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Nuclear Management Company, LLC

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U.S. Nuclear Regulatory Commission
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Monticello Nuclear Generating Plant
Docket No. 50-263
License No. DPR-22

Supplement to Irradiated Fuel Management Plan and Preliminary Decommissioning Cost Estimates for the Monticello Nuclear Generating Plant

Reference: 1) Nuclear Management Company, LLC (NMC) letter to the U.S. Nuclear Regulatory Commission (NRC), "Irradiated Fuel Management Plan and Preliminary Decommissioning Cost Estimates for Monticello Nuclear Generating Plant," (L-HU-05-022) dated December 20, 2005, (ADAMS Accession No. ML053550522).

On December 20, 2005, Nuclear Management Company, LLC (NMC) provided information concerning the Irradiated Fuel Management Plan and Preliminary Decommissioning Cost Estimates for the Monticello Nuclear Generating Plant (MNGP) (Reference 1). In response to questions raised during informal discussions with the NRC staff, Enclosure 1 provides supplemental cost information associated with an Independent Spent Fuel Storage Installation (ISFSI) planned for MNGP. Enclosure 2 provides a copy of "Decommissioning Cost Analysis for the Monticello Nuclear Generating Plant," dated October 2005, performed by TLG Services, Inc. for Northern States Power Co., d/b/a as Xcel Energy. The information in Enclosure 1 is based on the current operating license expiration date.

This letter contains no new commitments and no revisions to existing commitments.

Edward J. Weinkam
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Nuclear Management Company, LLC

Enclosures (2)

cc: Regional Administrator, USNRC, Region III
NRR Project Manager, Monticello Nuclear Generating Plant, USNRC
NRC Resident Inspector, Monticello Nuclear Generating Plant, USNRC
Xcel Energy (Attention: Charles Bomberger)

ENCLOSURE 1

Supplement to Irradiated Fuel Management Plan and Preliminary Decommissioning Cost Estimate

On December 20, 2005, Nuclear Management Company, LLC (NMC) provided information describing the present Irradiated Fuel Management Plan and Preliminary Decommissioning Cost Estimates for the Monticello Nuclear Generating Plant (MNGP) (Reference 1). This enclosure supplements Reference 1 in providing additional cost information associated with an Independent Spent Fuel Storage Installation (ISFSI) planned for MNGP. The information provided herein is drawn primarily from a study prepared by TLG Services, Inc. entitled, "Decommissioning Cost Analysis for Monticello Nuclear Generating Plant, October 2005," included as Enclosure 2. NMC is submitting this financial information on behalf of the plant owner, Northern States Power Co., d/b/a as Xcel Energy. Inclusion of costs in this Supplement is not intended to acknowledge that these costs will ultimately be borne by Xcel Energy or NMC, as some (or all) are expected to be the responsibility of the U.S. Department of Energy as a result of the breach of the Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste.

1. What is the cost to load fuel into canisters and transfer the spent canister to the ISFSI?

The study assumes an approximate five year period to transfer spent nuclear fuel from wet (pool) storage to dry storage. The transfer to dry storage should begin with the plant MNGP shutdown in September 2010 and is projected to end in March 2016. Dry fuel transfer costs are estimated at $12.1 million and capital costs (purchase of canisters and overpacks) are estimated at $30.2 million. These cost values include contingency.

An average cost of $300,000 per cask was estimated for the labor to load/transport the spent fuel from the pool to the ISFSI pad, based upon industry experience. For estimating purposes, $100,000 of this cost represents the cost to transfer the fuel from the ISFSI to the U.S. Department of Energy (DOE). This estimate did not include any costs for loading of canisters for fuel stored at the General Electric ISFSI pool facility in Morris, Illinois.

2. Define the start and completion of the construction of the ISFSI. What is the cost to construct the ISFSI?

ISFSI construction is anticipated to commence in July 2007 and be completed by June 2008. Section 3.3 of the "Final Environmental Impact

Statement to Establish an Independent Spent Fuel Storage Installation at Monticello Nuclear Generating Plant," before the Minnesota Department of Commerce (Docket No. E002/CN-05-123) filed March 27, 2006, estimates the cost to construct the ISFSI at approximately $ 3.5 million.

3. What is the schedule for SNF transfer to DOE?

The Decommissioning Cost Analysis for MNGP (Enclosure 2) models transfer of spent nuclear fuel to DOE to begin in 2031 and end in 2039. Total costs for DOE transfer are estimated at $4.6 million, including contingency.

4. What are the costs to operate both the wet and dry spent fuel storage facilities?

Annual costs (excluding labor) of approximately $630,576 and $75,353 are used for operation and maintenance of the spent fuel pool and the ISFSI, respectively. Operation of the spent fuel pool would be discontinued in 2016 after all fuel and greater-than-Class C (GTCC) waste materials are removed.

The Decommissioning Cost Analysis for MNGP (Enclosure 2, Table 3.1) estimates ISFSI operating costs average approximately $6.0 million per year. These costs include labor - $3.84 million, equipment and materials - $0.168 million, energy - $0.059 million and other (NRC license, emergency planning, etc.) - $1.95 million. These values include contingency.

5. Explain the $10 million expenditure after fuel is removed from the ISFSI and the break out of the $5.2 million ISFSI expenditure.

The increase in expenditure for year 2039 in Table 1(Reference 1) includes approximately $8.8 million for disposal of GTCC waste with the balance for ISFSI operation. The estimated $5.2 million costs for year 2040 include ISFSI license termination, insurance, taxes, heavy equipment rental, energy, and labor costs. These values include contingency.

ENCLOSURE 1

Supplement to Irradiated Fuel Management Plan and Preliminary Decommissioning Cost Estimate

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REFERENCE

1. Nuclear Management Company, LLC (NMC) letter to the U.S. Nuclear Regulatory Commission (NRC), "Irradiated Fuel Management Plan and Preliminary Decommissioning Cost Estimates for Monticello Nuclear Generating Plant," (L-HU-05-022) dated December 20, 2005, (ADAMS Accession No. ML053550522).

ENCLOSURE 2

DECOMMISSIONING COST ANALYSIS FOR THE MONTICELLO NUCLEAR GENERATING PLANT

PREPARED BY

TLG SERVICES, INC.

OCTOBER 2005

Document X01-1526-003, Rev. 0

DECOMMISSIONING COST ANALYSIS

for the

MONTICELLO NUCLEAR GENERATING PLANT

prepared for

XCEL ENERGY SERVICES, INC.

prepared by

TLG Services, Inc.
Bridgewater, Connecticut

October 2005

APPROVALS

Project Manager	**Francis W. Seymore**	10/5/05 **Date**
Project Engineer	**Benjamin J. Stochmal**	10/5/05 **Date**
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0		10-05-05		Original Issue

EXECUTIVE SUMMARY

This report presents an estimate of the cost to decommission the Monticello Nuclear Generating Plant (Monticello) for the DECON scenario following the scheduled cessation of plant operations. The analysis relies upon site-specific, technical information, originally developed in an evaluation in 2002-03,[1] updated to reflect current assumptions pertaining to the disposition of the nuclear unit and relevant industry experience in undertaking such projects. The updated estimate is designed to provide Xcel Energy Services, Inc., (Xcel) with sufficient information to assess its financial obligations, as they pertain to the eventual decommissioning of the nuclear station.

The primary goal of the decommissioning is the removal and disposal of the contaminated systems and structures so that the plant's operating license can be terminated. The analysis recognizes that spent fuel will be stored at the site in the plant's storage pool and/or in an independent spent fuel storage installation (ISFSI) until such time that it can be transferred to a U.S. Department of Energy (DOE) facility. Consequently, the estimate also includes those costs to manage and subsequently decommission these storage facilities.

The estimate is based on numerous fundamental assumptions, including regulatory requirements, project contingencies, low-level radioactive waste disposal practices, high-level radioactive waste management options, and site restoration requirements. The estimate incorporates a minimum cooling period of approximately 5½ years for the spent fuel that resides in the storage pool when operations cease. The estimate also includes the dismantling of non-essential structures and limited restoration of the site.

A single shutdown scenario was evaluated for the nuclear unit. The operating license for Monticello currently expires in September 2010. This date represents the expiration of the current NRC license; decommissioning activities at the unit begin on this date. An on-site ISFSI will be built to store spent fuel before the permanent plant shutdown. Spent fuel in the storage pool will be shipped to DOE or placed into the existing ISFSI within 5½ years of shutdown so as to facilitate decontamination and dismantling activities within the fuel handling area of the reactor building. Spent fuel storage operations continue at the site until the transfer of the fuel to the DOE is complete, assumed to be in the year 2039. Costs are included in the

1 "Decommissioning Cost Study for the Monticello Nuclear Generating Plant," Document No. X01-1475-003, TLG Services, Inc., July 2003.

estimate for this long-term caretaking activity. The decommissioning of the ISFSI is also included within the estimate.

Alternatives and Regulations

The Nuclear Regulatory Commission (NRC or Commission) provided initial decommissioning requirements in its rule adopted on June 27, 1988.[2] In this rule, the NRC set forth financial criteria for decommissioning licensed nuclear power facilities. The regulations addressed planning needs, timing, funding methods, and environmental review requirements for decommissioning. The rule also defined three decommissioning alternatives as being acceptable to the NRC: DECON, SAFSTOR, and ENTOMB.

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

The 60-year restriction has limited the practicality for the ENTOMB alternative at commercial reactors that generate significant amounts of long-lived radioactive material. In 1997, the Commission directed its staff to re-evaluate this alternative

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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.

and identify the technical requirements and regulatory actions that would be necessary for entombment to become a viable option. The resulting evaluation provided several recommendations, however, rulemaking has been deferred pending the completion of additional research studies, e.g., on engineered barriers.

In 1996, the NRC amended its decommissioning regulations to clarify ambiguities and codify procedures and terminology as a means of enhancing efficiency and uniformity in the decommissioning process.[6] The amendments allow for greater public participation and better define the transition process from operations to decommissioning. Regulatory Guide 1.184, issued in July 2000, further described the methods and procedures acceptable to the NRC staff for implementing the requirements of the 1996 amendments 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.

Methodology

The methodology used to develop the estimate described within this document follows the basic approach originally presented in the cost estimating guidelines[7] developed by the Atomic Industrial Forum (now Nuclear Energy Institute). This reference describes a unit factor method for determining decommissioning activity costs. The unit factors used in this analysis incorporate site-specific costs and the latest available information on worker productivity in decommissioning.

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

Contingency

Consistent with cost estimating practice, contingencies are applied to the decontamination and dismantling costs developed as "specific provision for

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

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."[8] The cost elements in the estimate is 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.

The use and role of contingency within decommissioning estimates is not a safety factor issue. Safety factors provide additional security and address situations that may never occur. Contingency funds, by contrast, are expected to be fully expended throughout the program. Inclusion of contingency is necessary to provide assurance that sufficient funding will be available to accomplish the intended tasks.

Low-Level Radioactive Waste Disposal

The contaminated and activated material generated in the decontamination and dismantling of a commercial nuclear reactor is classified as low-level (radioactive) waste, although not all of the material is suitable for "shallow-land" disposal. With the passage of the "Low-Level Radioactive Waste Policy Act" in 1980,[9] and its Amendments of 1985,[10] the states became ultimately responsible for the disposition of low-level radioactive waste generated within their own borders.

Monticello is currently able to access the disposal facility in Barnwell, South Carolina and the Envirocare facility in Clive, Utah (10 CFR 61 waste classification A only). However, in June 2000, South Carolina formally joined with Connecticut and New Jersey to form the Atlantic Compact. The legislation provides for South Carolina to gradually limit access to the Barnwell facility, with only Atlantic Compact members having access to the facility after mid-year 2008. Despite the closing of one of the two currently accessible commercial disposal sites, it is reasonable to assume that additional disposal capacity will be available to support reactor decommissioning, particularly for the isolation of the more highly radioactive material that is not suitable for disposal elsewhere. For estimating purposes, and as a proxy for future disposal facilities, waste disposal costs are

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

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

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

estimated using available pricing schedules for the currently operating facilities, i.e., Barnwell and Envirocare.

High-Level Radioactive Waste Management

Congress passed the "Nuclear Waste Policy Act"[11] (NWPA) in 1982, assigning the responsibility for disposal of the spent nuclear fuel created by the commercial nuclear generating plants to the DOE. Two permanent disposal facilities were envisioned, as well as an interim storage facility. To recover the cost, the legislation created a Nuclear Waste Fund through which money is collected from the sale of electricity generated by each nuclear power plant. The NWPA, along with the individual disposal contracts with the utilities, specified that the DOE was to begin accepting spent fuel by January 31, 1998.

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

Operation of DOE's yet-to-be constructed repository is contingent upon the review and approval of the facility's license application by the NRC, and the development of a national transportation system. For comparison, the Private Fuel Storage consortium submitted an application for an interim storage facility in 1997. The NRC granted an operating license for the facility in September 2005, after eight years of review. With a more technically complex and politically sensitive application for permanent disposal, it is not unreasonable to expect that the NRC's approval to construct the repository at Yucca Mountain would require at least as long a review period. The DOE has no plans for receiving spent fuel from commercial nuclear plant sites prior to this date and startup operations may be phased in, creating additional delays. For estimating purposes, Xcel has assumed that the earliest date that the high-level waste repository, or some interim storage facility, will be fully operational is 2015. This timetable is consistent with the findings of an evaluation issued to Congress by the Government Accounting Office.[12]

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

12 "Technical, Schedule, and Cost Uncertainties of the Yucca Mountain Repository Project," GAO-02-191, December 2001.

The NRC requires that licensees establish a program to manage and provide funding for the caretaking of all irradiated fuel at the reactor site until title of the fuel is transferred to the DOE.[13] The fuel will be stored in the storage pool and/or an ISFSI located on the Monticello site until the DOE has completed the transfer.

Monticello also has 1,058 spent fuel assemblies stored at the General Electric facility in Morris, Illinois, that must be transferred to DOE. Xcel is not responsible for operation or decommissioning costs for the GE facility in Morris. Given the DOE's allocation/receipt schedules and priority ranking for Monticello spent fuel stored in the on-site ISFSI and at GE Morris, and an anticipated rate of transfer, spent fuel is projected to remain at the site for approximately 29 years after the cessation of operations in 2010.

Site Restoration

The efficient removal of the contaminated materials at the site may result in damage to many of the site structures. Blasting, coring, drilling, and the other decontamination activities will substantially damage power block structures, potentially weakening the footings and structural supports. Prompt dismantlement once the license is terminated is clearly the most appropriate and cost-effective option. It is unreasonable to anticipate that these structures would be repaired and preserved after the radiological contamination is removed. The cost to dismantle site structures with a work force already mobilized is more efficient and less costly than if the process were deferred. Experience at shutdown generating stations has shown that plant facilities quickly degrade without maintenance, adding additional expense and creating potential hazards to the public and the demolition work force. Xcel has identified some existing site structures as likely to remain in use following the decommissioning project; consequently, these structures have been removed from the site restoration portion of the estimate. This analysis assumes that all site structures not identified for reuse that are within the restricted access area are removed to a nominal depth of three feet below the local grade level wherever possible. The site is then graded and stabilized.

Summary

The costs to decommission Monticello were evaluated for the DECON decommissioning scenario. The estimate assumes the eventual removal of all the contaminated and activated plant components and structural materials, such that the facility operator may then have unrestricted use of the site with no further

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

requirement for an NRC license. The spent fuel remains in storage at the site until such time that the transfer to a DOE facility can be completed. Once the transfer is complete, the storage facilities are also decommissioned.

The scenario analyzed for the purpose of generating the estimate is 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 Appendix C. A cost summary for the DECON scenario is provided at the end of this section for the major cost components.

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

Activity	Total
Decontamination	15,629
Removal	67,597
Packaging	9,987
Transportation	6,717
Waste Disposal	49,622
Off-site Waste Processing	41,732
Program Management [1]	317,226
Spent Fuel Pool Isolation	9,900
Spent Fuel Management	68,905
Insurance and Regulatory Fees	19,897
Energy	12,855
Characterization and Licensing Surveys	8,321
Property Taxes	25,999
Miscellaneous Equipment	8,733
Total [2]	663,122
NRC License Termination	446,819
Spent Fuel Management	188,889
Site Restoration	27,414

[1] Includes engineering and security
[2] Columns may not add due to rounding

1. INTRODUCTION

This report presents an estimate of the cost to decommission the Monticello Nuclear Generating Plant (Monticello), for the scenario described in Section 2, following a scheduled cessation of plant operations. The analysis is designed to provide the Xcel Energy Services, Inc. (Xcel) with sufficient information to assess its financial obligations, as they pertain to the eventual decommissioning of the nuclear station. It is not a detailed engineering document, but a financial analysis prepared in advance of the detailed engineering that will be required to carry out the decommissioning.

1.1 OBJECTIVES OF STUDY

The objectives of this study are to prepare a comprehensive estimate of the cost to decommission Monticello, to provide a sequence or schedule for the associated activities, and to develop waste stream projections from the decontamination and dismantling activities.

An operating license was issued on September 8, 1970 for Monticello. For the purposes of this study, the shutdown date used for scheduling the decommissioning activities for the DECON scenario is September 8, 2010, assuming a 40 year operating life (the current operating license's expiration date).

1.2 SITE DESCRIPTION

Monticello is located on the Mississippi River within the city limits of Monticello, in Wright County, Minnesota. The plant is located approximately 30 miles northwest of the Minneapolis-St. Paul area.

The Nuclear Steam Supply System (NSSS) consists of a single cycle, forced circulation, low power density boiling water reactor. This system was supplied by the General Electric Company and has a reference core design of 1775 MWt (thermal), with a corresponding (net dependable capability) electrical rating of 600 MWe (electric), with the reactor at rated power.

The reactor recirculation system is comprised of the reactor vessel; the two loop reactor recirculation system with its pumps, pipes, and valves; the main steam piping up to the main steam isolation valves; and the reactor auxiliary systems piping. The system is housed within a "containment system," consisting of a steel light bulb-shaped drywell, a steel doughnut-shaped pressure suppression chamber, and interconnecting vent pipes. This system provides the first containment barrier surrounding the reactor vessel and reactor primary system. The reactor building provides secondary containment and is designed as a controlled leakage structure.

The saturated steam leaving the reactor vessel flows through the four main steam lines to the main turbine located in the turbine building. After passing through the main turbine, low-pressure steam is condensed, the non-condensable gases are removed, and the condensate is demineralized before being returned to the reactor vessel through the reactor feedwater system heaters. The turbine-generator system converts the thermodynamic energy of the steam into electrical energy. The unit's turbine-generator consists of one single-flow, high-pressure, and two double-flow, low-pressure turbines driving a direct-coupled generator at 1800 rpm. Heat rejected in the main condenser is removed by the circulating water system.

The circulating water system has been designed for open cycle once-through cooling towers, closed cycle with cooling towers, or for variations of these modes, i.e., partial recirculation. The system for open cycle operation consists of an intake structure with two half-capacity circulating water pumps, piping river water through the condenser to a discharge structure where the water enters a 1000-foot long canal that returns the water to the river downstream from the intake. Two induced-draft cooling towers are used during the open and closed cycle operations. Cooled effluent returns by gravity to the intake structure from the cooling tower basins.

1.3 REGULATORY GUIDANCE

The Nuclear Regulatory Commission (NRC or Commission) provided initial decommissioning requirements in its rule "General Requirements for Decommissioning Nuclear Facilities," issued in June 1988.[1]* This rule set forth financial criteria for decommissioning licensed nuclear power facilities. The regulation addressed decommissioning planning needs, timing, funding methods, and environmental review requirements. The intent of the rule was to ensure that decommissioning would be accomplished in a safe and timely manner and that adequate funds would be available for this purpose. Subsequent to the rule, the NRC issued Regulatory Guide 1.159, "Assuring the Availability of Funds for Decommissioning Nuclear Reactors,"[2] which provided additional guidance to the licensees of nuclear facilities on the

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

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 recent rulemaking permitting the controlled release of a site, the NRC has re-evaluated this alternative.[3] The resulting feasibility study, based upon an assessment by Pacific Northwest National Laboratory, concluded that the method did have conditional merit for some, if not most, reactors. However, the staff also found that additional rulemaking would be needed before this option could be treated as a generic alternative. The NRC had considered rulemaking to alter the 60-year time for completing decommissioning and to clarify the use of engineered barriers for reactor entombments.[4] However, the NRC staff has recommended that rulemaking be deferred, based upon several factors, e.g., no licensee has committed to pursuing the entombment option, the unresolved issues associated with the disposition of greater-than-Class C material (GTCC), and the NRC's current priorities, at least until after the additional research studies are complete. The Commission concurred with the staff's recommendation.

The NRC published revisions to the general requirements for decommissioning nuclear power plants in 1996.[5] When the regulations were originally 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 new amendments allow for greater public participation and better define the transition process from operations to decommissioning.

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

1.3.1 Nuclear Waste Policy Act

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

After pursuing a national site selection process, the NWPA was amended in 1987 to designate Yucca Mountain, Nevada, as the only site to be evaluated for geologic disposal of high-level waste. Also in 1987, the DOE announced a five-year delay (1998 to 2003) in the opening date for the repository. Two years later, in 1989, an additional seven-year delay was announced, primarily due to problems in obtaining the permits necessary from the state of Nevada to perform the required characterization of the site. DOE announced in 2005 a further two year delay (2010 to 2012).

Generators have responded to this impasse by initiating legal action against the DOE and constructing supplemental storage as a means of maintaining necessary fuel storage operating margins. In an August 2000 ruling,[7] the U.S. Court of Appeals for the Federal Circuit reaffirmed the utility position that DOE had breached its contractual obligation. The DOE continues to maintain that its delayed performance is unavoidable because it does not have an operational repository and does not have authority to provide storage in the interim. Consequently the DOE has no plans to receive spent fuel from the commercial reactors until the repository is operational.

The NRC requires that licensees establish a program to manage and provide funding for the management of all irradiated fuel at the reactor until title of the fuel is transferred to the Secretary of Energy, pursuant to Title 10 of the Code of Federal Regulations (10 CFR), §50.54 (bb).[8] This funding requirement is fulfilled through inclusion of certain high-level waste cost elements in the decommissioning estimate, as identified in Section 3.

Xcel will construct an independent spent fuel storage installation (ISFSI) on the Monticello site prior to final plant shutdown. As such, no costs for construction of an ISFSI are included in this estimate.

For estimating purposes, the DOE is assumed to initiate spent fuel receipt from commercial generators in the year 2015. The DOE's generator allocation/receipt schedules are based upon the oldest fuel receiving the highest priority, but licensees are granted the ability to reallocate their allotments within their contracts. Given this scenario and an anticipated rate of transfer, spent fuel is projected to remain at the Monticello site for approximately 29 years after the cessation of operations, or until the year 2039.

1.3.2 Low-Level Radioactive Waste Acts

The contaminated and activated material generated in the decontamination and dismantling of a commercial nuclear reactor is classified as low-level (radioactive) waste, although not all of the material is suitable for "shallow-land" disposal. Congress passed the "Low-Level Radioactive Waste Policy Act" in 1980,[9] declaring the states as being ultimately responsible for the disposition of low-level radioactive waste generated within their own borders. The federal law encouraged the formation of regional groups or compacts to implement this objective safely, efficiently, and economically, and set a target date of 1986 for implementation. After little progress, the "Low-Level Radioactive Waste Policy Amendments Act of 1985,"[10] extended the implementation schedule, with specific milestones and stiff sanctions for non-compliance. However, to date, no new compact facilities have been successfully sited, licensed, and constructed.

Monticello is currently able to access the disposal facility in Barnwell, South Carolina and the Envirocare facility in Clive, Utah (for 10 CFR 61 Class A waste only). However, in June 2000, South Carolina formally joined with Connecticut and New Jersey to form the Atlantic Compact. The legislation allows South Carolina to gradually limit access to the Barnwell facility, with only Atlantic Compact members having access to the facility after mid-year 2008. It is reasonable to assume that additional disposal capacity will be required to support reactor decommissioning, particularly for the isolation of the more highly radioactive material that is not suitable for disposal elsewhere. However, for estimating purposes, and as a proxy for future disposal facilities, waste disposal costs are generated using available pricing schedules for the currently operating facilities, i.e., Barnwell and Envirocare.

1.3.3 Radiological Criteria for License Termination

In 1997, the NRC published Subpart E, "Radiological Criteria for License Termination,"[11] amending 10 CFR §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 estimate for Monticello assumes that the 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).[12] An additional limit of 4 millirem per year, as defined in 40 CFR §141.16, is applied to drinking water.[13]

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) [14] 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. DECON DECOMMISSIONING SCENARIO

A detailed cost estimate was developed to decommission Monticello assuming the DECON method of decommissioning. The estimate assumes that Monticello operates until September 2010. This date represents the expiration of the current NRC license. The DECON scenario assumes that decommissioning activities begin on this date. Any residual spent fuel is transferred to the ISFSI so as to facilitate decontamination and dismantling activities within the fuel handling area of the reactor building. Spent fuel storage operations continue at the site and at the General Electric facility in Morris, Illinois until the transfer of the fuel to the DOE is complete, assumed to be in the year 2039.

The following sections describe the basic activities associated with the scenario. 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 deactivation 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 would then be 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 cost estimate developed for Monticello is 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.

The cost scenario examined uses the DECON alternative, which is defined by the NRC, 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." 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 from nuclear plants. However, the study does estimate the costs incurred with the interim on-site storage of the fuel pending shipment by the DOE to an off-site disposal facility following permanent shutdown.

2.1 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 permanent shutdown conditions and requirements, a characterization of the facility and major components, and the development of the PSDAR.

This study assumes that Xcel builds an ISFSI to support continued plant operations prior to final shutdown; this ISFSI will continue to be used to store the spent fuel through and beyond decommissioning.

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 meeting 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 material, as defined by 10 CFR §61. Major components are further defined as comprising the reactor vessel and internals, large bore reactor recirculation 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, and 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. Decommissioning operations are scheduled around the fuel handling area to optimize the overall project schedule. The fuel is transferred to the DOE or the ISFSI as it decays to the point that it meets the heat load criteria of the containers. Consequently, it is assumed that the fuel pool remains operational for approximately 5½ years following the cessation of plant operations.

- 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.

2.2 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.

- Transfer of the steam separator and dryer assemblies to the dryer-separator pool for segmentation. Segmentation by weight and activity maximizes the loading of the shielded transport casks. The operations are conducted under water using remotely operated tooling and contamination controls.

- Disconnection of the control blades from the drives on the vessel lower head. Blades are transferred to the spent fuel pool for packaging.

- Disassembly, segmentation, and packaging of the core shroud and in-core guide tubes. Some of the material is expected to exceed Class C disposal requirements. As such, those segments are packaged in a modified fuel storage canister for geologic disposal.

- Disassembly and segmentation of the remaining reactor internals, including the jet pump assemblies, fuel support castings, and core plate assembly.

- Draining and decontamination of the reactor well and the permanent sealing of the spent fuel transfer gate. Install a shielded platform for segmentation of the reactor vessel. 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. Sections are transferred to the dryer-separator pool for packaging and interim storage.

- Disconnection of the control rod drives and instrumentation tubes from reactor vessel lower head. The lower reactor head and vessel supporting structure are then segmented.

- Removal of the reactor recirculation pumps. Exterior surfaces are decontaminated and openings covered. 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.

- 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 dryer-separator pool or the spent fuel pool.

- Demolition of the sacrificial shield activated concrete by controlled demolition.

- Expansion of the ISFSI and transfer of the spent fuel from the storage pool to the DOE and to the ISFSI pad for interim storage. Spent fuel storage operations continue throughout the active decommissioning period. Fuel transfer to DOE is expected to be completed by the end of the year 2039.

At least two years prior to the anticipated date of license termination, a License Termination Plan (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 meeting. 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 the drywell, disposing of the activated and contaminated sections as radioactive waste. Removal of any activated/contaminated concrete.

- Removal of the steel liners from the steam separator and dryer pool, reactor well, and spent fuel storage pool.

- Surveys of the decontaminated areas of the containment structures.

- Removal of the contaminated equipment and material from the turbine and radwaste buildings, and any other contaminated facility. Use radiation and contamination control techniques until radiation surveys 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 will facilitate surface decontamination and subsequent verification surveys required prior to obtaining release for demolition.

- Removal of the remaining components, equipment, and plant services in support of the area release survey(s).

- 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)."[15] 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.

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

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

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

Concrete rubble produced by demolition activities is processed to remove rebar and miscellaneous embedments. The processed material is then used on site to backfill voids. Excess materials are trucked to an off-site area for disposal as construction debris.

2.4 ISFSI OPERATIONS AND DECOMMISSIONING

The ISFSI will continue to operate under a separate and independent license (10 CFR §72) following the termination of the §50 operating license. Assuming the DOE starts accepting fuel in 2015, transfer of spent fuel from Monticello and from the GE facility in Morris, Illinois is anticipated to continue through the year 2039.

At the conclusion of the spent fuel transfer process, the on-site ISFSI will be decommissioned. The Commission will terminate the §72 license if it determines that the remediation of the ISFSI has been performed in accordance with an ISFSI license termination plan and that the final radiation survey and associated documentation demonstrate that the facility is suitable for release. Once the requirements are satisfied, the NRC can terminate the license for the ISFSI.

The assumed design for the ISFSI is based upon the use of a multi-purpose canister and a concrete module for pad storage. For purposes of this cost analysis, it is assumed that once the inner canisters containing the spent fuel assemblies have been removed, any required decontamination performed, and the license for the facility terminated, the modules can be dismantled using conventional techniques for the demolition of reinforced concrete. The concrete storage pad will then be removed, and the area graded and landscaped to conform to the surrounding environment.

3. COST ESTIMATE

The cost estimate prepared for decommissioning Monticello considers the unique features of the site, including the NSSS, power generation systems, support services, site buildings, and ancillary facilities. The basis of the estimate, 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 estimate was developed with site-specific, technical information originally developed in 2002-03[16]. The information was reviewed for the current analysis and updated as deemed appropriate. The site-specific considerations and assumptions used in the previous evaluation were also revisited. Modifications were incorporated where new information was available or experience from ongoing decommissioning programs provided viable alternatives or improved processes.

3.2 METHODOLOGY

The methodology used to develop the estimate follows the basic approach originally presented in the AIF/NESP-036 study report, "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates,"[17] and the DOE "Decommissioning Handbook."[18] These documents present a unit factor method for estimating decommissioning activity costs, which simplifies the estimating calculations. Unit factors for concrete removal ($/cubic yard), steel removal ($/ton), and cutting costs ($/inch) were developed using local labor rates. The activity-dependent costs were 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 relied upon information available in the industry publication, "Building Construction Cost Data," published by R.S. Means.[19]

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

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

Work Difficulty Factors

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

- Access Factor 10% to 20%
- Respiratory Protection Factor 10% to 50%
- Radiation/ALARA Factor 10% to 40%
- Protective Clothing Factor 10% to 30%
- Work Break Factor 8.33%

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

Scheduling Program Durations

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

3.3 FINANCIAL COMPONENTS OF THE COST MODEL

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

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

3.3.1 Contingency

The activity- and period-dependent costs are combined to develop the total decommissioning cost. A contingency is then applied on a line-item basis, using one or more of the contingency types listed in the AIF/NESP-036 study. "Contingencies" are defined in the American Association of Cost Engineers "Project and Cost Engineers' Handbook[20] as "specific provision for unforeseeable elements of cost within the defined project scope; particularly important where previous experience relating estimates and actual costs has shown that unforeseeable events which will increase costs are likely to occur." The cost elements in this analysis are based upon ideal conditions and maximum efficiency; therefore, consistent with industry practice, a contingency factor has been applied. In the AIF/NESP-036 study, the types of unforeseeable events that are likely to occur in decommissioning are discussed and guidelines are provided for percentage contingency in each category. It should be noted that contingency, as used in this analysis, does not account for price escalation and inflation in the cost of decommissioning over the remaining operating life of the station.

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

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

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

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

Decontamination	50%
Contaminated Component Removal	25%
Contaminated Component Packaging	10%
Contaminated Component Transport	15%
Low-Level Radioactive Waste Disposal	25%
Reactor Segmentation	75%
NSSS Component Removal	25%
Reactor Waste Packaging	25%
Reactor Waste Transport	25%
Reactor Vessel Component Disposal	50%
GTCC Disposal	15%
Non-Radioactive Component Removal	15%
Heavy Equipment and Tooling	15%
Supplies	25%
Engineering	15%
Energy	15%
Characterization and Termination Surveys	30%
Construction	15%
Taxes and Fees	10%
Insurance	10%
Staffing	15%

The contingency values are applied to the appropriate components of the estimate on a line item basis. A composite value is then reported at the end of the estimate. For this estimate, the composite contingency value is 17.8%.

3.3.2 Financial Risk

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

- Transition activities and costs: ancillary expenses associated with eliminating 50% to 80% of the site labor force shortly after the cessation of plant operations, added cost for worker separation packages throughout the decommissioning program, national or company-mandated retraining, and retention incentives for key personnel.

- Delays in approval of the decommissioning plan due to intervention, public participation in local community meetings, legal challenges, and national and local hearings.

- Changes in the project work scope from the baseline estimate, involving the discovery of unexpected levels of contaminants, contamination in places not previously expected, contaminated soil previously undiscovered (either radioactive or hazardous material contamination), variations in plant inventory or configuration not indicated by the as-built drawings.

- Regulatory changes, e.g., affecting worker health and safety, site release criteria, waste transportation, and disposal.

- Policy decisions altering national commitments, e.g., in the ability to accommodate certain waste forms for disposition or in the timetable for such, e.g., the start and rate of acceptance of spent fuel by the DOE.

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

It has been TLG's experience that the results of a risk analysis, when compared with the base case estimate for decommissioning, indicate that the chances of the base decommissioning estimate's being too high is a low probability, and the chances that the estimate is too low is a higher probability. This is mostly due to the pricing uncertainty for low-level radioactive waste burial, and to a lesser extent due to schedule increases from changes in plant conditions and to pricing variations in the cost of labor (both craft and staff). This cost study, however, does not add any additional cost 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 estimate.

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 of spent fuel generated from plant operations is not reflected within the estimate to decommission the Monticello site. Ultimate disposition of the spent fuel is within the province of the DOE's Waste Management System, as defined by the NWPA. As such, the disposal cost is financed by a 1 mill/kWhr surcharge paid into the DOE's waste fund during operations. However, the NRC requires licensees to establish a program to manage and provide funding for the management of all irradiated fuel at the reactors 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 estimate, as described below.

The total inventory of assemblies that will require handling during decommissioning is based upon several assumptions. The pickup of commercial fuel is assumed to begin in the year 2015 and will proceed on an oldest fuel first basis. The maximum rate at which the fuel is removed from the commercial sites is based upon an annual capacity at the geologic repository of 3,000 metric tons of uranium (MTU). Any delay in the startup of the repository or decrease in the rate of acceptance will correspondingly prolong the transfer process and result in the fuel remaining at the site longer.

The spent fuel will be stored in an ISFSI until such time that the transfer of spent fuel to the DOE can be completed. Assuming that the DOE commences repository operation in 2015, fuel is projected to be removed from the Monticello site by the year 2039.

Operation and maintenance costs for the storage facilities are included within the estimate and address the cost for staffing the facilities, as well as security, insurance, and licensing fees. The estimate includes the costs to load, and transfer the fuel storage canisters. Costs are also provided for the final disposition of the facilities once the transfer is complete.

Repository Startup

Operation of the DOE's yet-to-be constructed geologic repository is contingent upon the review and approval of the facility's license application by the NRC, the successful resolution of pending litigation, and the development of a national transportation system. For comparison, the Private Fuel Storage consortium submitted an application for an interim storage facility in 1997. The NRC granted an operating license for the facility in September 2005, after eight years of review. With a more technically complex and politically sensitive application for permanent disposal, it is not unreasonable to expect that NRC approval to construct the repository at Yucca Mountain will require at least as long a review period. Therefore, the spent fuel management plan described in this section is predicated upon the DOE initiating the pickup of commercial fuel in the year 2015. This timetable is consistent with the findings of an evaluation issued to Congress by the Government Accounting Office.[21]

Spent Fuel Management Model

For estimating purposes, spent fuel will be removed from the Monticello site by the end of year 2039. This assumes the continued use of an ISFSI expected to be constructed prior to final plant shutdown to support operations. Fuel residing in the pool following the cessation of plant operations is relocated to the ISFSI so that decommissioning can proceed on the fuel area of the reactor building. The assemblies will be relocated during the first five years. Costs are included for the purchase of the 35 canisters and overpacks required to empty the pool (an additional three will be used to package the GTCC).

Operation and maintenance costs for the ISFSI are included within the estimate and address the cost for staffing the facility, security, insurance, and licensing fees. Costs are also provided for the final disposition of the facility once the transfer is complete.

The DOE's repository program assumes that spent fuel will be accepted for disposal from the nation's commercial nuclear plants in the order (the "queue") in which it was removed from service ("oldest fuel first").[22] Repository operations were based upon annual industry-wide acceptance rates of 400 MTU/year for year 1, 600 MTU/ year for year 2, 1200 MTU/year for year 3, 2000 MTU/year for year 4, and 3000 MTU/year for year 5 and beyond.[23]

Canister Design

A multi-purpose storage canister with a 61-fuel assemblies capacity, is assumed for future cask acquisitions. A unit cost of $750,000 is used for pricing the internal multi-purpose canister (MPC) and concrete overpack. The DOE is assumed to provide the MPC for fuel transferred directly from the pool to the DOE at no cost to the owner.

Canister Loading and Transfer

An average cost of $300,000 is used for the labor to load/transport the spent fuel from the pool to the ISFSI pad, based upon industry experience. For estimating purposes, $100,000 of this cost is used to estimate the cost to transfer the fuel from the ISFSI to the DOE. This estimate did not include any costs for loading of canisters at the GE facility in Morris.

Operations and Maintenance

Annual costs (excluding labor) of approximately $630,576 and $75,353 are used for operation and maintenance of the spent fuel pool and the ISFSI, respectively.

ISFSI Design Considerations

A multi-purpose (storage and transport) dry shielded storage canister with a horizontal, reinforced concrete storage module is used as a basis for the cost analysis. Approximately 50% of the overpacks are assumed to have some level of neutron-induced activation as a result of the long-term storage of the fuel, i.e., to levels exceeding free-release limits. Approximately 10% of the concrete and steel is assumed to be removed from the overpacks for controlled disposal. The cost to dispose of this material, as well as the demolition of the ISFSI facility, is included in the estimate.

3.4.2 Reactor Vessel and Internal Components

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

The reactor pressure vessel and internal components are segmented for disposal in shielded, reusable transportation casks. Segmentation is performed in the dryer-separator pool, 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 will dictate segmentation and packaging methodology.

The dismantling of the reactor internals will generate radioactive waste considered unsuitable for shallow land disposal, i.e., GTCC. Although the material is not classified as high-level waste, the DOE has indicated it will accept this waste for disposal at the future high-level waste repository.[24] However, the DOE has not been forthcoming with an acceptance criteria or disposition schedule for this material, and numerous questions remain as to the ultimate disposal cost and waste form requirements. As such, for purposes of this study, the GTCC has been packaged and disposed of as high-level waste, at a cost equivalent to that envisioned for the spent fuel. It is not anticipated that the DOE would accept this waste prior to completing the transfer of spent fuel. Therefore, until such time the DOE is ready to accept

GTCC waste, it is reasonable to assume that this material would remain in storage at the Monticello site.

Intact disposal of the reactor vessel and internal components can provide savings in cost and worker exposure by eliminating the complex segmentation requirements, isolation of the GTCC material, and transport/storage of the resulting waste packages. Portland General Electric (PGE) was able to dispose of the Trojan reactor as an intact package. However, its location on the Columbia River simplified the transportation analysis since:

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

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

It is not known whether this option will be available when Monticello ceases operation. Future viability of this option will depend upon the burial site's ability to accept highly radioactive packages and effectively isolate them from the environment. Additionally, with BWRs, the diameter of the reactor vessel may severely limit overland transport. Consequently, the study assumes the reactor vessel will require segmentation, as a bounding condition.

3.4.3 <u>Primary System Components</u>

Reactor recirculation 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 recirculation 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 will be dismantled using conventional maintenance procedures. The turbine rotors and shafts will be removed to a laydown area. The lower turbine casings will be removed from their anchors by controlled demolition. The main condensers will also be disassembled and moved to a laydown area. Material is then prepared for transportation to an off-site recycling facility where it will be surveyed and designated for either decontamination or volume reduction, conventional disposal, or controlled disposal. Components will be 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.[25] The contaminated material will be packaged in Industrial Packages (IP-1, 2, or 3, as defined in subpart 173.411) for transport unless demonstrated to qualify as their own shipping containers. The reactor vessel and internal components are expected to be transported in accordance with §71, as Type B. It is conceivable that the reactor, due to its limited specific activity, could qualify as LSA II or III. However, the high radiation levels on the outer surface would require that additional shielding be incorporated within the packaging so as to attenuate the dose to levels acceptable for transport.

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

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

Transportation costs are based upon the mileage to the Envirocare facility in Clive, Utah. Memphis, Tennessee, is used as the destination for off-site processing. Transportation costs are estimated using published tariffs from Tri-State Motor Transit.[26]

3.4.6 Low-Level Radioactive Waste Disposal

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

Material requiring controlled disposal is packaged and transported to the Envirocare facility. Since Envirocare is currently unable to receive Class B and C waste, Barnwell rates are used as a proxy. Surcharges are added for the highly-activated components, e.g., generated in the segmentation of the reactor vessel.

3.4.7 Site Conditions Following Decommissioning

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

Xcel Energy has identified certain structures and site features that are candidates for reuse by a potential follow-on generating plant at the Monticello site. These structures are excluded from the scope of the estimate for decommissioning or site restoration.

Non-essential structures or buildings severely damaged in decontamination process are removed to a nominal depth of three feet below grade. Concrete rubble generated from demolition activities is processed and made available as clean fill. The excavations will be regraded such that the power block area will have a final contour consistent with adjacent surroundings.

The estimate does 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 estimate for decommissioning the site.

3.5.1 Estimating Basis

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

3.5.2 Labor Costs

The craft labor required to decontaminate and dismantle the nuclear unit will be acquired through standard site contracting practices. The current cost of labor at the site is used as an estimating basis. Costs for site administration, operations, construction, and maintenance personnel are based upon average salary information provided by Xcel or from comparable industry information.

Xcel will hire a Decommissioning Operations Contractor (DOC) to manage the decommissioning. The owner will provide site security, radiological health and safety, quality assurance and overall site administration during the decommissioning and demolition phases. Contract personnel will provide engineering services, e.g., for preparing the activity specifications, work procedures, activation, and structural analyses, under the direction of Xcel.

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.[27] Actual estimates are derived from the curie/gram values contained therein and adjusted for the different mass of the Monticello components, projected operating life, and different periods of decay. Additional short-lived isotopes were derived from CR-0130[28] and CR-0672,[29] and benchmarked to the long-lived values from CR-3474.

The disposal cost for the control blades removed from the vessel with the final core load is included within the estimate. Disposition of any blades stored in the pool from operations is considered an operating expense and therefore not accounted for in the estimate.

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

3.5.4 General

Transition Activities

Existing warehouses will be cleared of non-essential material and remain for use by Xcel and its subcontractors. The plant's operating staff will perform 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 estimate does 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. Xcel 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 estimate 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 owned by Xcel will be removed at no cost or credit to the decommissioning project. Disposition may include relocation to other facilities. Spare parts will also be 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 for the cost of energy consumption during decommissioning for tooling, lighting, ventilation, and essential services.

Insurance

Costs for continuing coverage (nuclear liability and property insurance) following cessation of plant operations and during decommissioning are included and based upon current operating premiums. Reductions in premiums, throughout the decommissioning process, are based upon the guidance and the limits for coverage defined in the NRC's proposed rulemaking "Financial Protection Requirements for Permanently Shutdown Nuclear Power Reactors."[30] NRC's financial protection requirements are based on various reactor (and spent fuel) configurations.

Taxes

Property taxes are included for all decommissioning periods.

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

A schedule of expenditures for the DECON scenario is provided in Table 3.1. Decommissioning costs are reported in the year of projected expenditure; however, the values are provided in thousands of 2005 dollars. Costs are not inflated, escalated, or discounted over the period of expenditure. The annual expenditures are based upon the detailed activity costs reported in Appendix C, along with the schedule discussed in Section 4.

TABLE 3.1
SCHEDULE OF ANNUAL EXPENDITURES
DECON
(thousands, 2005 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2010	14,695	1,714	619	13	4,710	21,751
2011	48,871	8,091	2,583	609	13,528	73,681
2012	48,907	20,287	2,255	36,608	8,692	116,749
2013	42,242	14,579	1,639	23,119	5,679	87,257
2014	38,299	9,390	1,473	7,573	3,792	60,528
2015	38,299	9,390	1,473	7,573	3,792	60,528
2016	32,209	4,418	891	7,002	3,781	48,300
2017	17,364	1,846	331	29	6,897	26,468
2018	14,488	4,470	196	0	1,958	21,113
2019	8,331	1,983	117	0	1,956	12,387
2020	3,848	169	59	0	1,960	6,035
2021	3,837	168	59	0	1,954	6,019
2022	3,837	168	59	0	1,954	6,019
2023	3,837	168	59	0	1,954	6,019
2024	3,848	169	59	0	1,960	6,035
2025	3,837	168	59	0	1,954	6,019
2026	3,837	168	59	0	1,954	6,019
2027	3,837	168	59	0	1,954	6,019
2028	3,848	169	59	0	1,960	6,035
2029	3,837	168	59	0	1,954	6,019
2030	3,837	168	59	0	1,954	6,019
2031	3,837	168	59	0	1,954	6,019
2032	3,848	169	59	0	1,960	6,035
2033	3,837	168	59	0	1,954	6,019
2034	3,837	168	59	0	1,954	6,019
2035	3,837	168	59	0	1,954	6,019
2036	3,848	169	59	0	1,960	6,035
2037	3,837	168	59	0	1,954	6,019
2038	3,837	168	59	0	1,954	6,019
2039	3,829	488	59	3	10,424	14,803
2040	1,164	1,095	97	369	2,397	5,122
	381,652	80,951	12,855	82,898	104,767	663,122

4. SCHEDULE ESTIMATE

The schedule for the decommissioning scenario considered in this study follows the sequence 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 is presented in Figure 4.1 for the DECON decommissioning alternative. The scheduling sequence assumes that fuel is removed from the spent fuel pool within the first 5½ years after operations cease. 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 2002" computer software.[31]

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 tables, 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 handling area of the reactor building is isolated until such time that all spent fuel has been discharged from the spent fuel pool to the DOE or to the ISFSI. Decontamination and dismantling of the storage pool is initiated once the transfer of spent fuel to the ISFSI or DOE is complete.

- 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 schedule for decommissioning Monticello. 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 also shown for the spent fuel cooling period, which determines the release of the fuel handling area of the reactor building for final decontamination.

A project timeline is provided in Figure 4.2. Milestone dates are based on a shutdown date of September 8, 2010.

FIGURE 4.1

ACTIVITY SCHEDULE

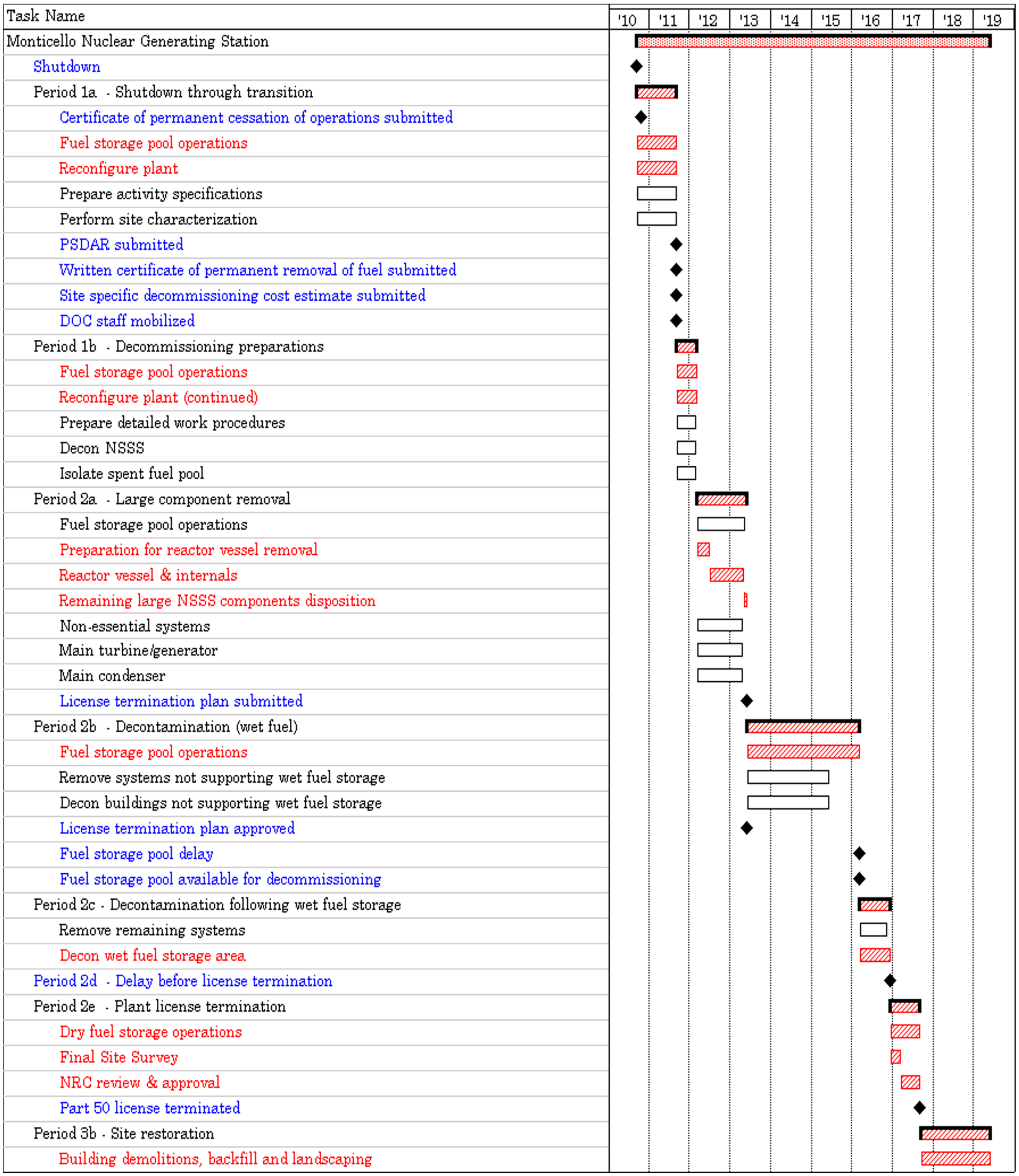
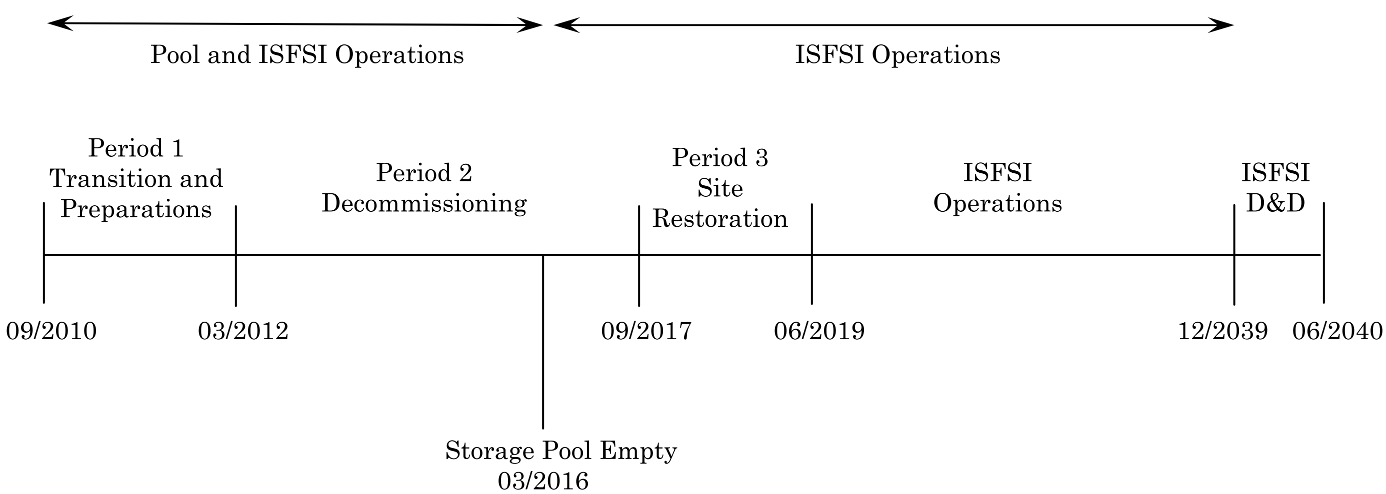


FIGURE 4.2

DECOMMISSIONING TIMELINE
(not to scale)

40 Year Operation
(Shutdown September 8, 2010)



5. RADIOACTIVE WASTES

The objectives of the decommissioning process are the removal of all radioactive material from the site that would restrict its future use and the termination of the NRC license(s). This currently requires the remediation of all radioactive material at the site in excess of applicable legal limits. Under the Atomic Energy Act,[32] the NRC is responsible for protecting the public from sources of ionizing radiation. Title 10 of the Code of Federal Regulations delineates the production, utilization, and disposal of radioactive materials and processes. In particular, §71 defines radioactive material and §61 specifies its disposition.

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

The volumes of radioactive waste generated during the various decommissioning activities at the site is shown on a line-item basis in Appendix C and summarized in Table 5.1. The quantified waste volume summaries shown in this table are consistent with §61 classifications. The volumes are calculated based on the exterior dimensions for containerized material and on the displaced volume of components serving as their own waste containers.

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

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

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

The waste material generated in the decontamination and dismantling of Monticello is primarily generated during Period 2. Material that is considered potentially contaminated when removed from the radiologically 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 the Envirocare facility, an average disposal rate of approximately $1.47 per pound was used. This schedule was used to estimate the disposal fees for most plant components and all activated concrete unsuitable for processing or recovery.

For the reactor vessel and internals and wastes resultant from liquid waste processing, the rate schedule for the Barnwell facility was used as a proxy for this higher activity waste, with additional surcharges for activity, and/or handling added as appropriate for the particular package.

The remaining volume of contaminated metallic and concrete debris is processed and conditioned at a Duratek facility. The contaminated metallic waste stream includes the lower activity components such as miscellaneous steel, metal siding, scaffolding, and structural steel. Metals are recycled at a unit rate of $3.00 per pound. Concrete, soil, asbestos and other bulk debris are disposed of at a rate of $0.82 per pound or approximately $82 per cubic foot. Dry active wastes, e.g., cloth, paper and plastics, are sent to the Envirocare facility for direct disposal from the site at $4.10 per pound or $82.00 per cubic foot, at an assumed density of 20 pounds per cubic foot.

TABLE 5.1
DECOMMISSIONING WASTE SUMMARY
DECON

	Class[1]	Waste Volume (cubic feet)	Weight (pounds)
Low-Level Radioactive Waste			
Containerized	A	59,212	5,137,316
Bulk	A	31,276	2,098,905
	B	7,970	1,157,713
	C	804	54,884
Geologic Repository (Greater-than Class C)			
	>C	408	83,570
Total [2]		99,670	8,532,388
Processed Waste (Off-Site)			12,088,970
Scrap Metal			29,922,913

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 Monticello relied upon the site-specific, technical information developed for a previous analysis prepared in 2002-03. While not an engineering study, the estimate provides Xcel Energy with sufficient information to assess their financial obligations, as they pertain to the eventual decommissioning of the nuclear station.

The estimate described in this report is based on numerous fundamental assumptions, including regulatory requirements, project contingencies, low-level radioactive waste disposal practices, high-level radioactive waste management options, and site restoration requirements. The decommissioning scenario assumes continued operation of the plant's spent fuel pool for a minimum of 5½ years following the cessation of operations for continued cooling of the assemblies. An ISFSI will be used to safeguard the spent fuel, once sufficiently cooled, until such time that the DOE can complete the transfer of the assemblies to its repository.

The cost projected to promptly decommission the nuclear unit upon the currently scheduled cessation of operations is estimated to be $663.1 million. The majority of this cost (approximately 67.4%) is associated with the physical decontamination and dismantling of the nuclear unit so that the license can be terminated. Another 28.5% is associated with the management, interim storage, and eventual transfer of the spent fuel. The remaining 4.1% is for the demolition of the designated structures and limited restoration of the site.

The primary cost contributors, identified in Table 6.1, 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 Xcel Energy 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, and the long-term care of the spent fuel.

As described in this report, the spent fuel pool will remain operational for a minimum of 5½ years following the cessation of operations. The pool will be isolated and an independent spent fuel island created. This will allow decommissioning operations to proceed in and around the pool area. Over the 5½-year period, the spent fuel will be packaged into transportable steel canisters and either loaded into a DOE-provided transport cask or transferred to the ISFSI until the DOE is able to receive them. Dry storage of the fuel under a separate license provides additional flexibility in the event the DOE is not able to meet the current timetable for completing the transfer of assemblies to an off-site facility and minimizes the associated caretaking expenses.

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, disposal of all low-level radioactive material, including concrete and structural steel, is at the Envirocare facility. Highly activated components, requiring additional isolation from the environment, are packaged for geologic disposal. The cost of geologic disposal is based upon a cost equivalent for spent fuel.

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

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

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

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

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

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

TABLE 6.1
SUMMARY OF DECOMMISSIONING COST ELEMENTS
DECON

Work Category	Cost 2005$ (thousands)	Percent of Total Cost
Decontamination	15,629	2.4
Removal	67,597	10.2
Packaging	9,987	1.5
Transportation	6,717	1.0
Waste Disposal	49,622	7.5
Off-site Waste Processing	41,732	6.3
Program Management [1]	317,226	47.8
Spent Fuel Pool Isolation	9,900	1.5
Spent Fuel Management	68,905	10.4
Insurance and Regulatory Fees	19,897	3.0
Energy	12,855	1.9
Characterization and Licensing Surveys	8,321	1.3
Property Taxes	25,999	3.9
Miscellaneous Equipment	8,733	1.3
Total [2]	663,122	100.0
NRC License Termination	446,819	67.4
Spent Fuel Management	188,889	28.5
Site Restoration	27,414	4.1

[1] Includes engineering and security
[2] Columns may not add due to rounding

7. REFERENCES

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

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

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

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

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

7. Maine Yankee Atomic Power Company, Connecticut Yankee Atomic Power Company, and Yankee Atomic Power Company v. United States, U.S. Court of Appeals for the Federal Circuit decision, Docket No. 99-5138, -5139, -5140, August 31, 2000.

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

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

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

7. REFERENCES
(continued)

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

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

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14. "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.

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

16. "Decommissioning Cost Study for the Monticello Nuclear Generating Plant," Document No. X01-1475-003, TLG Services, Inc., July 2003.

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

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

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

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

21. "Technical, Schedule, and Cost Uncertainties of the Yucca Mountain Repository Project," GAO-02-191, December 2001.

7. REFERENCES
(continued)

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

23. "Civilian Radioactive Waste Management System Total System Description," Revision 02 (TDR-CRW-SE-000002), DOE/RW-0500, September 2001.

24. "Strategy for Management and Disposal of Greater-Than-Class C Low-Level Radioactive Waste," Federal Register Volume 60, Number 48 (p 13424 et seq.), March 1995.

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

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

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

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31. "Microsoft Project 2002," Microsoft Corporation, Redmond, WA, 2002.

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

APPENDIX A

UNIT COST FACTOR DEVELOPMENT

APPENDIX A
UNIT COST FACTOR DEVELOPMENT

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

1. SCOPE

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

2. CALCULATIONS

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

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

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

* alpha designators indicate activities that can be performed in parallel

APPENDIX A
(continued)

3. LABOR REQUIRED

Crew	Number	Duration (hours)	Rate ($/hr)	Cost
Laborers	3.00	11.217	$39.86	$1,341.33
Craftsmen	2.00	11.217	$52.66	$1,181.37
Foreman	1.00	11.217	$53.21	$596.86
General Foreman	0.25	11.217	$55.21	$154.82
Fire Watch	0.05	11.217	$39.86	$22.36
Health Physics Technician	1.00	11.217	$51.87	$581.83
Total labor cost				$3,878.57

4. EQUIPMENT & CONSUMABLES COSTS

Equipment Costs	none
Consumables/Materials Costs	
-Blotting paper 50 @ $0.39/sq ft {1}	$19.50
-Plastic sheets/bags 50 @ $0.09/sq ft {2}	$4.50
-Gas torch consumables 1 @ $6.69 x 1 /hr {3}	$6.69
Subtotal cost of equipment and materials	$30.69
Overhead & profit on equipment and materials @ 16.5 %	$5.06
Total costs, equipment & material	$35.75

TOTAL COST:

Removal of contaminated heat exchanger <3000 pounds:	**$3,914.32**
Total labor cost:	$3,878.57
Total equipment/material costs:	$35.75
Total craft labor man-hours required per unit:	81.884

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. McMaster-Carr: Spill Control (7193T85), www.mcmaster.com online catalog
  2. R.S. Means (2005) Division 01540 Section 800-0200
  3. R.S. Means (2005) Division 01590 Section 400-6360

- Material and consumable costs were adjusted using the regional indices for Minneapolis, Minnesota.

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	0.43
Removal of clean pipe 0.25 to 2 inches diameter, $/linear foot	4.62
Removal of clean pipe >2 to 4 inches diameter, $/linear foot	6.57
Removal of clean pipe >4 to 8 inches diameter, $/linear foot	12.93
Removal of clean pipe >8 to 14 inches diameter, $/linear foot	24.99
Removal of clean pipe >14 to 20 inches diameter, $/linear foot	32.40
Removal of clean pipe >20 to 36 inches diameter, $/linear foot	47.69
Removal of clean pipe >36 inches diameter, $/linear foot	56.70
Removal of clean valve >2 to 4 inches	84.71
Removal of clean valve >4 to 8 inches	129.29
Removal of clean valve >8 to 14 inches	249.94
Removal of clean valve >14 to 20 inches	323.95
Removal of clean valve >20 to 36 inches	476.87
Removal of clean valve >36 inches	567.03
Removal of clean pipe hanger for small bore piping	27.32
Removal of clean pipe hanger for large bore piping	100.69
Removal of clean pump, <300 pound	215.96
Removal of clean pump, 300-1000 pound	604.40
Removal of clean pump, 1000-10,000 pound	2,397.06
Removal of clean pump, >10,000 pound	4,628.41
Removal of clean pump motor, 300-1000 pound	255.04
Removal of clean pump motor, 1000-10,000 pound	999.53
Removal of clean pump motor, >10,000 pound	2,248.92
Removal of clean heat exchanger <3000 pound	1,281.29
Removal of clean heat exchanger >3000 pound	3,215.05

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit
Removal of clean feedwater heater/deaerator	9,104.71
Removal of clean moisture separator/reheater	18,772.41
Removal of clean tank, <300 gallons	278.04
Removal of clean tank, 300-3000 gallon	880.76
Removal of clean tank, >3000 gallons, $/square foot surface area	7.38
Removal of clean electrical equipment, <300 pound	118.95
Removal of clean electrical equipment, 300-1000 pound	415.24
Removal of clean electrical equipment, 1000-10,000 pound	830.48
Removal of clean electrical equipment, >10,000 pound	1,966.02
Removal of clean electrical transformer < 30 tons	1,365.37
Removal of clean electrical transformer > 30 tons	3,932.02
Removal of clean standby diesel generator, <100 kW	1,394.61
Removal of clean standby diesel generator, 100 kW to 1 MW	3,112.84
Removal of clean standby diesel generator, >1 MW	6,444.23
Removal of clean electrical cable tray, $/linear foot	11.04
Removal of clean electrical conduit, $/linear foot	4.82
Removal of clean mechanical equipment, <300 pound	118.95
Removal of clean mechanical equipment, 300-1000 pound	415.24
Removal of clean mechanical equipment, 1000-10,000 pound	830.48
Removal of clean mechanical equipment, >10,000 pound	1,966.02
Removal of clean HVAC equipment, <300 pound	118.95
Removal of clean HVAC equipment, 300-1000 pound	415.24
Removal of clean HVAC equipment, 1000-10,000 pound	830.48
Removal of clean HVAC equipment, >10,000 pound	1,966.02
Removal of clean HVAC ductwork, $/pound	0.46

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit
Removal of contaminated instrument and sampling tubing, $/linear foot	1.42
Removal of contaminated pipe 0.25 to 2 inches diameter, $/linear foot	17.75
Removal of contaminated pipe >2 to 4 inches diameter, $/linear foot	31.53
Removal of contaminated pipe >4 to 8 inches diameter, $/linear foot	51.08
Removal of contaminated pipe >8 to 14 inches diameter, $/linear foot	100.86
Removal of contaminated pipe >14 to 20 inches diameter, $/linear foot	121.75
Removal of contaminated pipe >20 to 36 inches diameter, $/linear foot	169.85
Removal of contaminated pipe >36 inches diameter, $/linear foot	201.42
Removal of contaminated valve >2 to 4 inches	395.49
Removal of contaminated valve >4 to 8 inches	479.71
Removal of contaminated valve >8 to 14 inches	980.60
Removal of contaminated valve >14 to 20 inches	1,250.08
Removal of contaminated valve >20 to 36 inches	1,670.51
Removal of contaminated valve >36 inches	1,986.21
Removal of contaminated pipe hanger for small bore piping	96.62
Removal of contaminated pipe hanger for large bore piping	312.95
Removal of contaminated pump, <300 pound	851.53
Removal of contaminated pump, 300-1000 pound	1,972.62
Removal of contaminated pump, 1000-10,000 pound	6,448.35
Removal of contaminated pump, >10,000 pound	15,708.68
Removal of contaminated pump motor, 300-1000 pound	822.01
Removal of contaminated pump motor, 1000-10,000 pound	2,608.28
Removal of contaminated pump motor, >10,000 pound	5,855.79
Removal of contaminated heat exchanger <3000 pound	3,914.32
Removal of contaminated heat exchanger >3000 pound	11,286.93

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit
Removal of contaminated feedwater heater/deaerator	27,567.00
Removal of contaminated moisture separator/reheater	60,366.13
Removal of contaminated tank, <300 gallons	1,411.28
Removal of contaminated tank, >300 gallons, $/square foot	27.99
Removal of contaminated electrical equipment, <300 pound	670.49
Removal of contaminated electrical equipment, 300-1000 pound	1,614.87
Removal of contaminated electrical equipment, 1000-10,000 pound	3,108.31
Removal of contaminated electrical equipment, >10,000 pound	6,029.67
Removal of contaminated electrical cable tray, $/linear foot	32.32
Removal of contaminated electrical conduit, $/linear foot	14.50
Removal of contaminated mechanical equipment, <300 pound	746.69
Removal of contaminated mechanical equipment, 300-1000 pound	1,786.32
Removal of contaminated mechanical equipment, 1000-10,000 pound	3,432.81
Removal of contaminated mechanical equipment, >10,000 pound	6,029.67
Removal of contaminated HVAC equipment, <300 pound	746.69
Removal of contaminated HVAC equipment, 300-1000 pound	1,786.32
Removal of contaminated HVAC equipment, 1000-10,000 pound	3,432.81
Removal of contaminated HVAC equipment, >10,000 pound	6,029.67
Removal of contaminated HVAC ductwork, $/pound	1.90
Removal/plasma arc cut of contaminated thin metal components, $/linear in.	3.52
Additional decontamination of surface by washing, $/square foot	7.09
Additional decontamination of surfaces by hydrolasing, $/square foot	32.11
Decontamination rig hook up and flush, $/ 250 foot length	6,354.78
Chemical flush of components/systems, $/gallon	10.30
Removal of clean standard reinforced concrete, $/cubic yard	110.62

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit
Removal of grade slab concrete, $/cubic yard	151.95
Removal of clean concrete floors, $/cubic yard	282.56
Removal of sections of clean concrete floors, $/cubic yard	855.38
Removal of clean heavily rein concrete w/#9 rebar, $/cubic yard	182.50
Removal of contaminated heavily rein concrete w/#9 rebar, $/cubic yard	1,753.92
Removal of clean heavily rein concrete w/#18 rebar, $/cubic yard	230.83
Removal of contaminated heavily rein concrete w/#18 rebar, $/cubic yard	2,323.56
Removal heavily rein concrete w/#18 rebar & steel embedments, $/cubic yard	361.12
Removal of below-grade suspended floors, $/cubic yard	282.56
Removal of clean monolithic concrete structures, $/cubic yard	729.17
Removal of contaminated monolithic concrete structures, $/cubic yard	1,755.22
Removal of clean foundation concrete, $/cubic yard	569.94
Removal of contaminated foundation concrete, $/cubic yard	1,634.52
Explosive demolition of bulk concrete, $/cubic yard	25.55
Removal of clean hollow masonry block wall, $/cubic yard	76.06
Removal of contaminated hollow masonry block wall, $/cubic yard	275.65
Removal of clean solid masonry block wall, $/cubic yard	76.06
Removal of contaminated solid masonry block wall, $/cubic yard	275.65
Backfill of below-grade voids, $/cubic yard	13.78
Removal of subterranean tunnels/voids, $/linear foot	90.74
Placement of concrete for below-grade voids, $/cubic yard	91.85
Excavation of clean material, $/cubic yard	2.10
Excavation of contaminated material, $/cubic yard	33.46
Removal of clean concrete rubble (tipping fee included), $/cubic yard	77.81
Removal of contaminated concrete rubble, $/cubic yard	20.82

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit
Removal of building by volume, $/cubic foot	0.24
Removal of clean building metal siding, $/square foot	0.99
Removal of contaminated building metal siding, $/square foot	3.68
Removal of standard asphalt roofing, $/square foot	2.04
Removal of transite panels, $/square foot	1.97
Scarifying contaminated concrete surfaces (drill & spall), $/square foot	11.49
Scabbling contaminated concrete floors, $/square foot	6.77
Scabbling contaminated concrete walls, $/square foot	7.45
Scabbling contaminated ceilings, $/square foot	67.03
Scabbling structural steel, $/square foot	5.88
Removal of clean overhead crane/monorail < 10 ton capacity	580.74
Removal of contaminated overhead crane/monorail < 10 ton capacity	1,683.07
Removal of clean overhead crane/monorail >10-50 ton capacity	1,393.76
Removal of contaminated overhead crane/monorail >10-50 ton capacity	4,038.66
Removal of polar crane > 50 ton capacity	5,792.86
Removal of gantry crane > 50 ton capacity	24,575.11
Removal of structural steel, $/pound	0.33
Removal of clean steel floor grating, $/square foot	4.05
Removal of contaminated steel floor grating, $/square foot	12.04
Removal of clean free standing steel liner, $/square foot	11.07
Removal of contaminated free standing steel liner, $/square foot	32.83
Removal of clean concrete-anchored steel liner, $/square foot	5.54
Removal of contaminated concrete-anchored steel liner, $/square foot	38.24
Placement of scaffolding in clean areas, $/square foot	12.62
Placement of scaffolding in contaminated areas, $/square foot	22.54

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit
Landscaping with topsoil, $/acre	16,177.97
Cost of CPC B-88 LSA box & preparation for use	1,151.62
Cost of CPC B-25 LSA box & preparation for use	915.21
Cost of CPC B-12V 12 gauge LSA box & preparation for use	785.92
Cost of CPC B-144 LSA box & preparation for use	4,417.99
Cost of LSA drum & preparation for use	110.58
Cost of cask liner for CNSI 14 195 cask	7,841.84
Cost of cask liner for CNSI 8 120A cask (resins)	5,576.01
Cost of cask liner for CNSI 8 120A cask (filters)	5,576.01
Decontamination of surfaces with vacuuming, $/square foot	0.59

APPENDIX C

DETAILED COST ANALYSIS

DECON

Table C
Monticello Nuclear Generating Plant
DECON Decommissioning Cost Estimate
(Thousands of 2005 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
PERIOD 1a - Shutdown through Transition																					
Period 1a Direct Decommissioning Activities																					
1a.1.1	Prepare preliminary decommissioning cost	-	-	-	-	-	-	122	18	141	141	-	-	-	-	-	-	-	-	-	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	-	-	-	-	-	-	188	28	216	216	-	-	-	-	-	-	-	-	-	2,000
1a.1.7	Review plant dwgs & specs.	-	-	-	-	-	-	433	65	498	498	-	-	-	-	-	-	-	-	-	4,600
1a.1.8	Perform detailed rad survey									a											
1a.1.9	Estimate by-product inventory	-	-	-	-	-	-	94	14	108	108	-	-	-	-	-	-	-	-	-	1,000
1a.1.10	End product description	-	-	-	-	-	-	94	14	108	108	-	-	-	-	-	-	-	-	-	1,000
1a.1.11	Detailed by-product inventory	-	-	-	-	-	-	122	18	141	141	-	-	-	-	-	-	-	-	-	1,300
1a.1.12	Define major work sequence	-	-	-	-	-	-	705	106	811	811	-	-	-	-	-	-	-	-	-	7,500
1a.1.13	Perform SER and EA	-	-	-	-	-	-	292	44	335	335	-	-	-	-	-	-	-	-	-	3,100
1a.1.14	Perform Site-Specific Cost Study	-	-	-	-	-	-	470	71	541	541	-	-	-	-	-	-	-	-	-	5,000
1a.1.15	Prepare/submit License Termination Plan	-	-	-	-	-	-	385	58	443	443	-	-	-	-	-	-	-	-	-	4,096
1a.1.16	Receive NRC approval of termination plan									a											
Activity Specifications																					
1a.1.17.1	Plant & temporary facilities	-	-	-	-	-	-	463	69	532	479	-	53	-	-	-	-	-	-	-	4,920
1a.1.17.2	Plant systems	-	-	-	-	-	-	392	59	451	406	-	45	-	-	-	-	-	-	-	4,167
1a.1.17.3	NSSS Decontamination Flush	-	-	-	-	-	-	47	7	54	54	-	-	-	-	-	-	-	-	-	500
1a.1.17.4	Reactor internals	-	-	-	-	-	-	668	100	768	768	-	-	-	-	-	-	-	-	-	7,100
1a.1.17.5	Reactor vessel	-	-	-	-	-	-	611	92	703	703	-	-	-	-	-	-	-	-	-	6,500
1a.1.17.6	Sacrificial shield	-	-	-	-	-	-	47	7	54	54	-	-	-	-	-	-	-	-	-	500
1a.1.17.7	Moisture separators/reheaters	-	-	-	-	-	-	94	14	108	108	-	-	-	-	-	-	-	-	-	1,000
1a.1.17.8	Reinforced concrete	-	-	-	-	-	-	150	23	173	87	-	87	-	-	-	-	-	-	-	1,600
1a.1.17.9	Main Turbine	-	-	-	-	-	-	196	29	226	226	-	-	-	-	-	-	-	-	-	2,088
1a.1.17.10	Main Condensers	-	-	-	-	-	-	196	29	226	226	-	-	-	-	-	-	-	-	-	2,088
1a.1.17.11	Pressure suppression structure	-	-	-	-	-	-	188	28	216	216	-	-	-	-	-	-	-	-	-	2,000
1a.1.17.12	Drywell	-	-	-	-	-	-	150	23	173	173	-	-	-	-	-	-	-	-	-	1,600
1a.1.17.13	Plant structures & buildings	-	-	-	-	-	-	293	44	337	169	-	169	-	-	-	-	-	-	-	3,120
1a.1.17.14	Waste management	-	-	-	-	-	-	433	65	498	498	-	-	-	-	-	-	-	-	-	4,600
1a.1.17.15	Facility & site closeout	-	-	-	-	-	-	85	13	97	49	-	49	-	-	-	-	-	-	-	900
1a.1.17	Total	-	-	-	-	-	-	4,015	602	4,617	4,215	-	402	-	-	-	-	-	-	-	42,683
Planning & Site Preparations																					
1a.1.18	Prepare dismantling sequence	-	-	-	-	-	-	226	34	260	260	-	-	-	-	-	-	-	-	-	2,400
1a.1.19	Plant prep. & temp. svces	-	-	-	-	-	-	2,419	363	2,782	2,782	-	-	-	-	-	-	-	-	-	-
1a.1.20	Design water clean-up system	-	-	-	-	-	-	132	20	151	151	-	-	-	-	-	-	-	-	-	1,400
1a.1.21	Rigging/Cont. Cntrl Envlps/tooling/etc.	-	-	-	-	-	-	2,048	307	2,355	2,355	-	-	-	-	-	-	-	-	-	-
1a.1.22	Procure casks/liners & containers	-	-	-	-	-	-	116	17	133	133	-	-	-	-	-	-	-	-	-	1,230
1a.1	Subtotal Period 1a Activity Costs	-	-	-	-	-	-	11,861	1,779	13,640	13,238	-	402	-	-	-	-	-	-	-	78,609
Period 1a Additional Costs																					
1a.2.1	Spent Fuel Pool Isolation	-	-	-	-	-	-	8,609	1,291	9,900	9,900	-	-	-	-	-	-	-	-	-	-
1a.2	Subtotal Period 1a Additional Costs	-	-	-	-	-	-	8,609	1,291	9,900	9,900	-	-	-	-	-	-	-	-	-	-
Period 1a Collateral Costs																					
1a.3.1	Spent Fuel Capital and Transfer	-	-	-	-	-	-	5,034	755	5,789	-	5,789	-	-	-	-	-	-	-	-	-
1a.3	Subtotal Period 1a Collateral Costs	-	-	-	-	-	-	5,034	755	5,789	-	5,789	-	-	-	-	-	-	-	-	-
Period 1a Period-Dependent Costs																					
1a.4.1	Insurance	-	-	-	-	-	-	1,080	108	1,188	1,188	-	-	-	-	-	-	-	-	-	-

Table C
Monticello Nuclear Generating Plant
DECON Decommissioning Cost Estimate
(Thousands of 2005 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Period 1a Period-Dependent Costs (continued)																					
1a.4.2	Property taxes	-	-	-	-	-	-	1,970	197	2,167	2,167	-	-	-	-	-	-	-	-	-	-
1a.4.3	Health physics supplies	-	209	-	-	-	-	-	52	262	262	-	-	-	-	-	-	-	-	-	-
1a.4.4	Heavy equipment rental	-	277	-	-	-	-	-	42	319	319	-	-	-	-	-	-	-	-	-	-
1a.4.5	Disposal of DAW generated	-	-	5	3	-	33	-	9	51	51	-	-	-	404	-	-	-	8,103	99	-
1a.4.6	Plant energy budget	-	-	-	-	-	-	1,708	256	1,964	1,964	-	-	-	-	-	-	-	-	-	-
1a.4.7	NRC Fees	-	-	-	-	-	-	265	27	292	292	-	-	-	-	-	-	-	-	-	-
1a.4.8	Emergency Planning Fees	-	-	-	-	-	-	450	45	495	-	495	-	-	-	-	-	-	-	-	-
1a.4.9	Railtrack Maintenance Fee	-	-	-	-	-	-	80	12	92	92	-	-	-	-	-	-	-	-	-	-
1a.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	630	95	725	-	725	-	-	-	-	-	-	-	-	-
1a.4.11	ISFSI Operating Costs	-	-	-	-	-	-	75	11	87	-	87	-	-	-	-	-	-	-	-	-
1a.4.12	Security Staff Cost	-	-	-	-	-	-	2,403	360	2,763	2,763	-	-	-	-	-	-	-	-	-	58,921
1a.4.13	Utility Staff Cost	-	-	-	-	-	-	25,480	3,822	29,302	29,302	-	-	-	-	-	-	-	-	-	440,086
1a.4	Subtotal Period 1a Period-Dependent Costs	-	487	5	3	-	33	34,141	5,036	39,705	38,399	1,306	-	-	404	-	-	-	8,103	99	499,007
1a.0	TOTAL PERIOD 1a COST	-	487	5	3	-	33	59,645	8,862	69,035	61,537	7,095	402	-	404	-	-	-	8,103	99	577,616
PERIOD 1b - Decommissioning Preparations																					
Period 1b Direct Decommissioning Activities																					
Detailed Work Procedures																					
1b.1.1.1	Plant systems	-	-	-	-	-	-	445	67	512	461	-	51	-	-	-	-	-	-	-	4,733
1b.1.1.2	NSSS Decontamination Flush	-	-	-	-	-	-	94	14	108	108	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.3	Reactor internals	-	-	-	-	-	-	376	56	433	433	-	-	-	-	-	-	-	-	-	4,000
1b.1.1.4	Remaining buildings	-	-	-	-	-	-	127	19	146	37	-	110	-	-	-	-	-	-	-	1,350
1b.1.1.5	CRD housings & NIs	-	-	-	-	-	-	94	14	108	108	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.6	Incore instrumentation	-	-	-	-	-	-	94	14	108	108	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.7	Removal primary containment	-	-	-	-	-	-	188	28	216	216	-	-	-	-	-	-	-	-	-	2,000
1b.1.1.8	Reactor vessel	-	-	-	-	-	-	341	51	393	393	-	-	-	-	-	-	-	-	-	3,630
1b.1.1.9	Facility closeout	-	-	-	-	-	-	113	17	130	65	-	65	-	-	-	-	-	-	-	1,200
1b.1.1.10	Sacrificial shield	-	-	-	-	-	-	113	17	130	130	-	-	-	-	-	-	-	-	-	1,200
1b.1.1.11	Reinforced concrete	-	-	-	-	-	-	94	14	108	54	-	54	-	-	-	-	-	-	-	1,000
1b.1.1.12	Main Turbine	-	-	-	-	-	-	196	29	225	225	-	-	-	-	-	-	-	-	-	2,080
1b.1.1.13	Main Condensers	-	-	-	-	-	-	196	29	226	226	-	-	-	-	-	-	-	-	-	2,088
1b.1.1.14	Moisture separators & reheaters	-	-	-	-	-	-	188	28	216	216	-	-	-	-	-	-	-	-	-	2,000
1b.1.1.15	Radwaste building	-	-	-	-	-	-	257	39	295	266	-	30	-	-	-	-	-	-	-	2,730
1b.1.1.16	Reactor building	-	-	-	-	-	-	257	39	295	266	-	30	-	-	-	-	-	-	-	2,730
1b.1.1	Total	-	-	-	-	-	-	3,174	476	3,650	3,311	-	339	-	-	-	-	-	-	-	33,741
1b.1.2	Decon NSSS	142	-	-	-	-	-	-	71	213	213	-	-	-	-	-	-	-	-	1,067	-
1b.1	Subtotal Period 1b Activity Costs	142	-	-	-	-	-	3,174	547	3,862	3,524	-	339	-	-	-	-	-	-	1,067	33,741
Period 1b Additional Costs																					
1b.2.1	Site Characterization	-	-	-	-	-	-	2,187	656	2,843	2,843	-	-	-	-	-	-	-	-	-	-
1b.2.2	Mixed Waste	-	-	2	10	21	-	-	5	39	39	-	-	-	-	-	-	-	-	-	-
1b.2.3	RCRA Waste	-	-	0	4	1	-	-	1	6	6	-	-	-	-	-	-	-	-	-	-
1b.2	Subtotal Period 1b Additional Costs	-	-	2	15	22	-	2,187	662	2,888	2,888	-	-	-	-	-	-	-	-	-	-
Period 1b Collateral Costs																					
1b.3.1	Decon equipment	596	-	-	-	-	-	-	89	685	685	-	-	-	-	-	-	-	-	-	-
1b.3.2	DOC staff relocation expenses	-	-	-	-	-	-	1,306	196	1,502	1,502	-	-	-	-	-	-	-	-	-	-
1b.3.3	Process liquid waste	35	-	47	117	-	700	-	215	1,114	1,114	-	-	-	-	726	-	-	112,256	59	-
1b.3.4	Small tool allowance	-	1	-	-	-	-	-	0	1	1	-	-	-	-	-	-	-	-	-	-
1b.3.5	Pipe cutting equipment	-	957	-	-	-	-	-	143	1,100	1,100	-	-	-	-	-	-	-	-	-	-
1b.3.6	Decon rig	1,243	-	-	-	-	-	-	186	1,430	1,430	-	-	-	-	-	-	-	-	-	-
1b.3.7	Spent Fuel Capital and Transfer	-	-	-	-	-	-	3,681	552	4,234	-	4,234	-	-	-	-	-	-	-	-	-

Table C
Monticello Nuclear Generating Plant
DECON Decommissioning Cost Estimate
(Thousands of 2005 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
1b.3	Subtotal Period 1b Collateral Costs	1,874	957	47	117	-	700	4,987	1,382	10,065	5,832	4,234	-	-	-	726	-	-	112,256	59	-
	Period 1b Period-Dependent Costs																				
1b.4.1	Decon supplies	18	-	-	-	-	-	-	5	23	23	-	-	-	-	-	-	-	-	-	-
1b.4.2	Insurance	-	-	-	-	-	-	276	28	304	304	-	-	-	-	-	-	-	-	-	-
1b.4.3	Property taxes	-	-	-	-	-	-	988	99	1,086	1,086	-	-	-	-	-	-	-	-	-	-
1b.4.4	Health physics supplies	-	108	-	-	-	-	-	27	135	135	-	-	-	-	-	-	-	-	-	-
1b.4.5	Heavy equipment rental	-	139	-	-	-	-	-	21	160	160	-	-	-	-	-	-	-	-	-	-
1b.4.6	Disposal of DAW generated	-	-	3	2	-	18	-	5	27	27	-	-	-	219	-	-	-	4,394	54	-
1b.4.7	Plant energy budget	-	-	-	-	-	-	1,713	257	1,970	1,970	-	-	-	-	-	-	-	-	-	-
1b.4.8	NRC Fees	-	-	-	-	-	-	133	13	146	146	-	-	-	-	-	-	-	-	-	-
1b.4.9	Emergency Planning Fees	-	-	-	-	-	-	225	23	248	-	248	-	-	-	-	-	-	-	-	-
1b.4.10	Railtrack Maintenance Fee	-	-	-	-	-	-	40	6	46	46	-	-	-	-	-	-	-	-	-	-
1b.4.11	Spent Fuel Pool O&M	-	-	-	-	-	-	316	47	363	-	363	-	-	-	-	-	-	-	-	-
1b.4.12	ISFSI Operating Costs	-	-	-	-	-	-	38	6	43	-	43	-	-	-	-	-	-	-	-	-
1b.4.13	Security Staff Cost	-	-	-	-	-	-	1,205	181	1,385	1,385	-	-	-	-	-	-	-	-	-	29,541
1b.4.14	DOC Staff Cost	-	-	-	-	-	-	3,966	595	4,561	4,561	-	-	-	-	-	-	-	-	-	63,789
1b.4.15	Utility Staff Cost	-	-	-	-	-	-	12,775	1,916	14,691	14,691	-	-	-	-	-	-	-	-	-	220,646
1b.4	Subtotal Period 1b Period-Dependent Costs	18	247	3	2	-	18	21,674	3,228	25,190	24,535	655	-	-	219	-	-	-	4,394	54	313,976
1b.0	TOTAL PERIOD 1b COST	2,034	1,205	52	134	22	718	32,022	5,819	42,006	36,779	4,888	339	-	219	726	-	-	116,650	1,179	347,717
PERIOD 1 TOTALS		2,034	1,691	57	137	22	752	91,667	14,680	111,041	98,316	11,984	741	-	624	726	-	-	124,753	1,278	925,333
PERIOD 2a - Large Component Removal																					
	Period 2a Direct Decommissioning Activities																				
	Nuclear Steam Supply System Removal																				
2a.1.1.1	Recirculation System Piping & Valves	79	65	8	16	-	144	-	95	407	407	-	-	-	811	-	-	-	98,041	2,887	-
2a.1.1.2	Recirculation Pumps & Motors	28	43	13	27	31	148	-	72	362	362	-	-	96	945	-	-	-	111,100	1,563	-
2a.1.1.3	CRDMs & NIs Removal	138	107	170	72	-	137	-	158	782	782	-	-	-	3,741	-	-	-	93,194	4,779	-
2a.1.1.4	Reactor Vessel Internals	118	2,202	4,524	1,470	-	9,033	199	7,755	25,301	25,301	-	-	-	626	1,033	804	-	238,482	25,526	1,153
2a.1.1.5	Reactor Vessel	58	5,059	1,240	564	-	6,441	199	7,524	21,084	21,084	-	-	-	8,512	1,502	-	-	1,071,860	25,526	1,153
2a.1.1	Totals	422	7,475	5,954	2,148	31	15,903	399	15,604	47,936	47,936	-	-	96	14,635	2,536	804	-	1,612,677	60,282	2,306
	Removal of Major Equipment																				
2a.1.2	Main Turbine/Generator	-	255	408	245	5,257	151	-	968	7,285	7,285	-	-	38,944	1,148	-	-	-	1,855,487	5,201	-
2a.1.3	Main Condensers	-	911	182	110	2,348	68	-	632	4,250	4,250	-	-	17,396	513	-	-	-	828,816	18,831	-
	Cascading Costs from Clean Building Demolition																				
2a.1.4	Totals	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Disposal of Plant Systems																				
2a.1.5.1	Automatic Press Relief	-	80	3	6	98	19	-	41	247	247	-	-	803	145	-	-	-	45,632	1,653	-
2a.1.5.2	Chemistry Sampling	-	19	0	1	19	3	-	9	52	52	-	-	156	26	-	-	-	8,670	400	-
2a.1.5.3	Chemistry Sampling - Insulated	-	1	-	-	-	0	-	0	2	2	-	-	-	1	-	-	-	69	28	-
2a.1.5.4	Circulating Water - RCA	-	138	7	35	811	-	-	162	1,154	1,154	-	-	6,656	-	-	-	-	270,307	2,843	-
2a.1.5.5	Combustible Gas Control - Insul - RCA	-	19	0	1	26	-	-	9	55	55	-	-	212	-	-	-	-	8,617	370	-
2a.1.5.6	Combustible Gas Control - RCA	-	12	0	2	35	-	-	8	57	57	-	-	285	-	-	-	-	11,577	242	-
2a.1.5.7	Condensate & Feedwater	-	664	71	181	2,430	681	-	735	4,762	4,762	-	-	19,947	5,167	-	-	-	1,273,602	13,956	-
2a.1.5.8	Condensate & Feedwater - Insulated	-	325	13	35	509	112	-	192	1,186	1,186	-	-	4,176	852	-	-	-	245,987	6,772	-
2a.1.5.9	Condensate Demin	-	353	11	28	408	93	-	178	1,071	1,071	-	-	3,346	712	-	-	-	199,184	7,274	-
2a.1.5.10	Condensate Storage	-	496	14	46	869	74	-	281	1,781	1,781	-	-	7,131	615	-	-	-	339,959	10,225	-
2a.1.5.11	Control Rod Drive	-	2	-	0	2	0	-	1	6	6	-	-	19	3	-	-	-	1,003	41	-
2a.1.5.12	Control Rod Drive Hydraulic	-	286	6	15	202	52	-	118	678	678	-	-	1,658	398	-	-	-	102,941	5,874	-
2a.1.5.13	Core Spray	-	54	8	29	534	48	-	111	784	784	-	-	4,384	368	-	-	-	211,032	1,146	-
2a.1.5.14	Core Spray - Insulated	-	93	3	7	100	25	-	46	273	273	-	-	818	186	-	-	-	49,915	1,935	-

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Monticello Nuclear Generating Plant
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Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Disposal of Plant Systems (continued)																					
2a.1.5.15	Demin Water - Insulated - RCA	-	10	-	0	10	-	-	4	24	24	-	-	85	-	-	-	-	3,445	180	-
2a.1.5.16	Demin Water - RCA	-	27	0	1	31	-	-	12	71	71	-	-	253	-	-	-	-	10,278	507	-
2a.1.5.17	Diesel Oil - RCA	-	1	-	0	3	-	-	1	5	5	-	-	23	-	-	-	-	931	25	-
2a.1.5.18	Drywell Atmosphere Cooling - RCA	-	26	1	3	67	-	-	17	114	114	-	-	548	-	-	-	-	22,244	550	-
2a.1.5.19	EDG Emerg Service Water - Insul - RCA	-	0	-	-	0	-	-	-	1	1	-	-	2	-	-	-	-	84	4	-
2a.1.5.20	Electrical - Clean	-	8	-	-	-	-	-	1	10	-	-	10	-	-	-	-	-	-	182	-
2a.1.5.21	Emergency Service Water - Insul - RCA	-	14	0	1	17	-	-	6	37	37	-	-	137	-	-	-	-	5,544	277	-
2a.1.5.22	Emergency Service Water - RCA	-	1	-	-	2	-	-	1	3	3	-	-	13	-	-	-	-	512	22	-
2a.1.5.23	GEZIP - RCA	-	2	0	1	13	-	-	3	18	18	-	-	103	-	-	-	-	4,184	48	-
2a.1.5.24	Generator Physical Design - RCA	-	3	-	0	4	-	-	1	9	9	-	-	31	-	-	-	-	1,250	67	-
2a.1.5.25	H2-O2 Control Analyzing	-	4	0	0	1	1	-	1	8	8	-	-	6	9	-	-	-	1,048	80	-
2a.1.5.26	H2-O2 Control Analyzing - Insulated	-	4	0	0	1	1	-	1	8	8	-	-	6	9	-	-	-	1,048	80	-
2a.1.5.27	High Pressure Coolant Injection	-	45	3	7	118	19	-	35	228	228	-	-	972	147	-	-	-	52,675	953	-
2a.1.5.28	High Pressure Coolant Injection - Insula	-	145	5	13	195	45	-	79	483	483	-	-	1,598	340	-	-	-	95,346	3,009	-
2a.1.5.29	Hydrogen Cooling	-	5	-	-	-	-	-	1	6	-	-	6	-	-	-	-	-	-	118	-
2a.1.5.30	Hydrogen Cooling - RCA	-	4	-	0	5	-	-	2	11	11	-	-	39	-	-	-	-	1,600	79	-
2a.1.5.31	Hydrogen Seal Oil - RCA	-	11	0	1	23	-	-	6	42	42	-	-	189	-	-	-	-	7,669	211	-
2a.1.5.32	Hydrogen Water Chemistry - RCA	-	16	0	1	17	-	-	7	40	40	-	-	140	-	-	-	-	5,672	304	-
2a.1.5.33	Instrument & Service Air - RCA	-	144	2	9	215	-	-	70	440	440	-	-	1,768	-	-	-	-	71,810	2,730	-
2a.1.5.34	Main Condenser	-	128	5	11	162	38	-	68	413	413	-	-	1,333	290	-	-	-	80,131	2,652	-
2a.1.5.35	Main Steam	-	164	7	18	262	55	-	97	603	603	-	-	2,148	422	-	-	-	124,831	3,415	-
2a.1.5.36	Main Turbine	-	689	79	194	2,407	809	-	773	4,951	4,951	-	-	19,760	6,143	-	-	-	1,352,621	14,578	-
2a.1.5.37	Main Turbine - Insulated	-	144	7	20	308	62	-	102	644	644	-	-	2,530	471	-	-	-	144,976	3,026	-
2a.1.5.38	Miscellaneous	-	30	0	2	37	-	-	13	82	82	-	-	302	-	-	-	-	12,283	622	-
2a.1.5.39	Off Gas Recombiner	-	128	7	17	219	71	-	86	528	528	-	-	1,795	539	-	-	-	121,307	2,664	-
2a.1.5.40	Off Gas Recombiner - Insulated	-	246	7	15	166	66	-	106	606	606	-	-	1,366	500	-	-	-	100,350	5,078	-
2a.1.5.41	Post Accident Sampling	-	17	0	1	6	3	-	6	34	34	-	-	53	23	-	-	-	4,251	344	-
2a.1.5.42	Post Accident Sampling - Insulated	-	11	0	0	2	3	-	4	21	21	-	-	17	26	-	-	-	3,024	212	-
2a.1.5.43	RHR Service Water - Insulated - RCA	-	55	2	8	181	-	-	42	287	287	-	-	1,485	-	-	-	-	60,293	1,117	-
2a.1.5.44	RHR Service Water - RCA	-	3	-	0	4	-	-	1	9	9	-	-	35	-	-	-	-	1,410	57	-
2a.1.5.45	Reactor Feedwater Pump Seal	-	36	1	2	24	9	-	15	86	86	-	-	193	68	-	-	-	13,952	732	-
2a.1.5.46	Residual Heat Removal	178	172	60	96	780	559	-	409	2,256	2,256	-	-	6,406	4,244	-	-	-	640,605	4,053	-
2a.1.5.47	Residual Heat Removal - Insulated	336	376	23	45	410	243	-	393	1,826	1,826	-	-	3,367	1,840	-	-	-	301,810	10,294	-
2a.1.5.48	Rx Core Isolation Cooling	-	33	1	2	32	7	-	15	89	89	-	-	259	53	-	-	-	15,315	677	-
2a.1.5.49	Rx Core Isolation Cooling - Insulated	-	67	2	4	35	18	-	27	154	154	-	-	288	140	-	-	-	24,227	1,383	-
2a.1.5.50	Rx Recirculation	40	38	2	2	5	18	-	35	140	140	-	-	43	134	-	-	-	13,773	1,577	-
2a.1.5.51	Snubbers	-	120	1	3	46	8	-	40	218	218	-	-	377	63	-	-	-	20,991	2,547	-
2a.1.5.52	Standby Liquid Control - Insul - RCA	-	2	-	0	3	-	-	1	6	6	-	-	22	-	-	-	-	904	48	-
2a.1.5.53	Standby Liquid Control - RCA	-	17	0	1	30	-	-	9	58	58	-	-	245	-	-	-	-	9,969	340	-
2a.1.5.54	Stator Cooling - RCA	-	5	0	1	15	-	-	4	25	25	-	-	126	-	-	-	-	5,135	97	-
2a.1.5.55	Traversing Incore Probe	-	2	-	-	-	1	-	1	4	4	-	-	1	4	-	-	-	372	51	-
2a.1.5	Totals	554	5,499	354	866	11,897	3,147	-	4,387	26,705	26,689	-	16	97,654	23,940	-	-	-	6,106,371	117,747	-
2a.1.6	Scaffolding in support of decommissioning	-	1,601	11	7	139	4	-	424	2,187	2,187	-	-	1,030	51	-	-	-	51,492	22,564	-
2a.1	Subtotal Period 2a Activity Costs	976	15,742	6,910	3,376	19,673	19,273	399	22,015	88,363	88,347	-	16	155,119	40,288	2,536	804	-	10,454,840	224,624	2,306
Period 2a Additional Costs																					
2a.2.1	Curie Surcharge (excluding RPV)	-	-	-	-	-	581	-	145	726	726	-	-	-	-	-	-	-	-	-	-
2a.2	Subtotal Period 2a Additional Costs	-	-	-	-	-	581	-	145	726	726	-	-	-	-	-	-	-	-	-	-
Period 2a Collateral Costs																					
2a.3.1	Process liquid waste	79	-	188	426	-	2,576	-	766	4,035	4,035	-	-	-	-	2,759	-	-	441,895	161	-
2a.3.2	Small tool allowance	-	156	-	-	-	-	-	23	180	162	-	18	-	-	-	-	-	-	-	-
2a.3.3	Spent Fuel Capital and Transfer	-	-	-	-	-	-	9,086	1,363	10,448	-	10,448	-	-	-	-	-	-	-	-	-
2a.3	Subtotal Period 2a Collateral Costs	79	156	188	426	-	2,576	9,086	2,152	14,663	4,197	10,448	18	-	-	2,759	-	-	441,895	161	-

Table C
Monticello Nuclear Generating Plant
DECON Decommissioning Cost Estimate
(Thousands of 2005 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Period 2a Period-Dependent Costs																					
2a.4.1	Decon supplies	45	-	-	-	-	-	-	11	56	56	-	-	-	-	-	-	-	-	-	-
2a.4.2	Insurance	-	-	-	-	-	-	690	69	759	759	-	-	-	-	-	-	-	-	-	-
2a.4.3	Property taxes	-	-	-	-	-	-	2,439	244	2,683	2,415	-	268	-	-	-	-	-	-	-	-
2a.4.4	Health physics supplies	-	904	-	-	-	-	-	226	1,130	1,130	-	-	-	-	-	-	-	-	-	-
2a.4.5	Heavy equipment rental	-	1,673	-	-	-	-	-	251	1,924	1,924	-	-	-	-	-	-	-	-	-	-
2a.4.6	Disposal of DAW generated	-	-	60	35	-	381	-	107	583	583	-	-	-	4,650	-	-	-	93,174	1,142	-
2a.4.7	Plant energy budget	-	-	-	-	-	-	2,009	301	2,311	2,311	-	-	-	-	-	-	-	-	-	-
2a.4.8	NRC Fees	-	-	-	-	-	-	406	41	446	446	-	-	-	-	-	-	-	-	-	-
2a.4.9	Emergency Planning Fees	-	-	-	-	-	-	557	56	613	-	613	-	-	-	-	-	-	-	-	-
2a.4.10	Railtrack Maintenance Fee	-	-	-	-	-	-	99	15	113	113	-	-	-	-	-	-	-	-	-	-
2a.4.11	Spent Fuel Pool O&M	-	-	-	-	-	-	780	117	897	-	897	-	-	-	-	-	-	-	-	-
2a.4.12	ISFSI Operating Costs	-	-	-	-	-	-	93	14	107	-	107	-	-	-	-	-	-	-	-	-
2a.4.13	Security Staff Cost	-	-	-	-	-	-	3,713	557	4,269	4,269	-	-	-	-	-	-	-	-	-	91,046
2a.4.14	DOC Staff Cost	-	-	-	-	-	-	11,863	1,779	13,642	13,642	-	-	-	-	-	-	-	-	-	196,297
2a.4.15	Utility Staff Cost	-	-	-	-	-	-	17,497	2,625	20,122	20,122	-	-	-	-	-	-	-	-	-	282,177
2a.4	Subtotal Period 2a Period-Dependent Costs	45	2,577	60	35	-	381	40,145	6,412	49,656	47,770	1,617	268	-	4,650	-	-	-	93,174	1,142	569,520
2a.0	TOTAL PERIOD 2a COST	1,100	18,475	7,158	3,837	19,673	22,811	49,630	30,724	153,408	141,040	12,066	302	155,119	44,937	5,294	804	-	10,989,910	225,926	571,826
PERIOD 2b - Site Decontamination																					
Period 2b Direct Decommissioning Activities																					
Disposal of Plant Systems																					
2b.1.1.1	ALARA/Radiological	-	13	0	0	4	1	-	4	23	23	-	-	35	7	-	-	-	2,055	277	-
2b.1.1.2	Alternate N2 - RCA	-	10	-	0	11	-	-	4	26	26	-	-	93	-	-	-	-	3,765	185	-
2b.1.1.3	Decontamination Projects	-	1	-	-	0	-	-	0	1	1	-	-	2	0	-	-	-	128	17	-
2b.1.1.4	Electrical - Contaminated	-	304	3	14	291	8	-	124	744	744	-	-	2,389	64	-	-	-	102,708	6,324	-
2b.1.1.5	Electrical - Decontaminated	-	1,800	24	124	2,844	-	-	897	5,689	5,689	-	-	23,344	-	-	-	-	948,013	37,100	-
2b.1.1.6	Fire - RCA	-	66	1	3	75	-	-	28	173	173	-	-	614	-	-	-	-	24,917	1,315	-
2b.1.1.7	HVAC Ductwork	-	216	3	15	325	9	-	108	677	677	-	-	2,665	71	-	-	-	114,579	4,110	-
2b.1.1.8	HVAC/Chilled Water - RCA	-	207	3	15	335	-	-	104	664	664	-	-	2,752	-	-	-	-	111,779	3,956	-
2b.1.1.9	Heating & Ventilation	-	339	7	34	733	21	-	206	1,341	1,341	-	-	6,018	160	-	-	-	258,746	7,097	-
2b.1.1.10	Heating Boiler - Insulated - RCA	-	2	-	0	3	-	-	1	6	6	-	-	26	-	-	-	-	1,058	35	-
2b.1.1.11	Liquid Radwaste	407	463	19	34	374	161	-	423	1,881	1,881	-	-	3,073	1,377	-	-	-	234,130	17,065	-
2b.1.1.12	Makeup Demin - RCA	-	70	2	8	179	-	-	46	305	305	-	-	1,471	-	-	-	-	59,747	1,411	-
2b.1.1.13	Non-Essential Diesel Generator - RCA	-	19	1	8	173	-	-	32	234	234	-	-	1,424	-	-	-	-	57,832	394	-
2b.1.1.14	Off Gas Holdup	-	228	8	21	336	59	-	126	778	778	-	-	2,755	458	-	-	-	151,726	4,673	-
2b.1.1.15	Primary Containment	-	308	17	48	755	140	-	234	1,504	1,504	-	-	6,201	1,066	-	-	-	347,223	6,404	-
2b.1.1.16	Process Radiation Monitors	-	32	1	1	17	5	-	12	68	68	-	-	142	36	-	-	-	9,040	648	-
2b.1.1.17	Rx Bldg Closed Clng Water - Insul - RCA	-	73	1	5	119	-	-	37	235	235	-	-	977	-	-	-	-	39,675	1,459	-
2b.1.1.18	Rx Bldg Closed Clng Water - RCA	-	121	7	38	864	-	-	166	1,196	1,196	-	-	7,093	-	-	-	-	288,031	2,463	-
2b.1.1.19	Rx Component Handling Equip	19	99	7	15	141	77	-	77	434	434	-	-	1,158	585	-	-	-	99,571	2,455	-
2b.1.1.20	Rx Pressure Vessel	20	32	2	3	9	21	-	25	112	112	-	-	75	162	-	-	-	17,616	1,048	-
2b.1.1.21	Rx Water Cleanup	115	175	6	8	16	69	-	122	511	511	-	-	130	523	-	-	-	51,929	5,671	-
2b.1.1.22	Secondary Containment	-	85	3	8	124	24	-	47	290	290	-	-	1,017	180	-	-	-	57,431	1,754	-
2b.1.1.23	Service & Seal Water - Insulated - RCA	-	78	1	6	144	-	-	42	272	272	-	-	1,180	-	-	-	-	47,917	1,554	-
2b.1.1.24	Service & Seal Water - RCA	-	103	2	10	220	-	-	60	395	395	-	-	1,809	-	-	-	-	73,453	2,000	-
2b.1.1.25	Service Air Blower - RCA	-	10	0	1	25	-	-	6	43	43	-	-	206	-	-	-	-	8,364	203	-
2b.1.1.26	Solid Radwaste	225	327	14	27	291	128	-	275	1,288	1,288	-	-	2,387	1,063	-	-	-	184,304	10,555	-
2b.1.1.27	Structures & Buildings	-	54	1	3	44	8	-	23	132	132	-	-	357	60	-	-	-	19,916	1,127	-
2b.1.1.28	Wells & Domestic Water	-	6	-	-	-	-	-	1	7	-	-	7	-	-	-	-	-	-	144	-
2b.1.1.29	Wells & Domestic Water - RCA	-	33	0	2	42	-	-	15	92	92	-	-	342	-	-	-	-	13,874	628	-
2b.1.1	Totals	785	5,276	135	450	8,496	731	-	3,249	19,122	19,115	-	7	69,735	5,814	-	-	-	3,329,527	122,074	-
2b.1.2	Scaffolding in support of decommissioning	-	2,002	14	9	174	5	-	530	2,734	2,734	-	-	1,287	64	-	-	-	64,365	28,205	-

Table C
Monticello Nuclear Generating Plant
DECON Decommissioning Cost Estimate
(Thousands of 2005 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Decontamination of Site Buildings																					
2b.1.3.1	Reactor Building	3,682	2,216	102	302	5,857	375	-	3,423	15,958	15,958	-	-	48,077	4,597	-	-	-	2,410,318	115,483	-
2b.1.3.2	Admin	72	4	1	1	-	6	-	39	123	123	-	-	-	68	-	-	-	6,840	1,601	-
2b.1.3.3	HPCI Room	20	20	1	2	14	5	-	19	80	80	-	-	118	61	-	-	-	10,724	785	-
2b.1.3.4	Hot Shop	11	3	0	1	-	4	-	8	27	27	-	-	-	49	-	-	-	4,860	287	-
2b.1.3.5	LLRW Storage & Shipping	39	17	2	4	4	17	-	29	112	112	-	-	31	205	-	-	-	21,698	1,131	-
2b.1.3.6	Offgas Stack	257	170	5	12	164	26	-	204	838	838	-	-	1,343	321	-	-	-	86,523	8,429	-
2b.1.3.7	Offgas Storage & Compressor	27	12	2	3	3	12	-	21	80	80	-	-	25	150	-	-	-	15,942	789	-
2b.1.3.8	Radwaste	82	43	5	8	21	35	-	66	260	260	-	-	172	434	-	-	-	49,892	2,513	-
2b.1.3.9	Radwaste Material Storage Warehouse	43	17	2	4	-	19	-	32	118	118	-	-	-	234	-	-	-	23,400	1,203	-
2b.1.3.10	Recombiner	18	17	1	3	24	8	-	20	92	92	-	-	199	105	-	-	-	18,354	697	-
2b.1.3.11	Turbine	479	249	27	51	156	206	-	387	1,554	1,554	-	-	1,283	2,525	-	-	-	302,816	14,499	-
2b.1.3.12	Turbine Building Addition	40	15	2	4	-	17	-	28	105	105	-	-	-	205	-	-	-	20,478	1,092	-
2b.1.3	Totals	4,771	2,784	149	395	6,244	730	-	4,275	19,348	19,348	-	-	51,247	8,953	-	-	-	2,971,846	148,508	-
2b.1	Subtotal Period 2b Activity Costs	5,556	10,061	298	853	14,913	1,467	-	8,054	41,203	41,196	-	7	122,269	14,831	-	-	-	6,365,737	298,787	-
Period 2b Collateral Costs																					
2b.3.1	Process liquid waste	113	-	70	225	-	1,065	-	364	1,837	1,837	-	-	-	-	1,251	-	-	176,286	171	-
2b.3.2	Small tool allowance	-	206	-	-	-	-	-	31	237	237	-	-	-	-	-	-	-	-	-	-
2b.3.3	Spent Fuel Capital and Transfer	-	-	-	-	-	-	18,949	2,842	21,791	-	21,791	-	-	-	-	-	-	-	-	-
2b.3	Subtotal Period 2b Collateral Costs	113	206	70	225	-	1,065	18,949	3,237	23,865	2,074	21,791	-	-	-	1,251	-	-	176,286	171	-
Period 2b Period-Dependent Costs																					
2b.4.1	Decon supplies	741	-	-	-	-	-	-	185	926	926	-	-	-	-	-	-	-	-	-	-
2b.4.2	Insurance	-	-	-	-	-	-	1,539	154	1,693	1,693	-	-	-	-	-	-	-	-	-	-
2b.4.3	Property taxes	-	-	-	-	-	-	1,861	186	2,047	2,047	-	-	-	-	-	-	-	-	-	-
2b.4.4	Health physics supplies	-	1,437	-	-	-	-	-	359	1,796	1,796	-	-	-	-	-	-	-	-	-	-
2b.4.5	Heavy equipment rental	-	3,757	-	-	-	-	-	564	4,321	4,321	-	-	-	-	-	-	-	-	-	-
2b.4.6	Disposal of DAW generated	-	-	78	46	-	497	-	139	759	759	-	-	-	6,058	-	-	-	121,401	1,487	-
2b.4.7	Plant energy budget	-	-	-	-	-	-	3,541	531	4,072	4,072	-	-	-	-	-	-	-	-	-	-
2b.4.8	NRC Fees	-	-	-	-	-	-	906	91	996	996	-	-	-	-	-	-	-	-	-	-
2b.4.9	Emergency Planning Fees	-	-	-	-	-	-	1,243	124	1,367	-	1,367	-	-	-	-	-	-	-	-	-
2b.4.10	Railtrack Maintenance Fee	-	-	-	-	-	-	220	33	253	253	-	-	-	-	-	-	-	-	-	-
2b.4.11	Spent Fuel Pool O&M	-	-	-	-	-	-	1,742	261	2,003	-	2,003	-	-	-	-	-	-	-	-	-
2b.4.12	Radwaste Processing Equipment/Services	-	-	-	-	-	-	512	77	589	589	-	-	-	-	-	-	-	-	-	-
2b.4.13	ISFSI Operating Costs	-	-	-	-	-	-	208	31	239	-	239	-	-	-	-	-	-	-	-	-
2b.4.14	Security Staff Cost	-	-	-	-	-	-	6,642	996	7,638	7,638	-	-	-	-	-	-	-	-	-	162,881
2b.4.15	DOC Staff Cost	-	-	-	-	-	-	25,464	3,820	29,284	29,284	-	-	-	-	-	-	-	-	-	420,897
2b.4.16	Utility Staff Cost	-	-	-	-	-	-	38,494	5,774	44,269	44,269	-	-	-	-	-	-	-	-	-	618,373
2b.4	Subtotal Period 2b Period-Dependent Costs	741	5,194	78	46	-	497	82,373	13,325	102,253	98,643	3,610	-	-	6,058	-	-	-	121,401	1,487	1,202,151
2b.0	TOTAL PERIOD 2b COST	6,410	15,461	447	1,124	14,913	3,029	101,322	24,616	167,322	141,913	25,401	7	122,269	20,889	1,251	-	-	6,663,424	300,445	1,202,151
PERIOD 2c - Decontamination Following Wet Fuel Storage																					
Period 2c Direct Decommissioning Activities																					
2c.1.1	Remove spent fuel racks	444	41	53	79	-	713	-	428	1,757	1,757	-	-	-	5,402	-	-	-	484,706	906	-
Disposal of Plant Systems																					
2c.1.2.1	Cranes/Heavy Loads/Rigging - RCA	-	2	0	1	13	-	-	3	18	18	-	-	103	-	-	-	-	4,184	48	-
2c.1.2.2	Electrical - Contaminated Fuel Pool	-	32	0	1	29	1	-	13	77	77	-	-	240	6	-	-	-	10,332	665	-
2c.1.2.3	Electrical - Decontam. Fuel Pool Area	-	198	3	13	299	-	-	97	610	610	-	-	2,457	-	-	-	-	99,783	4,090	-
2c.1.2.4	Fire - RCA - Fuel Pool Area	-	7	-	0	7	-	-	3	18	18	-	-	62	-	-	-	-	2,499	142	-
2c.1.2.5	Fuel Pool Cooling & Cleanup	155	271	12	20	144	125	-	203	930	930	-	-	1,179	965	-	-	-	132,799	7,976	-
2c.1.2.6	Fuel Pool Cooling & Cleanup - Insulated	17	26	1	2	8	11	-	19	84	84	-	-	67	83	-	-	-	10,106	801	-
2c.1.2.7	HVAC Ductwork - Fuel Pool Area	-	24	0	2	36	1	-	12	75	75	-	-	296	8	-	-	-	12,731	457	-
2c.1.2.8	HVAC/Chilled Water - RCA Fuel Pool Area	-	21	0	1	27	-	-	9	59	59	-	-	223	-	-	-	-	9,072	394	-

Table C
Monticello Nuclear Generating Plant
DECON Decommissioning Cost Estimate
(Thousands of 2005 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Disposal of Plant Systems (continued)																					
2c.1.2.9	Instrument & Service Air-RCA-Fuel Pool	-	19	0	1	33	-	-	10	62	62	-	-	267	-	-	-	-	10,841	356	-
2c.1.2	Totals	173	600	17	41	596	138	-	368	1,933	1,933	-	-	4,894	1,062	-	-	-	292,347	14,928	-
Decontamination of Site Buildings																					
2c.1.3.1	Reactor (Post Fuel)	667	1,126	118	200	240	1,264	-	1,009	4,624	4,624	-	-	1,969	11,766	-	-	-	1,194,890	34,978	-
2c.1.3	Totals	667	1,126	118	200	240	1,264	-	1,009	4,624	4,624	-	-	1,969	11,766	-	-	-	1,194,890	34,978	-
2c.1.4	Scaffolding in support of decommissioning	-	400	3	2	35	1	-	106	547	547	-	-	257	13	-	-	-	12,873	5,641	-
2c.1	Subtotal Period 2c Activity Costs	1,283	2,167	191	322	871	2,115	-	1,910	8,861	8,861	-	-	7,120	18,242	-	-	-	1,984,816	56,453	-
Period 2c Collateral Costs																					
2c.3.1	Process liquid waste	60	-	40	125	-	626	-	209	1,060	1,060	-	-	-	-	699	-	-	99,258	92	-
2c.3.2	Small tool allowance	-	45	-	-	-	-	-	7	51	51	-	-	-	-	-	-	-	-	-	-
2c.3.3	Decommissioning Equipment Disposition	-	-	64	48	810	25	-	141	1,088	1,088	-	-	6,000	300	-	-	-	300,000	735	-
2c.3	Subtotal Period 2c Collateral Costs	60	45	104	173	810	651	-	357	2,200	2,200	-	-	6,000	300	699	-	-	399,258	827	-
Period 2c Period-Dependent Costs																					
2c.4.1	Decon supplies	115	-	-	-	-	-	-	29	144	144	-	-	-	-	-	-	-	-	-	-
2c.4.2	Insurance	-	-	-	-	-	-	420	42	461	461	-	-	-	-	-	-	-	-	-	-
2c.4.3	Property taxes	-	-	-	-	-	-	507	51	558	558	-	-	-	-	-	-	-	-	-	-
2c.4.4	Health physics supplies	-	322	-	-	-	-	-	81	403	403	-	-	-	-	-	-	-	-	-	-
2c.4.5	Heavy equipment rental	-	1,024	-	-	-	-	-	154	1,178	1,178	-	-	-	-	-	-	-	-	-	-
2c.4.6	Disposal of DAW generated	-	-	25	14	-	158	-	44	242	242	-	-	-	1,927	-	-	-	38,622	473	-
2c.4.7	Plant energy budget	-	-	-	-	-	-	515	77	592	592	-	-	-	-	-	-	-	-	-	-
2c.4.8	NRC Fees	-	-	-	-	-	-	247	25	271	271	-	-	-	-	-	-	-	-	-	-
2c.4.9	Emergency Planning Fees	-	-	-	-	-	-	151	15	166	-	166	-	-	-	-	-	-	-	-	-
2c.4.10	Railtrack Maintenance Fee	-	-	-	-	-	-	60	9	69	69	-	-	-	-	-	-	-	-	-	-
2c.4.11	Radwaste Processing Equipment/Services	-	-	-	-	-	-	279	42	321	321	-	-	-	-	-	-	-	-	-	-
2c.4.12	ISFSI Operating Costs	-	-	-	-	-	-	57	9	65	-	65	-	-	-	-	-	-	-	-	-
2c.4.13	Security Staff Cost	-	-	-	-	-	-	1,810	272	2,082	2,082	-	-	-	-	-	-	-	-	-	44,393
2c.4.14	DOC Staff Cost	-	-	-	-	-	-	4,805	721	5,526	5,526	-	-	-	-	-	-	-	-	-	78,571
2c.4.15	Utility Staff Cost	-	-	-	-	-	-	10,492	1,574	12,065	12,065	-	-	-	-	-	-	-	-	-	168,536
2c.4	Subtotal Period 2c Period-Dependent Costs	115	1,346	25	14	-	158	19,342	3,142	24,142	23,911	231	-	-	1,927	-	-	-	38,622	473	291,500
2c.0	TOTAL PERIOD 2c COST	1,458	3,558	320	510	1,681	2,924	19,342	5,410	35,203	34,972	231	-	13,120	20,470	699	-	-	2,422,697	57,753	291,500
PERIOD 2e - License Termination																					
Period 2e Direct Decommissioning Activities																					
2e.1.1	ORISE confirmatory survey	-	-	-	-	-	-	126	38	163	163	-	-	-	-	-	-	-	-	-	-
2e.1.2	Terminate license									a											
2e.1	Subtotal Period 2e Activity Costs	-	-	-	-	-	-	126	38	163	163	-	-	-	-	-	-	-	-	-	-
Period 2e Additional Costs																					
2e.2.1	License Termination Survey	-	-	-	-	-	-	4,088	1,226	5,315	5,315	-	-	-	-	-	-	-	-	72,073	-
2e.2	Subtotal Period 2e Additional Costs	-	-	-	-	-	-	4,088	1,226	5,315	5,315	-	-	-	-	-	-	-	-	72,073	-
Period 2e Collateral Costs																					
2e.3.1	DOC staff relocation expenses	-	-	-	-	-	-	1,306	196	1,502	1,502	-	-	-	-	-	-	-	-	-	-
2e.3	Subtotal Period 2e Collateral Costs	-	-	-	-	-	-	1,306	196	1,502	1,502	-	-	-	-	-	-	-	-	-	-
Period 2e Period-Dependent Costs																					
2e.4.1	Insurance	-	-	-	-	-	-	381	38	419	419	-	-	-	-	-	-	-	-	-	-
2e.4.2	Property taxes	-	-	-	-	-	-	505	51	556	556	-	-	-	-	-	-	-	-	-	-
2e.4.3	Health physics supplies	-	364	-	-	-	-	-	91	455	455	-	-	-	-	-	-	-	-	-	-
2e.4.4	Disposal of DAW generated	-	-	4	2	-	25	-	7	38	38	-	-	-	304	-	-	-	6,083	75	-

Table C
Monticello Nuclear Generating Plant
DECON Decommissioning Cost Estimate
(Thousands of 2005 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Period 2e Period-Dependent Costs (continued)																					
2e.4.5	Plant energy budget	-	-	-	-	-	-	256	38	295	295	-	-	-	-	-	-	-	-	-	-
2e.4.6	NRC Fees	-	-	-	-	-	-	246	25	270	270	-	-	-	-	-	-	-	-	-	-
2e.4.7	Emergency Planning Fees	-	-	-	-	-	-	150	15	165	-	165	-	-	-	-	-	-	-	-	-
2e.4.8	Railtrack Maintenance Fee	-	-	-	-	-	-	60	9	69	69	-	-	-	-	-	-	-	-	-	-
2e.4.9	ISFSI Operating Costs	-	-	-	-	-	-	57	8	65	-	65	-	-	-	-	-	-	-	-	-
2e.4.10	Security Staff Cost	-	-	-	-	-	-	990	148	1,138	1,138	-	-	-	-	-	-	-	-	-	24,269
2e.4.11	DOC Staff Cost	-	-	-	-	-	-	3,649	547	4,197	4,197	-	-	-	-	-	-	-	-	-	57,149
2e.4.12	Utility Staff Cost	-	-	-	-	-	-	6,129	919	7,048	7,048	-	-	-	-	-	-	-	-	-	83,374
2e.4	Subtotal Period 2e Period-Dependent Costs	-	364	4	2	-	25	12,423	1,897	14,715	14,485	230	-	-	304	-	-	-	6,083	75	164,791
2e.0	TOTAL PERIOD 2e COST	-	364	4	2	-	25	17,943	3,357	21,695	21,465	230	-	-	304	-	-	-	6,083	72,148	164,791
PERIOD 2 TOTALS		8,968	37,858	7,928	5,473	36,267	28,789	188,236	64,108	377,627	339,389	37,928	310	290,509	86,599	7,244	804	-	20,082,110	656,273	2,230,269
PERIOD 3b - Site Restoration																					
Period 3b Direct Decommissioning Activities																					
Demolition of Remaining Site Buildings																					
3b.1.1.1	Reactor Building	-	3,506	-	-	-	-	-	526	4,032	-	-	4,032	-	-	-	-	-	-	52,969	-
3b.1.1.2	Condensate Tanks Foundation	-	14	-	-	-	-	-	2	16	-	-	16	-	-	-	-	-	-	219	-
3b.1.1.3	Discharge Retention Basin	-	6	-	-	-	-	-	1	7	-	-	7	-	-	-	-	-	-	110	-
3b.1.1.4	HPCI Room	-	30	-	-	-	-	-	5	35	-	-	35	-	-	-	-	-	-	401	-
3b.1.1.5	Hot Shop	-	15	-	-	-	-	-	2	18	-	-	18	-	-	-	-	-	-	298	-
3b.1.1.6	Hydrogen & Oxygen Storage	-	1	-	-	-	-	-	0	1	-	-	1	-	-	-	-	-	-	21	-
3b.1.1.7	LLRW Storage & Shipping	-	102	-	-	-	-	-	15	117	-	-	117	-	-	-	-	-	-	1,794	-
3b.1.1.8	MSIV	-	3	-	-	-	-	-	0	3	-	-	3	-	-	-	-	-	-	59	-
3b.1.1.9	Offgas Stack	-	166	-	-	-	-	-	25	191	-	-	191	-	-	-	-	-	-	2,668	-
3b.1.1.10	Offgas Storage & Compressor	-	61	-	-	-	-	-	9	71	-	-	71	-	-	-	-	-	-	963	-
3b.1.1.11	Radwaste	-	382	-	-	-	-	-	57	439	-	-	439	-	-	-	-	-	-	5,795	-
3b.1.1.12	Recombiner	-	180	-	-	-	-	-	27	207	-	-	207	-	-	-	-	-	-	2,490	-
3b.1.1.13	Security Barrier	-	258	-	-	-	-	-	39	297	-	-	297	-	-	-	-	-	-	4,083	-
3b.1.1.14	Tank Farm	-	7	-	-	-	-	-	1	8	-	-	8	-	-	-	-	-	-	121	-
3b.1.1.15	Turbine	-	1,755	-	-	-	-	-	263	2,019	-	-	2,019	-	-	-	-	-	-	30,441	-
3b.1.1.16	Turbine Building Addition	-	49	-	-	-	-	-	7	56	-	-	56	-	-	-	-	-	-	971	-
3b.1.1.17	Turbine Pedestal	-	288	-	-	-	-	-	43	332	-	-	332	-	-	-	-	-	-	3,762	-
3b.1.1	Totals	-	6,826	-	-	-	-	-	1,024	7,850	-	-	7,850	-	-	-	-	-	-	107,166	-
Site Closeout Activities																					
3b.1.2	Remove Rubble	-	1,134	-	-	-	-	-	170	1,304	-	-	1,304	-	-	-	-	-	-	1,996	-
3b.1.3	Grade & landscape site	-	566	-	-	-	-	-	85	651	-	-	651	-	-	-	-	-	-	1,841	-
3b.1.4	Final report to NRC	-	-	-	-	-	-	147	22	169	169	-	-	-	-	-	-	-	-	-	1,560
3b.1	Subtotal Period 3b Activity Costs	-	8,526	-	-	-	-	147	1,301	9,974	169	-	9,805	-	-	-	-	-	-	111,003	1,560
Period 3b Additional Costs																					
3b.2.1	Concrete Crushing	-	210	-	6	-	-	-	32	248	-	-	248	-	-	-	-	-	-	1,402	-
3b.2	Subtotal Period 3b Additional Costs	-	210	-	6	-	-	-	32	248	-	-	248	-	-	-	-	-	-	1,402	-
Period 3b Collateral Costs																					
3b.3.1	Small tool allowance	-	77	-	-	-	-	-	11	88	-	-	88	-	-	-	-	-	-	-	-
3b.3	Subtotal Period 3b Collateral Costs	-	77	-	-	-	-	-	11	88	-	-	88	-	-	-	-	-	-	-	-
Period 3b Period-Dependent Costs																					
3b.4.1	Insurance	-	-	-	-	-	-	880	88	968	-	968	-	-	-	-	-	-	-	-	-
3b.4.2	Property taxes	-	-	-	-	-	-	1,168	117	1,284	-	1,284	-	-	-	-	-	-	-	-	-
3b.4.3	Heavy equipment rental	-	3,233	-	-	-	-	-	485	3,718	-	-	3,718	-	-	-	-	-	-	-	-

Table C
Monticello Nuclear Generating Plant
DECON Decommissioning Cost Estimate
(Thousands of 2005 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Period 3b Period-Dependent Costs (continued)																					
3b.4.4	Plant energy budget	-	-	-	-	-	-	296	44	341	-	102	238	-	-	-	-	-	-	-	-
3b.4.5	NRC ISFSI Fees	-	-	-	-	-	-	406	41	446	-	446	-	-	-	-	-	-	-	-	-
3b.4.6	Emergency Planning Fees	-	-	-	-	-	-	347	35	381	-	381	-	-	-	-	-	-	-	-	-
3b.4.7	Railtrack Maintenance Fee	-	-	-	-	-	-	138	21	159	159	-	-	-	-	-	-	-	-	-	-
3b.4.8	ISFSI Operating Costs	-	-	-	-	-	-	131	20	150	-	150	-	-	-	-	-	-	-	-	-
3b.4.9	Security Staff Cost	-	-	-	-	-	-	2,286	343	2,629	-	1,788	841	-	-	-	-	-	-	-	56,066
3b.4.10	DOC Staff Cost	-	-	-	-	-	-	9,197	1,380	10,576	-	-	10,576	-	-	-	-	-	-	-	142,877
3b.4.11	Utility Staff Cost	-	-	-	-	-	-	4,914	737	5,651	-	4,803	848	-	-	-	-	-	-	-	66,917
3b.4	Subtotal Period 3b Period-Dependent Costs	-	3,233	-	-	-	-	19,762	3,309	26,305	159	9,924	16,222	-	-	-	-	-	-	-	265,860
3b.0	TOTAL PERIOD 3b COST	-	12,046	-	6	-	-	19,909	4,654	36,615	328	9,924	26,363	-	-	-	-	-	-	112,405	267,420
PERIOD 3c - Fuel Storage Operations/Shipping																					
Period 3c Direct Decommissioning Activities																					
Period 3c Collateral Costs																					
3c.3.1	Spent Fuel Capital and Transfer	-	-	-	-	-	-	4,000	600	4,600	-	4,600	-	-	-	-	-	-	-	-	-
3c.3	Subtotal Period 3c Collateral Costs	-	-	-	-	-	-	4,000	600	4,600	-	4,600	-	-	-	-	-	-	-	-	-
Period 3c Period-Dependent Costs																					
3c.4.1	Insurance	-	-	-	-	-	-	10,409	1,041	11,450	-	11,450	-	-	-	-	-	-	-	-	-
3c.4.2	Property taxes	-	-	-	-	-	-	13,806	1,381	15,187	-	15,187	-	-	-	-	-	-	-	-	-
3c.4.3	Plant energy budget	-	-	-	-	-	-	1,051	158	1,208	-	1,208	-	-	-	-	-	-	-	-	-
3c.4.4	NRC ISFSI Fees	-	-	-	-	-	-	4,799	480	5,279	-	5,279	-	-	-	-	-	-	-	-	-
3c.4.5	Emergency Planning Fees	-	-	-	-	-	-	4,099	410	4,508	-	4,508	-	-	-	-	-	-	-	-	-
3c.4.6	Railtrack Maintenance Fee	-	-	-	-	-	-	1,633	245	1,878	-	1,878	-	-	-	-	-	-	-	-	-
3c.4.7	ISFSI Operating Costs	-	-	-	-	-	-	1,544	232	1,776	-	1,776	-	-	-	-	-	-	-	-	-
3c.4.8	Security Staff Cost	-	-	-	-	-	-	18,313	2,747	21,060	-	21,060	-	-	-	-	-	-	-	-	449,100
3c.4.9	Utility Staff Cost	-	-	-	-	-	-	49,109	7,366	56,475	-	56,475	-	-	-	-	-	-	-	-	705,729
3c.4	Subtotal Period 3c Period-Dependent Costs	-	-	-	-	-	-	104,764	14,059	118,823	-	118,823	-	-	-	-	-	-	-	-	1,154,829
3c.0	TOTAL PERIOD 3c COST	-	-	-	-	-	-	108,764	14,659	123,423	-	123,423	-	-	-	-	-	-	-	-	1,154,829
PERIOD 3d - GTCC shipping																					
Period 3d Direct Decommissioning Activities																					
Nuclear Steam Supply System Removal																					
3d.1.1.1	Vessel & Internals GTCC Disposal	-	-	300	-	-	7,353	-	1,133	8,786	8,786	-	-	-	-	-	-	408	83,570	-	-
3d.1.1	Totals	-	-	300	-	-	7,353	-	1,133	8,786	8,786	-	-	-	-	-	-	408	83,570	-	-
3d.1	Subtotal Period 3d Activity Costs	-	-	300	-	-	7,353	-	1,133	8,786	8,786	-	-	-	-	-	-	408	83,570	-	-
Period 3d Period-Dependent Costs																					
3d.4.1	Insurance	-	-	-	-	-	-	42	4	46	-	46	-	-	-	-	-	-	-	-	-
3d.4.2	Property taxes	-	-	-	-	-	-	55	6	61	-	61	-	-	-	-	-	-	-	-	-
3d.4.3	Plant energy budget	-	-	-	-	-	-	4	1	5	-	5	-	-	-	-	-	-	-	-	-
3d.4.4	NRC ISFSI Fees	-	-	-	-	-	-	19	2	21	-	21	-	-	-	-	-	-	-	-	-
3d.4.5	Emergency Planning Fees	-	-	-	-	-	-	16	2	18	-	18	-	-	-	-	-	-	-	-	-
3d.4.6	Railtrack Maintenance Fee	-	-	-	-	-	-	7	1	8	-	8	-	-	-	-	-	-	-	-	-
3d.4.7	ISFSI Operating Costs	-	-	-	-	-	-	6	1	7	-	7	-	-	-	-	-	-	-	-	-
3d.4.8	Security Staff Cost	-	-	-	-	-	-	73	11	84	-	84	-	-	-	-	-	-	-	-	1,800
3d.4.9	Utility Staff Cost	-	-	-	-	-	-	197	30	226	-	226	-	-	-	-	-	-	-	-	2,829
3d.4	Subtotal Period 3d Period-Dependent Costs	-	-	-	-	-	-	420	56	476	-	476	-	-	-	-	-	-	-	-	4,629
3d.0	TOTAL PERIOD 3d COST	-	-	300	-	-	7,353	420	1,189	9,263	8,786	476	-	-	-	-	-	408	83,570	-	4,629

Table C
Monticello Nuclear Generating Plant
DECON Decommissioning Cost Estimate
(Thousands of 2005 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
PERIOD 3e - ISFSI Decontamination																					
Period 3e Direct Decommissioning Activities																					
Period 3e Additional Costs																					
3e.2.1	ISFSI License Termination	-	461	8	48	-	298	1,393	407	2,614	-	2,614	-	-	3,266	-	-	-	330,923	7,438	2,560
3e.2	Subtotal Period 3e Additional Costs	-	461	8	48	-	298	1,393	407	2,614	-	2,614	-	-	3,266	-	-	-	330,923	7,438	2,560
Period 3e Collateral Costs																					
3e.3.1	Small tool allowance	-	4	-	-	-	-	-	1	4	-	4	-	-	-	-	-	-	-	-	-
3e.3	Subtotal Period 3e Collateral Costs	-	4	-	-	-	-	-	1	4	-	4	-	-	-	-	-	-	-	-	-
Period 3e Period-Dependent Costs																					
3e.4.1	Insurance	-	-	-	-	-	-	168	17	185	-	185	-	-	-	-	-	-	-	-	-
3e.4.2	Property taxes	-	-	-	-	-	-	223	22	246	-	246	-	-	-	-	-	-	-	-	-
3e.4.3	Heavy equipment rental	-	181	-	-	-	-	-	27	208	-	208	-	-	-	-	-	-	-	-	-
3e.4.4	Plant energy budget	-	-	-	-	-	-	57	8	65	-	65	-	-	-	-	-	-	-	-	-
3e.4.5	NRC ISFSI Fees	-	-	-	-	-	-	78	8	85	-	85	-	-	-	-	-	-	-	-	-
3e.4.6	Emergency Planning Fees	-	-	-	-	-	-	66	7	73	-	73	-	-	-	-	-	-	-	-	-
3e.4.7	Security Staff Cost	-	-	-	-	-	-	148	22	170	-	170	-	-	-	-	-	-	-	-	3,630
3e.4.8	Utility Staff Cost	-	-	-	-	-	-	290	43	333	-	333	-	-	-	-	-	-	-	-	2,420
3e.4	Subtotal Period 3e Period-Dependent Costs	-	181	-	-	-	-	1,030	155	1,365	-	1,365	-	-	-	-	-	-	-	-	6,050
3e.0	TOTAL PERIOD 3e COST	-	645	8	48	-	298	2,422	562	3,983	-	3,983	-	-	3,266	-	-	-	330,923	7,438	8,610
PERIOD 3f - ISFSI Site Restoration																					
Period 3f Direct Decommissioning Activities																					
Period 3f Additional Costs																					
3f.2.1	ISFSI Demolition & Site Restoration	-	558	-	-	-	-	41	90	689	-	689	-	-	-	-	-	-	-	1,934	160
3f.2	Subtotal Period 3f Additional Costs	-	558	-	-	-	-	41	90	689	-	689	-	-	-	-	-	-	-	1,934	160
Period 3f Collateral Costs																					
3f.3.1	Small tool allowance	-	1	-	-	-	-	-	0	1	-	1	-	-	-	-	-	-	-	-	-
3f.3	Subtotal Period 3f Collateral Costs	-	1	-	-	-	-	-	0	1	-	1	-	-	-	-	-	-	-	-	-
Period 3f Period-Dependent Costs																					
3f.4.1	Insurance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3f.4.2	Property taxes	-	-	-	-	-	-	113	11	124	-	124	-	-	-	-	-	-	-	-	-
3f.4.3	Heavy equipment rental	-	62	-	-	-	-	-	9	71	-	71	-	-	-	-	-	-	-	-	-
3f.4.4	Plant energy budget	-	-	-	-	-	-	29	4	33	-	33	-	-	-	-	-	-	-	-	-
3f.4.5	Security Staff Cost	-	-	-	-	-	-	75	11	86	-	86	-	-	-	-	-	-	-	-	1,830
3f.4.6	Utility Staff Cost	-	-	-	-	-	-	146	22	168	-	168	-	-	-	-	-	-	-	-	1,220
3f.4	Subtotal Period 3f Period-Dependent Costs	-	62	-	-	-	-	362	58	482	-	482	-	-	-	-	-	-	-	-	3,050
3f.0	TOTAL PERIOD 3f COST	-	622	-	-	-	-	402	148	1,172	-	1,172	-	-	-	-	-	-	-	1,934	3,210
PERIOD 3 TOTALS		-	13,313	308	54	-	7,651	131,917	21,212	174,455	9,114	138,978	26,363	-	3,266	-	-	408	414,493	121,777	1,438,697
TOTAL COST TO DECOMMISSION		11,002	52,862	8,293	5,664	36,289	37,191	411,820	100,000	663,122	446,819	188,890	27,414	290,509	90,489	7,970	804	408	20,621,360	779,328	4,594,298

Table C
Monticello Nuclear Generating Plant
DECON Decommissioning Cost Estimate
(Thousands of 2005 Dollars)

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

TOTAL COST TO DECOMMISSION WITH 17.76% CONTINGENCY:	$663,122	thousands of 2005 dollars
TOTAL NRC LICENSE TERMINATION COST IS 67.38% OR:	$446,819	thousands of 2005 dollars
SPENT FUEL MANAGEMENT COST IS 28.48% OR:	$188,889	thousands of 2005 dollars
NON-NUCLEAR DEMOLITION COST IS 4.13% OR:	$27,414	thousands of 2005 dollars
TOTAL RADWASTE VOLUME BURIED (without GTCC):	99,263	Cubic Feet
TOTAL GREATER THAN CLASS C RADWASTE VOLUME GENERATED:	408	Cubic Feet
TOTAL SCRAP METAL REMOVED:	14,961	Tons
TOTAL CRAFT LABOR REQUIREMENTS:	779,328	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