PSEG Nuclear LLC
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PSEG
Nuclear L.L.C.

10 CFR 50.75

LR-N09-00145
June 23, 2009

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Hope Creek Generating Station
Facility Operating License No. NPF-57
NRC Docket No. 50-354

Subject: Hope Creek Decommissioning Funding Report: Submittal of Hope Creek Site Specific SAFSTOR Estimate

References:
1) Letter from Jeffrie J. Keenan (PSEG Nuclear LLC) to USNRC, March 31, 2009, LR-N09-0074.
2) Letter from Jeffrie J. Keenan (PSEG Nuclear LLC) to USNRC, June 18, 2009, LR-N09-0139.

In Reference 1, PSEG Nuclear LLC (PSEG) submitted our biennial decommissioning funding status report. PSEG elected to employ the SAFSTOR method and reported our change in accordance with 10 CFR 50.75(f)(1). In Reference 2, PSEG indicated that the SAFSTOR site specific estimate for Hope Creek was targeted for docketed submittal on June 23, 2009. Consistent with that targeted date, attached to this letter is the "Forty Year SAFSTOR Decommissioning Cost Analysis for Hope Creek". This cost analysis which employs the SAFSTOR option demonstrates an appropriate level of funding for Hope Creek. Associated operational and maintenance costs during the SAFSTOR period are considered within the estimate.

There are no additional commitments made in this letter. Should you have any questions regarding this letter, please contact me at 856-339-5429.

Sincerely,

Jeffrie J. Keenan
Manager - Licensing

A001
NRR

cc: R. Ennis, Project Manager – USNRC
Robert E. Carlson, Chief, Financial Policy and Rulemaking Branch – USNRC
Michael A. Dusaniwskyj, Financial Policy and Rulemaking Branch - USNRC
NRC Senior Resident Inspector - Hope Creek

PSEG NUCLEAR LLC

FORTY-YEAR SAFSTOR DECOMMISSIONING COST ANALYSIS

FOR THE

HOPE CREEK GENERATING STATION

JUNE 23, 2009

Table of Contents

I. Summary

This report presents estimates of the cost to decommission the Hope Creek Nuclear Generating Station following the end of its current licensed operating period on April 11, 2026.[1]

This report relies in part on a December 2002 report by TLG Services entitled *Decommissioning Cost Analysis for the Hope Creek Nuclear Generating Station* ("TLG Report"), with updates to account for the time value of money and a change in decommissioning method from DECON to a forty-year SAFSTOR. The TLG Report is included in its entirety in Appendix B to this report.

This report is based on two fundamental assumptions: (1) spent nuclear fuel ("SNF") management costs will be borne by the United States Government; and (2) the Unit will be placed in a forty-year period of safe storage following end of license in 2026.

While spent fuels management costs are discussed in this report and its appendices, those costs are contractually the responsibility of the Government of the United States,[2] and are therefore not considered a liability that must be funded by the Hope Creek Decommissioning Trust Fund. Hope Creek has an on-site Independent Spent Fuel Storage Installation ("ISFSI"), that is appropriately sized to receive all SNF generated from Hope Creek through its licensed life.

PSEG Nuclear considered the following three decommissioning options for Hope Creek:

- DECON: The equipment, structures, and portions of the facility and site that contain radioactive contaminants are removed or decontaminated to a level that

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1 In the third quarter of 2009, PSEG Nuclear will be submitting an application for License Renewal that, if approved, would extend the operating period of Hope Creek for an additional 20 years. As that application has not yet been submitted or approved by the NRC, this report does not address license renewal.

2 *See* US Department of Energy Contract No. DE-CR01-83NE44411, Hope Creek Generating Station No. 1 Unit Contract for Disposal of Spent Fuel and/or High-Level Radioactive Waste (Jun. 1983), as amended.

permits termination of the license after cessation of operations. Until 2008, this was the strategy that was to be used to decommission Hope Creek.

- SAFSTOR: The facility is placed in a safe stable condition and maintained in that state until it is subsequently decontaminated and dismantled to levels that permit license termination. During SAFSTOR, a facility is left intact, but the fuel has been removed from the reactor vessel and radioactive liquids have been drained from systems and components and then processed. Radioactive decay occurs during the SAFSTOR period, thus reducing the levels of radioactivity in and on the material and potentially the quantity of material that must be disposed of during decontamination and dismantlement. This is the method PSEG will use to decommission Hope Creek.

- ENTOMB: involves encasing radioactive structures, systems, and components in a structurally long-lived substance, such as concrete. The entombed structure is appropriately maintained, and continued surveillance is carried out until the radioactivity decays to a level that permits termination of the license. Because most power reactors will have radionuclides in concentrations exceeding the limits for unrestricted use even after 100 years, this option will generally not be feasible and was not deemed to be viable for Hope Creek.

This report assumes a forty-year period of safe storage ("SAFSTOR") after end of its current licensed operating period. PSEG Nuclear LLC, the Operator of Hope Creek, has chosen a forty year SAFSTOR period (approximately 7.6 half-lives of the radioactive isotope Cobalt 60) as a prudent measure to reduce overall radiation exposure to workers during the decommissioning period. An added benefit of the SAFSTOR method is that worker efficiency will be greater due to fewer radiological restrictions during performance of the work. However, economic benefits from gains in efficiency will be partially off-set by maintenance and security costs during the SAFSTOR period, and these costs have been explicitly addressed in this report.

II. Methodology

The TLG Report provided in Appendix B to this report provided the primary source of information related to costs associated with decommissioning Hope Creek. PSEG personnel used the information in that report to develop the estimate applicable to SAFSTOR described in this report.

Because costs were reported in the TLG Report in 2002 dollars, the first step in the process was to escalate the 2002 costs to 2008 dollars. This re-evaluation produced an increase adjustment of 16% for 2008 Labor & Equipment Costs over the 2002 TLG Report. The New Jersey labor rates from 2003 through 2008 as well as Construction Equipment Costs over the same time frame were used to develop the overall adjustment. The SAFSTOR Decommissioning value was arrived at by taking the 2008 immediate decommissioning cost and adjusting it to reflect significant reduction in residual radioactivity thereby reducing/eliminating the radiation hazards during the dismantling and demolition. This expected improvement will lead to a reduction in overall decommissioning cost, and that improvement is reflected in this study. Details of the adjustment factors used are provided in Table 2.

Aside from the conversion from 2002 to 2008 dollars, two other significant changes were made to update the 2002 TLG Report to address the current forty-year SAFSTOR strategy for Hope Creek. The first change involved shifting the initial costs for preparing the plant for decommissioning from the start of the seven-year decommissioning and dismantlement period to prior to the start of the SAFSTOR period. These up-front costs are incurred in three years immediately following termination of operations. The second major change was adding a forty-year period of safe storage prior to final decommissioning. A timeline of these activities is shown in Appendix A to this report. Detailed information showing cash flows, major events, and assumptions is contained in a one-page summary in Table 5 of this report.

III. Tables

Table 1: Summary of Decommissioning Cost Elements

Work Category [3]	Cost 2002$ (thousands)	Cost 2008$ (thousands)	Percent of Total Costs
Decontamination	30,745	35,664	3.9%
Removal	192,120	222,859	24.5%
Packaging	16,049	18,617	2.0%
Transportation	6,008	6,969	0.8%
Waste Disposal	132,615	153,833	16.9%
Off-Site Waste Processing	53,630	62,211	6.8%
Program Management (incl. Eng. and Security)	260,625	302,325	33.3%
Spent Fuel Pool Isolation	9,060	10,510	1.2%
ISFSI Related (including capital)	40,239	46,677	5.1%
Insurance and Regulatory Fees	7,148	8,292	0.9%
Energy	11,769	13,652	1.5%
Characterization and Licensing Surveys	13,937	16,167	1.8%
Misc. Equipment and Site Services	9,157	10,622	1.2%
Total	783,102	908,398	100.0%
License termination (10 CFR § 50.75 decommissioning activities) [4]		790,991	
Site Restoration (non- 50.75 activities)		117,407	

3 Includes contingencies.
4 This total includes spent fuel management.

Table 2: Summary of Cost Efficiency Adjustments

	Factors	TLG 2002$ (thousands)	TLG 2008 $ (thousands)	SAFSTOR Adjustment Factors: Cost Efficiency Factor	SAFSTOR Adjustment Factors: Cost Reduction Adjustment Contam. To Decontam.	SAFSTOR 2008$ (thousands)
Decommissioning						
Non Contaminated	71%	$ 399,653	$ 463,597	90%	0%	$ 417,237
Contaminated	29%	$ 163,239	$ 189,357	0%	25%	$ 142,018
Spent Fuel Mgmt	100%	$ 50,144	$ 58,167	100%	0%	$ 58,167
Other Fixed	100%	$ 40,823	$ 47,355	100%	0%	$ 47,355
Sub-Total		$ 653,859	$ 758,476			$ 664,777
Contingency		$ 129,241	$ 149,920			$ 130,961
Total Hope Creek[5]		**$ 783,100**	**$ 908,396**			**$ 795,738**

5 Individual line items are rounded so totals may vary slightly due to round-off error.

Location: Hope Creek Generating Station
Project: Decommissioning of Nuclear Plants After Safe Storage

Decommissioning Cost For Hope Creek Nuclear Power Plant After Forty Years of Safe Storage

Analysis:

Bases of Cost - TLG Cost 2002

Plant Prep & Temp Service
Rigging Construction Control & Tooling
Security Staff (except Spent Fuel Mgt.)
Utility Staff (except Spent Fuel Mgt.)
Final Site Survey

Based on the cost of items to be decontaminated (from TLG estimate), determined that Contaminated Factors represent approx. 29% of the total cost to decommission a Nuclear Plant. Therefore, Non - contaminated factors represent approx. 71% of the total cost.

Cost Efficiency Factors:

The 2002 TLG Estimate was based on single unit demolition basis for Hope Creek, and in our review we acknowledge an economy scale should be applied since Salem and Hope Creek will be done in tandem.

We will reference EPRI study ESC-4685 SIA 83-420 a Nuclear Power Construction study prepared by United & Construction Inc. that supports multi unit construction has efficiency reduction (summarized below).

Station	Reactor Type	Multi Unit Efficiency Direct Craft Labor 1-2	1-3		
Hope Creek	BWR	11%-22%	28%-36%	Data Source EPRI p. 3-79 & 3-80	

Cost Assumptions:

Hope Creek -
In consideration of the EPRI study, efficiency reduced the variable costs. Fixed cost elements (see base cost allocation above) remain constant on a per unit basis. The TLG cost was reduced by 10% since this will be a mass demolition (non contaminated) vs. controlled demolition (contaminated)

The Spent Fuel will follow the same fact pattern and cash flow pattern as in the 2002 TLG Study for Hope Creek.

Since decommissioning after 40 yrs would be equivalent to normal demolition work in a Fossil Plant an additional allowance of 15% savings has been made to contaminated portion of the work only. (Working in a contaminated area can account for a loss of productivity of an additional 25% or 2 Man Hrs/Day). The breakdown of unproductive time is listed below: is based on field observations made at the nuclear sites.

Security:	0.5 MH	6.25%
Suit Up requirements (two times/day)	1 MH	12.5%
Clean up at the end of day	0.5 MH	6.3%
Total	2 MH	25.0%

The other factors affecting productivity in a contaminated area physical restrictions congestion, height adjustment in work space (crawl space or 40ft. In the air), outage schedule (comprised time line) and ALARA (level of allowance radiation) & proximity of other on going projects.
The cost assumptions correspond to present circumstances and to the present status & availability of technology.

Table 3: SAFSTOR vs. Non-SAFSTOR Summary of Costs

2008$
(millions)

Description	Non SAFSTOR TLG 2002	Non SAFSTOR TLG (esc.) 2008	SAFSTOR PSEG 2008
Site Specific Cost			
Lic. Termination	625.2	725.3	608.5
Spent Fuel Mgmt.	56.7	65.7	69.8
Site Restoration	101.2	117.4	117.4
Total (100% Share)	**783.1**	**908.4**	**795.7**
PSEG Share (w/Spent Fuel)[6]	**783.1**	**908.4**	**795.7**
Spent Fuel Costs	(56.7)	(65.7)	(69.8)
PS share (w/o Spent Fuel)	**726.4**	**842.7**	**725.9**
Site Restoration (PSEG Share)	(101.2)	(117.4)	(117.4)
PS share (w/o Site Restoration & Spent Fuel)	**625.2**	**725.3**	**608.5**

6 The spent fuel management cost include an allocation from the contingency shown on table 2.

Table 4: Schedule of Annual Expenditures

2008$
(thousands)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total[7]	O&M Security During SAFSTOR
2026	6,587	150	225	37	487	7,485	
2027	33,842	3,905	1,085	868	3,688	43,387	
2028	9,863	1,751	922	1,014	4,886	18,436	
2029							4,500
2030							4,500
2031							4,500
2032							4,500
2033							4,500
2034							4,500
2035							4,500
2036							4,500
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2059							4,500
2060							4,500
2061							4,500
2062							4,500
2063							4,500
2064							4,500
2065							4,500
2066							4,500

7 Includes total expenses including security and O&M for years 2026-2028 and 2069-2075. Values are rounded.

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total[7]	O&M Security During SAFSTOR
2067							4,500
2068							4,500
2069	29,150	1,580	779	25	1,297	32,832	
2070	29,045	9,580	731	18,494	7,813	65,663	
2071	43,304	13,013	1,088	29,620	11,470	98,495	
2072	106,793	14,165	2,438	30,556	10,202	164,158	
2073	84,654	10,588	2,680	22,243	11,154	131,326	
2074	82,342	11,618	757	79	3,699	98,495	
2075	43,978	18,619	411	-	2,651	65,663	
Total	**469,558**	**84,971**	**11,113**	**102,937**	**57,347**	**725,938**	**180,000**

Table 5: Projected Annual Cash Flows and Fund Balances

Year	Annual Expenditures 2008$ (thousands)	DTF Fund Balance 2% Real Rate of Return less expenditures	SAFSTOR Year	Notes
		320,400		Balance as of May 31, 2009
2009		324,138		2009 from May 31, 2009 to December 2009.
2010		330,621		
2011		337,233		
2012		343,978		
2013		350,857		
2014		357,875		
2015		365,032		
2016		372,333		
2017		379,779		Fund balances escalates at 2% per
2018		387,375		annum during remaiming period of
2019		395,122		operation
2020		403,025		
2021		411,085		
2022		419,307		
2023		427,693		
2024		436,247		
2025		444,972		
2026	7,485	446,386		Expenses to put plant in SAFSTOR
2027	43,387	411,927		Condition, includes security and
2028	18,436	401,730		O&M.
2029	4,500	405,264	1	
2030	4,500	408,870	2	
2031	4,500	412,547	3	
2032	4,500	416,298	4	
2033	4,500	420,124	5	
2034	4,500	424,026	6	
2035	4,500	428,007	7	
2036	4,500	432,067	8	
2037	4,500	436,208	9	
2038	4,500	440,433	10	
2039	4,500	444,741	11	
2040	4,500	449,136	12	
2041	4,500	453,619	13	
2042	4,500	458,191	14	
2043	4,500	462,855	15	
2044	4,500	467,612	16	
2045	4,500	472,464	17	
2046	4,500	477,414	18	
2047	4,500	482,462	19	
2048	4,500	487,611	20	
2049	4,500	492,863	21	Annual Security and O&M cost
2050	4,500	498,221	22	during SAFSTOR is $4.5MM.
2051	4,500	503,685	23	
2052	4,500	509,259	24	
2053	4,500	514,944	25	
2054	4,500	520,743	26	
2055	4,500	526,658	27	
2056	4,500	532,691	28	
2057	4,500	538,845	29	
2058	4,500	545,121	30	
2059	4,500	551,524	31	
2060	4,500	558,054	32	
2061	4,500	564,715	33	
2062	4,500	571,510	34	
2063	4,500	578,440	35	
2064	4,500	585,509	36	
2065	4,500	592,719	37	
2066	4,500	600,073	38	
2067	4,500	607,575	39	
2068	4,500	615,226	40	
2069	32,832	594,699		
2070	65,663	540,930		
2071	98,495	453,254		Costs during 7-year
2072	164,158	298,162		decommissioning period include
2073	131,326	172,799		security and O&M.
2074	98,495	77,761		
2075	65,663	13,653		

Table 6: Decommissioning Waste Summary

Please see Table 5.1, Decommissioning Waste Summary, in the TLG Report, attached as Appendix B to this report.

Table 7: Detailed Cost Analysis

Please see Appendix C in the TLG Report, attached as Appendix B to this report.

IV. Appendices

A. Time Line

B. December 2002 TLG Decommissioning Cost Analysis

Appendix A: Time Line

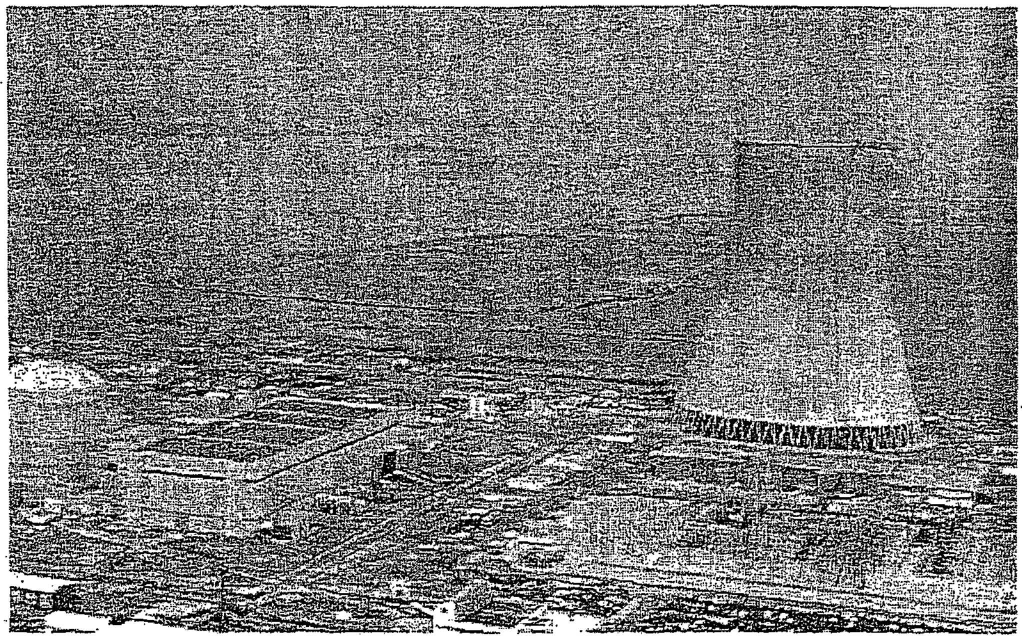
Activity	2026	2027	2028	2029 - 2068	2069	2070	2071	2072	2073	2074	2075
Shutdown through Transition	x	x	x								
Safe storage period				x							
Decommissioning and Site Restoration					x	x	x	x	x	x	x

Appendix B: December 2002 TLG Cost Analysis

DECOMMISSIONING COST ANALYSIS

for the

HOPE CREEK NUCLEAR GENERATING STATION



prepared for

PSEG NUCLEAR, LLC

prepared by

TLG Services, Inc.
Bridgewater, Connecticut

December 2002

APPROVALS

Project Manager	William A. Cloutier, Jr.	12/4/02 Date
Project Engineer	Albert A. Koehl	12/4/02 Date
Technical Manager	~~Geoffrey~~ M. Griffiths	12/5/02 Date
Quality Assurance Manager	Carolyn A. Palmer	12/05/02 Date

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REVISION LOG

No.	CRA No.	Date	Item Revised	Reason for Revision
0		12-05-02		Original Issue

EXECUTIVE SUMMARY

This report presents the costs to promptly decommission (decontaminate and dismantle) the Hope Creek Nuclear Generating Station (Hope Creek) following a scheduled cessation of plant operation. The analysis relies upon the site-specific, technical information developed for a previous evaluation prepared in 1995-96, updated to reflect current plant conditions and operating assumptions. The estimate is designed to provide PSEG Power, LLC with sufficient information to assess its financial obligations as they pertain to the eventual decommissioning of the nuclear station.

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 cooling period of approximately five years for the spent fuel that resides in the plant's storage pool when operations cease. Any residual fuel remaining in the pool after the five-year period will be relocated to an on-site, interim storage facility to await the transfer to a DOE facility. The estimate also includes the dismantling of non-essential structures and limited restoration of the site.

Alternatives and Regulations

The Nuclear Regulatory Commission (NRC) provided general decommissioning guidance in the rule adopted on June 27, 1988.[1] In this rule the NRC set forth technical and financial criteria for decommissioning licensed nuclear 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."[2]

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

2 Ibid. Page FR24022, Column 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."[3] 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."[4] As with the SAFSTOR alternative, decommissioning is currently required to be completed within 60 years.

The 60-year restriction has limited the practicality of the ENTOMB alternative at commercial reactors that generate significant amounts of long-lived radioactive material. As such, the NRC is currently re-evaluating this option and the technical requirements and regulatory actions that would be necessary for entombment to become a viable option.

In 1996, the NRC published revisions to the general requirements for decommissioning nuclear power plants to clarify ambiguities and codify procedures and terminology as a means of enhancing efficiency and uniformity in the decommissioning process. 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 describes the methods and procedures that are acceptable to the NRC staff for implementing the requirements of the 1996 revised rule that relate to the initial activities and the major phases of the decommissioning process. The costs and schedules presented in this analysis follow the general guidance and process 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[5] developed by the Atomic Industrial Forum (now Nuclear Energy Institute). This reference

3 Ibid.
4 Ibid. Page FR24023, Column 2.
5 T.S. LaGuardia et al., "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates," AIF/NESP-036, May 1986.

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.

The estimate also 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 technical challenges of decommissioning commercial nuclear units.

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

Contingency

Consistent with industry practice, contingencies are applied to the decontamination and dismantling costs developed as "specific provision for unforeseeable elements of cost within the defined project scope, particularly important where previous experience relating estimates and actual costs has shown that unforeseeable events which will increase costs are likely to occur."[6] 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 estimate, 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.

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

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 Disposal Act" in 1980, and its Amendments of 1985,[7] the states became ultimately responsible for the disposition of radioactive waste generated within their own borders.

New Jersey is a member of the three-state Atlantic Interstate Low-Level Radioactive Waste Management Compact, formed after South Carolina formally joined the Northeast Regional Compact. The Barnwell Low-Level Radioactive Waste Management Facility, located in South Carolina, is expected to be available to PSEG Nuclear to support the decommissioning of Hope Creek. It is also assumed that PSEG Nuclear could access other disposal sites should it prove cost effective. As such, rate schedules for both the Barnwell and the Envirocare facility in Utah were used to generate disposal costs.

High-Level Radioactive Waste Management

Congress passed the "Nuclear Waste Policy Act"[8] in 1982, assigning the responsibility for disposal of spent nuclear fuel created by the commercial nuclear generating plants to the DOE. This legislation also created a Nuclear Waste Fund to cover the cost of the program, which is funded by the sale of electricity from nuclear reactors since 1993, and an estimated equivalent value for assemblies irradiated prior to 1983. The Nuclear Waste Policy Act, along with the individual disposal contracts with 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. Operation of DOE's yet-to-be constructed geologic repository is currently scheduled for the year 2010, assuming that the licensing could be completed expeditiously and a national transportation system established. The agency 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.

The NRC requires licensees to 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. For estimating purposes, PSEG Nuclear has assumed that the high-level waste repository, or some interim storage facility, will be fully

7 "Low-Level Radioactive Waste Policy Amendments Act of 1985," Public Law 99-240, 1/15/86.

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

operational by 2015. Interim storage of the fuel, until the DOE has completed the transfer, will be in an independent facility located on the Artificial Island site. This will allow PSEG Nuclear to proceed with decommissioning and terminate its operating licenses in the shortest time possible.

The spent fuel storage facility, which is independently licensed and operated, will be sized to accommodate the inventory of spent fuel residing in the plant's storage pools at the cessation of operations, in addition to any operational inventory already in residence. When emptied, the station could be dismantled without maintaining the wet storage pools. Based upon this scenario, and an anticipated rate of transfer, spent fuel is projected to remain on site for approximately 20 years following the cessation of plant operations.

Site Restoration

The efficient removal of the contaminated materials at the site may result in damage to many of the site structures. Blasting, coring, drilling, and the other decontamination activities will substantially damage power block structures, potentially weakening the footings and structural supports. Prompt demolition once the license is terminated is clearly the most appropriate and cost-effective option. It is unreasonable to anticipate that these structures would be repaired and preserved after the radiological contamination is removed. The cost to dismantle site structures with a work force already mobilized is more efficient and less costly than if the process were deferred. Experience at shutdown generating stations has shown that plant facilities quickly degrade without maintenance, adding additional expense and creating potential hazards to the public and to the demolition work force. Consequently, this study assumes that site structures will be removed to a nominal depth of three feet below the local grade level wherever possible. The site will then be graded and stabilized.

Summary

The DECON decommissioning alternative involves the prompt removal of the contaminated and activated plant components, including structural materials, from the site following permanent shutdown. The facility operator may then have unrestricted use of the site with no further requirement for a license. This study assumes that the remainder of the non-essential plant systems and structures, not previously removed in support of license termination, are dismantled and the site restored.

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 is provided at the end of this section for the major cost components.

COST SUMMARY
(Thousands of 2002 Dollars)

Activity	Cost
Decontamination	30,745
Removal	192,120
Packaging	16,049
Transportation	6,008
Waste Disposal	132,615
Off-site Waste Processing	53,630
Program Management (including Engineering and Security)	260,625
Spent Fuel Pool Isolation	9,060
ISFSI Related (including capital)	40,239
Insurance and Regulatory Fees	7,148
Energy	11,769
Characterization and Licensing Surveys	13,937
Misc. Equipment and Site Services	9,157
Total [1]	783,102
License Termination [2]	681,889
Site Restoration	101,213

[1] Columns may not add due to rounding.
[2] Includes spent fuel management expenditures.

1. INTRODUCTION

This decommissioning analysis is designed to provide PSEG Power with sufficient information to prepare the financial planning documents for decommissioning, as required by the Nuclear Regulatory Commission (NRC or Commission). It is not a detailed assessment, but a financial analysis prepared in advance of the engineering and planning that will be required to carry out the decommissioning of the Hope Creek Nuclear Generating Station (Hope Creek).

1.1 OBJECTIVES OF STUDY

The objectives of this study are to prepare comprehensive estimates of the costs to decommission Hope Creek for the scenario outlined in Section 2; to define a sequence of events, and project the volume of waste produced from the decontamination and dismantling activities.

For the purposes of this study, the shutdown date was taken as April 11, 2026. This time frame, which reflects 40 years of operating life, was used as an input for scheduling the decommissioning activities.

1.2 SITE DESCRIPTION

Hope Creek is located on the southern part of Artificial Island on the east bank of the Delaware River in Lower Alloways Creek Township, Salem County, New Jersey. The site is 15 miles south of the Delaware Memorial Bridge, 18 miles south of Wilmington, Delaware, 30 miles southwest of Philadelphia, Pennsylvania, and 7½ miles southwest of Salem, New Jersey.

The Nuclear Steam Supply System (NSSS) consists of a boiling water reactor and a two-loop recirculation system. The generating unit has a rated core thermal power of 3,293 MWt (thermal) with a corresponding gross electrical output of approximately 1,118 MWe and a net electrical output of 1,067 megawatts (electric).

The two-loop reactor recirculation system contains two, vertical centrifugal pumps and is located within the "primary containment structure." This structure consists of the drywell, the suppression system, and interconnecting vent system. The drywell is a steel pressure vessel in the shape of a light bulb. The pressure suppression chamber is a torus-shaped steel pressure vessel located below and encircling the drywell.

This chamber is connected to the drywell by eight equally spaced vent pipes. These vent pipes are connected to a common header within the suppression chamber. Eighty downcomers, connected to the header, terminate below the water level of the suppression pool. As a system, the drywell, suppression chamber, and interconnecting piping, acts to reduce the pressure increase in the event of a local process system piping failure.

Heat produced in the reactor is converted to electrical energy by the power conversion system. A turbine-generator system converts the thermal energy of steam produced in the reactor vessel into mechanical shaft power and then into electrical energy. The unit's turbine generator consists of a tandem compound, six-flow, non-reheat unit. It is comprised of one double-flow, high-pressure turbine and three double-flow, low-pressure turbines driving a direct-coupled generator at 1,800 rpm. The turbine is operated in a closed feedwater cycle, which condenses the steam; the condensate/feedwater is returned to the reactor recirculation system. Heat rejected in the main condenser is removed by the circulating water system.

The circulating water system is designed to circulate the flow of water required to removed the heat load from the main condenser and other auxiliary equipment and to discharge it to the atmosphere through a natural draft cooling tower. Some heat may be rejected to the Delaware estuary from the cold water side of the cooling tower in the form of blowdown.

1.3 REGULATORY GUIDANCE

The NRC provided initial decommissioning guidance in its rule "General Requirements for Decommissioning Nuclear Facilities," issued in June 1988.[1]* This rule set forth technical and financial criteria for decommissioning licensed nuclear 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 guidance to the licensees of nuclear facilities on the financial methods acceptable to the NRC staff for complying with the requirements of the rule. The regulatory guide addressed the funding requirements and provided guidance on the content and form of the financial assurance mechanisms indicated in the rule amendments.

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

The rule defined three decommissioning alternatives as being acceptable to the NRC: DECON, SAFSTOR, and ENTOMB. It 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 could 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 definition of unrestricted release and 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. 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 is considering rulemaking to alter the 60-year time for completing decommissioning and to clarify the use of engineered barriers for reactor entombments. Pending completion of such rulemaking, entombment requests will be handled on a case-by-case basis.

In 1996, the NRC published revisions to the general requirements for decommissioning nuclear power plants.[3] When the decommissioning regulations were adopted in 1988, it was assumed that the majority of licensees would decommission at the end of the operating license life. Since that time, several licensees permanently and prematurely ceased operations without having submitted a decommissioning plan. In addition, these licensees requested exemptions from certain operating requirements as being unnecessary once the reactor is defueled. 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 would submit written certification to the NRC within 30 days after the decision to cease operations. Certification would also be required once the fuel was permanently removed from the reactor vessel. Submittal of these notices would 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 would be 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 would be required to submit an application to the NRC to terminate the license, along with a license termination plan (LTP).

1.3.1 Nuclear Waste Policy Act

Congress passed the Nuclear Waste Policy Act[4] in 1982, assigning the responsibility for disposal of spent nuclear fuel from the commercial nuclear generating plants to the Department of Energy (DOE). Two permanent disposal facilities were envisioned, as well as an interim facility. To recover the cost of permanent spent fuel disposal, this legislation created a Nuclear Waste Fund through which money was to be collected from the consumers of the electricity generated by commercial nuclear power plants. The Nuclear Waste Policy Act, along with the individual disposal contracts with utilities, specified that the DOE was to begin accepting spent fuel by January 31, 1998.

After pursuing a national site selection process, the Act 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 in the opening date for the repository, from 1998 to 2003. Two years later, in 1989, an additional 7-year delay was announced, primarily due to problems in obtaining the required permits from the state of Nevada to perform the required characterization of the site.

Generators have responded to this impasse by initiating legal action and constructing supplemental storage as a means of maintaining necessary operating margins. In a recent decision, the U.S. Court of Appeals for the Federal Circuit reaffirmed the utility position that DOE had breached its contractual obligation. However, even with the August 2000 ruling,[5] DOE's position has remained unchanged. The agency 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, DOE has no plans to receive spent fuel from commercial U.S. reactors before the year 2010.

The NRC requires licensees to establish a program to manage and provide funding for the management of all irradiated fuel at the reactor until title of the fuel is transferred to the Secretary of Energy in 10 CFR 50.54 (bb).[6] This funding requirement is fulfilled through inclusion of certain high-level waste cost elements within the estimates, as described below.

For estimating purposes, PSEG Nuclear has assumed that the high-level waste repository, or some interim storage facility, will be fully operational by 2015. Interim storage of the fuel, until the DOE has completed the transfer, will be in an independent facility located on the Artificial Island site. This will allow PSEG Nuclear to proceed with decommissioning and terminate its operating license in the shortest time possible.

Based upon the projected capacity of the spent fuel storage pool, supplemental storage will be required before the current operating license expires so as to maintain full core off-load capability. Therefore, this analysis assumes that an on-site independent spent fuel storage installation (ISFSI) will be constructed to support plant operation and will be available to support decommissioning

The spent fuel storage facility, which is independently licensed and operated, will be sized to accommodate the inventory of spent fuel residing in the plant's storage pool at the cessation of operations, in addition to any operational inventory already in residence. When emptied, the station could be dismantled without maintaining the wet storage pool. Based upon this scenario, and an anticipated rate of transfer, spent fuel is projected to remain on site for approximately 20 years following the cessation of plant operations.

Expenditures are included in the analysis for the isolation and continued operation of the spent fuel pool throughout the first five years of decommissioning. Expenses are also included for loading the spent fuel assemblies remaining in the storage pool after the cessation of plant operation into multi-purpose canisters, for canister costs and overpacks, and for the operation of the ISFSI through the year 2046, when all the fuel is expected to be transferred to the DOE.

1.3.2 Low-Level Radioactive Waste Policy Amendments Act

Congress passed the "Low-Level Radioactive Waste Disposal Act" in 1980, 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. With little progress, the "Amendments Act" of 1985[7] extended the target, with specific milestones and stiff sanctions for non-compliance.

New Jersey is a member of the three-state Atlantic Interstate Low-Level Radioactive Waste Management Compact, formed after South Carolina formally joined the Northeast Regional Compact. The Barnwell Low-Level Radioactive Waste Management Facility, located in South Carolina, is expected to be available to PSEG Nuclear to support the decommissioning of Hope Creek. It is also assumed that PSEG Nuclear could access other disposal sites should it prove cost-effective. As such, rate schedules for both the Barnwell as well as the Envirocare facility in Utah were used to generate disposal costs.

1.3.3 Radiological Criteria for License Termination

In 1997, the NRC published Subpart E, "Radiological Criteria for License Termination,"[8] amending Part 20 of Title 10 of the Code of Federal Regulations (10 CFR §20). This subpart provided radiological criteria for releasing a facility for unrestricted use. The regulation provides that the site could 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 residual radioactivity has been reduced to levels that are As Low As Reasonably Achievable (ALARA). The decommissioning estimate for Hope Creek 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). An additional limit of 4 millirem per year, as defined in 40 CFR Part 141.16, is applied to drinking water.

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) 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 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 EPA. However, if there are other hazardous materials on the site, EPA may be involved in the cleanup. As such, the possibility of dual regulation remains for certain licensees.

2. DECOMMISSIONING ALTERNATIVE

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

The conceptual approach that the NRC has described in its regulations divides decommissioning into three phases. The initial phase commences with the effective date of permanent cessation of operations and involves the transition of both plant and licensee from reactor operations, i.e., power production, to facility de-activation and closure. During the first phase, notification is to be provided to the NRC certifying the permanent cessation of operations and the removal of fuel from the reactor vessel. The licensee 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 estimates developed for Hope Creek are also divided into phases or periods; however, demarcation of the phases is based upon major milestones within the project or significant changes in the projected expenditures.

2.1 PERIOD 1 – PREPARATIONS

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

2.1.1 Engineering and Planning

The PSDAR, required within two years of the notice to cease operations, provides a description of the licensee's planned decommissioning activities, a timetable, and the associated financial requirements of the intended decommissioning program. Upon receipt of the PSDAR, the NRC will make the document available to the public for comment in a local hearing to be held in the vicinity of the reactor site. Ninety days following submittal and NRC receipt of the PSDAR, the licensee may begin to perform major decommissioning activities under a modified 10 CFR §50.59 procedure, i.e., without specific NRC approval. Major activities are defined as any activity that results in permanent removal of major radioactive components, permanently modifies the structure of the containment, or results in dismantling components (for shipment) containing Greater-than-Class C waste (GTCC), as defined by 10 CFR §61. Major components are further defined as comprising the reactor vessel and internals, large bore reactor 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 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, in conjunction with the development of the PSDAR, activity specifications, cost-benefit and safety analyses, work packages and procedures must be assembled in support of the proposed decontamination and dismantling activities.

2.1.2 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), sampling of internal piping contamination levels, and primary shield cores.

- Isolation of the spent fuel storage pool and fuel handling systems, such that decommissioning operations could commence on the balance of the plant. Decommissioning operations are scheduled around the fuel handling area to the greatest extent possible such that the overall project schedule is optimized. The fuel will be transferred to the DOE as it decays to the point that it meets the heat load criteria of the containers and, as such, it is assumed that the fuel pool will remain operational for a minimum of five 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

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. Building modifications may be required to the Reactor Building to facilitate access of large/heavy equipment. Modifications may also be required to the refueling area of the Reactor Building to support the segmentation of the reactor vessel internals and component extraction.

- Design and fabrication of temporary and permanent shielding to support removal and transportation activities, construction of contamination control envelopes, and the procurement of specialty tooling.

- Procurement (lease or purchase) of shipping canisters, cask liners, and industrial packages.

- 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.

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

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

- Disassembly, 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 will be packaged in a modified fuel canister for geologic disposal. Interim storage can be in the pool, as space permits, or in the ISFSI.

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

- Draining and decontamination of the reactor well and permanently sealing of the spent fuel transfer gate. Install shielded platform for segmentation of reactor vessel. Cutting operations are performed in-air using remotely operated equipment within a contamination control envelope, with the water level 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 will then be 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.

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

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

- Removal of remaining plant systems and associated components as they become nonessential to the decommissioning program or worker health and safety (e.g., waste collection and treatment systems, electrical power and ventilation systems).

- Removal of the steel liners from 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 structure.

- 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 could 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 would be 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 NUREG/CR-1575, "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM).[9] 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 may begin. Efficient removal of the contaminated materials and verification that residual radionuclide concentrations are below the NRC limits may result in substantial damage to many of the structures. Although performed in a controlled and safe manner, blasting, coring, drilling, scarification (surface removal), and the other decontamination activities will substantially degrade power block structures, including the Reactor, Auxiliary, and Fuel Handling Buildings. Verifying that subsurface radionuclide concentrations meet NRC site release requirements may 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 is deferred. Site facilities quickly degrade without maintenance, adding additional expense and creating potential hazards to the public and future workers. Abandonment creates a breeding ground for vermin infestation and other biological hazards.

This cost study presumes that non-essential structures and site facilities will be 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, and 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 off-site for disposal as construction debris.

2.4 POST PERIOD 3 – ISFSI OPERATIONS

The ISFSI will continue to operate under a separate and independent license (10 CFR §72) following the relocation of the spent fuel from the plant's storage pools. Transfer of spent fuel to a DOE or interim facility will be exclusively from the ISFSI once the fuel pools have been emptied and the structures released for decommissioning. Assuming initiation of the federal Waste Management System in 2015, transfer of spent fuel from Hope Creek is anticipated to continue through the year 2046. Any delay in the transfer process, for example, due to a delay in the scheduled opening of the geologic repository, a slower acceptance rate, or a combination of a delayed start date and lower transfer rate, will result in a longer on-site residence time for the fuel discharge from the reactor, and therefore additional caretaking expenses.

At the conclusion of the spent fuel transfer process, the 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 currently proposed design for the ISFSI is based upon the use of concrete overpacks 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 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 is then removed, and the area graded and landscaped to conform to the surrounding environment.

3. COST ESTIMATE

The cost estimate prepared for decommissioning Hope Creek consider the unique features of the site, including the nuclear steam supply system, power generation systems, support services, site buildings, and ancillary facilities. The bases of the estimate, including the sources of information relied upon, the estimating methodology employed, site-specific considerations and other pertinent assumptions are described in this section.

3.1 BASIS OF ESTIMATE

The current estimate was developed using the basic design information originally generated for the decommissioning analysis prepared in 1995-96.[10] The information was reviewed for the current estimate and updated, as deemed necessary. The site-specific considerations and assumptions used in the previous estimate 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 this cost estimate follows the basic approach originally presented in the AIF/NESP-036 study report, "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates,"[11] and the US DOE "Decommissioning Handbook."[12] 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 <u>activity-dependent</u> 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.[13]

This estimate 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 has provided additional insight into the process, the regulatory aspects, and 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 37%
• Protective Clothing Factor	10% to 30%
• Work Break Factor	8.33%
• Productivity	adjustable

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 relied upon productivity information available from the "Building Construction Cost Data" publication.

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

3.3 FINANCIAL COMPONENTS OF THE COST MODEL

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

Inherent in any cost estimate that does not rely on historical data is the inability to specify the precise source of costs imposed by factors such as tool breakage, accidents, illnesses, weather delays, and labor stoppages. In TLG's 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"[14] 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 estimate 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 estimate, 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, could 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 will be the disposition of the reactor vessel and internal components, which have become highly radioactive after a lifetime of exposure to radiation produced in the core. The disposition of these highly radioactive components forms the basis for the critical path (schedule) for decommissioning operations. Cost and schedule are inter-dependent 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 risk and uncertainties associated with this task are that the expected optimization 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 can range from 0% 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 overall contingency, when applied to the appropriate components of the estimates on a line item basis, results in an average value of 19.8%.

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.

- 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 much higher probability. This is mostly due to the pricing uncertainty for low-level radioactive waste burial, and to a lesser extent due to schedule increases from changes in plant conditions and to pricing variations in the cost of labor (both craft and staff). This cost study, however, does not add any additional costs to the estimate for financial risk since there is insufficient historical data from which to project future liabilities. Consequently, it is recommended that the areas of uncertainty or risk be 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

The cost to dispose of the spent fuel generated from plant operations is not reflected within the estimate to decommission Hope Creek. Ultimate disposition of the spent fuel is within the province of the DOE's Waste Management System, as defined by the Nuclear Waste Policy Act. As such, the disposal cost is financed by a 1 mill/kWhr surcharge paid into the DOE's waste fund during operations. However, the NRC requires licensees to establish a program to manage and provide funding for the management of all irradiated fuel at the reactor until title of the fuel is transferred to the Secretary of Energy. This funding requirement is fulfilled through inclusion of certain high-level waste cost elements within the estimate, as described herein.

The total inventory of assemblies that will need to be handled 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 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. A delay in the startup of the repository, or a decrease in the rate of acceptance rate, will correspondingly prolong the transfer process and extend the duration that the fuel remains at the site.

For estimating purposes, spent fuel will be removed from the Hope Creek site during, and following decommissioning, with the transfer complete by the end of year 2046. Built to support continuing plant operations, an ISFSI will be available to support decommissioning, i.e., the fuel residing in the pool following the cessation of plant operations could be relocated to the ISFSI so that decommissioning can proceed on the Reactor Building. The assemblies will be relocated to the ISFSI during the first five years following final shutdown. Costs are included for the purchase of the 25 canisters and overpacks required to empty the pool (an additional five will be used to package the GTCC).

Operation and maintenance costs for the ISFSI are included within the estimates 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.

ISFSI Design Considerations

A multi-purpose (storage and transport) dry shielded storage canister with a vertical, reinforced concrete storage silo is used as a basis for the cost analyses. Approximately 50% of the silos 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 of the disposition 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 presumed.

The reactor pressure vessel and internal components are segmented for disposal in shielded, reusable transportation casks. Segmentation will be performed in the dryer-separator pool, where a turntable and remote cutter are installed. The vessel will be 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 well. 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, DOE has indicated it will accept title to this waste for disposal at the future high-level waste repository.[15] 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 DOE would accept this waste prior to completing the transfer of spent fuel. Therefore, until such time as the DOE is ready to accept GTCC waste, it is reasonable to assume that this material would remain in storage at Hope Creek.

Intact disposal of the reactor vessel and internal components could 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, the location of the Trojan Nuclear Plant 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 Hope Creek ceases operation. Future viability of this option will depend upon the ultimate location of the disposal site, as well as the disposal site licensee's ability to accept highly radioactive packages and effectively isolate them from the environment. Consequently, as a bounding condition, the study assumes the reactor vessel will have to be segmented.

3.4.3 Primary System Components

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 shipped by shielded van. The reactor recirculation pumps and motors are lifted out intact, packaged, and transported for processing 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 condenser will also be disassembled and moved to a laydown area. Material will then be prepared for transportation to an off-site recycling facility where it will be surveyed and designated for decontamination, volume reduction, or 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 of the Code of Federal Regulations.[16] The contaminated material will be packaged in Industrial Packages (IP I, II, or III) 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 are 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, barge, and/or multi-wheeled transporter.

The low-level radioactive waste requiring controlled disposal will be sent to one of two currently available burial facilities. Transportation costs are based upon the mileage to either the Envirocare facility in Clive, Utah, or the Barnwell facility in South Carolina. Memphis, Tennessee will be used as the destination for off-site processing. Transportation costs are estimated using published tariffs from Tri-State Motor Transit.[17]

3.4.6 Low-Level Radioactive Waste Disposal

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

Material requiring controlled disposal will be packaged and transported to one of two currently available burial facilities. Very low-level radioactive material, e.g., structural steel and contaminated concrete, will be sent to Envirocare. More highly contaminated and activated material will be sent to Barnwell. Disposal fees are based upon current charges for operating waste with surcharges 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 PSEG Nuclear's own future plans for the site, e.g., the electrical switchyard will remain in support of the electrical transmission and distribution system.

The large underground tunnels between the cooling water intake, Turbine Building, and cooling tower will be isolated, sealed, and abandoned in place. Site utility and service piping are abandoned in place. Electrical manholes are backfilled with suitable earthen material and abandoned. Asphalt surfaces in the immediate vicinity of site buildings are broken up and the material used for backfill on site, if needed. The site access road will remain.

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.

Structures will be removed to a nominal depth of three feet below grade. Concrete rubble generated from demolition activities will be processed and made available as clean fill. The site will be graded following the removal of non-essential structures to conform to the adjacent landscape, and vegetation will be established to inhibit erosion. This degree of site restoration will constitute compliance with the CAFRA document dated July 9, 1976.

3.5 ASSUMPTIONS

The following are the major assumptions made in the development of the estimate for decommissioning the site. Decommissioning activities will be performed in accordance with the current regulations that are assumed to be in place at the time of decommissioning, including the Industrial Site Recovery Act (ISRA), which is mandatory under current New Jersey State Regulations.

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 units 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 PSEG Nuclear.

PSEG Nuclear, as the licensee, will oversee the decommissioning operations and provide site security, radiological controls, and overall site administration. PSEG Nuclear will provide contract management of the decommissioning labor force and subcontractors. Engineering services for preparing the activity specifications, work procedures, activation, and structural analyses, are provided by PSEG Nuclear personnel.

The costs associated for the transition of the operating organization to decommissioning, e.g., separation packages, retraining, severance, and incentives are not included in this estimate and are considered to be ongoing operating expenses.

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., cesium-137, strontium-90, 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.[18] Actual estimates are derived from the curie/gram values in NUREG/CR-3474 and adjusted for the different mass of Hope Creek components, projected operating life, and different periods of decay. Additional short-lived isotopes were derived from NUREG/CR-0130[19] and NUREG/CR-0672[20] and benchmarked to the long-lived values from NUREG/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 pools from operations is considered an operating expense and therefore not accounted for in the estimates.

Activation of the Reactor Building structure is confined to the sacrificial shield in this estimate. 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 and 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 PSEG Nuclear and its subcontractors. The warehouses may be dismantled as they become surplus to the decommissioning program. 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.
- Excess acid, caustic, and all chemicals listed (at shutdown) in the New Jersey "Right to Know Report" will be removed and the storage container returned to the vendor. It is assumed that these chemicals will have some value; therefore, the cost for their removal will be compensated through their subsequent sale.

Scrap and Salvage

The existing plant equipment is considered obsolete and suitable for scrap as deadweight quantities only. PSEG Nuclear will make economically reasonable efforts to salvage equipment following final plant shutdown. However, dismantling techniques assumed by TLG for equipment in this estimate 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 estimate does not attempt to quantify the value that PSEG Nuclear may realize based upon those efforts.

It is assumed, for purposes of this estimate, 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 from a facility currently being decommissioned has required the removal and disposition of the PCB-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 such items of personal property owned by PSEG Nuclear will be removed at no cost or credit to the decommissioning project. Disposition may include relocation to other generating 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." The NRC's financial protection requirements are based on various reactor (and spent fuel) configurations.

Property Taxes

Property tax payments will cease upon shutdown of each unit.

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

The costs projected for the decommissioning of Hope Creek are provided in Table 3.1. Decommissioning costs are reported in the year of projected expenditure; however, the values are provided in thousands of 2002 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 BY PERIOD
(Thousands, 2002 Dollars)

Year	Period 1 Preparations	Period 2 Decommissioning Operations	Period 3 Site Restoration	Period 4 Dry Fuel Storage *	Period 5 ISFSI Decommissioning	Totals
2026	38,285					38,285
2027	55,590	30,410				86,000
2028		135,734				135,734
2029		99,099				99,099
2030		81,337				81,337
2031		89,928				89,928
2032		98,728				98,728
2033		19,599	24,792			44,391
2034			49,179			49,179
2035			38,804	105		38,910
2036				500		500
2037				499		499
2038				499		499
2039				499		499
2040				500		500
2041				499		499
2042				499		499
2043				499		499
2044				500		500
2045				499		499
2046				14,090	2,429	16,519
	93,874	554,835	112,775	19,188	2,429	783,102

* Operating and decommissioning costs for the ISFSI are shared with the Salem Station

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 required cooling period for the spent fuel.

A schedule or sequence of activities is presented in Figure 4.1. The schedule reflects the prompt decommissioning alternative and the start date consistent with a scheduled shutdown in 2026. The sequence assumes that fuel will be removed from the spent fuel pool within the first five years. The key activities listed in the schedule do not reflect a one-to-one correspondence with those activities in the Appendix C cost table, but reflect dividing some activities for clarity and combining others for convenience. The schedule was prepared using the "Microsoft Project 2000" computer software.[21]

4.1 SCHEDULE ESTIMATE ASSUMPTIONS

The schedule was generated using a precedence network and associated software. Activity durations are based upon the actual man-hour estimates calculated for each area. The schedule was assembled by sequencing the work areas, considering work crew availability and material access/egress. The following assumptions were made in the development of the decommissioning schedule:

- The Reactor Building will continue to serve as the spent fuel storage/ transfer facility until such time that all spent fuel has been removed from site. The Reactor Building is expected to operate for approximately five years after the cessation of operations.

- All work (except vessel and internals removal activities) will be 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 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 Appendix C are based upon the durations developed in the schedule for the decommissioning of Hope Creek. 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.

The project timeline is shown in this section as Figure 4.2. Milestone dates are based on a 40-year plant operating life from the issuance of the operating license, a five-year wet storage period for the last core discharge, and continued operation of the ISFSI until DOE can complete the transfer.

FIGURE 4.1

DECOMMISSIONING ACTIVITY SCHEDULE

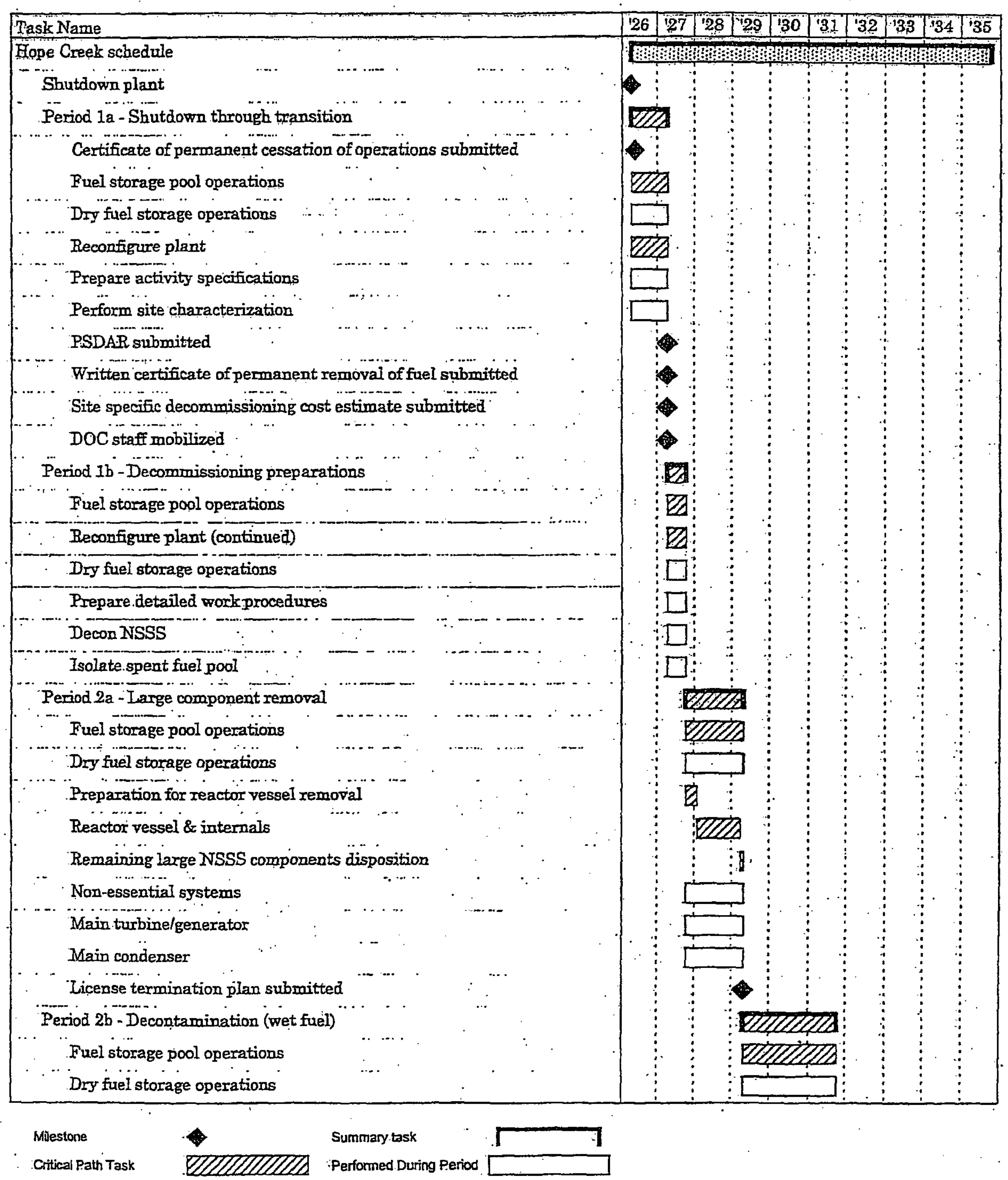


FIGURE 4.1

(continued)

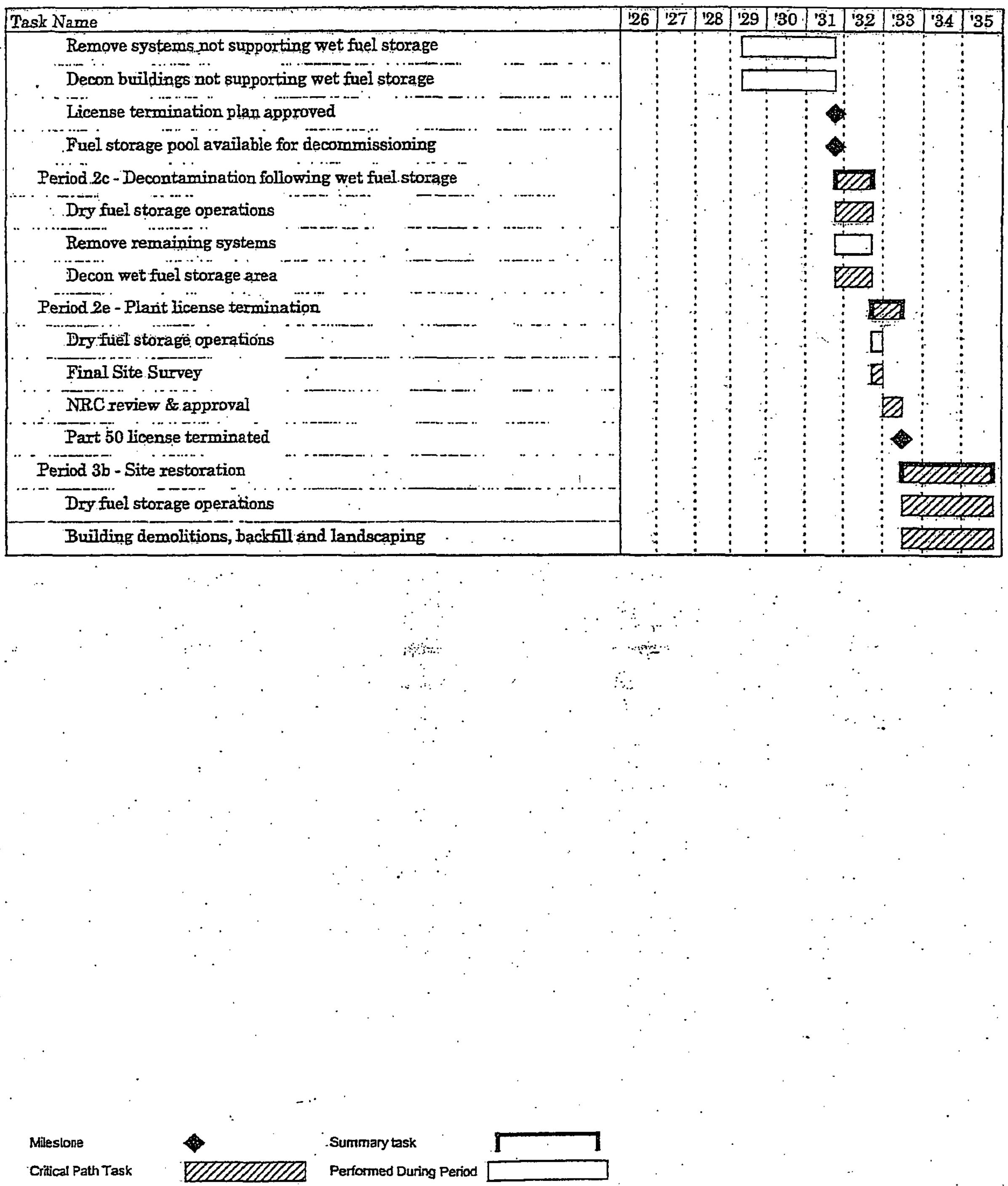
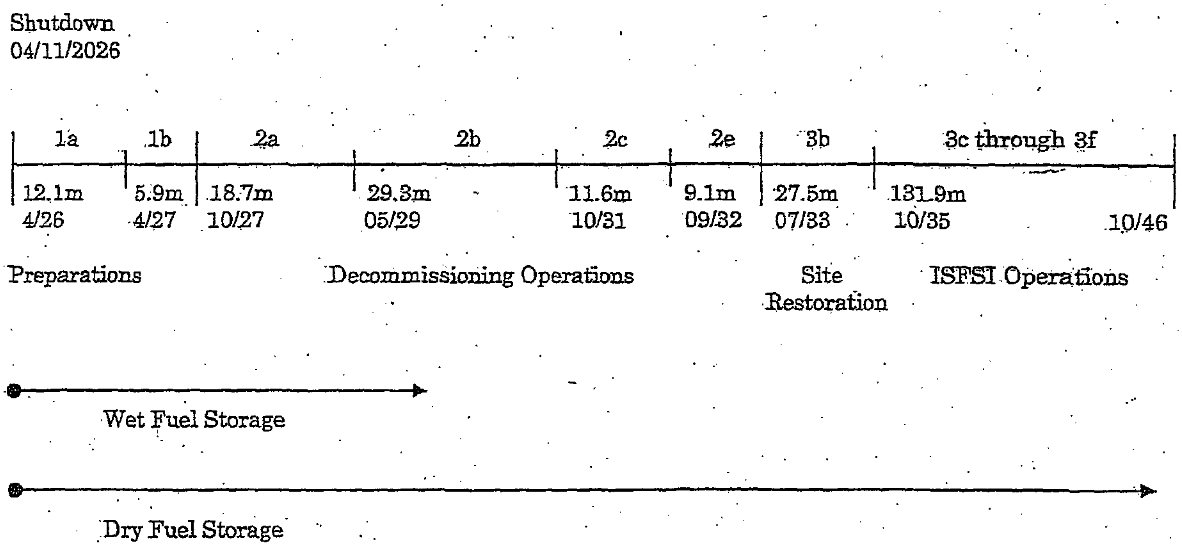


FIGURE 4.2

DECOMMISSIONING TIMELINE
(not to scale)



5. RADIOACTIVE WASTES

The objectives of the decommissioning process are the removal of all radioactive material from the site that would restrict its future use and the termination of the NRC license(s). This currently requires the remediation of all radioactive material at the site in excess of applicable legal limits. Under the Atomic Energy Act,[22] 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, 10 CFR §71 defines radioactive material and 10 CFR §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). For this study, commercially available steel containers are presumed to be used for the disposal of piping, small components, and concrete. Larger components can serve as their own containers, with proper closure of all openings, access ways, and penetrations.

The volumes of radioactive waste generated during the various decommissioning activities at the site are shown on a line-item basis in Appendix C and summarized in Table 5.1. The quantified waste volume summary shown in this table is consistent with §61 classifications. The volumes are calculated based on the exterior dimensions for containerized material. The volumes are calculated 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 and 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 Hope Creek will primarily be generated during Period 2. Material considered potentially contaminated when removed from the radiologically controlled area will be sent to processing facilities for conditioning and disposal at a unit cost of $2.00 per pound. Heavily contaminated components and activated materials will be routed for controlled disposal. The disposal volumes reported in the table reflects the savings resulting from reprocessing and recycling.

For purposes of constructing the estimate, the rate schedule for the Barnwell facility was used as a proxy for the higher activity waste. This schedule was used to estimate the disposal fees for the majority of plant components and activated concrete deemed unsuitable for processing or recovery. An average disposal rate of $415 per cubic foot was used, with additional surcharges for activity, dose rate and/or handling added, as appropriate for the particular package.

The remaining volume of contaminated metallic and concrete debris will be disposed of at the Envirocare facility. This includes lower activity material such as miscellaneous steel, metal siding, scaffolding and structural steel. A rate of $298 per cubic foot was used for containerized waste, $70 per cubic foot for disposal of DAW, and approximately $20 per cubic foot for bulk material, e.g., concrete.

TABLE 5.1

DECOMMISSIONING WASTE SUMMARY

	Waste Class[1]	Volume (cubic feet)	Weight (pounds)
Low-Level Radioactive Waste			
Barnwell, South Carolina (contaminated/activated metallic waste and concrete)			
	A	107,679	9,328,192
	B	20,945	3,230,562
	C	918	64,020
Envirocare, Utah (miscellaneous steel, contaminated/activated concrete)			
Containerized/DAW	A	48,467	4,386,491
Bulk	A	49,513	2,656,402
Geologic Repository (Greater-than Class C)			
	>C	851	166,199
Total[2]		228,374	19,831,866
Processed Waste (Off-Site)		233,125	
Scrap Metal			224,718,000

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

Costs were developed to decommission Hope Creek following a scheduled cessation of plant operations. The analysis relied upon the site-specific, technical information developed for a previous analysis prepared in 1995-96, then updated to reflect current plant conditions and operating assumptions. While not an engineering study, the estimate does provide PSEG Nuclear with sufficient information to assess its 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 approximately five 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 scenario also includes the costs for the dismantling of non-essential structures and limited restoration of the site.

The cost projected to promptly decommission Hope Creek is estimated to be $783.1 million. The majority of this cost (approximately 87.1%) is associated with the physical decontamination and dismantling of the nuclear unit and caretaking of the spent fuel, so that the license could be terminated. The remaining 12.9% is for the demolition of the remaining 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 and the duration of the program. It is assumed, for purposes of this analysis, that PSEG Nuclear will oversee the decommissioning program, managing 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 has been 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 approximately five years following the cessation of plant operation. The pool will be isolated and an independent spent fuel island created. This will allow decommissioning operations to proceed in and around the Reactor Building. Over the five-year period, the spent fuel will be packaged into transportable steel canisters for loading into a DOE-provided transport cask. The canisters will be stored in concrete overpacks at the ISFSI until DOE is able to receive them. Dry storage of the fuel under a separate license provides additional flexibility in the event 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 incurred by PSEG Nuclear.

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 the lower level material, including concrete and structural steel, will be at the Envirocare facility. The more highly radioactive material will be sent to the Barnwell facility, with the exception of selected reactor vessel components. 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 will be packaged for controlled disposal at one of the currently operating facilities. The costs identified for processing are all-inclusive, incorporating the ultimate disposition of the material.

Removal costs reflect the labor-intensive nature of the decommissioning process and 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 could be more cost-effective than deferral, due to the ultimate deterioration of facilities (and therefore the working conditions).

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 estimate, material will be primarily moved overland by truck.

Decontamination will be used to reduce the plant's radiation fields and minimize worker exposure. Slightly contaminated material or material located within a contaminated area will be sent to an off-site processing center, i.e., this estimate does not assume that contaminated plant components and equipment could be economically decontaminated for uncontrolled release in-situ. Centralized processing centers have proven to be a more efficient 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 need to be confirmed and will add to the expense of surveying the facilities alone.

The remaining costs include allocations for heavy equipment and temporary services, and 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

Work Category	Cost 2002$ (thousands)	Percent of Total Costs
Decontamination	30,745.4	3.9
Removal	192,120.4	24.5
Packaging	16,049.0	2.0
Transportation	6,008.1	0.8
Waste Disposal	132,615.0	16.9
Off-site Waste Processing	53,629.8	6.8
Program Management (including Engineering and Security)	260,624.7	33.3
Spent Fuel Pool Isolation	9,060.3	1.2
ISFSI Related (including capital)	40,238.9	5.1
Insurance and Regulatory Fees	7,147.7	0.9
Energy	11,768.5	1.5
Characterization and Licensing Surveys	13,936.8	1.8
Misc. Equipment and Site Services	9,156.8	1.2
Total	783,101.6	100.0

Note: Columns may not add due to rounding

7. REFERENCES

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

2. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.159, "Assuring the Availability of Funds for Decommissioning Nuclear Reactors," August 1990.

3. 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.

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

5. 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.

6. U.S. Code of Federal Regulations, Title 10, Part 50 – Domestic Licensing of Production and Utilization Facilities, Subpart 54 (bb), "Conditions of Licenses," January 2001 Edition.

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

8. 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.

9. "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)," NUREG/CR-1575, EPA 402-R-97-016, December 1997.

10. "Decommissioning Cost Estimate for the Hope Creek Nuclear Generating Station," Document No. P07-1180-004, TLG Services, Inc., September 1996.

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

7. REFERENCES
(continued)

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

13. "Building Construction Cost Data 2002," Robert Snow Means Company, Inc., Kingston, Massachusetts.

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

15. "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.

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

17. Tri-State Motor Transit Company, published tariffs, Interstate Commerce Commission (ICC), Docket No. MC-109397 and Supplements, 2000.

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

19. 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.

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

21. "Microsoft Project 2000," Microsoft Corporation, Redmond, WA, 1997.

22. "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	Critical Duration
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 in plastic, send to the waste processing area	60	60
	Totals (Activity/Critical)	355	255

Duration adjustment(s):	
+ Respiratory protection adjustment (50% of critical duration)	128
+ Radiation/ALARA adjustment (37.08% 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 min	673 min

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

APPENDIX A
(continued)

3. LABOR REQUIRED

Crew	Number	Duration (hr)	Rate ($/hr)	Cost
Laborers	3.00	11.217	40.61	1,366.57
Craftsmen	2.00	11.217	56.29	1,262.81
Foreman	1.00	11.217	60.17	674.93
General Foreman	0.25	11.217	67.66	189.74
Fire Watch	0.05	11.217	40.61	22.78
Health Physics Technician	1.00	11.217	45.90	514.86
Total labor cost				$4,031.69

4. EQUIPMENT & CONSUMABLES COSTS

Equipment Costs	none
Consumables/Materials Costs	
-Gas torch consumables 1 @ $4.57/hr x 1 hr {1}	$4.57
-Blotting paper 50 @ $0.47 sq ft {2}	$23.50
-Plastic sheets/bags 50 @ $0.12/sq ft {3}	$6.00
Subtotal cost of equipment and materials	$34.07
Overhead & sales tax on equipment and materials @ 16.00 %	$5.45
Total costs, equipment & material	$39.52

TOTAL COST:

Removal of contaminated heat exchanger <3000 pounds: $4,071.21

Total labor cost:	$4,031.69
Total equipment/material costs:	$39.52
Total craft labor man-hours required per unit:	81.884

5. NOTES AND REFERENCES

- Work difficulty factors were developed in conjunction with the AIF (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. R.S. Means (2002) Division 01590, Section 400-6360 pg 24
  2. McMaster-Carr Ed. 106 pg 1778
  3. R.S. Means (2002) Division 01540, Section 800-0200 pg 17

- Material and consumable costs were adjusted using the regional indices for Wilmington, Delaware.

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	0.46
Removal of clean pipe 0.25 to 2 inches diameter, $/linear foot	4.80
Removal of clean pipe >2 to 4 inches diameter, $/linear foot	6.93
Removal of clean pipe >4 to 8 inches diameter, $/linear foot	13.70
Removal of clean pipe >8 to 14 inches diameter, $/linear foot	26.29
Removal of clean pipe >14 to 20 inches diameter, $/linear foot	34.03
Removal of clean pipe >20 to 36 inches diameter, $/linear foot	50.10
Removal of clean pipe >36 inches diameter, $/linear foot	59.60
Removal of clean valves >2 to 4 inches	91.18
Removal of clean valves >4 to 8 inches	136.96
Removal of clean valves >8 to 14 inches	262.88
Removal of clean valves >14 to 20 inches	340.30
Removal of clean valves >20 to 36 inches	501.04
Removal of clean valves >36 inches	595.95
Removal of clean pipe fittings >2 to 4 in	101.25
Removal of clean pipe fittings >4 to 8 in	160.64
Removal of clean pipe fittings >8 to 14 in	262.88
Removal of clean pipe fittings >14 to 20	340.30
Removal of clean pipe fittings > 20 to 36	501.04
Removal of clean pipe hangers for small bore piping	28.12
Removal of clean pipe hangers for large bore piping	103.45
Removal of clean pumps, <300 pound	227.86
Removal of clean pumps, 300-1000 pound	640.33
Removal of clean pumps, 1000-10,000 pound	2,542.96
Removal of clean pumps, >10,000 pound	4,906.95

APPENDIX B
(continued)

Unit Cost Factor	Cost/Unit($)
Removal of clean pump motors, 300-1000 pound	271.14
Removal of clean pump motors, 1000-10,000 pound	1,061.82
Removal of clean pump motors, >10,000 pound	2,389.10
Removal of clean turbine-driven pumps > 10,000 pounds	6,577.50
Removal of clean heat exchanger <3000 pound	1,363.81
Removal of clean heat exchanger >3000 pound	3,417.62
Removal of clean feedwater heater/deaerator	9,646.37
Removal of clean moisture separator/reheater	19,849.31
Removal of clean tanks, <300 gallons	293.47
Removal of clean tanks, 300-3000 gallons	931.33
Removal of clean tanks, >3000 gallons, $/square foot surface area	7.81
Removal of clean electrical equipment, <300 pound	126.22
Removal of clean electrical equipment, 300-1000 pound	441.45
Removal of clean electrical equipment, 1000-10,000 pound	882.90
Removal of clean electrical equipment, >10,000 pound	2,112.91
Removal of clean electrical transformers < 30 tons	1,467.39
Removal of clean electrical transformers > 30 tons	4,225.80
Removal of clean standby diesel-generator, <100 kW	1,498.81
Removal of clean standby diesel-generator, 100 kW to 1 MW	3,345.43
Removal of clean standby diesel-generator, >1 MW	6,925.72
Removal of clean electrical cable tray, $/linear foot	11.66
Removal of clean electrical conduit, $/linear foot	5.08
Removal of clean mechanical equipment, <300 pound	126.22
Removal of clean mechanical equipment, 300-1000 pound	441.45
Removal of clean mechanical equipment, 1000-10,000 pound	882.90
Removal of clean mechanical equipment, >10,000 pound	2,112.91
Removal of clean HVAC equipment, <300 pound	126.22

APPENDIX B
(continued)

Unit Cost Factor	Cost/Unit($)
Removal of clean HVAC equipment, 300-1000 pound	441.45
Removal of clean HVAC equipment, 1000-10,000 pound	882.90
Removal of clean HVAC equipment, >10,000 pound	2,112.91
Removal of clean HVAC ductwork, $/pound	0.48
Removal of contaminated instrument and sampling tubing, $/linear foot	1.42
Removal of contaminated pipe 0.25 to 2 inches diameter, $/linear foot	18.49
Removal of contaminated pipe >2 to 4 inches diameter, $/linear foot	32.88
Removal of contaminated pipe >4 to 8 inches diameter, $/linear foot	52.70
Removal of contaminated pipe >8 to 14 inches diameter, $/linear foot	103.92
Removal of contaminated pipe >14 to 20 inches diameter, $/linear foot	125.17
Removal of contaminated pipe >20 to 36 inches diameter, $/linear foot	174.16
Removal of contaminated pipe >36 inches diameter, $/linear foot	206.34
Removal of contaminated valves >2 to 4 inches409.23	
Removal of contaminated valves >4 to 8 inches491.64	
Removal of contaminated valves >8 to 14 inches	1,004.93
Removal of contaminated valves >14 to 20 inches	1,279.12
Removal of contaminated valves >20 to 36 inches	1,707.42
Removal of contaminated valves >36 inches	2,029.16
Removal of contaminated pipe fittings >2 to 4 inches	222.48
Removal of contaminated pipe fittings > 4 to 8 inches	562.42
Removal of contaminated pipe fittings > 8 to 14 inches	1,004.93
Removal of contaminated pipe fittings > 14 to 20 inches	1,279.12
Removal of contaminated pipe fittings >20 to 36 inches	1,707.42
Removal of contaminated pipe hangers for small bore piping	96.90
Removal of contaminated pipe hangers for large bore piping 317.71	
Removal of contaminated pumps, <300 pound	872.56
Removal of contaminated pumps, 300-1000 pound	2,038.66
Removal of contaminated pumps, 1000-10,000 pound	6,721.04

APPENDIX B
(continued)

Unit Cost Factor	Cost/Unit($)
Removal of contaminated pumps, >10,000 pound	16,369.44
Removal of contaminated pump motors, 300-1000 pound	856.70
Removal of contaminated pump motors, 1000-10,000 pound	2,726.06
Removal of contaminated pump motors, >10,000 pound	6,120.23
Removal of contaminated turbine-driven pumps < 10,000 pounds	18,918.88
Removal of contaminated heat exchanger <3000 pound	4,071.21
Removal of contaminated heat exchanger >3000 pound	11,752.21
Removal of contaminated feedwater heater / deaerator	28,760.26
Removal of contaminated moisture separator / reheater	63,002.71
Removal of contaminated tanks, <300 gallons	1,448.59
Removal of contaminated tanks, >300 gallons, $/square foot	28.80
Removal of contaminated electrical equipment, <300 pound	684.21
Removal of contaminated electrical equipment, 300-1000 pound	1,664.73
Removal of contaminated electrical equipment, 1000-10,000 pound	3,204.54
Removal of contaminated electrical equipment, >10,000 pound	6,299.81
Removal of electrical transformers < 30 tons	5,079.02
Removal of electrical transformers > 30 tons	12,470.88
Removal of standby diesel-generator, < 100 kW	4,387.47
Removal of standby diesel-generator, 100 kW to 1 MW	9,471.87
Removal of standby diesel-generator, >1 MW	20,474.76
Removal of contaminated electrical cable tray, $/linear foot	32.93
Removal of contaminated electrical conduit, $/linear foot	14.92
Removal of contaminated mechanical equipment, <300 pound	761.89
Removal of contaminated mechanical equipment, 300-1000 pound	1,841.14
Removal of contaminated mechanical equipment, 1000-10,000 pound	3,538.42

APPENDIX B
(continued)

Unit Cost Factor	Cost/Unit($)
Removal of contaminated mechanical equipment, >10,000 pound	6,299.81
Removal of contaminated HVAC equipment, <300 pound	761.89
Removal of contaminated HVAC equipment, 300-1000 pound	1,841.14
Removal of contaminated HVAC equipment, 1000-10,000 pound	3,538.42
Removal of contaminated HVAC equipment, >10,000 pound	6,299.81
Removal of contaminated HVAC ductwork, $/pound	3.03
Removal of clean standard reinforced concrete, $/cubic yard	72.07
Removal of grade slab concrete, $/cubic yard	204.33
Removal of clean heavily rein concrete w/#9 rebar, $/cubic yard	211.46
Removal of clean heavily rein concrete w/#18 rebar, $/cubic yard	267.46
Removal of below-grade suspended floors, $/cubic yard	316.55
Removal of clean monolithic concrete structures, $/cubic yard	1,897.58
Removal of clean foundation concrete, $/cubic yard	626.97
Removal of clean hollow masonry block wall, $/cubic yard	75.24
Removal of clean solid masonry block wall, $/cubic yard	75.24
Placement of concrete for below-grade voids, $/cubic yard	99.90
Removal of subterranean tunnels/voids, $/ linear foot	141.76
Backfill of below grade voids, $/cubic yard	17.31
Excavation of clean material, $cubic yard	3.05
Removal of clean building metal siding, $/square foot	1.34
Removal of standard asphalt roofing, $/square foot	2.15
Removal of Galbestos panels, $/square foot	2.19
Scarifying contaminated concrete surfaces (drill & spall), $/square foot	12.54
Scabbling contaminated concrete floors, $/square foot	7.42
Scabbling contaminated concrete walls, $/square foot	8.15
Scabbling contaminated ceilings, $/square foot	73.38
Removal of clean overhead cranes/monorails < 10 ton capacity, each	623.14
Removal of contaminated overhead cranes/monorails < 10 ton capacity, ea.	1,734.71

APPENDIX B
(continued)

Unit Cost Factor	Cost/Unit($)
Removal of clean overhead cranes/monorails >10-50 ton capacity, each	1,495.51
Removal of contaminated overhead cranes/monorails >10-50 ton capacity, each	4,162.61
Removal of polar cranes > 50 ton capacity, each	6,286.50
Removal of gantry cranes > 50 ton capacity, each	26,411.28
Removal of clean structural steel, $/pound	0.35
Removal of clean steel floor grating, $/square foot	3.19
Removal of contaminated steel floor grating, $/square foot	9.69
Removal of clean free-standing steel liner, $/square foot	33.75
Removal of clean concrete-anchored steel liner, $/square foot	5.85
Removal of contaminated concrete-anchored steel liner, $/square foot	39.31
Placement of scaffolding in clean areas, $/square foot	13.73
Placement of scaffolding in contaminated areas, $/square foot	22.10
Removal of chain link fencing, $/linear foot	2.10
Removal of asphalt pavement, $/square foot	1.05
Core drilling 2 to 4 inch diameter, linear foot	354.68

APPENDIX C

DETAILED COST ANALYSES

TABLE C
HOPE CREEK NUCLEAR GENERATING STATION
DETAILED COST ANALYSIS
(Thousands of 2002 Dollars)

ctivity 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 Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
RIOD 1a - Shutdown through Transition																					
od 1a Direct Decommissioning Activities																					
1.1	Prepare preliminary decommissioning cost	-	-	-	-	-	-	96	14	109	109	-	-	-	-	-	-	-	-	-	1,300
1.2	Notification of Cessation of Operations									a											
1.3	Remove fuel & source material									n/a											
1.4	Notification of Permanent Defueling									a											
1.5	Deactivate plant systems & process waste									a											
1.6	Prepare and submit PSDAR	-	-	-	-	-	-	146	22	168	168	-	-	-	-	-	-	-	-	-	2,000
1.7	Review plant dwgs & specs.	-	-	-	-	-	-	336	50	386	386	-	-	-	-	-	-	-	-	-	4,600
1.8	Perform detailed rad survey									a											
1.9	Estimate by-product inventory	-	-	-	-	-	-	73	11	84	84	-	-	-	-	-	-	-	-	-	1,000
1.10	End product description	-	-	-	-	-	-	73	11	84	84	-	-	-	-	-	-	-	-	-	1,000
1.11	Detailed by-product inventory	-	-	-	-	-	-	95	14	109	109	-	-	-	-	-	-	-	-	-	1,300
1.12	Define major work sequence	-	-	-	-	-	-	547	82	629	629	-	-	-	-	-	-	-	-	-	7,500
1.13	Perform SER and EA	-	-	-	-	-	-	226	34	260	260	-	-	-	-	-	-	-	-	-	8,100
1.14	Perform Site-Specific Cost Study	-	-	-	-	-	-	365	55	420	420	-	-	-	-	-	-	-	-	-	5,000
1.15	Prepare/submit License Termination Plan	-	-	-	-	-	-	299	45	344	344	-	-	-	-	-	-	-	-	-	4,095
1.16	Receive NRC approval of termination plan									a											
ivity Specifications																					
1.17.1	Plant & temporary facilities	-	-	-	-	-	-	359	54	413	372	-	41	-	-	-	-	-	-	-	4,920
1.17.2	Plant systems	-	-	-	-	-	-	304	46	350	315	-	35	-	-	-	-	-	-	-	4,157
1.17.3	NSSS Decontamination Flush	-	-	-	-	-	-	36	5	42	42	-	-	-	-	-	-	-	-	-	500
1.17.4	Reactor internals	-	-	-	-	-	-	518	78	596	596	-	-	-	-	-	-	-	-	-	7,100
1.17.5	Reactor vessel	-	-	-	-	-	-	474	71	545	545	-	-	-	-	-	-	-	-	-	6,500
1.17.6	Sacrificial shield	-	-	-	-	-	-	36	5	42	42	-	-	-	-	-	-	-	-	-	500
1.17.7	Moisture separators/reheaters	-	-	-	-	-	-	73	11	84	84	-	-	-	-	-	-	-	-	-	1,000
1.17.8	Reinforced concrete	-	-	-	-	-	-	117	18	134	67	-	67	-	-	-	-	-	-	-	1,500
1.17.9	Turbine & condenser	-	-	-	-	-	-	304	46	350	350	-	-	-	-	-	-	-	-	-	4,157
1.17.10	Pressure suppression structure	-	-	-	-	-	-	146	22	168	168	-	-	-	-	-	-	-	-	-	2,000
1.17.11	Drywell	-	-	-	-	-	-	117	18	134	134	-	-	-	-	-	-	-	-	-	1,600
1.17.12	Plant structures & buildings	-	-	-	-	-	-	228	34	262	131	-	131	-	-	-	-	-	-	-	3,120
1.17.13	Waste management	-	-	-	-	-	-	336	50	386	386	-	-	-	-	-	-	-	-	-	4,600
1.17.14	Facility & site closeout	-	-	-	-	-	-	68	10	78	38	-	38	-	-	-	-	-	-	-	900
1.17	Total	-	-	-	-	-	-	3,118	467	3,580	3,266	-	312	-	-	-	-	-	-	-	42,674
nning & Site Preparations																					
1.18	Prepare dismantling sequence	-	-	-	-	-	-	175	26	201	201	-	-	-	-	-	-	-	-	-	2,400
1.19	Plant prep. & temp. svces	-	-	-	-	-	-	2,304	346	2,650	2,650	-	-	-	-	-	-	-	-	-	-
1.20	Design water clean-up system	-	-	-	-	-	-	102	15	117	117	-	-	-	-	-	-	-	-	-	1,400
1.21	Rigging/Cont. Cntrl Envlps/tooling/etc.	-	-	-	-	-	-	1,950	293	2,243	2,243	-	-	-	-	-	-	-	-	-	-
1.22	Procure casks/liners & containers	-	-	-	-	-	-	90	13	103	103	-	-	-	-	-	-	-	-	-	1,230
1	Subtotal Period 1a Activity Costs	-	-	-	-	-	-	9,989	1,498	11,487	11,175	-	312	-	-	-	-	-	-	-	78,600
2	Subtotal Period 1a Additional Costs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
riod 1a Period-Dependent Costs																					
4.1	Insurance	-	-	-	-	-	-	652	66	718	718	-	-	-	-	-	-	-	-	-	-
4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4.3	Health physics supplies	-	462	-	-	-	-	-	116	578	578	-	-	-	-	-	-	-	-	-	-
4.4	Heavy equipment rental	-	350	-	-	-	-	-	52	402	402	-	-	-	-	-	-	-	-	-	-
4.5	Disposal of DAW generated	-	-	14	4	-	52	-	15	86	86	-	-	-	748	-	-	-	14,991	184	-
4.6	Plant energy budget	-	-	-	-	-	-	1,646	247	1,893	1,893	-	-	-	-	-	-	-	-	-	-
4.7	NRC Fees	-	-	-	-	-	-	803	80	883	883	-	-	-	-	-	-	-	-	-	-
4.8	Emergency Planning Fees	-	-	-	-	-	-	84	3	87	-	87	-	-	-	-	-	-	-	-	-

TABLE C
HOPE CREEK NUCLEAR GENERATING STATION
DETAILED COST ANALYSIS
(Thousands of 2002 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 Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
Period 1a Period-Dependent Costs (continued)																					
1a.4.9	ISFSI Transfer and Capital Costs	-	-	-	-	-	-	366	55	421	-	421	-	-	-	-	-	-	-	-	-
1a.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	953	143	1,096	-	1,096	-	-	-	-	-	-	-	-	-
1a.4.11	*ISRA Compliance Staff*	-	-	-	-	-	-	816	122	939	939	-	-	-	-	-	-	-	-	-	-
1a.4.12	Dry Fuel Storage O&M Costs	-	-	-	-	-	-	28	3	27	-	27	-	-	-	-	-	-	-	-	-
1a.4.13	Security Staff Cost	-	-	-	-	-	-	1,150	172	1,322	1,322	-	-	-	-	-	-	-	-	-	59,244
1a.4.14	Utility Staff Cost	-	-	-	-	-	-	29,290	4,394	33,684	33,684	-	-	-	-	-	-	-	-	-	442,497
1a.4	Subtotal Period 1a Period-Dependant Costs	-	812	14	4	-	52	35,288	5,419	41,684	39,953	1,581	-	-	748	-	-	-	14,991	184	501,741
1a.0	TOTAL PERIOD 1a COST	-	812	14	4	-	52	45,222	6,917	53,021	51,128	1,581	312	-	748	-	-	-	14,991	184	580,341
PERIOD 1b - Decommissioning Preparations																					
Period 1b Direct Decommissioning Activities																					
Detailed Work Procedures																					
1b.1.1.1	Plant systems	-	-	-	-	-	-	845	52	897	857	-	40	-	-	-	-	-	-	-	4,733
1b.1.1.2	NSSS Decontamination Flush	-	-	-	-	-	-	73	11	84	84	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.3	Reactor internals	-	-	-	-	-	-	292	44	336	336	-	-	-	-	-	-	-	-	-	4,000
1b.1.1.4	Remaining buildings	-	-	-	-	-	-	98	15	113	28	-	85	-	-	-	-	-	-	-	1,350
1b.1.1.5	CRD housings & NIs	-	-	-	-	-	-	73	11	84	84	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.6	Incore instrumentation	-	-	-	-	-	-	73	11	84	84	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.7	Removal primary containment	-	-	-	-	-	-	11	2	12	12	-	-	-	-	-	-	-	-	-	145
1b.1.1.8	Reactor vessel	-	-	-	-	-	-	265	40	305	305	-	-	-	-	-	-	-	-	-	3,630
1b.1.1.9	Facility closeout	-	-	-	-	-	-	88	13	101	50	-	50	-	-	-	-	-	-	-	1,200
1b.1.1.10	Sacrificial shield	-	-	-	-	-	-	88	13	101	101	-	-	-	-	-	-	-	-	-	1,200
1b.1.1.11	Reinforced concrete	-	-	-	-	-	-	73	11	84	42	-	42	-	-	-	-	-	-	-	1,000
1b.1.1.12	Turbine & condensers	-	-	-	-	-	-	304	46	350	350	-	-	-	-	-	-	-	-	-	4,167
1b.1.1.13	Moisture separators & reheaters	-	-	-	-	-	-	146	22	168	168	-	-	-	-	-	-	-	-	-	2,000
1b.1.1.14	Radwaste building	-	-	-	-	-	-	199	30	229	206	-	23	-	-	-	-	-	-	-	2,730
1b.1.1.15	Reactor building	-	-	-	-	-	-	199	30	229	206	-	23	-	-	-	-	-	-	-	2,730
1b.1.1	Total	-	-	-	-	-	-	2,826	349	2,675	2,413	-	263	-	-	-	-	-	-	-	31,886
1b.1.2	Decon NSSS	534	-	-	-	-	-	-	267	801	801	-	-	-	-	-	-	-	-	1,067	-
1b.1	Subtotal Period 1b Activity Costs	534	-	-	-	-	-	2,326	616	3,477	3,214	-	263	-	-	-	-	-	-	1,067	31,886
Period 1b Additional Costs																					
1b.2.1	Spent Fuel Pool Isolation	-	-	-	-	-	-	7,879	1,182	9,060	9,060	-	-	-	-	-	-	-	-	-	-
1b.2.2	Site Characterization	-	-	-	-	-	-	696	104	800	800	-	-	-	-	-	-	-	-	-	-
1b.2	Subtotal Period 1b Additional Costs	-	-	-	-	-	-	8,574	1,286	9,860	9,860	-	-	-	-	-	-	-	-	-	-
Period 1b Collateral Costs																					
1b.3.1	Decon equipment	710	-	-	-	-	-	-	107	817	817	-	-	-	-	-	-	-	-	-	-
1b.3.2	Process liquid waste	28	-	224	222	-	2,137	-	604	3,215	3,215	-	-	-	-	2,642	-	-	437,254	97	-
1b.3.3	Small tool allowance	-	1	-	-	-	-	-	0	1	1	-	-	-	-	-	-	-	-	-	-
1b.3.4	Pipe cutting equipment	-	911	-	-	-	-	-	137	1,048	1,048	-	-	-	-	-	-	-	-	-	-
1b.3	Subtotal Period 1b Collateral Costs	738	912	224	222	-	2,137	-	847	5,081	5,081	-	-	-	-	2,642	-	-	437,254	97	-
Period 1b Period-Dependent Costs																					
1b.4.1	Decon supplies	22	-	-	-	-	-	-	5	27	27	-	-	-	-	-	-	-	-	-	-
1b.4.2	Insurance	-	-	-	-	-	-	322	32	354	354	-	-	-	-	-	-	-	-	-	-
1b.4.3	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1b.4.4	Health physics supplies	-	232	-	-	-	-	-	58	290	290	-	-	-	-	-	-	-	-	-	-
1b.4.5	Heavy equipment rental	-	173	-	-	-	-	-	26	198	198	-	-	-	-	-	-	-	-	-	-

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TABLE C
HOPE CREEK NUCLEAR GENERATING STATION
DETAILED COST ANALYSIS
(Thousands of 2002 Dollars)

...ivity ...dex	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 Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
...d 1b Period-Dependent Costs (continued)																					
.6	Disposal of DAW generated	-	-	7	2	-	27	-	8	44	44	-	-	-	385	-	-	-	7,725	95	-
.7	Plant energy budget	-	-	-	-	-	-	1,623	244	1,867	1,867	-	-	-	-	-	-	-	-	-	-
.8	NRC Fees	-	-	-	-	-	-	181	18	199	199	-	-	-	-	-	-	-	-	-	-
.9	Emergency Planning Fees	-	-	-	-	-	-	17	2	18	-	18	-	-	-	-	-	-	-	-	-
.10	ISFSI Transfer and Capital Costs	-	-	-	-	-	-	1,007	151	1,158	-	1,158	-	-	-	-	-	-	-	-	-
.11	Spent Fuel Pool O&M	-	-	-	-	-	-	470	71	541	-	541	-	-	-	-	-	-	-	-	-
.12	ISRA Compliance Staff	-	-	-	-	-	-	408	60	468	468	-	-	-	-	-	-	-	-	-	-
.13	Dry Fuel Storage O&M Costs	-	-	-	-	-	-	11	2	13	-	13	-	-	-	-	-	-	-	-	-
.14	Security Staff Cost	-	-	-	-	-	-	567	85	652	652	-	-	-	-	-	-	-	-	-	29,219
.15	Utility Staff Cost	-	-	-	-	-	-	14,446	2,167	16,612	16,612	-	-	-	-	-	-	-	-	-	218,234
.	Subtotal Period 1b Period-Dependent Costs	22	404	7	2	-	27	19,048	2,928	22,496	20,706	1,730	-	-	385	-	-	-	7,725	95	247,453
	TOTAL PERIOD 1b COST	1,294	1,817	231	224	-	2,164	29,946	5,677	40,864	38,881	1,730	263	-	385	2,642	-	-	444,979	1,258	279,339
...OD 1 TOTALS		1,294	2,129	246	228	-	2,218	75,168	12,594	93,874	89,989	3,810	576	-	1,134	2,642	-	-	459,970	1,442	859,680
...OD 2a - Large Component Removal																					
...d 2a Direct Decommissioning Activities																					
...ar Steam Supply System Removal																					
.1.1	Recirculation System Piping & Valves	128	102	23	16	-	597	-	268	1,227	1,227	-	-	-	1,654	-	-	-	142,614	4,338	-
.1.2	Recirculation Pumps & Motors	93	46	16	12	80	784	-	219	1,089	1,089	-	-	104	1,031	-	-	-	150,250	1,626	-
.1.3	CRDMs & NIs Removal	220	165	329	47	-	689	-	364	1,814	1,814	-	-	-	5,586	-	-	-	141,063	7,193	-
.1.4	Reactor Vessel Internals	214	2,288	5,635	1,260	-	11,605	225	9,383	30,610	30,610	-	-	-	878	2,353	918	-	455,665	33,348	1,466
.1.5	Reactor Vessel	39	4,671	1,708	476	-	9,083	225	8,564	24,906	24,906	-	-	-	10,925	2,379	-	-	1,429,550	38,348	1,466
.1	Totals	690	7,272	7,709	1,810	80	22,789	449	18,898	59,646	59,645	-	-	104	19,933	4,732	918	-	2,319,141	79,852	2,932
...val of Major Equipment																					
.2	Main Turbine/Generator	-	482	607	197	5,452	3,562	-	1,917	12,207	12,207	-	-	27,260	11,311	-	-	-	1,014,885	9,403	-
.3	Main Condensers	-	2,119	594	148	5,598	1,931	-	1,828	12,257	12,257	-	-	27,989	6,148	-	-	-	651,650	41,623	-
...val of Plant Systems																					
.4.1	Circulating Water (DA)	-	140	-	-	-	-	-	21	161	-	-	161	-	-	-	-	-	-	2,958	-
.4.2	Circulating Water - ROA (DA)	-	259	8	15	592	-	-	217	1,491	1,491	-	-	4,950	-	-	-	-	-	5,212	-
.4.3	Circulating Water Acid Injection (DE)	-	8	-	-	-	-	-	1	10	-	-	10	-	-	-	-	-	-	184	-
.4.4	Circulating Water Dispersion (DG)	-	10	-	-	-	-	-	1	11	-	-	11	-	-	-	-	-	-	203	-
.4.5	Circulating Water Hypochlorination (DD)	-	46	-	-	-	-	-	7	53	-	-	53	-	-	-	-	-	-	955	-
.4.6	Condensate (AD)	-	1,775	231	70	1,838	8,091	-	2,276	12,281	12,281	-	-	9,191	13,897	-	-	-	1,246,886	56,576	-
.4.7	Condensate Demineralizer Process (AR)	-	654	38	12	387	829	-	434	2,354	2,354	-	-	1,937	2,044	-	-	-	169,574	13,285	-
.4.8	Condensate Pre-filter	-	174	19	6	146	481	-	188	1,014	1,014	-	-	729	1,122	-	-	-	98,462	3,532	-
.4.9	Condensate Transfer (AP)	-	930	50	15	513	1,082	-	587	3,178	3,178	-	-	2,567	2,592	-	-	-	221,371	18,832	-
.4.10	Condenser Air Removal (CG)	-	489	19	8	310	444	-	270	1,491	1,491	-	-	1,649	1,014	-	-	-	90,909	8,876	-
.4.11	Containment Atmosphere Control (GS)	-	262	2	4	247	-	-	108	618	618	-	-	1,233	-	-	-	-	-	5,268	-
.4.12	Cooling Tower (DB)	-	18	-	-	-	-	-	3	21	-	-	21	-	-	-	-	-	-	394	-
.4.13	Extraction Steam (AF)	-	1,102	53	25	1,070	1,216	-	749	4,215	4,215	-	-	5,852	2,775	-	-	-	248,900	22,439	-
.4.14	Feedwater (AE)	-	701	76	24	644	2,090	-	806	4,341	4,341	-	-	3,222	4,766	-	-	-	427,604	14,466	-
.4.15	Gaseous Radwaste (HA)	-	848	31	17	791	849	-	498	2,834	2,834	-	-	3,953	1,526	-	-	-	132,796	17,146	-
.4.16	Generator Gas Control (GC)	-	28	0	0	16	-	-	9	53	53	-	-	79	-	-	-	-	-	514	-
.4.17	Generator Seal Oil (CD)	-	47	0	1	51	-	-	20	119	119	-	-	256	-	-	-	-	-	923	-
.4.18	Gland Steam Removal (CJ,CP,CV)	-	267	2	4	242	-	-	104	618	618	-	-	1,209	-	-	-	-	-	5,874	-
.4.19	Leak Detection (SK)	-	4	0	0	1	3	-	2	10	10	-	-	3	3	-	-	-	685	79	-
.4.20	Leak Rate Test Equipment (GP)	-	13	0	0	4	5	-	5	27	27	-	-	20	12	-	-	-	1,056	256	-
.4.21	Lube Oil Storg/Transfr/Purification (OF)	-	45	-	-	-	-	-	7	52	-	-	52	-	-	-	-	-	-	938	-

TABLE C
HOPE CREEK NUCLEAR GENERATING STATION
DETAILED COST ANALYSIS
(Thousands of 2002 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 Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
Disposal of Plant Systems (continued)																					
2a.1.4.22	MSIV Sealing (KP)	-	5	0	0	3	-	-	2	11	11	-	-	16	-	-	-	-	-	103	-
2a.1.4.23	Main Generator (MA)	-	8	0	0	18	-	-	5	31	31	-	-	90	-	-	-	-	-	152	-
2a.1.4.24	Main Steam (AB)	-	820	39	20	893	892	-	569	3,233	3,233	-	-	4,467	2,034	-	-	-	182,467	16,859	-
2a.1.4.25	Main Turbine (AC)	-	769	71	30	1,158	1,788	-	825	4,641	4,641	-	-	5,790	4,079	-	-	-	365,924	15,761	-
2a.1.4.26	Main Turbine Control Oil (CH)	-	96	1	1	62	-	-	34	193	193	-	-	310	-	-	-	-	-	1,784	-
2a.1.4.27	Miscellaneous (QC,QM,XX)	-	0	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	-	8	-
2a.1.4.28	Neutron Monitoring (SE)	-	55	4	1	17	112	-	45	235	235	-	-	88	255	-	-	-	22,955	1,151	-
2a.1.4.29	Reactor Protection (SB)	-	13	-	-	-	-	-	2	15	-	-	15	-	-	-	-	-	-	267	-
2a.1.4.30	Safety & Turbine Auxiliary Cooling (EG)	-	2,811	37	70	4,588	-	-	1,405	8,911	8,911	-	-	22,938	-	-	-	-	-	57,302	-
2a.1.4.31	Sampling (RC)	-	289	5	1	26	80	-	97	498	498	-	-	129	182	-	-	-	16,328	6,235	-
2a.1.4.32	Stator Cooling (CE)	-	47	0	1	38	-	-	18	103	103	-	-	191	-	-	-	-	-	914	-
2a.1.4.33	Steam Removal (FW)	-	61	-	-	-	-	-	9	70	-	-	70	-	-	-	-	-	-	1,315	-
2a.1.4.34	Turbine Generator Lube Oil (GB)	-	157	4	8	493	-	-	115	777	777	-	-	2,465	-	-	-	-	-	3,119	-
2a.1.4.35	Turbine Sealing Steam (CA)	-	502	19	7	275	481	-	278	1,513	1,518	-	-	1,377	984	-	-	-	88,255	10,136	-
2a.1.4	Totals	-	13,405	711	338	14,823	16,194	-	9,711	55,182	54,769	-	393	74,116	87,383	-	-	-	3,313,568	273,507	-
2a.1.5	Scaffolding in support of decommissioning	-	2,066	20	5	222	48	-	565	2,926	2,926	-	-	1,109	153	-	-	-	13,760	46,433	-
2a.1	Subtotal Period 2a Activity Costs	690	25,844	5,561	2,498	26,125	44,813	449	33,016	142,216	141,828	-	393	180,577	74,935	4,732	918	-	7,213,104	450,818	2,932
Period 2a Additional Costs																					
2a.2.1	Curie Surcharge (Excluding RPV)	-	-	-	-	-	1,347	-	337	1,684	1,684	-	-	-	-	-	-	-	-	-	-
2a.2	Subtotal Period 2a Additional Costs	-	-	-	-	-	1,347	-	337	1,684	1,684	-	-	-	-	-	-	-	-	-	-
Period 2a Collateral Costs																					
2a.3.1	Process liquid waste	56	-	21	50	-	242	-	98	467	467	-	-	-	-	392	-	-	49,459	77	-
2a.3.2	Small tool allowance	-	401	-	-	-	-	-	60	461	415	-	46	-	-	-	-	-	-	-	-
2a.3	Subtotal Period 2a Collateral Costs	56	401	21	50	-	242	-	158	928	882	-	46	-	-	392	-	-	49,459	77	-
Period 2a Period-Dependent Costs																					
2a.4.1	Decon supplies	67	-	-	-	-	-	-	17	84	84	-	-	-	-	-	-	-	-	-	-
2a.4.2	Insurance	-	-	-	-	-	-	1,010	101	1,111	1,111	-	-	-	-	-	-	-	-	-	-
2a.4.3	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2a.4.4	Health physics supplies	-	2,258	-	-	-	-	-	564	2,822	2,822	-	-	-	-	-	-	-	-	-	-
2a.4.5	Heavy equipment rental	-	2,932	-	-	-	-	-	440	3,372	3,372	-	-	-	-	-	-	-	-	-	-
2a.4.6	Disposal of DAW generated	-	-	175	48	-	659	-	189	1,071	1,071	-	-	-	9,409	-	-	-	188,558	2,310	-
2a.4.7	Plant energy budget	-	-	-	-	-	-	2,420	363	2,783	2,783	-	-	-	-	-	-	-	-	-	-
2a.4.8	NRC Fees	-	-	-	-	-	-	496	50	546	546	-	-	-	-	-	-	-	-	-	-
2a.4.9	Emergency Planning Fees	-	-	-	-	-	-	52	5	57	-	57	-	-	-	-	-	-	-	-	-
2a.4.10	ISFSI Transfer and Capital Costs	-	-	-	-	-	-	275	41	316	-	316	-	-	-	-	-	-	-	-	-
2a.4.11	Spent Fuel Pool O&M	-	-	-	-	-	-	1,475	221	1,697	-	1,697	-	-	-	-	-	-	-	-	-
2a.4.12	ISRA Compliance Staff	-	-	-	-	-	-	1,263	189	1,453	1,453	-	-	-	-	-	-	-	-	-	-
2a.4.13	Dry Fuel Storage O&M Costs	-	-	-	-	-	-	36	5	41	-	41	-	-	-	-	-	-	-	-	-
2a.4.14	Security Staff Cost	-	-	-	-	-	-	2,220	333	2,553	2,553	-	-	-	-	-	-	-	-	-	114,411
2a.4.15	Utility Staff Cost	-	-	-	-	-	-	41,666	6,250	47,915	47,915	-	-	-	-	-	-	-	-	-	626,423
2a.4	Subtotal Period 2a Period-Dependent Costs	67	5,190	175	48	-	659	50,912	8,769	65,820	63,710	2,110	-	-	9,409	-	-	-	188,558	2,310	740,834
2a.0	TOTAL PERIOD 2a COST	813	30,934	5,777	2,596	26,125	46,761	51,361	42,260	210,648	208,098	2,110	439	180,577	84,344	5,125	918	-	7,451,121	453,205	743,766

TABLE C
HOPE CREEK NUCLEAR GENERATING STATION
DETAILED COST ANALYSIS
(Thousands of 2002 Dollars)

vity lex	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 Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
	IOD 2b - Site Decontamination																				
	d 2b Direct Decommissioning Activities																				
	al of Plant Systems																				
1 1	Control Rod Drive Hydraulic Supply (BF)	-	1,522	84	15	274	1,590	-	830	4,315	4,315	-	-	1,371	3,630	-	-	-	325,259	29,896	-
1 2	Core Spray Control (BE)	207	348	32	7	110	807	-	418	1,925	1,925	-	-	552	1,842	-	-	-	166,188	8,524	-
1 3	Drywell Ventilation (GT)	-	60	2	1	83	24	-	34	204	204	-	-	418	56	-	-	-	4,986	1,165	-
1 4	HPCI Steam (FD)	-	147	9	3	70	217	-	103	549	549	-	-	352	494	-	-	-	44,330	2,995	-
1 5	High Pressure Coolant Injection (BJ)	120	181	36	8	111	893	-	350	1,700	1,700	-	-	557	2,038	-	-	-	182,751	4,412	-
1 6	Miscellaneous Nuclear Boiler Recirc (BB)	1	139	8	3	86	219	-	105	562	562	-	-	431	501	-	-	-	44,910	2,888	-
1 7	RCIC Steam (FE,FC)	318	384	15	7	308	344	-	390	1,765	1,765	-	-	1,538	785	-	-	-	70,389	10,236	-
1 8	Reactor Auxiliaries Cooling (ED)	-	529	10	18	1,154	-	-	309	2,019	2,019	-	-	5,771	-	-	-	-	-	10,490	-
1 9	Reactor Core Isolation Cooling (BD)	49	97	11	2	31	276	-	124	589	589	-	-	155	629	-	-	-	56,446	2,520	-
1 10	Reactor Water Cleanup (BG)	240	369	28	5	71	576	-	370	1,654	1,654	-	-	354	1,314	-	-	-	117,858	10,340	-
1 11	Refueling Water Transfer (BN)	41	92	3	2	82	59	-	71	349	349	-	-	408	135	-	-	-	12,136	2,145	-
1 12	Residual Heat Removal (BC)	1,130	1,178	190	42	595	4,787	-	2,158	10,030	10,030	-	-	2,973	10,808	-	-	-	969,876	30,400	-
1 13	Standby Liquid Control (BH)	-	41	0	1	41	-	-	16	99	99	-	-	204	-	-	-	-	-	799	-
	Totals	2,106	5,086	424	113	3,016	9,743	-	5,272	25,760	25,760	-	-	15,079	22,233	-	-	-	1,993,667	116,770	-
2	Scaffolding in support of decommissioning	-	2,582	25	6	277	60	-	706	3,656	3,656	-	-	1,386	192	-	-	-	17,199	58,041	-
	tamination of Site Buildings																				
3.1	Reactor Building	6,041	3,096	816	276	3,170	6,367	-	5,965	25,529	25,529	-	-	15,851	24,764	-	-	-	2,239,997	172,651	-
3.2	Low Level Radwaste Storage Facility	119	59	9	7	8	18	-	81	295	295	-	-	39	694	-	-	-	59,076	3,366	-
3.3	Service & Radwaste Building	499	252	41	31	87	105	-	353	1,319	1,319	-	-	185	2,662	-	-	-	255,202	14,835	-
3.4	Turbine Building	1,989	1,311	166	128	918	289	-	1,568	6,368	6,868	-	-	4,589	10,176	-	-	-	1,000,920	63,894	-
3	Totals	8,648	4,719	880	442	4,183	6,774	-	7,968	33,511	33,511	-	-	20,663	38,196	-	-	-	3,555,195	253,746	-
	Subtotal Period 2b Activity Costs	10,754	12,387	1,278	561	7,426	16,577	-	13,944	62,927	62,927	-	-	37,128	60,620	-	-	-	5,566,061	428,557	-
	d 2b Collateral Costs																				
1	Process liquid waste	88	-	678	670	-	6,480	-	1,817	9,674	9,674	-	-	-	-	7,954	-	-	1,315,776	295	-
2	Small tool allowance	-	386	-	-	-	-	-	58	444	444	-	-	-	-	-	-	-	-	-	-
	Subtotal Period 2b Collateral Costs	88	386	678	670	-	6,480	-	1,875	10,119	10,119	-	-	-	-	7,954	-	-	1,315,776	295	-
	d 2b Period-Dependent Costs																				
1	Decon supplies	1,832	-	-	-	-	-	-	458	2,290	2,290	-	-	-	-	-	-	-	-	-	-
2	Insurance	-	-	-	-	-	-	624	62	686	686	-	-	-	-	-	-	-	-	-	-
3	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	Health physics supplies	-	2,590	-	-	-	-	-	648	3,238	3,238	-	-	-	-	-	-	-	-	-	-
5	Heavy equipment rental	-	4,800	-	-	-	-	-	720	5,520	5,520	-	-	-	-	-	-	-	-	-	-
6	Disposal of DAW generated	-	-	169	47	-	636	-	183	1,035	1,036	-	-	-	9,089	-	-	-	182,142	2,232	-
7	Plant energy budget	-	-	-	-	-	-	3,000	450	3,450	3,450	-	-	-	-	-	-	-	-	-	-
8	NRC Fees	-	-	-	-	-	-	708	71	779	779	-	-	-	-	-	-	-	-	-	-
9	Emergency Planning Fees	-	-	-	-	-	-	81	8	90	-	90	-	-	-	-	-	-	-	-	-
10	ISFSI Transfer and Capital Costs	-	-	-	-	-	-	23,006	3,451	26,456	-	26,456	-	-	-	-	-	-	-	-	-
11	Spent Fuel Pool O&M	-	-	-	-	-	-	2,317	348	2,664	-	2,664	-	-	-	-	-	-	-	-	-
12	Radwaste Processing Equipment/Services	-	-	-	-	-	-	440	66	506	506	-	-	-	-	-	-	-	-	-	-
13	ISRA Compliance Staff	-	-	-	-	-	-	1,984	298	2,281	2,281	-	-	-	-	-	-	-	-	-	-
14	Dry Fuel Storage O&M Costs	-	-	-	-	-	-	56	8	65	-	65	-	-	-	-	-	-	-	-	-
15	Security Staff Cost	-	-	-	-	-	-	2,794	419	3,213	3,213	-	-	-	-	-	-	-	-	-	143,994
16	Utility Staff Cost	-	-	-	-	-	-	63,874	9,581	73,455	73,455	-	-	-	-	-	-	-	-	-	963,360
	Subtotal Period 2b Period-Dependent Costs	1,832	7,390	169	47	-	636	98,884	16,770	125,728	96,453	29,275	-	-	9,089	-	-	-	182,142	2,232	1,107,354
	TOTAL PERIOD 2b COST	12,670	20,163	2,120	1,278	7,426	23,644	98,884	32,669	198,773	169,498	29,275	-	37,128	69,709	7,954	-	-	7,063,978	431,083	1,107,354

TABLE C
HOPE CREEK NUCLEAR GENERATING STATION
DETAILED COST ANALYSIS
(Thousands of 2002 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 Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
PERIOD 2c - Decontamination Following Wet Fuel Storage																					
Period 2c Direct Decommissioning Activities																					
2c.1.1	Remove spent fuel racks	827	76	187	85	1,321	456	-	768	8,616	8,616	-	-	6,606	1,451	-	-	-	130,201	1,622	-
Disposal of Plant Systems																					
2c.1.2.1	Administration Building HVAC (GC)	-	49	-	-	-	-	-	7	56	-	-	56	-	-	-	-	-	-	1,082	-
2c.1.2.2	Asphlt Strg/Pmp Hse/Aux Boiler HVAC (GF)	-	32	-	-	-	-	-	5	37	-	-	37	-	-	-	-	-	-	649	-
2c.1.2.3	Auxiliary Oil Storage (JA)	-	190	-	-	-	-	-	28	218	-	-	218	-	-	-	-	-	-	3,861	-
2c.1.2.4	Auxiliary Steam Generators (FA)	-	44	-	-	-	-	-	7	51	-	-	51	-	-	-	-	-	-	920	-
2c.1.2.5	Breathing Air (KG,KH)	-	300	2	4	242	-	-	112	660	660	-	-	1,212	-	-	-	-	-	5,830	-
2c.1.2.6	Building & Equip Radwaste Drains (HG)	2,637	2,960	145	80	152	4,108	-	3,127	13,160	13,160	-	-	761	9,637	-	-	-	840,555	104,933	-
2c.1.2.7	Chemical Waste (LD)	-	20	-	-	-	-	-	3	22	-	-	22	-	-	-	-	-	-	421	-
2c.1.2.8	Chilled Water (GB)	-	851	12	22	1,428	-	-	431	2,744	2,744	-	-	7,140	-	-	-	-	-	16,723	-
2c.1.2.9	Control Area Chilled Water (GJ)	-	195	-	-	-	-	-	29	225	-	-	225	-	-	-	-	-	-	4,271	-
2c.1.2.10	Control Room Supply & Exhaust (GK)	-	34	-	-	-	-	-	5	40	-	-	40	-	-	-	-	-	-	732	-
2c.1.2.11	Decon Facility (HD)	-	101	3	1	18	94	-	52	269	269	-	-	92	218	-	-	-	19,149	1,999	-
2c.1.2.12	Demineralized Water Makeup/Transfer (AN)	-	708	7	18	844	-	-	308	1,878	1,878	-	-	4,220	-	-	-	-	-	13,623	-
2c.1.2.13	Diesel Area Supply & Exhaust (GM)	-	49	-	-	-	-	-	7	57	-	-	57	-	-	-	-	-	-	1,052	-
2c.1.2.14	Diesel Fuel Oil Storage & Transfer (JE)	-	170	-	-	-	-	-	26	196	-	-	196	-	-	-	-	-	-	3,518	-
2c.1.2.15	Domestic Water (KD)	-	76	-	-	-	-	-	11	87	-	-	87	-	-	-	-	-	-	1,636	-
2c.1.2.16	Domestic Water - RCA (KD)	-	154	1	2	101	-	-	67	324	324	-	-	504	-	-	-	-	-	3,022	-
2c.1.2.17	Electrical	-	3,810	-	-	-	-	-	672	4,882	-	-	4,882	-	-	-	-	-	-	77,827	-
2c.1.2.18	Electrical - RCA	-	1,016	11	14	827	119	-	411	2,397	2,397	-	-	4,136	271	-	-	-	24,309	20,565	-
2c.1.2.19	Electrical - RCA (Clean)	-	2,215	18	32	2,101	-	-	875	5,241	5,241	-	-	10,506	-	-	-	-	-	43,910	-
2c.1.2.20	Filtration/Recirc & Ventilation (GU)	-	85	2	1	66	36	-	41	231	231	-	-	332	82	-	-	-	7,331	1,689	-
2c.1.2.21	Fire Protection (KC)	-	321	-	-	-	-	-	48	369	-	-	369	-	-	-	-	-	-	6,640	-
2c.1.2.22	Fire Protection - RCA (KC)	-	930	6	11	699	-	-	339	1,985	1,985	-	-	3,497	-	-	-	-	-	18,589	-
2c.1.2.23	Fresh Water (AM)	-	57	-	-	-	-	-	9	66	-	-	66	-	-	-	-	-	-	1,187	-
2c.1.2.24	Fuel Pool Cooling (EC)	-	660	40	11	280	938	-	447	2,376	2,376	-	-	1,402	2,166	-	-	-	191,922	13,411	-
2c.1.2.25	Instrument Compressed Air (KB)	-	529	3	5	319	-	-	181	1,037	1,037	-	-	1,593	-	-	-	-	-	10,082	-
2c.1.2.26	Intake Structure HVAC (GQ)	-	11	-	-	-	-	-	2	13	-	-	13	-	-	-	-	-	-	231	-
2c.1.2.27	Liquid/Chemical Radwaste (HB)	1,672	2,038	180	39	771	3,914	-	2,463	11,077	11,077	-	-	3,856	10,011	-	-	-	800,834	67,521	-
2c.1.2.28	Normal Drains (LF,LG)	-	76	-	-	-	-	-	11	88	-	-	88	-	-	-	-	-	-	1,676	-
2c.1.2.29	Oily Waste (LE)	-	107	-	-	-	-	-	16	123	-	-	123	-	-	-	-	-	-	2,273	-
2c.1.2.30	Plant Heating (GA)	-	659	4	7	461	-	-	235	1,366	1,366	-	-	2,305	-	-	-	-	-	12,789	-
2c.1.2.31	Primary Containment Instrument Gas (KL)	-	82	1	2	106	-	-	37	228	228	-	-	532	-	-	-	-	-	1,526	-
2c.1.2.32	Process Radiation Monitoring (SP)	-	115	1	1	59	22	-	43	242	242	-	-	295	60	-	-	-	4,466	2,318	-
2c.1.2.33	Rad Laundry (HH,ZZ)	-	72	2	1	22	58	-	36	192	192	-	-	109	134	-	-	-	11,868	1,431	-
2c.1.2.34	Radwaste Tank Vent Filters (GH)	-	416	7	5	244	127	-	174	972	972	-	-	1,220	290	-	-	-	25,989	8,098	-
2c.1.2.35	Reactor Building HVAC (GR)	-	638	6	7	416	73	-	242	1,381	1,381	-	-	2,080	166	-	-	-	14,861	11,863	-
2c.1.2.36	Security (RG)	-	5	-	-	-	-	-	1	6	-	-	6	-	-	-	-	-	-	100	-
2c.1.2.37	Service Area Supply & Exhaust Air (GL)	-	40	-	-	-	-	-	6	46	-	-	46	-	-	-	-	-	-	882	-
2c.1.2.38	Service Compressed Air (KA)	-	536	3	6	374	-	-	191	1,110	1,110	-	-	1,868	-	-	-	-	-	10,167	-
2c.1.2.39	Service Water (EA)	-	57	-	-	-	-	-	8	65	-	-	65	-	-	-	-	-	-	1,182	-
2c.1.2.40	Service Water - RCA (EA)	-	214	6	10	678	-	-	157	1,065	1,066	-	-	3,389	-	-	-	-	-	4,289	-
2c.1.2.41	Service Water Hypochlorination (EP,EQ)	-	65	-	-	-	-	-	10	75	-	-	75	-	-	-	-	-	-	1,340	-
2c.1.2.42	Solid Radwaste (HC)	-	841	86	18	267	1,980	-	757	3,948	3,948	-	-	1,335	4,693	-	-	-	405,187	16,886	-
2c.1.2.43	Standby/Emergency Diesel Generator (KJ)	-	137	-	-	-	-	-	21	158	-	-	158	-	-	-	-	-	-	2,854	-
2c.1.2.44	Storm Drains (LA,LB)	-	1,227	-	-	-	-	-	184	1,411	-	-	1,411	-	-	-	-	-	-	26,161	-
2c.1.2.45	Suppression Pool/Torus Cleanup (EE)	-	64	2	1	30	48	-	33	178	178	-	-	151	109	-	-	-	9,785	1,307	-
2c.1.2.46	Turbine Building HVAC (GE)	-	849	9	10	566	133	-	333	1,900	1,900	-	-	2,832	304	-	-	-	27,228	15,932	-
2c.1.2	Totals	4,309	23,818	557	250	11,074	11,648	-	12,097	63,747	55,959	-	7,789	55,370	28,125	-	-	-	2,383,484	549,198	-

TABLE C
HOPE CREEK NUCLEAR GENERATING STATION
DETAILED COST ANALYSIS
(Thousands of 2002 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 Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
	econtamination of Site Buildings																				
1.3.1	Reactor (post fuel)	725	1,024	126	87	93	1,393	-	1,006	4,464	4,454	-	-	467	7,854	-	-	-	740,573	32,835	-
1.3	Totals	725	1,024	125	87	93	1,393	-	1,006	4,454	4,454	-	-	467	7,854	-	-	-	740,573	32,835	-
1.4	Scaffolding in support of decommissioning	-	516	5	1	66	12	-	141	731	731	-	-	277	38	-	-	-	3,440	11,608	-
1	Subtotal Period 2c Activity Costs	5,861	26,428	825	878	12,544	13,509	-	14,008	72,648	64,759	-	7,789	62,720	37,468	-	-	-	3,257,698	595,263	-
	eriod 2c Collateral Costs																				
3.1	Process liquid waste	228	-	401	498	-	3,960	-	1,219	6,306	6,306	-	-	-	-	5,225	-	-	810,324	418	-
3.2	Small tool allowance	-	549	-	-	-	-	-	81	625	625	-	-	-	-	-	-	-	-	-	-
3.3	Decommissioning Equipment Disposition	-	-	48	13	640	117	-	117	835	835	-	-	2,700	373	-	-	-	33,507	739	-
3	Subtotal Period 2c Collateral Costs	228	548	449	511	640	4,077	-	1,417	7,766	7,766	-	-	2,700	373	5,225	-	-	843,831	1,152	-
	eriod 2c Period-Dependent Costs																				
4.1	Decon supplies	140	-	-	-	-	-	-	35	175	175	-	-	-	-	-	-	-	-	-	-
4.2	Insurance	-	-	-	-	-	-	103	10	113	113	-	-	-	-	-	-	-	-	-	-
4.3	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4.4	Health physics supplies	-	2,486	-	-	-	-	-	622	3,108	3,108	-	-	-	-	-	-	-	-	-	-
4.5	Heavy equipment rental	-	1,905	-	-	-	-	-	286	2,191	2,191	-	-	-	-	-	-	-	-	-	-
4.6	Disposal of DAW generated	-	-	168	44	-	595	-	171	968	968	-	-	-	8,505	-	-	-	170,446	2,088	-
4.7	Plant energy budget	-	-	-	-	-	-	635	95	730	730	-	-	-	-	-	-	-	-	-	-
4.8	NRC Fees	-	-	-	-	-	-	356	36	392	392	-	-	-	-	-	-	-	-	-	-
4.9	Emergency Planning Fees	-	-	-	-	-	-	32	3	36	-	36	-	-	-	-	-	-	-	-	-
4.10	Radwaste Processing Equipment/Services	-	-	-	-	-	-	349	52	401	401	-	-	-	-	-	-	-	-	-	-
4.11	ISRA Compliance Staff	-	-	-	-	-	-	787	118	905	905	-	-	-	-	-	-	-	-	-	-
4.12	Dry Fuel Storage O&M Costs	-	-	-	-	-	-	23	3	26	-	26	-	-	-	-	-	-	-	-	-
4.13	Security Staff Cost	-	-	-	-	-	-	1,109	166	1,275	1,275	-	-	-	-	-	-	-	-	-	57,146
4.14	Utility Staff Cost	-	-	-	-	-	-	21,647	3,247	24,895	24,895	-	-	-	-	-	-	-	-	-	329,726
4	Subtotal Period 2c Period-Dependent Costs	140	4,391	168	44	-	595	25,041	4,845	35,214	35,153	61	-	-	8,505	-	-	-	170,446	2,088	386,871
.0	TOTAL PERIOD 2c COST	6,229	30,863	1,431	928	13,084	18,181	25,041	20,270	115,528	107,679	61	7,789	65,420	46,347	5,225	-	-	4,271,975	598,504	386,871
	ERIOD 2e - License Termination																				
	eriod 2e Direct Decommissioning Activities																				
.1.1	ORISE confirmatory survey	-	-	-	-	-	-	122	37	158	158	-	-	-	-	-	-	-	-	-	-
.1.2	Terminate license									a											
.1	Subtotal Period 2e Activity Costs	-	-	-	-	-	-	122	37	158	158	-	-	-	-	-	-	-	-	-	-
	eriod 2e Additional Costs																				
.2.1	Final Site Survey	-	-	-	-	-	-	11,286	1,693	12,978	12,978	-	-	-	-	-	-	-	-	227,317	-
.2	Subtotal Period 2e Additional Costs	-	-	-	-	-	-	11,286	1,693	12,978	12,978	-	-	-	-	-	-	-	-	227,317	-
	eriod 2e Period-Dependent Costs																				
.4.1	Insurance	-	-	-	-	-	-	80	8	88	88	-	-	-	-	-	-	-	-	-	-
.4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
.4.3	Health physics supplies	-	1,125	-	-	-	-	-	281	1,406	1,406	-	-	-	-	-	-	-	-	-	-
.4.4	Disposal of DAW generated	-	-	10	3	-	39	-	11	54	54	-	-	-	553	-	-	-	11,274	138	-
.4.5	Plant energy budget	-	-	-	-	-	-	248	37	285	285	-	-	-	-	-	-	-	-	-	-
.4.6	NRC Fees	-	-	-	-	-	-	305	31	336	336	-	-	-	-	-	-	-	-	-	-
.4.7	Emergency Planning Fees	-	-	-	-	-	-	25	3	28	-	28	-	-	-	-	-	-	-	-	-
.4.8	ISRA Compliance Staff	-	-	-	-	-	-	614	92	706	706	-	-	-	-	-	-	-	-	-	-
.4.9	Dry Fuel Storage O&M Costs	-	-	-	-	-	-	17	3	20	-	20	-	-	-	-	-	-	-	-	24,446
.4.10	Security Staff Cost	-	-	-	-	-	-	474	71	545	545	-	-	-	-	-	-	-	-	-	-

TABLE C
HOPE CREEK NUCLEAR GENERATING STATION
DETAILED COST ANALYSIS
(Thousands of 2002 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 Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
Period 2e Period-Dependent Costs (continued)																					
2e.4.11	Utility Staff Cost	-	-	-	-	-	-	11,540	1,731	13,271	13,271	-	-	-	-	-	-	-	-	-	167,177
2e.4	Subtotal Period 2e Period-Dependent Costs	-	1,125	10	8	-	89	13,304	2,266	16,749	16,701	48	-	-	563	-	-	-	11,274	138	191,623
2e.0	TOTAL PERIOD 2e COST	-	1,125	10	8	-	89	24,711	3,997	29,886	29,838	48	-	-	563	-	-	-	11,274	227,455	191,623
PERIOD 2 TOTALS		19,712	82,583	18,839	4,805	46,635	88,626	199,997	99,136	554,836	516,113	31,494	8,228	233,125	200,963	18,304	918	-	18,798,350	1,710,248	2,429,615
PERIOD 3b - Site Restoration																					
Period 3b Direct Decommissioning Activities																					
Demolition of Remaining Site Buildings																					
3b.1.1.1	Reactor Building	-	13,159	-	-	-	-	-	1,974	15,133	2,270	-	12,863	-	-	-	-	-	-	164,666	-
3b.1.1.2	Administration Bldg (U2 Turbine Bldg)	-	1,887	-	-	-	-	-	283	2,170	-	-	2,170	-	-	-	-	-	-	25,536	-
3b.1.1.3	Administration Building (TB2)	-	1,671	-	-	-	-	-	251	1,921	-	-	1,921	-	-	-	-	-	-	26,644	-
3b.1.1.4	Aux Boiler & Domestic Wtr Pre-Treat Bldg	-	459	-	-	-	-	-	69	527	-	-	527	-	-	-	-	-	-	6,222	-
3b.1.1.5	Barge Facility	-	3,125	-	-	-	-	-	469	3,594	-	-	3,594	-	-	-	-	-	-	40,381	-
3b.1.1.6	Carpenter Shop	-	34	-	-	-	-	-	5	39	-	-	39	-	-	-	-	-	-	549	-
3b.1.1.7	Centralized Warehouse	-	1,541	-	-	-	-	-	231	1,772	-	-	1,772	-	-	-	-	-	-	18,426	-
3b.1.1.8	Change House	-	139	-	-	-	-	-	21	160	-	-	160	-	-	-	-	-	-	1,793	-
3b.1.1.9	Circulating Water Pump Structure	-	1,919	-	-	-	-	-	288	2,207	-	-	2,207	-	-	-	-	-	-	29,328	-
3b.1.1.10	Cooling Tower	-	496	-	-	-	-	-	74	570	-	-	570	-	-	-	-	-	-	7,678	-
3b.1.1.11	Diesel & Control Building	-	4,662	-	-	-	-	-	699	5,362	-	-	5,362	-	-	-	-	-	-	67,685	-
3b.1.1.12	Fire Water Pump House	-	36	-	-	-	-	-	5	42	-	-	42	-	-	-	-	-	-	518	-
3b.1.1.13	Fire Water Tank Fdn and Valve Pit	-	91	-	-	-	-	-	14	104	-	-	104	-	-	-	-	-	-	1,160	-
3b.1.1.14	Guard House	-	157	-	-	-	-	-	24	180	-	-	180	-	-	-	-	-	-	2,658	-
3b.1.1.15	Guard House Emergency Generator Building	-	7	-	-	-	-	-	1	8	-	-	8	-	-	-	-	-	-	110	-
3b.1.1.16	Low Level Radwaste Storage Facility	-	879	-	-	-	-	-	132	1,011	51	-	960	-	-	-	-	-	-	12,018	-
3b.1.1.17	Miscellaneous Site Structures	-	325	-	-	-	-	-	49	374	-	-	374	-	-	-	-	-	-	5,518	-
3b.1.1.18	Miscellaneous Yard Tanks & Pads	-	1,408	-	-	-	-	-	211	1,619	-	-	1,619	-	-	-	-	-	-	17,417	-
3b.1.1.19	Nuclear Service Building	-	386	-	-	-	-	-	58	444	-	-	444	-	-	-	-	-	-	6,197	-
3b.1.1.20	Service & Radwaste Building	-	6,021	-	-	-	-	-	903	6,924	692	-	6,232	-	-	-	-	-	-	88,754	-
3b.1.1.21	Service Water Intake Structure	-	1,364	-	-	-	-	-	205	1,568	-	-	1,568	-	-	-	-	-	-	16,680	-
3b.1.1.22	Turbine Building	-	14,436	-	-	-	-	-	2,165	16,601	1,660	-	14,941	-	-	-	-	-	-	238,992	-
3b.1.1.23	Turbine Pedestal	-	1,606	-	-	-	-	-	241	1,846	-	-	1,846	-	-	-	-	-	-	19,164	-
3b.1.1.24	Unit 2 Reactor Building Foundation	-	6,143	-	-	-	-	-	921	7,065	-	-	7,065	-	-	-	-	-	-	74,280	-
3b.1.1.25	Unit 2 Turbine Pedestal	-	1,444	-	-	-	-	-	217	1,660	-	-	1,660	-	-	-	-	-	-	17,091	-
3b.1.1	Totals	-	63,394	-	-	-	-	-	9,509	72,903	4,673	-	68,230	-	-	-	-	-	-	889,459	-
Site Closeout Activities																					
3b.1.2	BackFill Site	-	1,351	-	-	-	-	-	203	1,554	-	-	1,554	-	-	-	-	-	-	6,011	-
3b.1.3	Grade & landscape site	-	593	-	-	-	-	-	89	681	-	-	681	-	-	-	-	-	-	1,946	-
3b.1.4	Final report to NRC	-	-	-	-	-	-	114	17	131	131	-	-	-	-	-	-	-	-	-	1,550
3b.1	Subtotal Period 3b Activity Costs	-	65,338	-	-	-	-	114	9,818	75,270	4,804	-	70,466	-	-	-	-	-	-	897,416	1,550
Period 3b Additional Costs																					
3b.2.1	Concrete Crushing	-	-	-	-	-	-	1,515	227	1,742	-	-	1,742	-	-	-	-	-	-	9,071	-
3b.2.2	Asbestos Disposal	-	-	-	-	-	-	1,405	211	1,616	1,616	-	-	-	-	-	-	-	-	-	-
3b.2	Subtotal Period 3b Additional Costs	-	-	-	-	-	-	2,920	438	3,358	1,616	-	1,742	-	-	-	-	-	-	9,071	-
Period 3b Collateral Costs																					
3b.3.1	Small tool allowance	-	822	-	-	-	-	-	123	945	-	-	945	-	-	-	-	-	-	-	-
3b.3	Subtotal Period 3b Collateral Costs	-	822	-	-	-	-	-	123	945	-	-	945	-	-	-	-	-	-	-	-

TABLE C
HOPE CREEK NUCLEAR GENERATING STATION
DETAILED COST ANALYSIS
(Thousands of 2002 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 Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
	od 3b Period-Dependent Costs																				
1	Insurance	-	-	-	-	-	-	243	24	268	0	241	27	-	-	-	-	-	-	-	-
2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	Heavy equipment rental	-	6,097	-	-	-	-	-	915	7,012	-	-	7,012	-	-	-	-	-	-	-	-
4	Plant energy budget	-	-	-	-	-	-	376	56	432	-	216	216	-	-	-	-	-	-	-	-
5	NRC ISFSI Fees	-	-	-	-	-	-	183	18	201	-	201	-	-	-	-	-	-	-	-	-
6	Emergency Planning Fees	-	-	-	-	-	-	76	8	84	-	84	-	-	-	-	-	-	-	-	-
7	ISFSI Transfer and Capital Costs	-	-	-	-	-	-	503	76	579	-	579	-	-	-	-	-	-	-	-	-
8	Dry Fuel Storage O&M Costs	-	-	-	-	-	-	53	8	61	-	61	-	-	-	-	-	-	-	-	-
9	Security Staff Cost	-	-	-	-	-	-	1,438	216	1,654	(0)	1,108	546	-	-	-	-	-	-	-	74,134
10	Utility Staff Cost	-	-	-	-	-	-	19,929	2,989	22,918	-	11,457	11,457	-	-	-	-	-	-	-	285,776
	Subtotal Period 3b Period-Dependent Costs	-	6,097	-	-	-	-	22,797	4,309	33,203	(0)	13,946	19,257	-	-	-	-	-	-	-	359,910
	TOTAL PERIOD 3b COST	-	72,257	-	-	-	-	25,830	14,688	112,775	6,419	13,946	92,410	-	-	-	-	-	-	906,487	861,470
	RIOD 3c - Fuel Storage Operations/Shipping																				
	od 3c Direct Decommissioning Activities																				
	o direct activities in this period																				
	od 3c Period-Dependent Costs																				
.1	Insurance	-	-	-	-	-	-	1,109	111	1,220	-	1,220	-	-	-	-	-	-	-	-	-
.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
.3	Plant energy budget	-	-	-	-	-	-	285	43	328	-	328	-	-	-	-	-	-	-	-	-
.4	NRC ISFSI Fees	-	-	-	-	-	-	857	86	942	-	942	-	-	-	-	-	-	-	-	-
.5	Emergency Planning Fees	-	-	-	-	-	-	359	36	395	-	395	-	-	-	-	-	-	-	-	-
.6	ISFSI Transfer and Capital Costs	-	-	-	-	-	-	1,784	268	2,052	-	2,052	-	-	-	-	-	-	-	-	-
.7	Dry Fuel Storage O&M Costs	-	-	-	-	-	-	240	36	276	-	276	-	-	-	-	-	-	-	-	-
.8	Utility Staff Cost	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Subtotal Period 3c Period-Dependent Costs	-	-	-	-	-	-	4,634	579	5,213	-	5,213	-	-	-	-	-	-	-	-	-
.0	TOTAL PERIOD 3c COST	-	-	-	-	-	-	4,634	579	5,213	-	5,213	-	-	-	-	-	-	-	-	-
	RIOD 3d - GTCC shipping																				
	iod 3d Direct Decommissioning Activities																				
	clear Steam Supply System Removal																				
1.1.1	Vessel & Internals GTCC Disposal	-	-	-	-	-	11,910	-	1,787	13,697	13,697	-	-	-	-	-	-	851	-	-	-
1.1	Totals	-	-	-	-	-	11,910	-	1,787	13,697	13,697	-	-	-	-	-	-	851	-	-	-
1	Subtotal Period 3d Activity Costs	-	-	-	-	-	11,910	-	1,787	13,697	13,697	-	-	-	-	-	-	851	-	-	-
	iod 3d Period-Dependent Costs																				
4.1	Insurance	-	-	-	-	-	-	4	0	5	-	5	-	-	-	-	-	-	-	-	-
4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4.3	Plant energy budget	-	-	-	-	-	-	1	0	1	-	1	-	-	-	-	-	-	-	-	-
4.4	NRC ISFSI Fees	-	-	-	-	-	-	5	0	5	-	5	-	-	-	-	-	-	-	-	-
4.5	Emergency Planning Fees	-	-	-	-	-	-	2	0	2	-	2	-	-	-	-	-	-	-	-	-
4.6	ISFSI Transfer and Capital Costs	-	-	-	-	-	-	229	34	263	-	263	-	-	-	-	-	-	-	-	-
4.7	Dry Fuel Storage O&M Costs	-	-	-	-	-	-	1	0	1	-	1	-	-	-	-	-	-	-	-	-
4.8	Utility Staff Cost	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
.4	Subtotal Period 3d Period-Dependent Costs	-	-	-	-	-	-	242	35	278	-	278	-	-	-	-	-	-	-	-	-
.0	TOTAL PERIOD 3d COST	-	-	-	-	-	11,910	242	1,822	13,975	13,697	278	-	-	-	-	-	851	-	-	-

TABLE C
HOPE CREEK NUCLEAR GENERATING STATION
DETAILED COST ANALYSIS
(Thousands of 2002 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 Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
PERIOD 3e - ISFSI Decontamination																					
Period 3e Direct Decommissioning Activities																					
	No direct activities in this period																				
Period 3e Additional Costs																					
3e.2.1	ISFSI License Termination	-	516	5	40	-	159	487	248	1,454	-	1,454	-	-	8,563	-	-	-	407,348	8,422	864
3e.2	Subtotal Period 3e Additional Costs	-	516	5	40	-	159	487	248	1,454	-	1,454	-	-	8,563	-	-	-	407,348	8,422	864
Period 3e Collateral Costs																					
3e.3.1	Small tool allowance	-	7	-	-	-	-	-	1	8	-	8	-	-	-	-	-	-	-	-	-
3e.3	Subtotal Period 3e Collateral Costs	-	7	-	-	-	-	-	1	8	-	8	-	-	-	-	-	-	-	-	-
Period 3e Period-Dependent Costs																					
3e.4.1	Insurance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3e.4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3e.4.3	Heavy equipment rental	-	170	-	-	-	-	-	26	196	-	196	-	-	-	-	-	-	-	-	-
3e.4.4	Plant energy budget	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3e.4.5	Utility Staff Cost	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3e.4	Subtotal Period 3e Period-Dependent Costs	-	170	-	-	-	-	-	26	196	-	196	-	-	-	-	-	-	-	-	-
3e.0	TOTAL PERIOD 3e COST	-	692	5	40	-	159	487	278	1,657	-	1,657	-	-	8,563	-	-	-	407,348	8,422	864
PERIOD 3f - ISFSI Site Restoration																					
Period 3f Direct Decommissioning Activities																					
	No direct activities in this period																				
Period 3f Additional Costs																					
3f.2.1	ISFSI Site Restoration	-	547	-	-	-	-	12	139	698	-	698	-	-	-	-	-	-	-	2,497	54
3f.2	Subtotal Period 3f Additional Costs	-	547	-	-	-	-	12	139	698	-	698	-	-	-	-	-	-	-	2,497	54
Period 3f Collateral Costs																					
3f.3.1	Small tool allowance	-	2	-	-	-	-	-	0	3	-	3	-	-	-	-	-	-	-	-	-
3f.3	Subtotal Period 3f Collateral Costs	-	2	-	-	-	-	-	0	3	-	3	-	-	-	-	-	-	-	-	-
Period 3f Period-Dependent Costs																					
3f.4.1	Insurance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3f.4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3f.4.3	Heavy equipment rental	-	62	-	-	-	-	-	9	71	-	71	-	-	-	-	-	-	-	-	-
3f.4.4	Plant energy budget	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3f.4.5	Utility Staff Cost	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3f.4	Subtotal Period 3f Period-Dependent Costs	-	62	-	-	-	-	-	9	71	-	71	-	-	-	-	-	-	-	-	-
3f.0	TOTAL PERIOD 3f COST	-	611	-	-	-	-	12	148	771	-	771	-	-	-	-	-	-	-	2,497	54
PERIOD 3 TOTALS		-	78,560	5	40	-	12,069	81,205	17,612	134,892	20,116	21,866	92,410	-	8,563	-	-	851	407,348	917,406	382,388
TOTAL COST TO DECOMMISSION		21,006	188,274	13,689	5,078	46,685	102,911	306,871	129,243	788,102	625,219	56,670	101,213	238,125	205,659	20,945	918	851	19,665,670	2,628,096	8,651,683

TABLE C
HOPE CREEK NUCLEAR GENERATING STATION
DETAILED COST ANALYSIS
(Thousands of 2002 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 Weight Lbs.	Craft Manhours	Utility and Contractor Manhours

TOTAL COST TO DECOMMISSION WITH 13.77% CONTINGENCY:	$783,102	thousands of 2002 dollars
TOTAL NRC LICENSE TERMINATION COST IS 79.84% OR	$625,219	thousands of 2002 dollars
SPENT FUEL MANAGEMENT COST IS 7.24% OR:	$56,670	thousands of 2002 dollars
NON-NUCLEAR DEMOLITION COST IS 12.92% OR:	$101,213	thousands of 2002 dollars
TOTAL PRIMARY SITE RADWASTE VOLUME BURIED:	129,549	cubic feet
TOTAL SECONDARY SITE RADWASTE VOLUME BURIED:	97,980	cubic feet
TOTAL GREATER THAN CLASS C RADWASTE VOLUME GENERATED:	851	cubic feet
TOTAL SCRAP METAL REMOVED:	112,359	tons
TOTAL CRAFT LABOR REQUIREMENTS:	2,629,026	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