	-
4b.1.2.48	KE - Fuel Hndlg & Strg Reactor Vssl Serv	-	11	1	5	74	-	-	15	106	106	-	-	882	-	-	-	-	35,813	332	-
4b.1.2.49	KJ - Standby Diesel Engine	-	192	-	-	-	-	-	29	221	-	-	221	-	-	-	-	-	-	6,749	-
4b.1.2.50	LA - Sanitary Drains	-	7	-	-	-	-	-	1	8	-	-	8	-	-	-	-	-	-	290	-
4b.1.2.51	LA - Sanitary Drains RCA	-	18	0	1	23	-	-	8	51	51	-	-	272	-	-	-	-	11,053	422	-
4b.1.2.52	LB - Roof Drains	-	33	-	-	-	-	-	5	38	-	-	38	-	-	-	-	-	-	1,276	-
4b.1.2.53	LB - Roof Drains RCA	-	100	3	11	179	-	-	54	348	348	-	-	2,139	-	-	-	-	86,858	2,694	-
4b.1.2.54	LC - Yard Drains	-	3	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	96	-
4b.1.2.55	LD - Chemical & Detergent Waste	-	74	1	4	67	-	-	29	175	175	-	-	797	-	-	-	-	32,369	2,139	-
4b.1.2.56	LF - Floor & Equipment Drains	-	920	85	86	557	887	-	557	3,092	3,092	-	-	6,660	3,627	-	-	-	510,199	26,164	-
4b.1.2.57	RM - Process Sampling & Analysis	-	83	1	5	83	-	-	34	207	207	-	-	990	-	-	-	-	40,200	2,450	-
4b.1.2.58	Radwaste Bldg Non-System Specific	-	113	3	8	111	12	-	50	297	297	-	-	1,329	50	-	-	-	57,274	3,253	-
4b.1.2.59	Radwaste Bldg Non-System Specific RCA	-	791	20	67	1,061	-	-	369	2,308	2,308	-	-	12,684	-	-	-	-	516,103	21,919	-
4b.1.2.60	Reactor Bldg Non-System Specific	-	57	1	3	42	5	-	22	130	130	-	-	502	19	-	-	-	21,639	1,569	-
4b.1.2.61	Reactor Bldg Non-System Specific RCA	-	397	7	25	399	-	-	164	992	992	-	-	4,768	-	-	-	-	193,612	10,425	-
4b.1.2.62	SBO Diesel Generator	-	104	-	-	-	-	-	16	119	-	-	119	-	-	-	-	-	-	3,610	-
4b.1.2.63	SJ - Nuclear Sampling	-	47	1	4	57	-	-	21	129	129	-	-	677	-	-	-	-	27,501	1,430	-
4b.1.2.64	ST - Sewage Treatment	-	62	-	-	-	-	-	9	71	-	-	71	-	-	-	-	-	-	2,318	-
4b.1.2.65	SZ - Service Air	-	49	-	-	-	-	-	7	56	-	-	56	-	-	-	-	-	-	1,892	-
4b.1.2.66	VA - I&C Shop HVAC	-	4	-	-	-	-	-	1	5	-	-	5	-	-	-	-	-	-	155	-
4b.1.2.67	VB - I&C Shop Computer Room HVAC	-	3	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	106	-
4b.1.2.68	VC - Health Physics Computer Room HVAC	-	6	-	-	-	-	-	1	7	-	-	7	-	-	-	-	-	-	208	-
4b.1.2.69	VJ - Shop Bldg Machine Shop Area Vent	-	2	-	-	-	-	-	0	2	-	-	2	-	-	-	-	-	-	57	-
4b.1.2.70	VL - Shop Building HVAC	-	3	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	101	-
4b.1.2.71	VS - Admin Bldg HVAC	-	7	-	-	-	-	-	1	9	-	-	9	-	-	-	-	-	-	262	-
4b.1.2.72	VT - Tech Support Building HVAC	-	2	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	87	-
4b.1.2.73	VW - Waste Water Treatment Ventilation	-	1	-	-	-	-	-	0	2	-	-	2	-	-	-	-	-	-	52	-
4b.1.2.74	WD - Domestic Water	-	22	-	-	-	-	-	3	25	-	-	25	-	-	-	-	-	-	870	-
4b.1.2.75	WM - Makeup Demineralizer	-	103	-	-	-	-	-	15	118	-	-	118	-	-	-	-	-	-	3,929	-
4b.1.2.76	WS - Plant Services Water	-	84	-	-	-	-	-	13	97	-	-	97	-	-	-	-	-	-	3,297	-
4b.1.2.77	WS - Plant Services Water RCA	-	26	3	10	154	-	-	31	224	224	-	-	1,838	-	-	-	-	74,625	782	-
4b.1.2.78	WT - Waste Water Treatment	-	20	-	-	-	-	-	3	23	-	-	23	-	-	-	-	-	-	769	-
4b.1.2.79	WZ - Radioactive Liquid Waste	-	30	4	4	21	41	-	22	120	120	-	-	247	167	-	-	-	21,067	783	-
4b.1.2.80	Yard Non-System Specific	-	17	-	-	-	-	-	3	19	-	-	19	-	-	-	-	-	-	603	-
4b.1.2	Totals	-	10,257	433	802	10,210	2,694	-	4,661	29,057	25,936	-	3,121	122,048	11,036	-	-	-	5,684,496	304,640	-
4b.1.3	Scaffolding in support of decommissioning	-	1,298	42	13	168	39	-	365	1,924	1,924	-	-	1,809	160	-	-	-	91,958	50,887	-
Decontamination of Site Buildings																					
4b.1.4.1	Reactor	756	666	32	178	498	480	-	769	3,378	3,378	-	-	5,955	7,366	-	-	-	874,512	38,198	-
4b.1.4.2	Auxiliary	384	171	10	49	172	130	-	301	1,217	1,217	-	-	2,058	1,956	-	-	-	250,317	15,248	-
4b.1.4.3	Communication Corridor - Contaminated	8	3	0	1	1	3	-	6	22	22	-	-	17	42	-	-	-	4,296	306	-
4b.1.4.4	Fuel Building	492	489	8	24	226	54	-	420	1,713	1,713	-	-	2,705	584	-	-	-	158,264	27,455	-
4b.1.4.5	Hot Machine Shop	11	5	0	1	-	3	-	7	27	27	-	-	-	51	-	-	-	4,446	421	-
4b.1.4.6	RWST Foundation Decon	-	6	0	4	-	11	-	5	26	26	-	-	-	183	-	-	-	15,840	95	-
4b.1.4.7	Radwaste	205	61	3	13	71	34	-	139	525	525	-	-	844	474	-	-	-	74,469	7,523	-
4b.1.4.8	Radwaste Drum Storage	23	8	0	3	6	7	-	17	63	63	-	-	66	115	-	-	-	12,565	850	-
4b.1.4.9	Radwaste Storage Building	59	14	1	6	-	18	-	38	135	135	-	-	-	297	-	-	-	25,740	2,911	-
4b.1.4	Totals	1,937	1,421	55	279	974	740	-	1,702	7,108	7,108	-	-	11,646	11,067	-	-	-	1,420,450	92,107	-
4b.1	Subtotal Period 4b Activity Costs	2,382	13,023	800	1,181	11,352	5,001	-	7,386	41,125	38,005	-	3,121	135,503	28,513	-	-	-	7,610,049	449,355	-
Period 4b Additional Costs																					
4b.2.1	Final Survey Program Management	-	-	-	-	-	-	1,307	392	1,699	1,699	-	-	-	-	-	-	-	-	-	12,480
4b.2.2	Remedial Action Surveys	-	-	-	-	-	-	2,528	760	3,287	3,287	-	-	-	-	-	-	-	-	51,767	-
4b.2.3	Operational Equipment	-	-	17	52	603	-	-	100	772	772	-	-	11,710	-	-	-	-	292,750	32	-
4b.2	Subtotal Period 4b Additional Costs	-	-	17	52	603	-	3,835	1,251	5,758	5,758	-	-	11,710	-	-	-	-	292,750	51,798	12,480
Period 4b Collateral Costs																					
4b.3.1	Process decommissioning water waste	12	-	21	40	-	91	-	38	211	211	-	-	-	204	-	-	-	12,256	40	-
4b.3.3	Small tool allowance	-	242	-	-	-	-	-	36	278	278	-	-	-	-	-	-	-	-	-	-
4b.3.4	Decommissioning Equipment Disposition	-	-	138	50	556	129	-	137	1,011	1,011	-	-	6,000	529	-	-	-	304,968	88	-
4b.3.5	On-site survey and release of 44.30 tons clean metallic waste	-	-	-	-	-	-	61	6	67	67	-	-	-	-	-	-	-	-	-	-
4b.3	Subtotal Period 4b Collateral Costs	12	242	159	100	556	220	61	218	1,568	1,568	-	-	6,000	733	-	-	-	317,224	128	-
Period 4b Period-Dependent Costs																					
4b.4.1	Decon supplies	1,323	-	-	-	-	-	-	331	1,653	1,653	-	-	-	-	-	-	-	-	-	-
4b.4.2	Insurance	-	-	-	-	-	-	2,565	257	2,822	2,822	-	-	-	-	-	-	-	-	-	-
4b.4.3	Property taxes	-	-	-	-	-	-	522	52	575	575	-	-	-	-	-	-	-	-	-	-

Table D
Wolf Creek Generating Station
SAFSTOR Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Period 4b Period-Dependent Costs (continued)																					
4b.4.4	Health physics supplies	-	3,634	-	-	-	-	-	909	4,543	4,543	-	-	-	-	-	-	-	-	-	-
4b.4.5	Heavy equipment rental	-	5,314	-	-	-	-	-	797	6,112	6,112	-	-	-	-	-	-	-	-	-	-
4b.4.6	Disposal of DAW generated	-	-	136	38	-	340	-	104	618	618	-	-	-	6,491	-	-	-	129,811	212	-
4b.4.7	Plant energy budget	-	-	-	-	-	-	3,906	586	4,492	4,492	-	-	-	-	-	-	-	-	-	-
4b.4.8	NRC Fees	-	-	-	-	-	-	1,503	150	1,653	1,653	-	-	-	-	-	-	-	-	-	-
4b.4.9	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	998	150	1,148	1,148	-	-	-	-	-	-	-	-	-	-
4b.4.10	Corporate Allocations	-	-	-	-	-	-	511	77	587	587	-	-	-	-	-	-	-	-	-	-
4b.4.11	Security Staff Cost	-	-	-	-	-	-	5,336	800	6,136	6,136	-	-	-	-	-	-	-	-	-	162,321
4b.4.12	DOC Staff Cost	-	-	-	-	-	-	26,849	4,027	30,877	30,877	-	-	-	-	-	-	-	-	-	348,017
4b.4.13	Utility Staff Cost	-	-	-	-	-	-	42,326	6,349	48,675	48,675	-	-	-	-	-	-	-	-	-	612,926
4b.4	Subtotal Period 4b Period-Dependent Costs	1,323	8,949	136	38	-	340	84,517	14,589	109,891	109,891	-	-	-	6,491	-	-	-	129,811	212	1,123,264
4b.0	TOTAL PERIOD 4b COST	3,717	22,214	1,112	1,370	12,511	5,561	88,413	23,443	158,342	155,221	-	3,121	153,213	35,737	-	-	-	8,349,833	501,493	1,135,744
PERIOD 4f - License Termination																					
Period 4f Direct Decommissioning Activities																					
4f.1.1	ORISE confirmatory survey	-	-	-	-	-	-	163	49	212	212	-	-	-	-	-	-	-	-	-	-
4f.1.2	Terminate license									a											
4f.1	Subtotal Period 4f Activity Costs	-	-	-	-	-	-	163	49	212	212	-	-	-	-	-	-	-	-	-	-
Period 4f Additional Costs																					
4f.2.1	Final Site survey	-	-	-	-	-	-	6,238	1,871	8,109	8,109	-	-	-	-	-	-	-	-	152,819	6,240
4f.2	Subtotal Period 4f Additional Costs	-	-	-	-	-	-	6,238	1,871	8,109	8,109	-	-	-	-	-	-	-	-	152,819	6,240
Period 4f Collateral Costs																					
4f.3.1	DOC staff relocation expenses	-	-	-	-	-	-	1,239	186	1,425	1,425	-	-	-	-	-	-	-	-	-	-
4f.3	Subtotal Period 4f Collateral Costs	-	-	-	-	-	-	1,239	186	1,425	1,425	-	-	-	-	-	-	-	-	-	-
Period 4f Period-Dependent Costs																					
4f.4.2	Property taxes	-	-	-	-	-	-	162	16	178	178	-	-	-	-	-	-	-	-	-	-
4f.4.3	Health physics supplies	-	767	-	-	-	-	-	192	958	958	-	-	-	-	-	-	-	-	-	-
4f.4.4	Disposal of DAW generated	-	-	8	2	-	19	-	6	34	34	-	-	-	360	-	-	-	7,203	12	-
4f.4.5	Plant energy budget	-	-	-	-	-	-	323	48	372	372	-	-	-	-	-	-	-	-	-	-
4f.4.6	NRC Fees	-	-	-	-	-	-	467	47	514	514	-	-	-	-	-	-	-	-	-	-
4f.4.7	Corporate Allocations	-	-	-	-	-	-	64	10	73	73	-	-	-	-	-	-	-	-	-	-
4f.4.8	Security Staff Cost	-	-	-	-	-	-	810	122	932	932	-	-	-	-	-	-	-	-	-	19,337
4f.4.9	DOC Staff Cost	-	-	-	-	-	-	4,849	727	5,577	5,577	-	-	-	-	-	-	-	-	-	58,817
4f.4.10	Utility Staff Cost	-	-	-	-	-	-	5,985	898	6,883	6,883	-	-	-	-	-	-	-	-	-	76,543
4f.4	Subtotal Period 4f Period-Dependent Costs	-	767	8	2	-	19	12,661	2,065	15,521	15,521	-	-	-	360	-	-	-	7,203	12	154,697
4f.0	TOTAL PERIOD 4f COST	-	767	8	2	-	19	20,300	4,171	25,266	25,266	-	-	-	360	-	-	-	7,203	152,831	160,937
PERIOD 4 TOTALS		4,041	52,671	15,023	7,438	22,667	48,959	161,551	67,557	379,907	374,181	-	5,726	279,757	89,566	501	393	2,217	18,624,340	1,032,125	1,974,550
PERIOD 5b - Site Restoration																					
Period 5b Direct Decommissioning Activities																					
Demolition of Remaining Site Buildings																					
5b.1.1.1	Reactor	-	4,279	-	-	-	-	-	642	4,920	-	-	4,920	-	-	-	-	-	-	50,067	-
5b.1.1.2	Access Vaults	-	15	-	-	-	-	-	2	18	-	-	18	-	-	-	-	-	-	251	-
5b.1.1.3	Administration	-	197	-	-	-	-	-	30	227	-	-	227	-	-	-	-	-	-	4,467	-
5b.1.1.4	Auxiliary	-	3,368	-	-	-	-	-	505	3,873	-	-	3,873	-	-	-	-	-	-	49,968	-
5b.1.1.5	Auxiliary Boiler	-	27	-	-	-	-	-	4	31	-	-	31	-	-	-	-	-	-	619	-
5b.1.1.6	Chemical Addition Structure	-	39	-	-	-	-	-	6	44	-	-	44	-	-	-	-	-	-	735	-
5b.1.1.7	Circ Water Pump Enclosure	-	5	-	-	-	-	-	1	5	-	-	5	-	-	-	-	-	-	164	-
5b.1.1.8	Circ Water Travel Screen Enclosure	-	4	-	-	-	-	-	1	5	-	-	5	-	-	-	-	-	-	100	-
5b.1.1.9	Circulating Water Discharge Structure	-	145	-	-	-	-	-	22	167	-	-	167	-	-	-	-	-	-	2,373	-
5b.1.1.10	Circulating Water Intake & Screenhouse	-	139	-	-	-	-	-	21	160	-	-	160	-	-	-	-	-	-	2,059	-
5b.1.1.11	Communication Corridor - Clean	-	1,054	-	-	-	-	-	158	1,212	-	-	1,212	-	-	-	-	-	-	17,215	-
5b.1.1.12	Communication Corridor - Contaminated	-	49	-	-	-	-	-	7	56	-	-	56	-	-	-	-	-	-	674	-
5b.1.1.13	Covered Walkways	-	10	-	-	-	-	-	1	11	-	-	11	-	-	-	-	-	-	242	-
5b.1.1.14	Diesel Generator	-	411	-	-	-	-	-	62	472	-	-	472	-	-	-	-	-	-	5,492	-
5b.1.1.15	E.S.W.S. Pumphouse	-	229	-	-	-	-	-	34	263	-	-	263	-	-	-	-	-	-	3,019	-
5b.1.1.16	ESWS Valve House	-	12	-	-	-	-	-	2	14	-	-	14	-	-	-	-	-	-	243	-
5b.1.1.17	FLEX Building NO. 1 & 2	-	550	-	-	-	-	-	83	633	-	-	633	-	-	-	-	-	-	10,361	-
5b.1.1.18	Fuel Building	-	1,731	-	-	-	-	-	260	1,991	-	-	1,091	-	-	-	-	-	-	22,580	-
5b.1.1.10	GOB - Administration Building	-	265	-	-	-	-	-	40	305	-	-	305	-	-	-	-	-	-	5,819	-

Table D
Wolf Creek Generating Station
SAFSTOR Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Llc. 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
Demolition of Remaining Site Buildings (continued)																					
5b.1.1.20	Hot Machine Shop	-	17	-	-	-	-	-	3	19	-	-	19	-	-	-	-	-	-	417	-
5b.1.1.21	M.M.O. Building	-	253	-	-	-	-	-	38	291	-	-	291	-	-	-	-	-	-	3,483	-
5b.1.1.22	Material Center West	-	98	-	-	-	-	-	15	112	-	-	112	-	-	-	-	-	-	2,512	-
5b.1.1.23	Misc Structures and Additions	-	72	-	-	-	-	-	11	83	-	-	83	-	-	-	-	-	-	1,523	-
5b.1.1.24	Miscellaneous Site Foundations	-	354	-	-	-	-	-	53	407	-	-	407	-	-	-	-	-	-	7,074	-
5b.1.1.25	Miscellaneous Site Structures	-	1,445	-	-	-	-	-	217	1,662	-	-	1,662	-	-	-	-	-	-	20,147	-
5b.1.1.26	New Covered Walkway	-	8	-	-	-	-	-	1	9	-	-	9	-	-	-	-	-	-	160	-
5b.1.1.27	Oil Separator and Waste Tank	-	2	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	48	-
5b.1.1.28	Radwaste	-	1,513	-	-	-	-	-	227	1,740	-	-	1,740	-	-	-	-	-	-	21,798	-
5b.1.1.29	Radwaste Drum Storage	-	210	-	-	-	-	-	32	242	-	-	242	-	-	-	-	-	-	3,840	-
5b.1.1.30	Radwaste Storage Building	-	97	-	-	-	-	-	15	112	-	-	112	-	-	-	-	-	-	2,323	-
5b.1.1.31	SBO Diesel Generator	-	336	-	-	-	-	-	50	387	-	-	387	-	-	-	-	-	-	6,705	-
5b.1.1.32	Security Main Gate North	-	85	-	-	-	-	-	13	98	-	-	98	-	-	-	-	-	-	1,720	-
5b.1.1.33	Security Additions 2010	-	27	-	-	-	-	-	4	31	-	-	31	-	-	-	-	-	-	489	-
5b.1.1.34	Security/Guardhouse	-	45	-	-	-	-	-	7	51	-	-	51	-	-	-	-	-	-	845	-
5b.1.1.35	Site Diesel Generator	-	3	-	-	-	-	-	1	4	-	-	4	-	-	-	-	-	-	61	-
5b.1.1.36	Support Complex	-	28	-	-	-	-	-	4	33	-	-	33	-	-	-	-	-	-	697	-
5b.1.1.37	Turbine Building	-	2,613	-	-	-	-	-	392	3,005	-	-	3,005	-	-	-	-	-	-	55,694	-
5b.1.1.38	Turbine Pedestal	-	922	-	-	-	-	-	138	1,060	-	-	1,060	-	-	-	-	-	-	10,928	-
5b.1.1.39	Waste Water Treatment	-	19	-	-	-	-	-	3	22	-	-	22	-	-	-	-	-	-	407	-
5b.1.1.40	Water Treatment Building North (Z110)	-	55	-	-	-	-	-	8	63	-	-	63	-	-	-	-	-	-	911	-
5b.1.1	Totals	-	20,732	-	-	-	-	-	3,110	23,841	-	-	23,841	-	-	-	-	-	-	328,286	-
Site Closeout Activities																					
5b.1.2	Remove Rubble	-	914	-	-	-	-	-	137	1,051	-	-	1,051	-	-	-	-	-	-	5,383	-
5b.1.3	Grade & landscape site	-	111	-	-	-	-	-	17	128	-	-	128	-	-	-	-	-	-	512	-
5b.1.4	Final report to NRC	-	-	-	-	-	-	176	26	202	202	-	-	-	-	-	-	-	-	-	1,560
5b.1	Subtotal Period 5b Activity Costs	-	21,757	-	-	-	-	176	3,290	25,222	202	-	25,020	-	-	-	-	-	-	334,180	1,560
Period 5b Additional Costs																					
5b.2.1	Concrete Crushing	-	877	-	-	-	-	9	133	1,019	-	-	1,019	-	-	-	-	-	-	4,585	-
5b.2.2	Circulating Water Intake Cofferdam	-	279	-	-	-	-	-	42	321	-	-	321	-	-	-	-	-	-	2,540	-
5b.2.3	E.S.W.S. Pumphouse Cofferdam	-	372	-	-	-	-	-	56	428	-	-	428	-	-	-	-	-	-	3,386	-
5b.2.4	Excavation of Underground Services	-	2,100	-	-	-	-	864	445	3,409	-	-	3,409	-	-	-	-	-	-	15,949	-
5b.2.5	Construction Debris	-	-	-	-	-	-	1,770	266	2,036	-	-	2,036	-	-	-	-	-	-	-	-
5b.2	Subtotal Period 5b Additional Costs	-	3,627	-	-	-	-	2,644	941	7,212	-	-	7,212	-	-	-	-	-	-	26,460	-
Period 5b Collateral Costs																					
5b.3.1	Small tool allowance	-	192	-	-	-	-	-	29	221	-	-	221	-	-	-	-	-	-	-	-
5b.3.2	Corporate Allocations	-	-	-	-	-	-	50	8	58	-	-	58	-	-	-	-	-	-	-	-
5b.3	Subtotal Period 5b Collateral Costs	-	192	-	-	-	-	50	36	279	-	-	279	-	-	-	-	-	-	-	-
Period 5b Period-Dependent Costs																					
5b.4.2	Property taxes	-	-	-	-	-	-	312	31	343	-	-	343	-	-	-	-	-	-	-	-
5b.4.3	Heavy equipment rental	-	4,510	-	-	-	-	-	676	5,186	-	-	5,186	-	-	-	-	-	-	-	-
5b.4.4	Plant energy budget	-	-	-	-	-	-	311	47	358	-	-	358	-	-	-	-	-	-	-	-
5b.4.5	Security Staff Cost	-	-	-	-	-	-	1,560	234	1,794	-	-	1,794	-	-	-	-	-	-	-	37,234
5b.4.6	DOC Staff Cost	-	-	-	-	-	-	8,806	1,330	10,195	-	-	10,195	-	-	-	-	-	-	-	105,497
5b.4.7	Utility Staff Cost	-	-	-	-	-	-	4,523	678	5,202	-	-	5,202	-	-	-	-	-	-	-	60,506
5b.4	Subtotal Period 5b Period-Dependent Costs	-	4,510	-	-	-	-	15,572	2,997	23,079	-	-	23,079	-	-	-	-	-	-	-	203,237
5b.0	TOTAL PERIOD 5b COST	-	30,086	-	-	-	-	18,442	7,264	55,791	202	-	55,589	-	-	-	-	-	-	360,640	204,797
PERIOD 5 TOTALS		-	30,086	-	-	-	-	18,442	7,264	55,791	202	-	55,589	-	-	-	-	-	-	360,640	204,797
TOTAL COST TO DECOMMISSION		9,597	93,249	15,494	8,054	22,682	50,398	683,175	151,855	1,034,501	852,540	119,221	62,740	281,907	100,034	501	393	2,217	19,062,260	1,491,871	7,733,828

Table D
Wolf Creek Generating Station
SAFSTOR Decommissioning Cost Estimate
(thousands of 2014 dollars)

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

TOTAL COST TO DECOMMISSION WITH 17.2% CONTINGENCY:	$1,034,501	thousands of 2014 dollars
TOTAL NRC LICENSE TERMINATION COST IS 82.41% OR:	$852,540	thousands of 2014 dollars
SPENT FUEL MANAGEMENT COST IS 11.52% OR:	$119,221	thousands of 2014 dollars
NON-NUCLEAR DEMOLITION COST IS 6.06% OR:	$62,740	thousands of 2014 dollars
TOTAL LOW-LEVEL RADIOACTIVE WASTE VOLUME BURIED (EXCLUDING GTCC):	100,927	cubic feet
TOTAL GREATER THAN CLASS C RADWASTE VOLUME GENERATED:	2,217	cubic feet
TOTAL SCRAP METAL REMOVED:	69,161	tons
TOTAL CRAFT LABOR REQUIREMENTS:	1,491,871	man-hours

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

APPENDIX E

COST SENSITIVITY OF LONG-TERM, ON-SITE SPENT FUEL STORAGE

APPENDIX E

COST SENSITIVITY OF LONG-TERM, ON-SITE SPENT FUEL STORAGE

Introduction

As discussed in the last Decommissioning Cost Analysis for Wolf Creek issued in August 2011, developments in the area of spent nuclear fuel disposal suggest a possibility that the federal government may not have removed all of Wolf Creek's spent nuclear fuel and high-level radioactive waste (hereafter, simply "spent fuel") from the station by the time the plant has been decommissioned. There still is much uncertainty in this area. However, WCNOC asked TLG to consider that possibility, to make some assumptions regarding potential effects of the government's delayed removal of spent fuel from Wolf Creek, and to conduct a cost sensitivity analysis reflecting those assumptions. The following discussion is the result of that analysis. Because the assumptions used in this Appendix E analysis are so speculative at this point, the hypothetical cost effects shown here have not been included in the overall updated cost estimate in this report.

Congress passed the "Nuclear Waste Policy Act"[1] (NWPA) in 1982, assigning the federal government's long-standing responsibility for disposal of the spent nuclear fuel created by the commercial nuclear generating plants to the Department of Energy (DOE). The NWPA provided that DOE would enter into contracts with generators in which DOE would promise to take the generator's spent fuel and high-level radioactive waste and the generators would pay the cost of the disposition services for that material. The NWPA, along with the individual contracts with the generators, 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 accept any spent fuel or high level waste, as required by the NWPA and its contracts. Delays continue and, as a result, generators are no closer to shipping spent fuel today than in 1998.

Politically, the country is at an impasse on high-level waste disposal. The current administration has cut the budget for the geological repository program while promising to "conduct a comprehensive review of policies for managing the back end of the nuclear fuel cycle ... make recommendations for a new plan."[2] Towards this goal,

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

2 Charter of the Blue Ribbon Commission on America's Nuclear Future, "Objectives and Scope of Activities," http://www.brc.gov/index.php?q=page/charter

the administration appointed a *Blue Ribbon Commission on America's Nuclear Future* (Blue Ribbon Commission) to make recommendations for a new plan for nuclear waste disposal. The Blue Ribbon Commission's charter includes a requirement that it consider "[O]ptions for safe storage of used nuclear fuel while final disposition pathways are selected and deployed."[3]

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

- "[T]he United States [should] establish a program that leads to the timely development of one or more consolidated storage facilities[4]
- "[T]he United States should undertake an integrated nuclear waste management program that leads to the timely development of one or more permanent deep geological facilities for the safe disposal of spent fuel and high-level nuclear waste."[5]

In January 2013, the DOE issued the "Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste," in response to the recommendations made by the Blue Ribbon Commission and as "a framework for moving toward a sustainable program to deploy an integrated system capable of transporting, storing, and disposing of used nuclear fuel..."[6] This document states: "With the appropriate authorizations from Congress, the Administration currently plans to implement a program over the next 10 years that:

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

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3 Ibid.

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

5 Ibid., p.27

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

- Makes demonstrable progress on the siting and characterization of repository sites to facilitate the availability of a geologic repository by 2048."

Completion of the decommissioning process (release of the entire site for unrestricted use) is highly dependent upon the DOE's ability to remove spent fuel from the site in a timely manner. DOE's repository program is currently based upon the premise that spent fuel allocations would be accepted for disposal from the nation's commercial nuclear plants, with limited exceptions, in the order in which it was discharged from the reactor (i.e., establishing a national "queue"). Even if spent fuel could be transferred to a federal facility for interim storage (in the absence of a permanent disposal facility), the nature of the queue would be expected to result in a long backlog of spent fuel at each site. Under the current system, as can be seen at sites where reactors have been decommissioned, the owner(s) can anticipate several decades of continuing, on-site storage of the spent fuel before the transfer could be expected to be complete.

It should be noted that the cost to dispose of the spent fuel generated from plant operations is not reflected within the estimates. 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, until recently, the disposal cost was being financed by a 1 mill/kWhr surcharge on nuclear generated energy delivered to customers, the fee being paid into the DOE's waste fund during operations. The D.C. Circuit ruling on November 19, 2013, ordered the DOE to submit a proposal to Congress to suspend the Nuclear Waste Fund fee "until such time as either the Secretary chooses to comply with the Act as it is currently written, or until Congress enacts an alternative waste management plan". The fee was reduced to 0.0mill/kWh as of May 16, 2014. The fee is expected to be reinstated in the future.

Nonetheless, the NRC requires licensees to establish a program to manage and provide funding for the management of all irradiated fuel at the reactor site until title to the fuel is transferred to the Secretary of Energy.[7] The post-shutdown costs incurred to satisfy this requirement are described below.

Base Analyses

The estimates described in the main report (and detailed in Appendix C and D) are based in general upon 1) a 2025 start date for DOE initiating transfer of commercial spent fuel to a federal facility, and 2) a 2032 start date for the transfer of spent fuel from the Wolf Creek site based on an "oldest fuel first" priority, and the DOE

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

achieving an annual rate of transfer (3,000 metric tons of uranium per year) as reflected in DOE's latest Acceptance Priority Ranking and Annual Capacity Report.[8]

The assumed 2025 DOE start date is nominally based on the last position stated by the DOE. More importantly, the estimates assume that the DOE would give priority to fuel at shutdown sites,[9] i.e., it assumed that Congress would "(1)...direct the Department to take spent nuclear fuel from decommissioned commercial nuclear power reactors as soon as possible; (2) to establish an expedited siting process; and (3) to authorize the Department to construct and operate the facility under its regulatory authority, or, if the facility were to be constructed and operated under a U.S. Nuclear Regulatory Commission license, to provide for an expedited siting and licensing process."[10]

Under this scenario, once Wolf Creek permanently ceases operation, DOE would expedite the removal of spent fuel from the site. The cost estimates described in the main body of this report assumed that:

- The spent fuel pool would be at capacity following the final core off-load and contain freshly discharged assemblies (from the most recent refueling cycles) as well as the final reactor core
- DOE would give priority to the spent fuel stored in the pool.
- The spent fuel pool would be emptied within the first five and one-half years following plant shutdown.[11] This would allow decommissioning to be completed and the site released for unrestricted use within a relatively short time (see Figure 4.2) or placed into long-term storage without the need of maintaining/operating a spent fuel storage facility.

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8 "Acceptance Priority Ranking and Annual Capacity Report," U.S. DOE, Office of Civilian Radioactive Waste Management, DOE/RW-0567, July 2004

9 "Blue Ribbon Commission on America's Nuclear Future, Report to the Secretary of Energy," http://www.brc.gov/sites/default/files/documents/brc_finalreport_jan2012.pdf, p. 42, January 2012: "[A]ccepting spent fuel according to the OFF priority ranking instead of giving priority to shutdown reactor sites could greatly reduce the cost savings that could be achieved through consolidated storage if priority could be given to accepting spent fuel from shutdown reactor sites before accepting fuel from still-operating plants. .... The magnitude of the cost savings that could be achieved by giving priority to shutdown sites appears to be large enough (i.e., in the billions of dollars) to warrant DOE exercising its right under the Standard Contract to move this fuel first."

10 "Report to Congress on the Demonstration of the Interim Storage of Spent Nuclear Fuel from Decommissioned Nuclear Power Reactor Sites" DOE/RW-0596, December 2008

11 It is assumed that the five and one-half years provides the necessary cooling for the final core to meet transport requirements for decay heat

- The DOE is assumed to use its Transport, Aging and Disposal canister to empty the wet storage pool.[12] The canisters would be provided to WCNOC at no cost, however, Wolf Creek staff/or contractors would load, seal and transfer the multi-purpose canisters into a DOE-provided transport cask.
- Once the pool is emptied, the DOE would remove the spent fuel stored at the Wolf Creek Independent Spent Fuel Storage Installation (ISFSI). The current analysis assumes that 592 assemblies would be placed in dry storage during plant operations (i.e., maintain full core off-load capability in the spent fuel pool); 16 equivalent dry storage system modules.
- The ISFSI would be decommissioned in conjunction with the dismantling of the adjacent power block structures.
- Greater-than-Class C (GTCC)[13] material would be transferred directly to the DOE following the segmentation of the reactor internals.

Alternative Analysis

In 2008, the DOE issued a report to Congress in which it concluded that it did not have authority, under present law, to accept spent nuclear fuel for interim storage from decommissioned commercial nuclear power reactor sites.[14] It also concluded that legislation would be required that would eliminate the limitations in the Nuclear Waste Policy Act of 1982, as amended, on taking commercial spent nuclear fuel for interim storage prior to the opening of the Yucca Mountain repository.

For illustrative purposes only, this alternative analysis examines the impact of the status quo (i.e., the queue), on decommissioning and the resulting cost for long-term, on-site storage of the spent fuel generated during plant operations.[15] Under this scenario:

- DOE pickup of spent fuel would continue beyond the cessation of plant operations at the rates published for the Kansas Gas and Electric Company in the latest Acceptance Priority Ranking and Annual Capacity Report

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12 "Transport, Aging and Disposal Canister System Performance Specification," U.S. DOE, Civilian Radioactive Waste Management System, DOC ID: WMO-TADCS-000001, Rev.1, March 2008

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

14 "Report to Congress on the Demonstration of the Interim Storage of Spent Nuclear Fuel from Decommissioned Nuclear Power Reactor Sites" DOE/RW-0596, December 2008

15 This analysis does not consider that the cost incurred would most likely be reimbursable as a result of DOE's breach of contract due to it non-performance

- Pickup of spent fuel beyond the last published date would be based upon the plant average of the previous ten years
- The residual inventory in the spent fuel pool after the five and one-half years of cooling would be transferred to the ISFSI
- Wolf Creek would utilize a dry storage system that can accommodate 37 assemblies per module
- The ISFSI would be expanded to accommodate the additional dry fuel storage modules needed to empty the spent fuel pool and the GTCC generated during the decommissioning (on the premise that the GTCC would not be accepted by the DOE until after the transfer of the spent fuel was completed)[16]
- WCNOC would operate the ISFSI and manage the spent fuel until such time that the DOE could complete the transfer to an off-site facility
- The DOE would accept the multi-purpose canister without the need for repackaging the assemblies, i.e., the DOE transport cask could accommodate the multi-purpose canister without modification
- WCNOC staff or WCNOC contracted staff would transfer the multi- purpose canister into the DOE-provided transport cask
- The concrete storage overpack and ISFSI pad would be decommissioned once the transfer is completed (2081)

The impact of these assumptions, as compared to the Base Analysis, is summarized as follows.

	Base Case	Alternative
Spent fuel pool inventory at shutdown (assemblies)	1,774	1,774
ISFSI inventory at shutdown (assemblies)	592	592
Spent fuel transferred to the DOE during decommissioning (assemblies)	1,774	336
Spent fuel transferred to the ISFSI for interim storage within 5-½ years after shutdown (assemblies)	0	1,438
Number of additional dry-storage modules need to support decommissioning (including GTCC)	0	39
Transfer of Spent Fuel to DOE Complete (year)	2050	2081

[16] GTCC is assumed to be disposed of as it is generated in the base analysis, avoiding the need for interim storage

In essence, spent fuel is on site for additional 28 years after plant decommissioning, during which time WCNOC maintains and operates the ISFSI under a General (10 CFR Part 50) or Site-Specific (Part 72) license.

The alternative estimate is based upon a nominal value of $1.0 million for the capital cost of a dry storage module and an associated loading cost and transfer cost of $300,000 (from the wet pool to the ISFSI). A unit cost of $150,000 (one half the wet loading cost) was used for transferring the multipurpose canisters from the concrete overpacks at the ISFSI into the DOE-provided transport cask. All such numbers are based on comparative data.

The cost of operating an ISFSI, once decommissioning is complete, is shown in the following schedule, particularly in the years 2054 through 2081 following the decommissioning of Wolf Creek. Annual expenditures include the costs for:

- Periodic Spent Fuel Transfer
- Nuclear Insurance
- Property Taxes
- NRC ISFSI Licensing Fees and Oversight Costs
- Emergency Planning Fees
- ISFSI Operating Costs (maintenance budget, including energy, lighting, and remote surveillance systems)
- Security Staff (full time, round-the-clock)
- WCNOC Staff (for ISFSI operations, maintenance, and fuel transfer activities)

The schedule of expenditure in the following table delineates the cost contributors by year of expenditures as well as cost contributor (e.g., labor, materials, and waste disposal). Costs are reported in 2014 dollars and are not inflated, escalated, or discounted over the period of expenditure.

Since it is assumed that the DOE would not accept GTCC waste prior to completing the transfer of spent fuel, the cost of GTCC disposal is shown in the final year of ISFSI operation (2081). This same cost is included during the decommissioning phase in the base analyses (e.g., in Table 3.1, during years 2046-2048 for the DECON alternative).

While this analysis attempts to capture the cost for long-term spent fuel management at the Wolf Creek site, under the scenario outlined above, it is WCNOC's position that the DOE has a contractual obligation to accept Wolf Creek's fuel earlier than the

projections set out above consistent with its contract commitments. No assumption made in this analysis should be interpreted to be inconsistent with this claim.

TABLE E
DECON ALTERNATIVE WITH LONG-TERM SPENT FUEL MANAGEMENT
SCHEDULE OF TOTAL ANNUAL EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2045	53,663	4,247	1,950	32	7,042	66,934
2046	76,316	28,804	3,580	16,826	22,121	147,647
2047	74,296	36,065	2,285	40,592	12,135	165,373
2048	67,272	24,217	1,979	20,314	9,615	123,397
2049	63,166	17,666	1,804	9,191	8,202	100,028
2050	55,621	14,633	1,543	9,128	7,438	88,363
2051	36,128	5,509	656	3,295	4,007	49,595
2052	25,974	14,132	274	4	3,590	43,974
2053	17,218	9,831	177	0	3,181	30,406
2054	5,193	233	72	0	2,378	7,876
2055	5,193	233	72	0	2,378	7,876
2056	5,208	234	72	0	2,384	7,898
2057	5,193	233	72	0	2,378	7,876
2058	5,193	233	72	0	2,378	7,876
2059	5,193	233	72	0	2,378	7,876
2060	5,208	234	72	0	2,384	7,898
2061	5,193	233	72	0	2,378	7,876
2062	5,193	233	72	0	2,378	7,876
2063	5,193	233	72	0	2,378	7,876
2064	5,208	234	72	0	2,384	7,898
2065	5,193	233	72	0	2,378	7,876
2066	5,193	233	72	0	2,378	7,876
2067	5,193	233	72	0	2,378	7,876
2068	5,208	234	72	0	2,384	7,898
2069	5,193	233	72	0	2,378	7,876
2070	5,193	233	72	0	2,378	7,876
2071	5,193	233	72	0	2,378	7,876
2072	5,208	234	72	0	2,384	7,898
2073	5,193	233	72	0	2,378	7,876
2074	5,193	233	72	0	2,378	7,876
2075	5,193	233	72	0	2,378	7,876

TABLE E (continued)
DECON ALTERNATIVE WITH LONG-TERM SPENT FUEL MANAGEMENT
SCHEDULE OF TOTAL ANNUAL EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2076	5,208	234	72	0	2,384	7,898
2077	5,193	233	72	0	2,378	7,876
2078	5,193	233	72	0	2,378	7,876
2079	5,193	233	72	0	2,378	7,876
2080	5,208	234	72	0	2,384	7,898
2081	5,065	1,190	75	310	16,606	23,246
2082	1,741	670	57	1,899	2,602	6,968
Total	616,783	163,261	16,328	101,591	160,780	1,058,743

APPENDIX F

RESPONSE TO JUNE 13, 2013 ORDER

APPENDIX F

RESPONSE TO JUNE 13, 2013 ORDER

In its Order dated June 13, 2013, the State Corporation Commission of the State of Kansas closed Docket No. 13-WCNE-204-GIE but required the parties to update its estimate on the total capital costs for the Wolf Creek Independent Spent Fuel Storage Installation (ISFSI) in future decommissioning financing plans.

This Order appeared to be predicated on the then-current plan for executing the ISFSI project, which placed requests for quotes and award of contracts in the year 2014. Lower than expected fuel consumption has allowed Wolf Creek to delay implementation of the ISFSI project.

WCNOC's current plan for executing the ISFSI project is as follows:

- 2016: Issue requests for quotes, receive proposals, award contracts, and begin design development.
- 2017-2019: Vendor design and procurement, develop and issue plant design change packages and field work packages, install pad, lighting, security systems, construct necessary additional buildings, and establish haul path.
- 2020: Receive system and install components, install Transfer Equipment, perform site acceptance testing, notify the Nuclear Regulatory Commission of the plant's intent to begin dry storage of spent fuel, and prepare for first load campaign in the fall 2020.

As explained below, consequently, it is premature to provide a specific response to the question in the Commission's Order. The Wolf Creek ISFSI project still is at a very preliminary stage with virtually all key project decisions remaining to be made. These decisions involve design, development, installation and operation of the ISFSI. These decisions will affect the ultimate capital and operating costs of the project and the timing of when those costs will be incurred. Some of the major decisions, none of which have yet been made, include:

- Designer of the project, vendor of the components, and builder of the project.
- Amount of cooling time for assemblies in the spent fuel pool before moving to dry cask.
- Number of spent fuel assemblies per canister.
- One or multiple locations for the ISFSI.

- Full or partial sized pad initially built.
- Locate the ISFSI inside or outside the plant's current Protected Area Boundary.
- Haul path transport method (vehicle or rail).
- Number and type of canisters and casks to purchase in a year.
- Whether the load team will be site personnel, a "partner" arrangement, or turnkey.
- Whether to own, lease or share transfer equipment.

Our review of selected available industry information, and informal inquiries from various industry sources, suggest that the range of total (not annual) capital cost for ISFSI projects has been between $45 million and $85 million. However, these cost differences are highly dependent upon the combination of key decisions made for each project. This cost range is presented here for illustrative purposes only and should not be deemed to be estimates for the Wolf Creek facility because of the various diverging influences discussed above.

In addition to the numerous uncertainties mentioned above, another significant uncertainty is the number of years over which the ISFSI will be needed to store Wolf Creek's spent fuel. That uncertainty is caused in large part by the federal government's continued inability to achieve a workable solution for disposal, or at least temporary storage, of the nation's spent fuel, described in more detail in the main report.