GPU NUCLEAR

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March 27, 2015
TMI-15-036

10 CFR 50.75
10 CFR 50.82

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

SUBJECT:
Three Mile Island Nuclear Station, Unit 2
Docket No. 50-320, License No. DPR-73
Decommissioning Funding Status Report for the Three Mile Island Nuclear Station, Unit 2

Pursuant to 10 CFR 50.75 and 10 CFR 50.82, GPU Nuclear, Inc. is hereby submitting three (3) reports to the Nuclear Regulatory Commission (NRC) for Three Mile Island Nuclear Station, Unit 2 for the year ending December 31, 2014. Attachment 1 provides a decommissioning funding status report based on the Nuclear Regulatory Commission (NRC) formula described in 10 CFR 50.75(c). Attachment 2 provides a decommissioning funding status report based upon a site-specific decommissioning cost estimate. Attachment 3 contains a financial assurance status report as required by 10 CFR 50.82(a)(8)(v).

Enclosure A provides a copy of the *Decommissioning Cost Analysis for Three Mile Island Unit 2*, December 2014. Enclosure B provides a copy of the *Escalation Analysis for Three Mile Island Unit 2 2013 Site-Specific Decommissioning Cost Estimate*, February 2015.

There are no regulatory commitments contained in this letter. If there are any questions or if additional information is required, please contact Mr. Thomas A. Lentz, Manager - FirstEnergy Nuclear Operating Company Fleet Licensing, at (330) 315-6810.

Sincerely,

Gregory H. Halnon

Gregory H. Halnon
Director, Fleet Regulatory Affairs

Attachments:
1. Three Mile Island Nuclear Station, Unit 2 Decommissioning Funding Status Report – NRC Formula
2. Three Mile Island Nuclear Station, Unit 2 Decommissioning Funding Status Report – Site-Specific Decommissioning Cost Estimate
3. Three Mile Island Nuclear Station, Unit 2 Financial Assurance Status Report

Enclosures:
A. *Decommissioning Cost Analysis for Three Mile Island Unit 2*, December 2014
B. *Escalation Analysis for Three Mile Island Unit 2 2013 Site-Specific Decommissioning Cost Estimate*, February 2015

cc: NRC Region I Administrator
NRC Project Manager
NRC Resident Inspector

Three Mile Island Nuclear Station, Unit 2 Decommissioning Funding
Status Report – NRC Formula

This report reflects the FirstEnergy Corp. subsidiary ownership interests in the Three Mile Island Nuclear Station, Unit 2 as of December 31, 2014.

1. The minimum decommissioning fund estimate, pursuant to 10 CFR 50.75(b) and (c) (see Schedule 1):

Metropolitan Edison Company	$252,161,563
Pennsylvania Electric Company	126,080,782
Jersey Central Power & Light Company	126,080,782
FirstEnergy Corp. Consolidated	$504,323,126

2. The amount accumulated in external trust funds as of December 31, 2014:

	After Tax
Metropolitan Edison Company	$338,038,657
Pennsylvania Electric Company	182,710,464
Jersey Central Power & Light Company	211,780,107
FirstEnergy Corp. Consolidated	$732,529,228

3. There are no longer any funds to be collected from the ratepayers.

4. The assumptions used regarding escalation in decommissioning cost, rates of earnings on decommissioning funds, and rates of other factors used in funding projections:

Consolidated Ownership Interest in Unit	100%
Estimated Net Investment Rate	2.00%
Year of Site Restoration Completion	2053
Year of Three Mile Island Nuclear Station, Unit 1 Operating License Expiration	2034

An additional assumption is that the decommissioning activities for Three Mile Island Nuclear Station, Unit 2 will commence after the shutdown of Three Mile Island Nuclear Station, Unit 1. Three Mile Island Nuclear Station, Unit 2 transitions from a Post-Defueling Monitored Storage status to decommissioning in 2040.

5. There are no contracts upon which the owners/licensees are relying pursuant to 10 CFR 50.75(e)(1)(v).

6. There are no modifications to the licensee's current method of providing financial assurance since the last submitted report.

7. There were no amendments to the trust agreements for the above-mentioned owners of Three Mile Island Nuclear Station, Unit 2.

8. Mathematical rounding was performed during the development of the supporting calculations.

Schedule 1
FIRSTENERGY CORP.
Calculation of Minimum Financial Assurance Amount
December 31, 2014
THREE MILE ISLAND NUCLEAR STATION, UNIT 2

Pennsylvania Regions

Labor (L) = Northeast
Energy (E) = National
Waste Burial (B) = Generic

For PWR Unit

	Adjustment Factor	Ratio	Escalation Factor[1]
L =	2.661	0.65	1.73
E =	2.222	0.13	0.289
B =	13.885	0.22	3.055

PWR Escalation Factor = 5.074

Base Amount for PWR between 1200 MWt and 3400 MWt = ($75 + 0.0088P) million
(P = power level in megawatts thermal = 2772)

($75 + 0.0088(2772)) million = $99,393,600

Escalated Amount for unit[1] =
99,393,600 x 5.074 = **$504,323,126**

Owner/Licensee[1]	Ownership	
Pennsylvania Electric Company	25%	$126,080,782
Jersey Central Power & Light Company	25%	$126,080,782
Metropolitan Edison Company	50%	$252,161,563
FirstEnergy Corp. Consolidated	100%	**$504,323,126**

Note 1: Mathematical rounding was performed during the development of the supporting calculations.

1. Decommissioning funds estimated to be required pursuant to 10 CFR 50.75(b) and (c) are based upon a site-specific decommissioning cost study, *Decommissioning Cost Analysis for Three Mile Island Unit 2*, dated December 2014, and escalated to 2014 dollars:

Radiological	$1,180,928,000
Non-Radiological	40,560,000
FirstEnergy Corp. Consolidated	$1,221,488,000

2. The amount accumulated in external trust funds as of December 31, 2014:

	After Tax
Metropolitan Edison Company	$338,038,657
Pennsylvania Electric Company	182,710,464
Jersey Central Power & Light Company	211,780,107
FirstEnergy Corp. Consolidated	$732,529,228

3. There are no longer any funds to be collected from the ratepayers.

4. The assumptions used regarding escalation in decommissioning cost, rates of earnings on decommissioning funds, and rates of other factors used in funding projections:

Consolidated Ownership Interest in Unit	100%
Estimated Rate of Escalation in Decommissioning Costs	2.77%
Estimated After-Tax Rate of Return	2.00%
Year of Site Restoration Completion	2053
Year of Three Mile Island Nuclear Station, Unit 1 end of license	2034

An additional assumption is that the decommissioning activities for Three Mile Island Nuclear Station, Unit 2 will commence after the shutdown of Three Mile Island Nuclear Station, Unit 1. Three Mile Island Nuclear Station, Unit 2 transitions from a Post-Defueling Monitored Storage status to decommissioning in 2040.

5. There are no contracts upon which the owners/licensees are relying pursuant to 10 CFR 50.75(e)(1)(v).

6. There are no modifications to the licensee's current method of providing financial assurance since the last submitted report.

7. There were no amendments to the trust agreements for the above-mentioned owners of Three Mile Island Nuclear Station, Unit 2.

8. Site-Specific Cost Analysis Assumptions

   10 CFR 50.75(e)(1)(i), states, in part, that:

   > A licensee that has prepaid funds based on a site-specific estimate under 50.75(b)(1) of this section may take credit for projected earnings on the prepaid decommissioning trust funds, using up to a 2 percent annual real rate of return from the time of future funds' collection through the projected decommissioning period, provided that the site-specific estimate is based on a period of safe storage that is specifically described in the estimate.

   In accordance with Regulatory Guide 1.159, Revision 2, a facility specific analysis may be used to demonstrate the adequacy of decommissioning funds, provided that:

   > NRC-required cost estimate for decommissioning costs, as defined in 10 CFR 50.2, is equal to or greater than the amount stated in the formulas in 10 CFR 50.75(c)(1) and (2).

   The site-specific radiological decommissioning cost estimate is $1,180,928,000 which is greater than the 10 CFR 50.75(c) cost estimate of $504,323,126. The analysis assumes a 2 percent yearly rate of return. The analysis also assumes a period of safe storage. The cash flows were contained in a decommissioning cost estimate that was prepared for Three Mile Island Nuclear Station, Unit 2. The cash flow analysis assumes the yearly expenses are incurred at the beginning of year.

   Schedule 1 provides the site-specific analysis. The analysis values are in 2014 dollars. The analysis includes both the radiological and site restoration costs.

9. Mathematical rounding was performed during the development of the supporting calculations.

10. References:

    A. *Decommissioning Cost Analysis for Three Mile Island Unit 2*, December 2014

    B. *Escalation Analysis for Three Mile Island Unit 2 2013 Site-Specific Decommissioning Cost Estimate*, February 2015

Schedule 1

FIRSTENERGY CORP.
Funding Analysis
December 31, 2014
THREE MILE ISLAND NUCLEAR STATION, UNIT 2

		After-Tax
Estimated Net Investment Rate		2.00%
Estimated Escalation Rate		-
Estimated After-Tax Rate of Return		2.00%
Qualified Trust Balance on December 31, 2014	$732,529,228	
Non-Qualified Trust Balance on December 31, 2014	-	
Total	$732,529,228	

Year	Beginning Balance	Deposits	Earnings	Withdrawal[1]	Ending Balance
2015	732,529,228	-	14,463,385	(9,360,000)[2]	737,632,613
2016	737,632,613	-	14,690,092	(3,128,000)	749,194,705
2017	749,194,705	-	14,921,494	(3,120,000)	760,996,199
2018	760,996,199	-	15,157,524	(3,120,000)	773,033,723
2019	773,033,723	-	15,398,274	(3,120,000)	785,311,997
2020	785,311,997	-	15,643,680	(3,128,000)	797,827,677
2021	797,827,677	-	15,894,154	(3,120,000)	810,601,831
2022	810,601,831	-	16,149,637	(3,120,000)	823,631,467
2023	823,631,467	-	16,410,229	(3,120,000)	836,921,697
2024	836,921,697	-	16,675,874	(3,128,000)	850,469,571
2025	850,469,571	-	16,946,991	(3,120,000)	864,296,562
2026	864,296,562	-	17,223,531	(3,120,000)	878,400,093
2027	878,400,093	-	17,505,602	(3,120,000)	892,785,695
2028	892,785,695	-	17,793,154	(3,128,000)	907,450,849
2029	907,450,849	-	18,086,617	(3,120,000)	922,417,466
2030	922,417,466	-	18,385,949	(3,120,000)	937,683,415
2031	937,683,415	-	18,691,268	(3,120,000)	953,254,684
2032	953,254,684	-	19,002,534	(3,128,000)	969,129,217
2033	969,129,217	-	19,320,184	(3,120,000)	985,329,402
2034	985,329,402	-	19,644,188	(3,120,000)	1,001,853,590
2035	1,001,853,590	-	19,974,672	(3,120,000)	1,018,708,262
2036	1,018,708,262	-	20,311,605	(3,128,000)	1,035,891,867
2037	1,035,891,867	-	20,655,437	(3,120,000)	1,053,427,304

Schedule 1 (Continued)

Year	Beginning Balance	Deposits	Earnings	Withdrawal[1]	Ending Balance
2038	1,053,427,304	-	21,006,146	(3,120,000)	1,071,313,450
2039	1,071,313,450	-	21,363,869	(3,120,000)	1,089,557,319
2040	1,089,557,319	-	20,693,006	(54,907,000)	1,055,343,326
2041	1,055,343,326	-	19,291,187	(90,784,000)	983,850,512
2042	983,850,512	-	17,396,970	(114,002,000)	887,245,482
2043	887,245,482	-	15,464,870	(114,002,000)	788,708,352
2044	788,708,352	-	13,487,887	(114,314,000)	687,882,239
2045	687,882,239	-	11,477,605	(114,002,000)	585,357,844
2046	585,357,844	-	9,695,777	(100,569,000)	494,484,621
2047	494,484,621	-	8,387,952	(75,087,000)	427,785,573
2048	427,785,573	-	7,049,871	(75,292,000)	359,543,445
2049	359,543,445	-	5,689,129	(75,087,000)	290,145,574
2050	290,145,574	-	4,301,171	(75,087,000)	219,359,745
2051	219,359,745	-	2,934,615	(72,629,000)	149,665,360
2052	149,665,360	-	2,348,847	(32,223,000)	119,791,207
2053	119,791,207	-	1,811,724	(29,205,000)	92,397,931
			TOTAL	(1,221,478,000)	

Notes:
1. Withdrawal are assumed to be made at the beginning of the period.
2. The *Decommissioning Cost Analysis for Three Mile Island Unit 2*, December 2014, had withdrawals for the years 2013 and 2014. Those withdrawals were included in the 2015 period.

Three Mile Island Nuclear Station, Unit 2 Financial Assurance Status Report

1. Formal decommissioning has not started at the Three Mile Island Nuclear Station, Unit 2. A special disbursement of decommissioning trust funds occurred in 2005 for $416,400.00. Notification of this use of decommissioning funds was made to the NRC by letter dated February 1, 2005 (Accession No. ML050380143). No funds were spent on decommissioning activities in 2014.

2. Decommissioning funds estimated to be required are based upon a site-specific decommissioning cost study, *Decommissioning Cost Analysis for Three Mile Island Unit 2*, dated December 2014, and escalated to 2014 dollars:

Radiological	$1,180,928,000
Non-Radiological	40,560,000
FirstEnergy Corp. Consolidated	$1,221,488,000

3. The amount accumulated in external trust funds as of December 31, 2014:

	After Tax
Metropolitan Edison Company	$338,038,657
Pennsylvania Electric Company	182,710,464
Jersey Central Power & Light Company	211,780,107
FirstEnergy Corp. Consolidated	$732,529,228

4. There are no longer any funds to be collected from the ratepayers.

5. There are no modifications to the licensee's current method of providing financial assurance since the last submitted report.

6. There were no amendments to the trust agreements for the above-mentioned owners of Three Mile Island Nuclear Station, Unit 2.

7. Mathematical rounding was performed during the development of the supporting calculations.

8. References:

   A. *Decommissioning Cost Analysis for Three Mile Island Unit 2*, December 2014

   B. *Escalation Analysis for Three Mile Island Unit 2 2013 Site-Specific Decommissioning Cost Estimate*, February 2015

Enclosure A
TMI-15-036

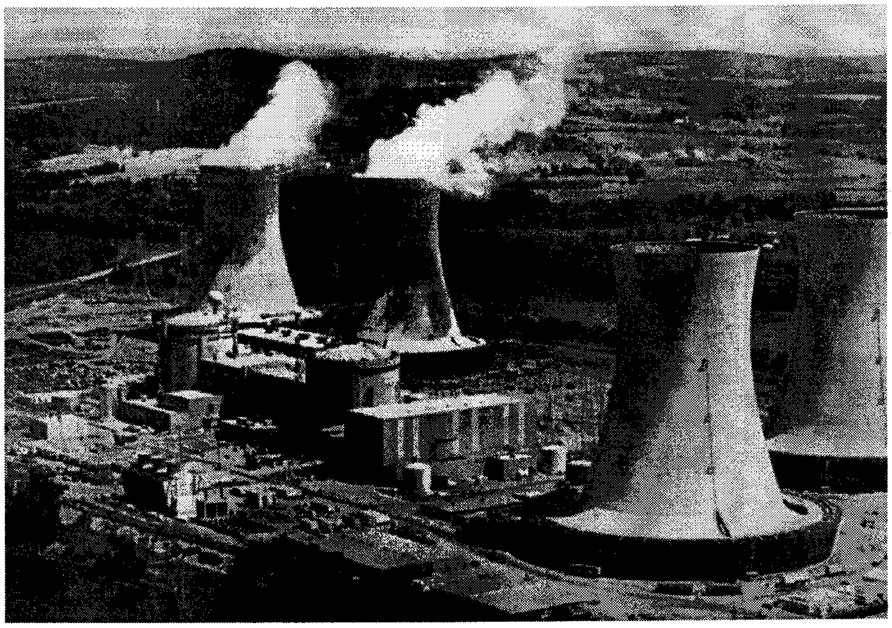
Decommissioning Cost Analysis for Three Mile Island Unit 2,
December 2014
(123 pages follow)

Document F07-1676-001, Rev. 0

DECOMMISSIONING COST ANALYSIS

for

THREE MILE ISLAND UNIT 2



prepared for

FirstEnergy Corporation

prepared by

TLG Services, Inc.
Bridgewater, Connecticut

December 2014

APPROVALS

Project Manager	**Francis W. Seymore**	12/11/14 **Date**
Project Engineer	**Mark S. Houghton**	12/11/14 **Date**
Technical Manager	**William A. Cloutier, Jr.**	12/11/2014 **Date**

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

SECTION PAGE

TABLES

FIGURES

APPENDICES

REVISION LOG

No.	CRA No.	Date	Item Revised	Reason for Revision
0		12-11-14		Original Issue

EXECUTIVE SUMMARY

This report presents estimates of the cost to decommission the Three Mile Island, Unit 2 nuclear unit (TMI-2) for the selected decommissioning scenarios following the scheduled cessation of plant operations at the adjacent Unit 1 reactor. This analysis relies upon site-specific, technical information, originally developed in an evaluation for the GPU Nuclear Corporation in 1995-96,[1] and last updated in 2008 for FirstEnergy.[2] The analysis has been further updated to reflect current assumptions pertaining to the disposition of the nuclear unit and relevant industry experience in undertaking such projects. The updated estimates are designed to provide the FirstEnergy Corporation with sufficient information to assess its financial obligations, as they pertain to the eventual decommissioning of the nuclear unit.

The decommissioning of TMI-2 is a continuation of the decontamination efforts started in the 1980s, following its accident. The ultimate goal of the decommissioning is to remove the radioactive material from the site that would preclude its release for unrestricted use.

The estimates are based on numerous fundamental assumptions, including regulatory requirements, project contingencies, radioactive waste disposal options, and site remediation requirements. The estimates also include the dismantling of non-essential structures and limited restoration of the site.

<u>Alternatives and Regulations</u>

The Nuclear Regulatory Commission (NRC or Commission) provided initial decommissioning requirements in its rule adopted on June 27, 1988.[3] In this rule, the NRC set forth financial criteria for decommissioning licensed nuclear power facilities. The regulations addressed planning needs, timing, funding methods, and environmental review requirements for decommissioning. The rule also defined three decommissioning alternatives as being acceptable to the NRC: DECON, SAFSTOR, and ENTOMB.

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1 "Decommissioning Cost Estimate for the Three Mile Island, Unit 2," Document No. G01-1196-003, TLG Services, Inc., February 1996.

2 "Decommissioning Cost Estimate for Three Mile Island Unit 2," Document No. F07-1601-002, TLG Services, Inc., January 2009.

3 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.

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."[4]

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."[5] 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."[6] 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. In 1997, the Commission directed its staff to re-evaluate this alternative and identify the technical requirements and regulatory actions that would be necessary for entombment to become a viable option. The resulting evaluation provided several recommendations, however, rulemaking has been deferred pending the completion of additional research studies, e.g., on engineered barriers.

In 1996, the NRC published revisions to the general requirements for decommissioning nuclear power plants to clarify ambiguities and codify procedures and terminology as a means of enhancing efficiency and uniformity in the decommissioning process. [7] The amendments allow for greater public participation and better define the transition process from operations to decommissioning. Regulatory Guide 1.184, issued in July 2000, further described the methods and procedures acceptable to the NRC staff for implementing the requirements of the 1996 revised rule relating to the initial activities and major phases of the decommissioning

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4 Ibid. Page FR24022, Column 3.

5 Ibid

6 Ibid. Page FR24023, Column 2.

7 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.

process. The costs and schedules presented in this analysis follow the general guidance and processes described in the amended regulations.

Decommissioning Scenarios

Three decommissioning scenarios were evaluated for the nuclear unit. The two delayed dismantling scenarios, Delayed DECON and SAFSTOR, include some consideration of the decommissioning activities planned at the adjacent Unit 1. The scenarios selected are representative of alternatives available to the owner and are defined as follows:

1. DECON: The adjacent TMI-1 is promptly decommissioned upon the scheduled cessation of operations in 2034. TMI-2 transitions from a Post-Defueling Monitored Storage status to decommissioning in 2040. The decommissioning program for TMI-2 runs independently from the TMI-1 decommissioning effort; license termination of Unit 2 occurs in 2053, approximately 10 years after Unit 1 completes its decommissioning program (exclusive of the on-site ISFSI operations for Unit 1 fuel).

2. Delayed DECON: One of the decommissioning alternatives for Unit 1 is to defer decommissioning until the spent fuel has been removed from the site.[8] This scenario assumes that the decontamination and dismantling activities at TMI-2 are synchronized with the adjacent unit such that the licenses for both units are terminated concurrently.

3. SAFSTOR: In the second scenario, TMI-1 is placed into long-term storage. TMI-2 remains in storage until such time that decommissioning activities can be coordinated with Unit 1. As with the first scenario, termination of the licenses is coordinated.

The scenarios consider that Exelon Generation has extended the operating license at the adjacent Unit 1 to 2034. The scenarios are also based upon the premise that decommissioning work at Unit 2 would not begin prior to final shutdown of Unit 1 in 2034, consistent with the agreement between Exelon and FirstEnergy.

Methodology

The methodology used to develop the estimates described within this document follows the basic approach originally presented in the cost estimating guidelines [9] developed by the Atomic Industrial Forum (now Nuclear Energy Institute). This reference

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8 Timelines for the Unit 1 decommissioning scenarios are included in Section 4 of this report.

9 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.

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

Contingency

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

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

Low-Level Radioactive Waste Disposal

The contaminated and activated material generated in the decontamination and dismantling of a commercial nuclear reactor is generally 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

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

Amendments of 1985, [11] the states became ultimately responsible for the disposition of low-level radioactive waste generated within their own borders. It was expected that groups of states would combine together to jointly deal with their radioactive wastes; these organizations are referred to as waste disposal compacts.

Few approved facilities for the disposal of LLW are currently available. Construction of the newest facility, in Texas, is now complete and the facility was declared operational by the operator, Waste Control Specialists (WCS), in November 2011. The facility will be able to accept limited quantities of non-Compact waste; however, at this time the cost for non-Compact generators is being negotiated on an individual basis.

All options and services currently available to FirstEnergy for disposition of the various waste streams produced by the decommissioning process were considered. The majority of the low-level radioactive waste designated for direct disposal (Class A [12]) can be sent to Energy*Solutions'* facility in Clive, Utah. Therefore, disposal costs for Class A waste were based upon FirstEnergy's agreement with Energy*Solutions*. This facility is not licensed to receive the higher activity portion (Classes B and C) of the decommissioning waste stream.

The Texas facility is licensed to receive the higher activity waste forms (Classes B and C). As such, for this analysis, disposal costs for the Class B and C waste were based upon the preliminary and indicative information on the cost for such from WCS.

Waste exceeding Class C limits (limited to material closest to the reactor core, or material contaminated with spent fuel debris from the March 1979 accident) is generally not suitable for shallow-land disposal (i.e., low-level radioactive waste with concentrations of radionuclides that exceed the limits established by the NRC for Class C radioactive waste, referred to as Greater Than Class C (GTCC)). The Low-Level Radioactive Waste Policy Amendments Act of 1985 assigned the federal government the responsibility for the disposal of this material. The Act also stated that the beneficiaries of the activities resulting in the generation of such radioactive waste bear all reasonable costs of disposing of such waste. However, to date, the federal government has not identified a cost for disposing of GTCC or a schedule for acceptance.

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

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

For purposes of this analysis, this material is packaged in the same multipurpose canisters used for spent fuel storage/transport (e.g., at TMI-1) and designated for geologic disposal. The GTCC is shipped directly to a disposal facility as it is generated.

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

Material removed during decommissioning that is free of contamination will be designated for conventional disposal or reuse / recovery.

Fuel-Bearing Waste Management

There will be some wastes generated in the decommissioning of TMI-2 that are not suitable for shallow land burial and therefore cannot be shipped for disposal to Energy*Solutions*. This material, primarily associated with systems and structures contaminated with fuel debris, requires greater isolation from the environment. For estimating purposes, a geologic waste repository, or some interim storage facility, is assumed to be available for the disposal of this material.

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

Today, the country is at an impasse on high-level waste disposal, even with the License Application for a geologic repository submitted by the DOE to the NRC in 2008. The current administration has cut the budget for the repository program while promising to "conduct a comprehensive review of policies for managing the back end of the nuclear fuel cycle ... and make recommendations for a new plan."[13] Towards this goal, the administration appointed a Blue Ribbon Commission on America's Nuclear Future (Blue Ribbon Commission) to make recommendations for a new plan for nuclear waste disposal. The Blue Ribbon Commission's charter

13 Blue Ribbon Commission on America's Nuclear Future Charter, http://cybercemetery.unt.edu/archive/brc/20120620215336/http://brc.gov/index.php?q=page/charter

includes a requirement that it consider "[o]ptions for safe storage of used nuclear fuel while final disposition pathways are selected and deployed."[14]

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

- "[T]he United States [should] establish a program that leads to the timely development of one or more consolidated storage facilities"[15]
- "[T]he United States should undertake an integrated nuclear waste management program that leads to the timely development of one or more permanent deep geological facilities for the safe disposal of spent fuel and high-level nuclear waste."[16]

In January 2013, the DOE issued the "Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste," in response to the recommendations made by the Blue Ribbon Commission and as "a framework for moving toward a sustainable program to deploy an integrated system capable of transporting, storing, and disposing of used nuclear fuel..."[17]

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

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

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14 Ibid.

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

16 Ibid., p.27

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

- Makes demonstrable progress on the siting and characterization of repository sites to facilitate the availability of a geologic repository by 2048."[18]

Completion of the decommissioning process is dependent upon the DOE's ability to remove spent fuel from the site in a timely manner. DOE's repository program had assumed that spent fuel allocations would be accepted for disposal from the nation's commercial nuclear plants, with limited exceptions, in the order (the "queue") in which it was discharged from the reactor.[19]

The estimates for TMI-2 assume the timely removal of waste designated for geologic disposal, without the need for interim on site storage (once containerized).

Site Restoration

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

Summary

The costs to decommission TMI-2 are evaluated for three decommissioning scenarios. Regardless of the timing of the decommissioning activities, the estimates assume the eventual removal of all the contaminated and neutron-activated plant components and

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18 Ibid., p.2

19 U.S. Code of Federal Regulations, Title 10, Part 961.11, Article IV – Responsibilities of the Parties, B. DOE Responsibilities, 5.(a) ... DOE shall issue an annual acceptance priority ranking for receipt of SNF and/or HLW at the DOE repository. This priority ranking shall be based on the age of SNF and/or HLW as calculated from the date of discharge of such materials from the civilian nuclear power reactor. The oldest fuel or waste will have the highest priority for acceptance ..."

structural materials, such that the facility operator may then have unrestricted use of the site with no further requirement for an license.

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

DECON COST SUMMARY
DECOMMISSIONING COST ELEMENTS
(thousands of 2013 dollars)

Cost Element	Total
Decontamination	35,403
Removal	189,064
Packaging	28,008
Transportation	26,427
Waste Disposal	276,112
Off-site Waste Processing	11,053
Program Management [1]	484,509
Security	55,590
Insurance and Regulatory Fees	15,766
Energy	18,061
Characterization and Licensing Surveys	10,844
Property Taxes	0
Miscellaneous Equipment	23,851
Site O&M	4,968
PDMS Monitoring	8,908
Total [2]	1,188,564

Cost Element	
NRC License Termination	1,149,098
Site Restoration	39,467
Total [2]	1,188,564

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

DELAYED DECON COST SUMMARY
DECOMMISSIONING COST ELEMENTS
(thousands of 2013 dollars)

Cost Element	Total[1]
Decontamination	35,321
Removal	190,858
Packaging	28,007
Transportation	26,310
Waste Disposal	276,022
Off-site Waste Processing	11,053
Program Management [2]	472,755
Security	46,850
Insurance and Regulatory Fees	21,899
Energy	19,459
Characterization and Licensing Surveys	10,844
Property Taxes	0
Miscellaneous Equipment	26,259
Site O&M	4,968
PDMS Monitoring	6,949
Total [3]	1,177,554

Cost Element	
License Termination	1,139,536
Site Restoration	38,018
Total [3]	1,177,554

[1] Includes dormancy costs following TMI-1 shutdown in 2034
[2] Includes engineering costs
[3] Columns may not add due to rounding

SAFSTOR COST SUMMARY
DECOMMISSIONING COST ELEMENTS
(thousands of 2013 dollars)

Cost Element	Total[1]
Decontamination	35,286
Removal	196,595
Packaging	28,065
Transportation	26,298
Waste Disposal	275,884
Off-site Waste Processing	11,206
Program Management [2]	482,930
Security	56,699
Insurance and Regulatory Fees	41,497
Energy	28,227
Characterization and Licensing Surveys	10,844
Property Taxes	0
Miscellaneous Equipment	33,617
Site O&M	4,968
PDMS Monitoring	6,949
Total [3]	1,239,065

Cost Element	
License Termination	1,201,047
Site Restoration	38,018
Total [3]	1,239,065

[1] Includes dormancy costs following TMI-1 shutdown in 2034
[2] Includes engineering costs
[3] Columns may not add due to rounding

1. INTRODUCTION

This report presents estimates of the cost to decommission the Three Mile Island Unit 2 nuclear unit (TMI-2) for the scenarios described in Section 2. This analysis relies upon site-specific, technical information, originally developed in an evaluation for the GPU Nuclear Corporation in 1995-96 [1]*, and last updated in 2008 for FirstEnergy Corporation.[2] The analysis is designed to provide the FirstEnergy Corporation with sufficient information to assess its financial obligations, as they pertain to the eventual decommissioning of the nuclear unit. It is not a detailed engineering document, but a financial analysis prepared in advance of the detailed engineering that will be required to carry out the decommissioning.

1.1 OBJECTIVES OF STUDY

The objective of this study was to prepare estimates of the cost, schedule, and waste volumes generated to decommission TMI-2, including all areas affected by the March 1979 accident.

Three decommissioning scenarios were evaluated for TMI-2. In the delayed scenarios (Delayed DECON and SAFSTOR) decommissioning activities are coordinated to some extent with the adjacent operating unit (TMI-1 or Unit 1). The scenarios consider that Exelon Generation has extended the operating license for Unit 1 to 2034. The three scenarios are also based upon the premise that decommissioning work at Unit 2 would not begin prior to final shutdown of Unit 1 in 2034, consistent with the agreement between Exelon and FirstEnergy.

DECON The adjacent TMI-1 is promptly decommissioned upon the scheduled cessation of operations in 2034. TMI-2 transitions from a Post-Defueling Monitored Storage status to decommissioning in 2040. The decommissioning program for TMI-2 runs independent from the TMI-1 decommissioning effort; license termination of Unit 2 occurs in 2053, approximately 10 years after Unit 1 completes its decommissioning program (exclusive of the on-site ISFSI operations for Unit 1 fuel).

Delayed DECON Decommissioning of TMI-2 commences upon the removal of TMI-1's spent fuel from the site in 2051. The decommissioning program for TMI-2 runs concurrently with the TMI-1 decommissioning effort and concludes with the termination of both licenses.

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

SAFSTOR TMI-1 is placed into safe-storage with decommissioning deferred 60 years. TMI-2 remains in storage with decommissioning deferred until it can be sequenced with TMI-1. The decommissioning program for TMI-2 runs concurrently with the TMI-1 decommissioning effort and concludes with the termination of both licenses.

1.2 SITE DESCRIPTION

TMI-2 is located on the northern-most section of Three Mile Island near the east shore of the Susquehanna River in Dauphin County, Pennsylvania. The station is comprised of two pressurized water reactors. This study specifically addresses the decommissioning requirements for Unit 2, although the timing of each scenario is dependent upon the associated activities at the adjacent unit.

The nuclear steam supply system (NSSS) consists of a pressurized water reactor rated at a core thermal power level of 2772 MWth with a corresponding turbine-generator gross output of 959 MWe. The NSSS consists of the reactor with two independent primary coolant loops, each containing two reactor coolant pumps and a steam generator. An electrically heated pressurizer and connecting piping complete the system. The system is housed within a steel-lined, post-tensioned concrete structure (reactor building) in the shape of a right, vertical cylinder with a hemispherical dome and a flat, reinforced concrete basemat. A welded steel liner plate, anchored to the inside face of the reactor building, serves as a leak-tight membrane.

Heat produced in the reactor was converted to electrical energy by the turbine generator system. This system converted the thermal energy of the steam into mechanical shaft power and then into electrical energy. The turbine-generator is a tandem-compound design, consisting of one double-flow, high pressure turbine and two double-flow, low-pressure turbines driving a directly coupled generator at 1800 rpm. The turbine operated in a closed feedwater cycle where steam was condensed, feedwater heated, and ultimately returned to the steam generators. Heat rejected in the main condensers was removed by the condenser circulating and river water systems.

The condenser circulating water was cooled in two hyperbolic natural draft cooling towers located to the east of the station. The towers provided the heat sink required for removal of waste heat in the power plant's thermal cycle. Cooling tower blowdown was discharged to the Susquehanna River.

TMI-2's operating license was issued on February 8, 1978, with commercial operation declared on December 30, 1978. On March 28, 1979, the unit experienced an accident initiated by interruption of secondary feedwater flow. The steam generator boiled dry, resulting in the reduction of primary-to-secondary heat exchange. This caused an increase in the primary coolant temperature, creating a surge into the pressurizer, and an increase in system pressure. The pilot operated relief valve (PORV) opened to relieve the pressure, but failed to close when the pressure decreased. The reactor coolant pumps were turned off and a core heat-up began as the water level decreased to uncover the top of the core. The melting temperature of the zircaloy fuel cladding was exceeded, resulting in relocation of the molten zircaloy and some liquefied fuel to the lower core regions, solidifying near the coolant interface. Based on the end-state core and core support assembly configuration and supporting analysis of the degraded core heat-up, it is believed that as the crust failed, molten core material migrated to the lower internals. The majority of the molten material flowed down through the region of the southeastern assemblies and into the core bypass region. A portion of the molten core material flowed around the bypass region and migrated down into the lower internals and lower head region. Limited damage to the core support assembly occurred as the core material flowed to the lower plenum. It is estimated that about 17 - 20 tons of material relocated to the lower internals and lower head region. Several in-core instrument guide tubes were melted but overall vessel integrity was maintained throughout the accident.

As a result of this accident, small quantities of core debris and fission products were transported through the RCS and the reactor building as a result of the coolant flow through the PORV and the makeup and purification system (MU&P) during the accident. In addition, a small quantity of core debris was transported to the auxiliary and fuel handling buildings (AFHB) via the MU&P. Further spread of the debris also occurred as part of the post-accident water processing cleanup activities.

GPU Nuclear conducted a substantial program to defuel the reactor vessel and decontaminate the facility. As a result, TMI-2 has been placed in a safe, inherently stable condition suitable for long-term management, and any threat to the public health and safety has been eliminated. Fuel and core material removed in the defueling has been shipped off site. The current long-term management condition is termed Post-Defueling Monitored Storage (PDMS). The costs for maintaining TMI-2 in this state from 2013 until the shutdown of Unit 1 in 2034 (PDMS is continued until 2040 for the DECON scenario) is included in the cost estimates in this analysis.

Substantial contaminated areas still exist on site, as well as trace quantities of spent nuclear fuel (SNF). Several cubicles in the auxiliary and fuel handling buildings remain locked, and the basement of the reactor building has been uninhabitable since the accident. The quantity of fuel remaining at TMI-2 is a small fraction of the initial fuel load; approximately 99% was successfully removed in the defueling. Additionally large quantities of radioactive fission products were released into various systems and structures. Most of this radioactivity was removed as part of the waste processing activities during the TMI-2 Clean-up Program which concluded with entry into Post-Defueling Monitored Storage in December 1993. Significant quantities of radioactive fission products were removed from the reactor coolant system in preparation for the PDMS. However, the remaining 1% of the fuel and the remaining fission products pose unique problems in completing the decommissioning of TMI-2. A summary of the quantity and suspected location of the remaining fuel debris is provided in Tables 1.1 through 1.3.

1.3 REGULATORY GUIDANCE

The Nuclear Regulatory Commission (NRC or Commission) provided initial decommissioning requirements in its rule "General Requirements for Decommissioning Nuclear Facilities," issued in June 1988 [3]. This rule set forth financial criteria for decommissioning licensed nuclear power facilities. The regulation addressed decommissioning planning needs, timing, funding methods, and environmental review requirements. The intent of the rule was to ensure that decommissioning would be accomplished in a safe and timely manner and that adequate funds would be available for this purpose. Subsequent to the rule, the NRC issued Regulatory Guide 1.159, "Assuring the Availability of Funds for Decommissioning Nuclear Reactors,"[4] which provided additional guidance to the licensees of nuclear facilities on the financial methods acceptable to the NRC staff for complying with the requirements of the rule. The regulatory guide addressed the funding requirements and provided guidance on the content and form of the financial assurance mechanisms indicated in the rule.

The rule defined three decommissioning alternatives as being acceptable to the NRC: DECON, SAFSTOR, and ENTOMB. The DECON alternative, the option evaluated for this analysis, assumes that any contaminated or activated portion of the plant's systems, structures, and facilities are removed or decontaminated to levels that permit the site to be released for unrestricted use shortly after the cessation of plant operations. The rule also placed limits on the time allowed to complete the decommissioning process. For SAFSTOR, the process is restricted in overall duration to 60 years, unless it can be shown that a longer duration is necessary to protect public health and safety. The guidelines for ENTOMB are similar, providing the NRC with both sufficient leverage and flexibility to ensure that these deferred options are only used in situations where it is reasonable and consistent with the definition of decommissioning. At the conclusion of a 60-year dormancy period (or longer for ENTOMB if the NRC approves such a case), the site would still require significant remediation to meet the unrestricted release limits for license termination. To use a decommissioning scenario in which the license has not been terminated within 60 years of the final shutdown date, FirstEnergy will need Commission approval pursuant to 10 CFR 50.82(a)(3) for completion of decommissioning beyond 60 years.

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.[5] 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.[6] However, the staff also found that additional rulemaking would be needed before this option could be treated as a generic alternative. Rulemaking has been deferred pending the completion of additional research studies, e.g., on engineered barriers. However, this study assumes that the ENTOMB alternative is a viable option for TMI-2 and that a storage period of 100 years would be acceptable.

The NRC published revisions to the general requirements for decommissioning nuclear power plants in 1996.[7] When the regulations were adopted in 1988, it was assumed that the majority of licensees would decommission at the end of the facility's licensed life. Since that time, several licensees permanently and prematurely ceased operations. Exemptions from certain operating requirements were required once the reactor was defueled to facilitate the decommissioning. Each case was handled individually, without clearly defined generic requirements. The NRC amended the decommissioning regulations in 1996 to clarify ambiguities and codify procedures and terminology as a means of enhancing efficiency and uniformity in the decommissioning process. The new amendments allow for greater public participation and better define the transition process from operations to decommissioning.

1.3.1 Nuclear Waste Policy Act

Congress passed the Nuclear Waste Policy Act[8] in 1982, assigning the federal government's long-standing responsibility for disposal of the spent nuclear fuel created by the commercial nuclear generating plants to the DOE. The DOE was to begin accepting spent fuel by January 31, 1998; however, to date no progress in the removal of spent fuel from commercial generating sites has been made.

Today, the country is at an impasse on high-level waste disposal, even with the License Application for a geologic repository submitted by the DOE to the NRC in 2008. The current administration has cut the budget for the repository program while promising to "conduct a comprehensive review of policies for managing the back end of the nuclear fuel cycle ... and make recommendations for a new plan."[9] Towards this goal, the administration appointed a Blue Ribbon Commission on America's Nuclear Future (Blue Ribbon Commission) to make recommendations for a new plan for nuclear waste disposal. The Blue Ribbon Commission's charter includes a requirement that it consider "[o]ptions for safe storage of used nuclear fuel while final disposition pathways are selected and deployed."

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

- "[T]he United States [should] establish a program that leads to the timely development of one or more consolidated storage facilities"[10]
- "[T]he United States should undertake an integrated nuclear waste management program that leads to the timely development of one or more permanent deep geological facilities for the safe disposal of spent fuel and high-level nuclear waste."

In January 2013, the DOE issued the "Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste," in response to the recommendations made by the Blue Ribbon Commission and as "a framework for moving toward a sustainable program to deploy an integrated system capable of transporting, storing, and disposing of used nuclear fuel..."[11]

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

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

and allows for acceptance of enough used nuclear fuel to reduce expected government liabilities; and

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

Completion of the decommissioning process is dependent upon the DOE's ability to remove spent fuel from the site in a timely manner. DOE's repository program had assumed that spent fuel allocations would be accepted for disposal from the nation's commercial nuclear plants, with limited exceptions, in the order (the "queue") in which it was discharged from the reactor.[12]

The estimates for TMI-2 assume the timely removal of waste designated for geologic disposal, without the need for interim on site storage (once containerized).

1.3.2 Low-Level Radioactive Waste Acts

The contaminated and activated material generated in the decontamination and dismantling of a commercial nuclear reactor is generally 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"[13] in 1980 and its Amendments of 1985, [14] the states became ultimately responsible for the disposition of low-level radioactive waste generated within their own borders. It was expected that groups of states would combine together to jointly deal with their radioactive wastes; these organizations are referred to as waste disposal compacts.

Few approved facilities for the disposal of LLW are currently available. Construction of the newest facility, in Texas, is now complete and the facility was declared operational by the operator, Waste Control Specialists (WCS), in November 2011. The facility will be able to accept limited quantities of non-Compact waste; however, at this time the cost for non-Compact generators is being negotiated on an individual basis.

All options and services currently available to FirstEnergy for disposition of the various waste streams produced by the decommissioning process were considered. The majority of the low-level radioactive waste designated for direct disposal (Class A [15]) can be sent to Energy*Solutions*' facility in Clive, Utah. Therefore, disposal costs for Class A waste were based upon FirstEnergy's agreement with

Energy*Solutions*. This facility is not licensed to receive the higher activity portion (Classes B and C) of the decommissioning waste stream.

The Texas facility is licensed to receive the higher activity waste forms (Classes B and C). As such, for this analysis, disposal costs for the Class B and C waste were based upon the preliminary and indicative information on the cost for such from WCS.

Waste exceeding Class C limits (limited to material closest to the reactor core, or material contaminated with spent fuel debris from the March 1979 accident) is generally not suitable for shallow-land disposal (i.e., low-level radioactive waste with concentrations of radionuclides that exceed the limits established by the NRC for Class C radioactive waste, referred to as Greater Than Class C (GTCC)). The Low-Level Radioactive Waste Policy Amendments Act of 1985 assigned the federal government the responsibility for the disposal of this material. The Act also stated that the beneficiaries of the activities resulting in the generation of such radioactive waste bear all reasonable costs of disposing of such waste. However, to date, the federal government has not identified a cost for disposing of GTCC or a schedule for acceptance.

For purposes of this analysis, this material is packaged in the same multipurpose canisters used for spent fuel storage/transport (e.g., at TMI-1) and designated for geologic disposal. The GTCC is shipped directly to a disposal facility as it is generated.

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

1.3.3 Radiological Criteria for License Termination

In 1997, the NRC published Subpart E, "Radiological Criteria for License Termination," amending 10 CFR §20. This subpart provides radiological criteria for releasing a facility for unrestricted use. The regulation states that the site can be released for unrestricted use if radioactivity levels are such that the average member of a critical group would not receive a Total Effective Dose Equivalent (TEDE) in excess of 25 millirem per year, and provided that residual radioactivity has been reduced to levels that are As Low As Reasonably Achievable (ALARA). The decommissioning estimates for TMI-2 assume 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).[16] An additional limit of 4 millirem per year, as defined in 40 CFR §141.16, is applied to drinking water.[17]

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) [18] provides that EPA will defer exercise of authority under CERCLA for the majority of facilities decommissioned under NRC authority. The MOU also includes provisions for NRC and EPA consultation for certain sites when, at the time of license termination, (1) groundwater contamination exceeds EPA-permitted levels; (2) NRC contemplates restricted release of the site; and/or (3) residual radioactive soil concentrations exceed levels defined in the MOU.

The MOU does not impose any new requirements on NRC licensees and should reduce the involvement of the EPA with NRC licensees who are decommissioning. Most sites are expected to meet the NRC criteria for unrestricted use, and the NRC believes that only a few sites will have groundwater or soil contamination in excess of the levels specified in the MOU that trigger consultation with the EPA. However, if there are other hazardous materials on the site, the EPA may be involved in the cleanup. As such, the possibility of dual regulation remains for certain licensees. The present study does not include any costs for this occurrence.

TABLE 1.1

INVENTORY OF SPENT FUEL AUXILIARY AND FUEL HANDLING BUILDINGS [19]

Cubical	Location	SNF Quantity (g)
AX004	Seal Injection Valve Room	30
AX006	Make-up Pump 1B	70
AX007	Make-up Pump 1A	230
AX015a	Cleanup Filters	50
AX015b	Cleanup Filters	50
AX114	MU&P Demineralizer 1A	1,060
AX115	MU&P Demineralizer 1B	130
AX019	Waste Disposal Liquid Valve Room	10
FH001	MU Suction Valve Room	460
AX012	AB Sump Tank Room	100
AX020	Reactor Coolant Bleed Tank 1B	1,750
AX020	Reactor Coolant Bleed Tank 1C	1,750
AX021	Reactor Coolant Bleed Tank 1A	310
AX024	AB Sump Filters	20
AX112	Seal Return Coolers and Filter Room	300
AX116	Makeup Tank Room	310
AX117	MU&P Filter Room	60
AX131	Miscellaneous Waste Tank Room	100
AX128	Instrument and Valve Room	10
AX218	Concentrated Waste Storage Tanks	10
AX501	RB Spray Pump 1A	10
AX502	RB Spray Pump 1B	10
AX503	DHR Pump 1A	10
AX504	DHR Pump 1B	10
FH003a	MU Discharge Valves	10
FH003b	MU Discharge Valves	100
FH004	Westinghouse Valve Room	160

TABLE 1.1
(continued)
INVENTORY OF SPENT FUEL
AUXILIARY AND FUEL HANDLING BUILDINGS

Cubical	Location	SNF Quantity (g)
FH101	MU&P Valve Room	320
FH112	Annulus	10
FH109	Spent Fuel Pool "A"	3,800
	Embedded Valves & Piping (MU System)	170
	Embedded Valves & Piping (WDL System)	40
	TOTAL	**11,460**

TABLE 1.2
INVENTORY OF SPENT FUEL
REACTOR BUILDING

Area/Component	SNF Quantity (g)
Reactor Vessel	925,000
RV Head Assembly	1,300
RV Upper Plenum Assembly	2,100
Fuel Transfer Canal	18,900
Core Flood System	4,900
"A" D-ring	21,000
Upper Endfitting Storage Area	5,900
Reactor Coolant Drain Tank	100
Letdown Coolers	3,700
RB Basement and Sump	1,300
Tool Decontamination Facility (347')	100
Defueling Water Cleanup System	3,700
Defueling Tool Rack	600
Temp React Vessel Filtration System	4,400
RB Drains	5,100
Total	**998,100**

TABLE 1.3
INVENTORY OF SPENT FUEL
REACTOR COOLANT SYSTEM

Component	SNF Quantity (g)
Pressurizer (including surge line)	500
Decay Heat Drop Line	1,500
"A" SIDE	
OTSG Upper Tubesheet	1,400
Tube Bundle	1,700
Lower Head and J-legs	4,000
Hot Legs	900
Cold Legs	7,200
Core Flood Line	600
"B" SIDE	
OTSG Upper Tubesheet	36,000
Tube Bundle	9,100
Lower Head and J-legs	10,100
Hot Legs	1,800
Cold Legs	2,400
Core Flood Line	400
RCS Surface Films	4,600
Reactor Coolant Pumps	6,200
Total	**88,400**

2. DECOMMISSIONING ALTERNATIVES

Detailed cost estimates were developed to decommission TMI-2 for three scenarios. Although the alternatives differ with respect to technique, process, cost, and schedule, they attain the same result: the ultimate release of the site for unrestricted use.

Three decommissioning cost scenarios were evaluated for the nuclear unit. The scenarios assume that Exelon will operate the adjacent Unit 1 until its license expiration date in 2034. The scenarios are defined as follows:

1. DECON: The adjacent TMI-1 is promptly decommissioned upon the scheduled cessation of operations in 2034. TMI-2 transitions from a PDMS status to decommissioning in 2040. The decommissioning program for TMI-2 runs concurrently with the TMI-1 decommissioning effort; license termination of Unit 2 occurs in 2053, approximately 10 years after Unit 1 completes its decommissioning program (exclusive of the on-site ISFSI operations for Unit 1 fuel).

2. Delayed DECON: Unit 1 defers decommissioning until its spent fuel has been removed from the site. This scenario assumes that the decontamination and dismantling activities at TMI-2 are synchronized with the adjacent unit such that the licenses for both units are terminated concurrently.

3. SAFSTOR: TMI-1 is placed into long-term storage. TMI-2 remains in storage until such time that decommissioning activities can be coordinated with Unit 1. As with the first scenario, termination of the licenses is coordinated.

The nomenclature for these three scenarios is consistent with the Unit 1 decommissioning cost estimate. For each of the scenarios, Post-Defueling Monitored Storage (PDMS) costs of approximately $3.1 million per year have been included from 2013 until Unit 1 shutdown in 2034 (DECON continues the PDMS charges until 2040). Other decommissioning costs (including dormancy costs for the Delayed DECON and SAFSTOR scenarios) are only accrued following TMI-1 shutdown.

The conceptual approach that the NRC has described in its regulations divides decommissioning into three phases. The initial phase addresses the transition of reactor operations (i.e., power production) to facility de-activation and closure. 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 TMI-2 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.

The following sections describe the basic activities associated with each alternative. The three scenarios are essentially identical; all being variations of the NRC's SAFSTOR scenario following a dormancy period. The technical assumptions are unchanged with the only difference in the second and third scenarios being the delay in start of decommissioning expenditures and the additional storage cost during the delay period.

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 nuclear unit and licensee from reactor operations (i.e., power production) to facilitate de-activation and closure. This phase was completed when TMI-2 began the PDMS phase; the plant is in SAFSTOR dormancy.

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 TMI-2 are also divided into phases or periods; however, demarcation of the phases is based upon major milestones within the project or significant changes in the projected expenditures.

2.1 DECON

As stated previously, the naming convention of the three Unit 2 decommissioning scenarios is consistent with the Unit 1 decommissioning scenarios. This scenario runs concurrent with the Unit 1 DECON scenario, and therefore is referred to as DECON for Unit 2, even though the unit is currently in SAFSTOR dormancy.

2.1.1 Period 2 - Dormancy

The second phase identified by the NRC in its rule addresses licensed activities during a storage period and is applicable to the PDMS phase from 2013 to 2040 for the DECON alternative (the delayed scenarios terminate PDMS with Unit 1 shutdown, and begin a standard SAFSTOR dormancy program in 2034). TMI-2 has been in a dormant condition since entry into PDMS in December 1993. This estimate includes the yearly $3.1 million PDMS costs for maintaining TMI-2 until the start of decommissioning in 2040.

Dormancy activities during PDMS include a 24-hour security force (primarily provided by the operating Unit 1), preventive and corrective maintenance on security systems, area lighting, general building maintenance, heating and ventilation of buildings, routine radiological inspections of contaminated structures, maintenance of structural integrity, and a site environmental and radiation monitoring program. Maintenance personnel perform equipment maintenance, inspection activities, routine services to maintain safe conditions, adequate lighting, heating, and ventilation, and periodic preventive maintenance on essential site services. Most site labor activities are provided by Exelon personnel under contract to FirstEnergy.

An environmental surveillance program is carried out during the dormancy period to ensure that releases of radioactive material to the environment are prevented and/or detected and controlled. Appropriate emergency procedures are established and initiated for potential releases that exceed prescribed limits.

Security during the dormancy period is conducted primarily to prevent unauthorized entry and to protect the public from the consequences of its own actions. Security is provided by fences, sensors, alarms, and other surveillance equipment. Fire and radiation alarms are also monitored.

2.1.2 Period 3 - Preparations

Preparations include the planning for the removal of the remaining fuel-bearing components, decontamination of the structures and the dismantling of the remaining equipment and facilities. Typically, the process is described within a Post-Shutdown Decommissioning Activities Report (PSDAR) or a Decommissioning Plan (DP). Although the exact format and content of the decommissioning planning document has not been identified, as a minimum Technical Specification 3.2.1.1 requires NRC approval prior to removal of greater than 42 kilograms of fuel from the reactor vessel. Thus in addition to the planning document, changes may be required to the existing technical specifications prior to the start of major decommissioning activities.

Engineering and Planning

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

The estimate assumes that FirstEnergy will provide project oversight. However, the majority of the professional, managerial, technical and administrative support staff will be provided by a decommissioning operations contractor (DOC).

Site Preparations

In preparation for active decommissioning, the following activities are initiated:

- Characterization of the site and surrounding environs. This includes radiation surveys of the reactor building including: the basement and elevator block wall area, areas surrounding major components (including the reactor vessel and its internals, steam generators), internal piping, and primary shield cores. Surveys of the auxiliary and fuel handling building with emphasis on areas with known and potential alpha contamination and know fission products. Surveys and sample analysis will also be performed on exterior buildings, land areas surrounding the facility, subsurface soil and groundwater.
- Specification of transport and disposal requirements for highly radioactive waste and/or hazardous waste, including shielding and waste stabilization.
- Development of procedures for occupational exposure control, control and release of liquid and gaseous effluent, processing of radwaste (including dry-active waste, resins, filter media, metallic and non-metallic components generated in decommissioning), site security and emergency programs, and industrial safety.

2.1.3 Period 4 - Decommissioning Operations

This period includes the physical decommissioning activities associated with the removal and disposal of contaminated and highly radioactive components and structures, including the successful termination of the license. Significant decommissioning activities in this phase include:

- Construction of temporary facilities and/or modification of existing facilities to support dismantling activities. This may include a centralized processing area to facilitate equipment removal and component preparations for off-site disposal.
- Refurbishment of the containment air control envelope building located outside the reactor building equipment hatch. A prefabricated metal containment building located on the 305' level of the reactor building will be required for the handling of highly contaminated material being removed from the basement or the operating deck elevations.
- Modification of the containment structure to facilitate handling of large equipment. This will include an evaluation to determine whether a temporary crane should be installed or whether the existing polar crane should be refurbished (the reactor vessel head will be the heaviest lift under the current removal scenario with the in-situ segmentation of the reactor vessel and steam generators).
- Reconfiguration and modification of site structures and facilities as needed to support decommissioning operations. This may include the upgrading of roads and rail facilities (on- and off-site) to facilitate hauling and transport. Modifications may also be required to the refueling area of the building to support the segmentation of the reactor vessel internals and component extraction.
- Design and fabrication of temporary and permanent shielding to support removal and transportation activities, construction of contamination control envelopes, and the procurement of specialty tooling.
- Procurement (lease or purchase) of shipping canisters, cask liners, and industrial packages.
- Decontamination of components and structures as required to control (minimize) worker exposure.
- Decontamination of the reactor building so as to reduce working area dose rates and improve working conditions. The reactor building basement is known to be highly contaminated and will

require remote operations and tooling for the initial decontamination effort.

- Inventory, decontamination and removal of legacy equipment inventory left over from the defueling campaign.
- Installation of a water processing system to filter and treat water from the reactor coolant system and fuel handling pool.
- Removal of piping and components no longer essential to support decommissioning operations.
- Removal of control rod drive housings and the head service structure from reactor vessel head. Segmentation of the vessel closure head.
- Segmentation of the upper internals assemblies. The plenum is currently stored in the fuel transfer canal. Segmentation will maximize the loading of the shielded transport casks, i.e., by weight and activity. The operations are conducted under water using remotely operated tooling and contamination controls.
- Disassembly and segmentation of the remaining reactor internals, including the core former and lower core support assembly. All internals components below the top of the fuel are expected to exceed Class C disposal requirements due to fuel contamination. As such, the segments will be packaged in modified fuel storage canisters for geologic disposal.
- Segmentation of the reactor vessel. A shielded platform is installed for segmentation as cutting operations are performed in-air using remotely operated equipment within a contamination control envelope. The water level is maintained just below the cut to minimize the working area dose rates. Segments are transferred in-air to containers that are stored under water, for example, in an isolated area of the refueling canal.
- Removal of the steam generators and pressurizer for material recovery and controlled disposal. Due to the high internal and external radioactivity, these components can not serve as their own shipping containers. The steam generators are assumed to be segmented in-place. The pressurizer is assumed to be cut in half and shipped in a sealed and shielded shipping and burial container. Steel shielding will be added, as necessary, to those external areas of the package to meet transportation limits and regulations.
- Removal of free standing concrete structures in the reactor building.

- Removal of the remaining internal structures within the reactor building including: the polar crane, inner pools and wall liners, biological shield, D-rings, floors and walls.

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

- Removal of remaining plant systems and associated components as they become nonessential to the decommissioning program or worker health and safety (e.g., waste collection and treatment systems, electrical power and ventilation systems).
- Processing of the structural material in the reactor, auxiliary and fuel handling buildings. Approximately 90% of the concrete removed at this stage is assumed to meet free release criteria. The remainder is sent to a waste processor. The free-released concrete is available as fill. Excess concrete is disposed of in an industrial landfill.
- Removal of contaminated yard piping and any contaminated soil.
- Transfer of greater-than-Class C (GTCC) material to the DOE.
- Surveys of the decontaminated areas not designated for complete removal and disposal.
- Remediation and removal of the contaminated equipment and material from the auxiliary and fuel buildings and any other contaminated facility. Certain areas in the auxiliary and spent fuel handling buildings contain very high contamination and radiation levels and will require additional resource and increased radiological protection to complete the decontamination. Radiation and contamination controls will be utilized until residual levels indicate that the structures and equipment can be released for unrestricted access and conventional demolition. This activity may necessitate the dismantling and disposition of most of the systems

and components (both clean and contaminated) located within these buildings. This activity facilitates surface decontamination and subsequent verification surveys required prior to obtaining release for demolition.

- Most of the power block structures (Reactor, Auxiliary and Fuel Handling) will be removed to below the building foundations / basemat to ensure that no radioactive material remains on site.
- Material that is designated as scrap or general disposal (survey and release) is transferred to a designed waste processing vendor for a confirmatory survey and, if permitted, released for unrestricted disposition. Contaminated material is characterized and segregated for additional off-site processing (disassembly, chemical cleaning, volume reduction, and waste treatment), and/or packaged for controlled disposal at a low-level radioactive waste disposal facility.

Incorporated into the LTP is the Final Survey Plan. This plan identifies the radiological surveys to be performed once the decontamination activities are completed and is developed using the guidance provided in the "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)."[20] 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 license if it determines that site remediation has been performed in accordance with the LTP, and that the terminal radiation survey and associated documentation demonstrate that the facility is suitable for release.

2.1.4 Period 5 - Site Restoration

Following completion of decommissioning operations, site restoration activities will begin. Efficient removal of the contaminated materials and verification that residual radionuclide concentrations are below the NRC limits will result in substantial damage to many of the remaining structures.

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

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

2.2 SAFSTOR and Delayed DECON

The decontamination and dismantling activities in this scenario are identical to those described in Section 2.1 for DECON. However, the start of active decommissioning is deferred to coordinate with the timing of the Unit 1 Delayed DECON and SAFSTOR scenarios. As such, the presence of the dormancy period incurs storage costs (correspondingly greater for the SAFSTOR scenario, with its longer dormancy period).

While it is expected that radiation dose levels will decrease over the duration of the longer dormancy period, the nature of radionuclides involved and the difficulties in working in plant areas contaminated with these radionuclides will require similar operational and radiological controls to those envisioned for earlier scenario. As such, there have been no changes incorporated into the costs to perform the field decommissioning activities identified in Section 2.1 for this scenario. Note that, with Unit 1 permanently shut down, there are dormancy costs for Unit 2 included in the estimate following the cessation of the PDMS charges in 2034.

3. COST ESTIMATE

The cost estimates prepared for decommissioning TMI-2 consider the radiological status, unique conditions of the site, including the NSSS, power generation systems, support services, site buildings, and ancillary facilities. The basis of the estimates, including the sources of information relied upon, the estimating methodology employed, site-specific considerations, and other pertinent assumptions, is described in this section.

3.1 BASIS OF ESTIMATE

The estimates rely upon site-specific, technical information originally developed in an evaluation prepared for the GPU Nuclear Corporation in 1995-96, and last updated for FirstEnergy in 2008. The information was reviewed for the current analysis and updated as deemed appropriate. The site-specific considerations and assumptions used in the previous evaluation were also revisited. Modifications were incorporated where new information was available or experience from ongoing decommissioning programs provided viable alternatives or improved processes.

Some of the technical assumptions that were used are due to the unique nature and characteristics of the plant as a result of the March 1979 accident. Following the accident, TMI-2 was defueled and extensive decontamination activities were performed. This successfully removed approximately 99% of the original fuel and resulting fuel debris. Removal of the residual 1% was neither cost effective nor warranted due to the high radiation fields in the reactor building and adjoining auxiliary and fuel handling buildings. The remaining equipment and components containing spent nuclear fuel (SNF) will be removed, sealed and/or encapsulated in preparation for disposal during the decommissioning program.

3.2 METHODOLOGY

The methodology used to develop the estimates follows the basic approach originally presented in the AIF/NESP-036 study report, "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates,"[21] and the DOE "Decommissioning Handbook."[22] These documents present a unit factor method for estimating decommissioning activity costs, which simplifies the estimating calculations. Unit factors for concrete removal ($/cubic yard), steel removal ($/ton), and cutting costs ($/inch) were developed using local labor rates. The activity-dependent costs were estimated with the item quantities (cubic yards and tons), developed from plant drawings and inventory documents. Removal rates and material costs for the conventional disposition of components and structures relied upon information available in the industry publication, "Building Construction Cost Data," published by R.S. Means.[23]

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

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

Work Difficulty Factors

TLG has historically applied work difficulty adjustment factors (WDFs) to account for the inefficiencies in working in a power plant environment and increase the time required to perform the activity. WDFs were assigned to each unique set of unit factors, commensurate with the inefficiencies associated with working in confined, hazardous environments. The WDF sets were developed considering the extremely difficult working conditions associated with working in high radiation areas and in areas with high alpha particle contamination. The same work difficulty factor sets were used for all three scenarios. This assumption was based upon the relatively high levels of long-lived radioactivity that exists today plus the high levels of alpha contamination.

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. Given the radiological status of some areas at TMI-2, the range of the WDF's was increased. The ranges used for the WDFs are identified in the following table.

Work Difficulty Factors

	Other Power Block	Fuel/Aux Buildings	Reactor Building	NSSS Components
Access	20%	30%	30%	40%
Respiratory Protection	0-25%	200%	50%	200%
Radiation/ALARA	10-25%	40%	40%	100%
Protective Clothing	0-30%	50%	50%	50%
Work Break	8.33%	8.33%	8.33%	8.33%

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.

As shown above, higher WDF's sets were assigned to systems located in the reactor building and to systems which contain SNF and/or high levels of radioactive materials. The resulting man-hours, or crew-hours, are used in the development of the decommissioning program schedule, using resource loading and event sequencing considerations. The scheduling of conventional removal and dismantling activities are based upon productivity information available from the "Building Construction Cost Data" publication.

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

3.3 IMPACT OF DECOMMISSIONING MULTIPLE REACTOR UNITS

The DECON scenario for TMI-2 decommissioning operates independently from the adjacent Unit 2. The delayed decommissioning modes, Delayed DECON and SAFSTOR, consider opportunities to achieve economies of scale, by sharing costs between units, and coordinating the sequence of work activities. There will also be schedule constraints, particularly where there are requirements for specialty equipment and staff, or practical limitations on when final status surveys can take place. A summary of the principal impacts are listed below.

- Consistent with the agreement between FirstEnergy and Exelon regarding the timing of decommissioning activities at TMI-2, it is assumed that decommissioning at TMI-2 will not begin prior to 2034. Under the terms of this agreement, decommissioning activities at Unit 2 cannot begin while Unit 1 is still in commercial operation. The decommissioning scenarios used in this analysis are structured to integrate to the extent possible with a Unit 1 decommissioning scenario.
- Since the security program for the site is likely to be an integrated approach, the security guard force is assumed to be shared to varying degrees between the units, depending upon the level of activities at each unit. This reduces the security costs for the decommissioning estimates for both units on site.
- The final radiological survey schedule is also affected by a two-unit decommissioning schedule. It would be considered impractical to try to complete the final status survey of Unit 1, while Unit 2 still has ongoing radiological remediation work and waste handling in process. As such, this analysis has structured the decommissioning scenarios for Unit 2 to coordinate the final status survey for the station.

3.4 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.

3.4.1 Contingency

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

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"[24] as "specific provision for unforeseeable elements of cost within the defined project scope; particularly important where previous experience relating estimates and actual costs has shown that unforeseeable events which will increase costs are likely to occur." The cost elements in this analysis are based upon ideal conditions and maximum efficiency; therefore, consistent with industry practice, a contingency factor has been applied. In the AIF/NESP-036 study, the types of unforeseeable events that are likely to occur in decommissioning are discussed and guidelines are provided for percentage contingency in each category. It should be noted that contingency, as used in this analysis, does not account for price escalation and inflation in the cost of decommissioning over the time intervals identified for each scenario.

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

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

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

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

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

The contingency values are applied to the appropriate components of the estimates on a line item basis. A composite value is then reported at the end of each estimate. For example, the composite contingency value reported for the DECON alternative is 20.3%. Values for the other alternatives are delineated within the detailed cost tables in Appendices D and E.

3.4.2 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:

- Delays in approval of the decommissioning plan due to intervention, public participation in local community meetings, legal challenges, and national and local hearings.
- Changes in the project work scope from the baseline estimate, involving the discovery of unexpected levels of contaminants, contamination in places not previously expected, contaminated soil previously undiscovered (either radioactive or hazardous material contamination), variations in plant inventory or configuration not indicated by the as-built drawings.
- Regulatory changes, e.g., affecting worker health and safety, site release criteria, waste transportation, and disposal.
- Policy decisions altering national commitments, e.g., in the ability to accommodate certain waste forms for disposition or in the timetable for such, e.g., the start and rate of acceptance of spent fuel by the DOE.
- Pricing changes for basic inputs, such as labor, energy, materials, and burial. Some of these inputs may vary slightly, e.g. -10% to +20%; burial could vary from -50% to +200% or more.

It has been TLG's experience that the results of a risk analysis, when compared with the base case estimate for decommissioning, indicate that the chances of the base decommissioning estimate's being too high is a low probability, and the chances that the estimate is too low is a higher probability. This is mostly due to the pricing uncertainty for low-level radioactive waste burial, and to a lesser extent due to schedule increases from changes in plant conditions and to pricing variations in the cost of labor (both craft and staff). This cost study, however, does not include any additional costs for financial risk since there is insufficient historical data from which to project future liabilities. Consequently, the areas of uncertainty or risk should be revisited periodically and addressed through repeated revisions or updates of the base estimate.

3.5 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. Unless otherwise noted, these assumptions are applicable to all three scenarios.

3.5.1 Spent Fuel Management

The cost to dispose of spent fuel generated from plant operations is not reflected within the estimates to decommission the TMI-2 site. The majority of the spent fuel was removed during the TMI-2 Clean-up Program's reactor vessel defueling effort which concluded in January 1990. Title to the spent fuel that was removed was transferred to the DOE.

The remainder of the fuel (about 1%) is dispersed within the primary system and to a lesser extent in other systems and structures. This residual material will be removed as radioactive waste and is included in the waste disposal volumes discussed in Section 5.

Repository Availability

There will be some wastes generated in the decommissioning of TMI-2 that are not suitable for shallow land burial and therefore cannot be shipped for disposal to either Waste Control Specialists or Energy*Solutions*. This material, primarily associated with systems and structures contaminated with fuel debris, requires greater isolation from the environment.

The estimates for TMI-2 assume the timely removal of waste designated for geologic disposal, without the need for interim on site storage (once containerized).

3.5.2 Reactor Vessel and Internal Components

The majority of the reactor internal components have already been removed as a result of the accident recovery effort in the 1980's. These components are currently being stored within the reactor building. This estimate assumes that these components are segmented and shipped in shielded, reusable transportation casks commensurate with the start of major reactor vessel removal activities, i.e., Period 4a of each scenario.

The reactor pressure vessel and remaining internal components (essentially the core barrel, core former, thermal shield, and flow distributor) are segmented and packaged for disposal in shielded, reusable transportation casks. Segmentation of the remaining internal components is performed in the refueling canal, where a turntable and remote cutter are installed. The vessel is segmented in place, using a mast-mounted cutter supported off the lower head and directed from a shielded work platform installed overhead in the reactor cavity. Transportation cask specifications and transportation regulations will dictate segmentation and packaging methodology.

It is anticipated that all neutron-activated components in the reactor vessel and internals would meet existing disposal requirements as delineated in 10 CFR §61, due to the short operating history. However, the fission products and transuranic material present on all surfaces in the vessel and internals are expected to exceed Class C limits, in particular for those components located below the top of the core. The reactor vessel and the upper portions of the internals are assumed to meet Class A limits following decontamination.

The dismantling of the reactor internals will generate radioactive waste considered unsuitable for shallow land disposal, i.e., GTCC. Although the material is not classified as high-level waste, the DOE has indicated it will accept this waste for disposal at the future high-level waste repository.[25] 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.

For purposes of this analysis, the GTCC has been packaged and disposed of as high-level waste. It is also assumed that the DOE will accept the GTCC material in a timely manner so as not to affect the TMI-2 decommissioning schedule. No additional costs are included for the temporary storage of GTCC material.

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

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

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

It is not known whether this option will be available for TMI-2. Future viability of this option will depend upon the ultimate location of the disposal site, as well as the disposal site licensee's ability to accept highly radioactive packages and effectively isolate them from the environment. Consequently, the study assumes the reactor vessel will require segmentation, as a bounding condition.

3.5.3 Steam Generators

With the high levels of radioactivity and contamination both in the reactor building and within the steam generators, this estimate assumes that the steam generators will be segmented in place instead of one piece removal.

The removal sequence assumed for the estimate is as follows:

- Remove the upper steam generator channel head by wire sawing the shell and tubes immediately below the upper tube sheet.
- Segment and decontaminate the upper channel head in the fuel transfer pool.

- Install a steam generator work platform to allow in-place underwater segmentation of the steam generator internals.
- Remove the steam generator tubing and associated shroud and support plates.
- Remove the steam generator cylindrical shell.
- Remove the lower steam generator channel head.
- Segment and decontaminate the lower channel head in the fuel transfer pool.

The steam generator tubing is packaged and shipped and buried as Class B waste. Steam generator tube support plates, shrouds, and shell plates are transported and buried as Class A waste. The estimate assumes that the steam generator channel heads will be decontaminated using a combination of machining and ultra high pressure (UHP) water sprays such that the components can be shipped and buried as Class A waste.

Waste that is generated as a result of the machining and normal filtering of the water in the steam generators and the fuel transfer pool is assumed to be highly radioactive and is packaged and transferred to the DOE as GTCC waste.

3.5.4 Other Primary System Components

The following discussion deals with the decontamination, removal and disposition of the pressurizer, reactor coolant piping, reactor coolant pumps and motors, and the core flood tanks.

A combination of in-place decontamination, and remote decontamination of components in the fuel transfer pool was assumed in the estimate.

The pressurizer and the core flood tanks are decontaminated in-place using UHP. Once decontaminated, the pressurizer is cut in half, removed from the reactor building, grouted, and packaged in a shielded container for rail shipment and burial as Class A waste. The core flood tanks are assumed to be segmented, packaged and shipped as Class A waste.

Hot leg piping is accessed by cutting a hole in the core barrel. A combination of underwater remote retrieval and vacuuming is used to remove fuel and fission product material. Hot and cold leg piping and fittings are removed and placed in the fuel transfer pool for additional decontamination. Hydrolasing is used to remove radioactive materials. Removed material is collected using filters and demineralizers, packaged, and transferred to the DOE as GTCC material. Decontaminated piping is packaged, shipped and buried as Class A waste.

The reactor coolant pump motors are removed intact and placed in shielded containers for rail transport and burial as Class A material.

Reactor coolant pumps are disassembled and placed in the fuel transfer pool for decontamination. Pump components are decontaminated using UHP to remove the majority of the radioactive material. Following decontamination, the components are packaged in shielded containers for rail transport and buried as Class A material. Material removed as a result of the decontamination process is collected using filters and shipped as GTCC material. The estimates also assume that process water used for reactor coolant system decontamination and in the fuel transfer pool is processed using cesium/strontium preferential cation demineralizers. The resin waste is processed and buried as Class C radioactive waste.

3.5.5 Other Systems Known to Contain High Levels of Radioactivity

Systems in the reactor building and portions of systems in the auxiliary and fuel handling buildings are known to contain high levels of radioactivity and potentially spent fuel material from the accident. The estimates recognize the difficulty in removing these components by increasing the work difficulty factors associated with removal of these systems. The estimates also assume that these components will be packaged for direct disposal (no recycling). The disposal costs of these waste streams were also adjusted, as appropriate, to include curie surcharges commensurate with the higher radioactivity levels.

These systems and components will be decontaminated with UHP sprays to removal fuel solids and sludge from fuel bearing components in the fuel and auxiliary buildings. Solids and sludge resulting from the UHP process will be transferred to the reactor building to be packaged in canisters used for NSSS decontamination.

3.5.6 Reactor Building Structures Decontamination

Significant radioactive contamination exists throughout the TMI-2 reactor building. This contamination is due to fission products (^{90}Sr and ^{137}Cs in particular) released from the damaged fuel. The radiation levels are not expected to decrease significantly from current levels due to the long half lives of these elements. The dispersion of spent fuel within the reactor building includes alpha-decaying isotopes in addition to the beta and gamma radiation normally encountered during decommissioning. These unusual conditions require additional controls and more engineered decommissioning methods to perform the structure decontamination and demolition.

Based upon these conditions, the estimates assume that the entire interior structure of the reactor building is removed and disposed as potentially contaminated material.

The lower elevations of the reactor building are highly contaminated. Significant activity has been absorbed in the concrete block walls, in the four-foot thick D-ring concrete walls, and on the lower level concrete floors. Initial decontamination of this area (Period 4a) is assumed to be performed using remotely-operated machines. Surface material will be bulk removed from the concrete walls, packaged in shielded casks and, on average concentration, buried as Class B waste (i.e., most of the debris mass will be Class A, but there will be hot spots ranging to Class C or GTCC).

Once the highly contaminated surfaces are decontaminated, free standing concrete walls will be removed (in Period 4b using more conventional means) and shipped for direct burial as radioactive waste.

The upper portion of the containment inner steel liner and the entire polar crane will be removed using conventional radioactive demolition techniques (in Period 4b) and packaged, shipped and buried as radioactive waste. Following liner removal, the outer reactor building concrete walls will be demolished. This remaining structural material from the reactor building will be surveyed on site, with 90% of the concrete volume assumed to meet free release criteria. The remaining 10% is sent to a waste processor. The free released concrete is acceptable for use as fill. Excess material will be sent to an industrial landfill.

3.5.7 Demolition of Other Contaminated Structures

Significant contamination exists within the auxiliary and fuel buildings. Similar to the reactor building, locations within these buildings will require special engineered methods to safely decontaminate and dispose of the structures.

The estimate assumes that the entire auxiliary and fuel building structures (all walls and floors down to the footings) will be removed and the resultant structural material monitored and processed with the same criteria as the reactor building.

Selected areas of the buildings will require remote operated machines and dedicated engineered ventilation systems and enclosures to allow decontamination and material removal.

3.5.8 Main Turbine and Condenser

The main turbine will be dismantled using conventional maintenance procedures. The remaining turbine internals will be removed to a laydown area. The lower turbine casings will be removed from their anchors by controlled demolition. This study recognizes that one of the low pressure turbine rotors and the main electrical generator has already been removed from the site. The main condensers will also be disassembled and moved to a laydown area. Material is then prepared for transportation to an off-site recycling facility where it will be surveyed and designated for either decontamination or volume reduction, conventional disposal, or controlled disposal. Components will be packaged and readied for transport in accordance with the intended disposition.

3.5.9 Transportation Methods

Contaminated piping, components, and structural material other than the highly contaminated reactor coolant system components and reactor building structures will qualify as LSA-I, II or III or Surface Contaminated Object, SCO-I or II, as described in Title 49.[26] The contaminated material will be packaged in Industrial Packages (IP-1, IP-2 or IP-3, as defined in subpart 173.411) for transport unless demonstrated to qualify as their own shipping containers. It is anticipated that the reactor vessel, after decontamination with UHP water sprays, and due to its limited operating lifetime, will qualify as LSA II or III, once the reactor internals and remaining fuel debris is removed. Portions of the reactor vessel internal components are expected to be transported to the DOE's geologic repository in spent fuel casks by rail.

Waste resulting from filtering and demineralization of the reactor coolant system, and processing the fuel transfer pool water is assumed to require shipment in shielded truck casks. Transport of other highly radioactive waste such as reactor coolant system components, and waste from the decontamination of the reactor building basement are by shielded truck cask. Truck cask shipments may exceed 95,000 pounds, including payload, supplementary shielding, cask tie-downs, and tractor-trailer. The maximum level of activity per shipment assumed permissible was based upon the license limits of the available shielded transport casks. The segmentation scheme for the vessel and internal segments is designed to meet these limits.

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

Truck transportation costs are estimated using published tariffs from Tri-State Motor Transit.[27]

The low-level radioactive waste requiring controlled disposal will be sent to the Energy*Solutions* facility in Clive, Utah. Memphis, Tennessee, is used as the destination for off-site processing. Bulk material shipped off site to the waste processor or to Energy*Solutions* is primarily moved via gondola railcars.

3.5.10 Low-Level Radioactive Waste Disposal

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

All options and services currently available to FirstEnergy for disposition of the various waste streams produced by the decommissioning process were considered. The majority of the low-level radioactive waste designated for direct disposal can be sent to Energy*Solutions*' facility in Clive, Utah. Therefore, disposal costs for

Class A waste were based upon FirstEnergy's agreement with Energy*Solutions*. This facility is not licensed to receive the higher activity portion (Classes B and C) of the decommissioning waste stream.

Very low-level radioactive waste, e.g., structural steel and contaminated concrete, is sent to a waste processing facility. More highly contaminated and activated material is sent to Energy*Solutions*. Disposal fees are based upon current charges for operating waste.

Waste Control Specialists (WCS) is licensed to receive the higher activity waste forms (Classes B and C). As such, for this analysis, disposal costs for the Class B and C waste were based upon the preliminary and indicative information on the cost for such from WCS.

The Idaho National Engineering and Environmental Laboratory (INEEL) is currently storing waste from the TMI-2 defueling operation. Costs have been included in this estimate to pay INEEL for the final disposal of this waste; the timing of when this payment occurs will be dependent upon the DOE's schedule for cleanup of INEEL. This estimate assumes that the payment occurs during Period 4 of each cost scenario.

This study assumes that most of the concrete resulting from the demolition of the reactor, auxiliary and fuel handling buildings can be surveyed and released on site for fill of below grade voids, or shipped off site to a local construction debris landfill. Should there be restrictions to this approach; the cost impact on the decommissioning program could become quite large, potentially up to tens of millions of dollars.

3.5.11 Additional Decommissioning Facilities

Additional specialized facilities are required in support of the decommissioning. These include refurbishment of the containment air control envelope building located outside the reactor building equipment hatch, and the contamination control cubicle located outside the other personnel airlock, for reactor building radiological control and access. Construction of a prefabricated metal enclosure at the 305 foot elevation within the reactor building for the handling of highly-contaminated material will be required. A radioactive waste packaging and processing facility will also be required (Note that such a facility already exists on site, but will require refurbishment).

3.5.12 Remediation of Soil and Underground Piping

The estimates include the cost to remove certain underground piping. An allowance is also included for the removal, packaging, transportation and disposal of approximately 49,000 cubic feet of contaminated soil.

3.5.13 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 termination survey and associated documentation demonstrate that the facility is suitable for release. The NRC's involvement in the decommissioning process will end at this point. Building codes and environmental regulations will dictate the next step in the decommissioning process, as well as the owner's own future plans for the site.

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

This estimate assumes the reactor, auxiliary, fuel buildings will be removed completely, i.e., down to and including their foundations and basemats. Concrete from these buildings will be surveyed on-site using conventional monitoring equipment; concrete which meets the release criteria will be disposed of either on site as fill, or in an off-site landfill.

3.6 ASSUMPTIONS

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

3.6.1 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.

All costs are reported in 2013 dollars.

No costs have been included for the preparation of an environmental impact statement, should it be required.

3.6.2 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 FirstEnergy or from comparable industry information.

FirstEnergy will provide limited oversight support staff in the areas of overall management, licensing, radiological and industrial safety and engineering. It will also hire a DOC to provide the balance of the professional, management, administrative and physical staff.

This study assumes that there is some sharing of security staffing positions with the adjacent Unit 1. This has the effect of lowering site security costs.

3.6.3 Design Conditions

Fuel cladding failure as a result of the accident will most likely prevent shipment of untreated major NSSS components under current transportation regulations and disposal requirements. Therefore, this estimate assumes that aggressive mechanical decontamination of reactor coolant system components is required prior to shipment.

The estimated curie contents of the vessel and internals are neutron activation products derived from those listed in NUREG/CR-3474.[28] Actual estimates are derived from the curie/gram values contained therein and adjusted for the different mass of the TMI-2 components, the operating history of 95 effective full-power days, and different periods of decay. Additional short-lived isotopes were derived from CR-0130 [29] and CR-0672 [30] and benchmarked to the long-lived values from CR-3474. The activation products present in the reactor vessel base metal are assumed to be the controlling factor in their disposal, following surface decontamination of fuel debris.

Reactor vessel internals whose elevation in the reactor places them at or below the original top of the fuel assemblies are assumed to be both sufficiently geometrically complex to preclude effective decontamination and contaminated with spent fuel so as to require disposal as GTCC material.

Control elements and incore detector assemblies are assumed to have been removed with the damaged fuel.

Neutron activation of the reactor building structure and the biological shield is considered minimal due to the short operating life of TMI-2.

3.6.4 General

The plant staff will perform the following activities (FirstEnergy staff will be augmented as necessary, either by direct hiring, or by subcontracting to fulfill the staff requirements):

- Drain and collect lubricating oils for recycle and/or sale.
- Process defueling waste inventories, i.e., the estimates include costs for the removal of lead shielding and spent fuel handling equipment that remains in the reactor building.

Scrap and Salvage

Material located within the radiation controlled area, and not shipped for direct disposal, is sent off-site for survey and release.

Furniture, tools, mobile equipment such as forklifts, trucks, bulldozers, and other property owned by FirstEnergy (and outside the radiation controlled area) is removed at no cost or credit to the decommissioning project. Disposition may include relocation to other facilities. Spare parts are also available for alternative use.

Energy

For estimating purposes, the plant is assumed to be de-energized, with the exception of those facilities associated with long term dormancy. 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) during dormancy and decommissioning are included and based upon current PDMS premiums and anticipated shared costs with the adjacent Unit 1. 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."[31] The NRC's financial protection requirements are based on various reactor configurations.

Taxes

Property taxes are not included.

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.

3.7 COST ESTIMATE SUMMARY

A schedule of expenditures for each scenario is provided in Tables 3.1 through 3.3. Decommissioning costs are reported in the year of projected expenditure; however, the values are provided in thousands of 2013 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 Appendices C through E, along with the schedule discussed in Section 4.

TABLE 3.1

DECON ALTERNATIVE
SCHEDULE OF TOTAL ANNUAL EXPENDITURES
(thousands, 2013 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2013	2,486	0	224	0	326	3,036
2014	2,486	0	224	0	326	3,036
2015	2,486	0	224	0	326	3,036
2016	2,493	0	224	0	327	3,044
2017	2,486	0	224	0	326	3,036
2018	2,486	0	224	0	326	3,036
2019	2,486	0	224	0	326	3,036
2020	2,493	0	224	0	327	3,044
2021	2,486	0	224	0	326	3,036
2022	2,486	0	224	0	326	3,036
2023	2,486	0	224	0	326	3,036
2024	2,493	0	224	0	327	3,044
2025	2,486	0	224	0	326	3,036
2026	2,486	0	224	0	326	3,036
2027	2,486	0	224	0	326	3,036
2028	2,493	0	224	0	327	3,044
2029	2,486	0	224	0	326	3,036
2030	2,486	0	224	0	326	3,036
2031	2,486	0	224	0	326	3,036
2032	2,493	0	224	0	327	3,044
2033	2,486	0	224	0	326	3,036
2034	2,486	0	224	0	326	3,036
2035	2,486	0	224	0	326	3,036
2036	2,493	0	224	0	327	3,044
2037	2,486	0	224	0	326	3,036
2038	2,486	0	224	0	326	3,036
2039	2,486	0	224	0	326	3,036

TABLE 3.1
(continued)
DECON ALTERNATIVE
SCHEDULE OF TOTAL ANNUAL EXPENDITURES
(thousands, 2013 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2040	42,184	1,311	854	22	9,056	53,427
2041	57,835	6,878	1,122	14,512	7,989	88,337
2042	50,240	15,149	1,122	33,610	10,808	110,929
2043	50,240	15,149	1,122	33,610	10,808	110,929
2044	50,377	15,191	1,125	33,702	10,838	111,233
2045	50,240	15,149	1,122	33,610	10,808	110,929
2046	47,661	12,938	1,024	27,517	8,718	97,858
2047	42,771	8,743	838	15,960	4,752	73,063
2048	42,888	8,767	840	16,004	4,765	73,263
2049	42,771	8,743	838	15,960	4,752	73,063
2050	42,771	8,743	838	15,960	4,752	73,063
2051	41,768	8,391	810	15,131	4,570	70,671
2052	24,331	4,863	255	814	1,091	31,354
2053	18,079	7,945	104	1,820	471	28,418
Total	671,323	137,959	18,061	258,232	102,989	1,188,564

TABLE 3.2

DELAYED DECON ALTERNATIVE
SCHEDULE OF TOTAL ANNUAL EXPENDITURES
(thousands, 2013 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2013	2,486	0	224	0	326	3,036
2014	2,486	0	224	0	326	3,036
2015	2,486	0	224	0	326	3,036
2016	2,493	0	224	0	327	3,044
2017	2,486	0	224	0	326	3,036
2018	2,486	0	224	0	326	3,036
2019	2,486	0	224	0	326	3,036
2020	2,493	0	224	0	327	3,044
2021	2,486	0	224	0	326	3,036
2022	2,486	0	224	0	326	3,036
2023	2,486	0	224	0	326	3,036
2024	2,493	0	224	0	327	3,044
2025	2,486	0	224	0	326	3,036
2026	2,486	0	224	0	326	3,036
2027	2,486	0	224	0	326	3,036
2028	2,493	0	224	0	327	3,044
2029	2,486	0	224	0	326	3,036
2030	2,486	0	224	0	326	3,036
2031	2,486	0	224	0	326	3,036
2032	2,493	0	224	0	327	3,044
2033	2,486	0	224	0	326	3,036
2034	1,150	240	236	4	482	2,112
2035	588	341	242	6	547	1,724
2036	590	342	242	6	548	1,728
2037	588	341	242	6	547	1,724
2038	588	341	242	6	547	1,724
2039	588	341	242	6	547	1,724

TABLE 3.2
(continued)
DELAYED DECON ALTERNATIVE
SCHEDULE OF TOTAL ANNUAL EXPENDITURES
(thousands, 2013 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2040	590	342	242	6	548	1,728
2041	588	341	242	6	547	1,724
2042	588	341	242	6	547	1,724
2043	588	341	242	6	547	1,724
2044	590	342	242	6	548	1,728
2045	21,420	885	555	15	4,901	27,776
2046	59,412	3,573	1,122	5,617	9,680	79,404
2047	51,713	13,861	1,122	30,900	9,785	107,381
2048	50,377	15,181	1,125	33,687	10,824	111,194
2049	50,239	15,140	1,122	33,595	10,795	110,890
2050	50,239	15,140	1,122	33,595	10,795	110,890
2051	50,239	15,140	1,122	33,595	10,795	110,890
2052	40,986	8,757	840	15,988	4,751	71,322
2053	40,874	8,733	838	15,945	4,738	71,128
2054	40,874	8,733	838	15,945	4,738	71,128
2055	40,874	8,733	838	15,945	4,738	71,128
2056	40,986	8,757	840	15,988	4,751	71,322
2057	28,132	3,949	456	4,649	2,275	39,461
2058	24,464	11,029	156	2,509	700	38,859
2059	1,008	469	6	107	28	1,619
Total	651,122	141,727	19,459	258,143	107,103	1,177,554

TABLE 3.3

SAFSTOR ALTERNATIVE
SCHEDULE OF TOTAL ANNUAL EXPENDITURES
(thousands, 2013 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2013	2,486	0	224	0	326	3,036
2014	2,486	0	224	0	326	3,036
2015	2,486	0	224	0	326	3,036
2016	2,493	0	224	0	327	3,044
2017	2,486	0	224	0	326	3,036
2018	2,486	0	224	0	326	3,036
2019	2,486	0	224	0	326	3,036
2020	2,493	0	224	0	327	3,044
2021	2,486	0	224	0	326	3,036
2022	2,486	0	224	0	326	3,036
2023	2,486	0	224	0	326	3,036
2024	2,493	0	224	0	327	3,044
2025	2,486	0	224	0	326	3,036
2026	2,486	0	224	0	326	3,036
2027	2,486	0	224	0	326	3,036
2028	2,493	0	224	0	327	3,044
2029	2,486	0	224	0	326	3,036
2030	2,486	0	224	0	326	3,036
2031	2,486	0	224	0	326	3,036
2032	2,493	0	224	0	327	3,044
2033	2,486	0	224	0	326	3,036
2034	1,147	239	236	4	481	2,107
2035	584	339	242	6	546	1,716
2036	585	340	242	6	548	1,721
2037	584	339	242	6	546	1,716
2038	584	339	242	6	546	1,716
2039	584	339	242	6	546	1,716
2040	585	340	242	6	548	1,721
2041	584	339	242	6	546	1,716
2042	584	339	242	6	546	1,716
2043	584	339	242	6	546	1,716
2044	585	340	242	6	548	1,721

TABLE 3.3
(continued)
SAFSTOR ALTERNATIVE
SCHEDULE OF TOTAL ANNUAL EXPENDITURES
(thousands, 2013 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2045	584	339	242	6	546	1,716
2046	584	339	242	6	546	1,716
2047	584	339	242	6	546	1,716
2048	585	340	242	6	548	1,721
2049	584	339	242	6	546	1,716
2050	584	339	242	6	546	1,716
2051	584	339	242	6	546	1,716
2052	585	340	242	6	548	1,721
2053	584	339	242	6	546	1,716
2054	584	339	242	6	546	1,716
2055	584	339	242	6	546	1,716
2056	585	340	242	6	548	1,721
2057	584	339	242	6	546	1,716
2058	584	339	242	6	546	1,716
2059	584	339	242	6	546	1,716
2060	585	340	242	6	548	1,721
2061	584	339	242	6	546	1,716
2062	584	339	242	6	546	1,716
2063	584	339	242	6	546	1,716
2064	585	340	242	6	548	1,721
2065	584	339	242	6	546	1,716
2066	584	339	242	6	546	1,716
2067	584	339	242	6	546	1,716
2068	585	340	242	6	548	1,721
2069	584	339	242	6	546	1,716
2070	584	339	242	6	546	1,716
2071	584	339	242	6	546	1,716
2072	585	340	242	6	548	1,721
2073	584	339	242	6	546	1,716
2074	584	339	242	6	546	1,716
2075	584	339	242	6	546	1,716
2076	585	340	242	6	548	1,721

TABLE 3.3
(continued)
SAFSTOR ALTERNATIVE
SCHEDULE OF TOTAL ANNUAL EXPENDITURES
(thousands, 2013 dollars)

Year	Labor	Equipment & Materials	Energy	Burial	Other	Total
2077	584	339	242	6	546	1,716
2078	584	339	242	6	546	1,716
2079	584	339	242	6	546	1,716
2080	585	340	242	6	548	1,721
2081	5,872	477	321	8	1,651	8,330
2082	59,162	2,301	1,122	1,449	11,987	76,021
2083	54,312	11,604	1,122	26,141	7,999	101,178
2084	50,377	15,177	1,125	33,673	10,818	111,171
2085	50,239	15,136	1,122	33,581	10,789	110,867
2086	50,239	15,136	1,122	33,581	10,789	110,867
2087	50,239	15,136	1,122	33,581	10,789	110,867
2088	43,421	10,455	916	20,657	6,353	81,802
2089	40,801	8,729	838	15,920	4,729	71,017
2090	40,801	8,729	838	15,920	4,729	71,017
2091	40,801	8,729	838	15,920	4,729	71,017
2092	40,913	8,753	840	15,963	4,742	71,211
2093	32,864	5,738	599	8,866	3,193	51,259
2094	24,035	8,524	196	1,821	857	35,434
2095	7,527	3,503	46	803	207	12,086
Total	671,870	153,977	28,227	258,157	126,834	1,239,065

4. SCHEDULE ESTIMATE

The schedules for the decommissioning scenarios considered in this study follow the sequence presented in the AIF/NESP-036 study, with minor changes to reflect recent experience and site-specific constraints.

A schedule or sequence of activities is presented in Figure 4.1 through 4.3 for the three decommissioning scenarios. The key activities listed in the schedule do not reflect a one-to-one correspondence with those activities in the cost tables, but reflect dividing some activities for clarity and combining others for convenience. The schedule was prepared using the "Microsoft Project 2010" computer software.[32]

4.1 SCHEDULE ESTIMATE ASSUMPTIONS

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

- The DECON alternative begins decommissioning of TMI-2 in 2040. The existing PDMS yearly costs of $3.1 million are continued until that date.
- The existing PDMS yearly costs cease upon the shutdown of the adjacent Unit 1 on April 19, 2034 for the Delayed DECON and SAFSTOR scenarios; normal SAFSTOR dormancy costs will commence at that date until decommissioning begins.
- The Delayed DECON alternative defers decommissioning of TMI-2 until TMI-1's spent fuel has been removed from the site. This scenario assumes that the decontamination and dismantling activities at TMI-2 are synchronized with the adjacent unit such that the licenses for both units are terminated concurrently.
- The SAFSTOR alternative places TMI-2 into long-term storage along with TMI-1. TMI-2 remains in storage until such time that decommissioning activities can be coordinated with Unit 1. As with the second scenario, termination of the licenses is concurrent.
- All work (except vessel and internals removal and some of the decontamination of NSSS components in the refueling canal) is per-

formed during an 8-hour workday, 5 days per week, with no overtime. There are eleven paid holidays per year.

- Steam generator removal activities are performed with limited parallel work on the A and B steam generators.
- Reactor and internals removal activities are performed by using separate crews for different activities working on different shifts, with a corresponding backshift charge for the second shift.
- Multiple crews work parallel activities to the maximum extent possible, consistent with optimum efficiency, adequate access for cutting, removal and laydown space, and with the stringent safety measures necessary during demolition of heavy components and structures.
- Reactor building basement decontamination using remote equipment will occur prior to the start of reactor coolant system component removal.

4.2 PROJECT SCHEDULE

The period-dependent costs presented in the detailed cost tables are based upon the durations developed in the schedule for decommissioning TMI-2. 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.

Project timelines are provided in Figures 4.2 through 4.4.

FIGURE 4.1
DECON
ACTIVITY SCHEDULE

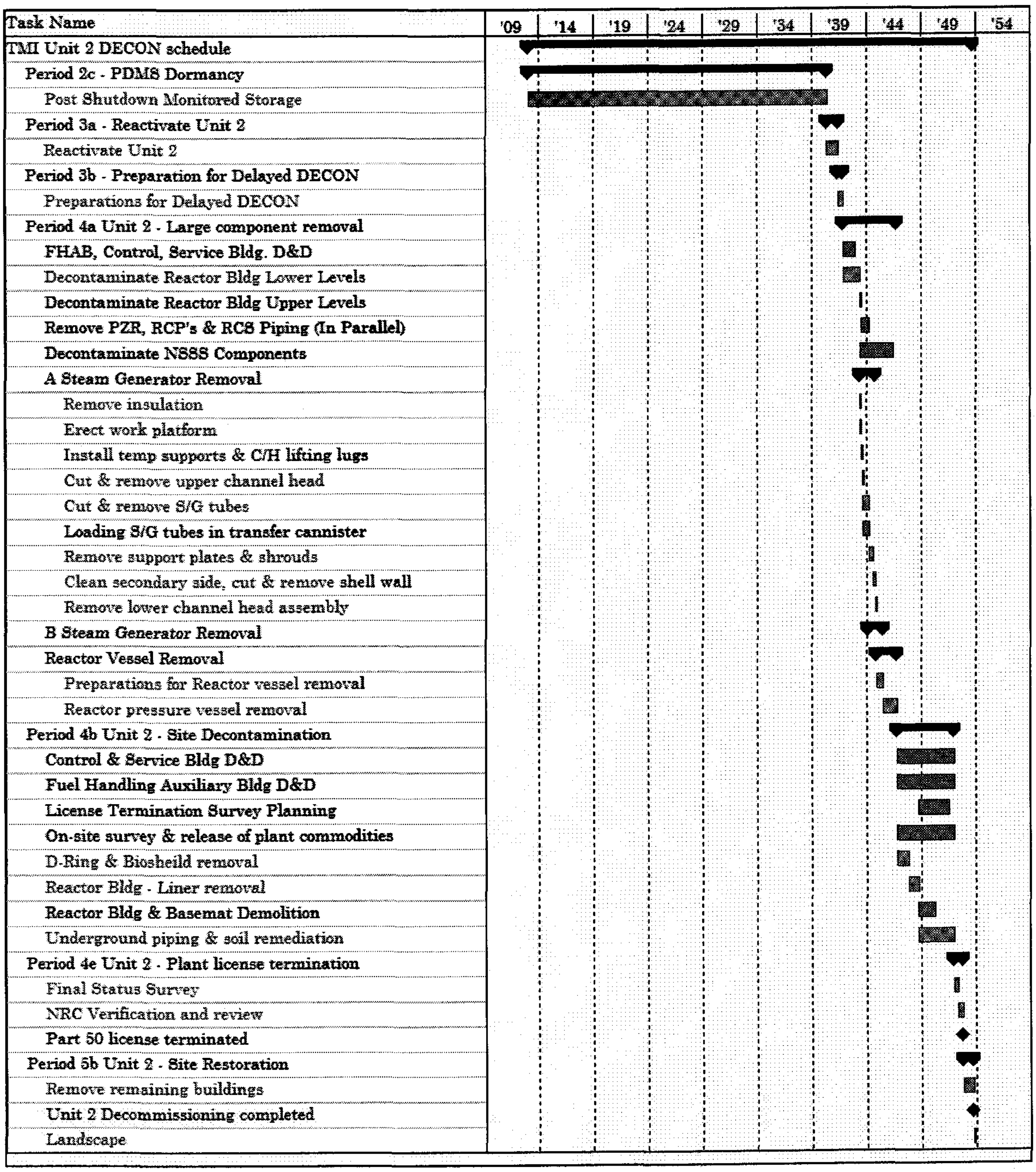


FIGURE 4.2
DECOMMISSIONING TIMELINE
DECON
(not to scale)

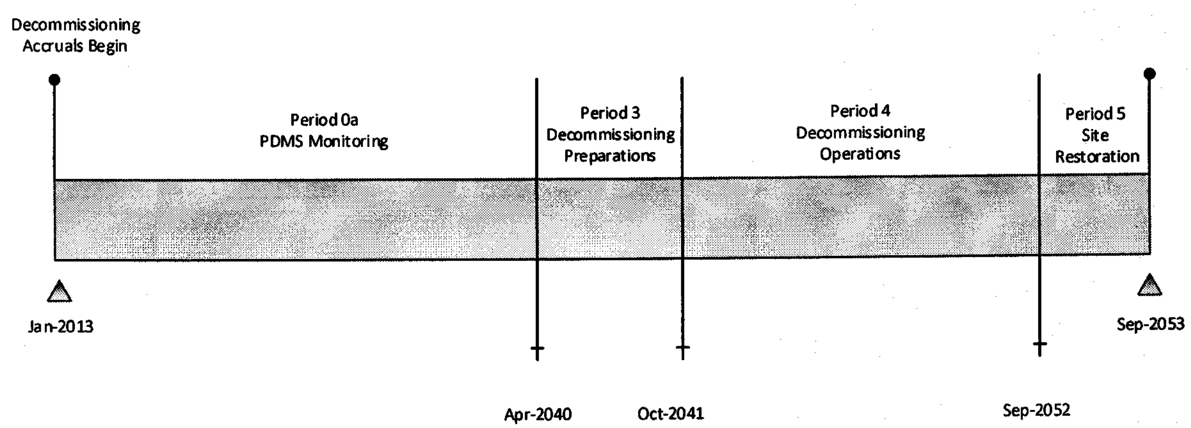


FIGURE 4.3
DECOMMISSIONING TIMELINE
DELAYED DECON
(not to scale)

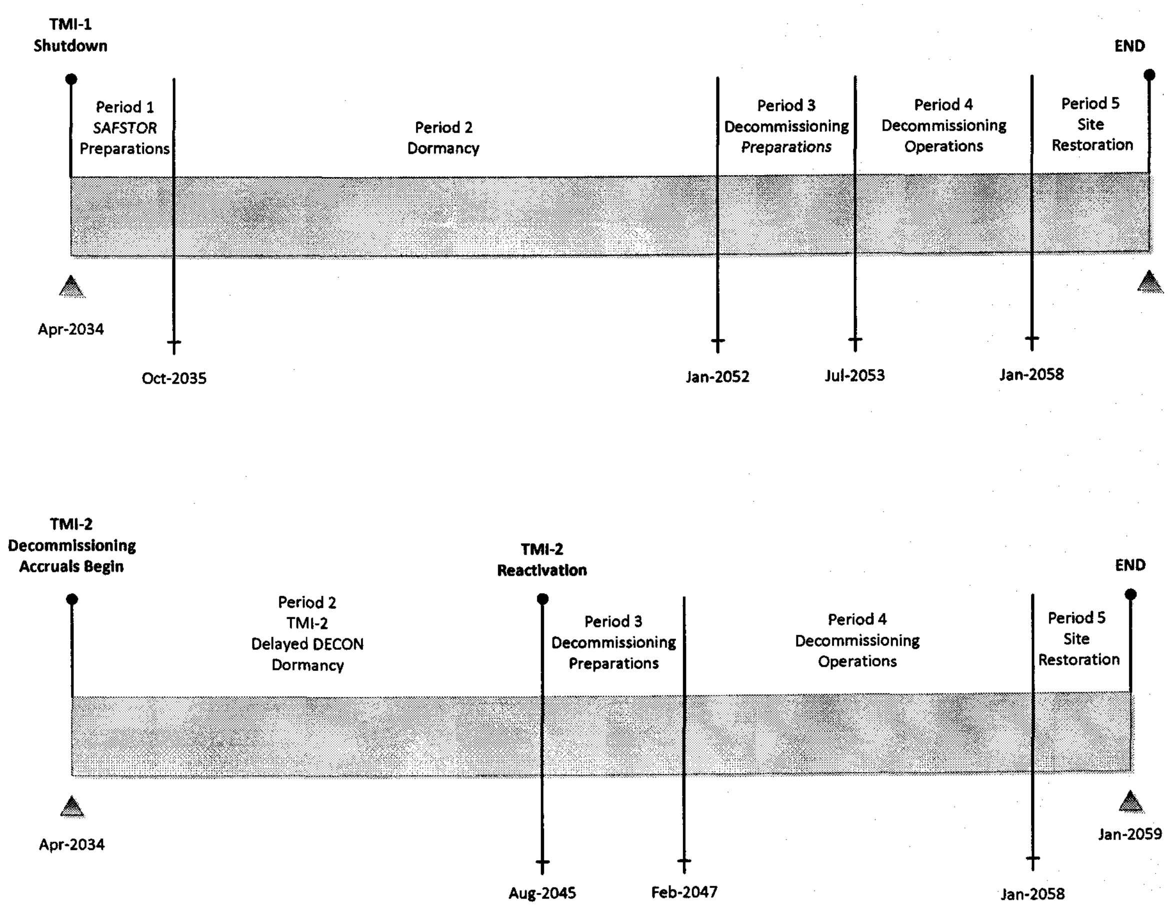
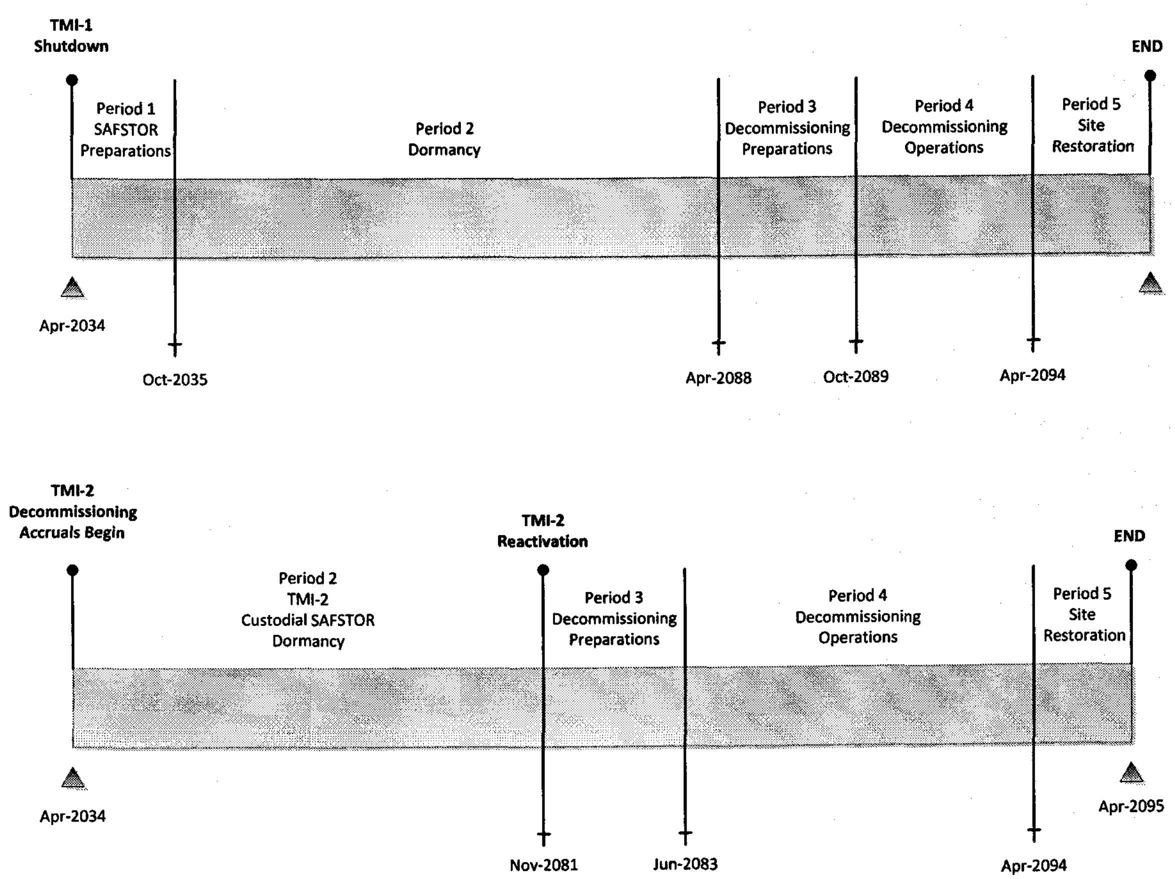


FIGURE 4.4
DECOMMISSIONING TIMELINE
SAFSTOR
(not to scale)



5. RADIOACTIVE WASTES

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

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

Figure 5.1 summarizes the categories of radioactive waste streams and their disposition. Figure 5.2 identifies of the intended disposal site and processing center.

The volumes of radioactive waste generated during the various decommissioning activities at the site is shown on a line-item basis in Appendices C, D, and E and summarized in Tables 5.1 through 5.3. The quantified waste volume summaries shown in these tables are consistent with §61 classifications. The volumes are calculated based on the exterior dimensions for containerized material and on the displaced volume of components serving as their own waste containers.

The reactor vessel, internals, other reactor coolant system components, and certain structural materials are categorized as large quantity shipments and, accordingly, will be shipped in reusable, shielded truck casks with disposable liners or LSA boxes shipped within shielded vans. In calculating disposal costs, the burial fees are applied against the liner volume, as well as the special handling requirements of the payload.

Most of the waste generated by the decommissioning process appears to be Class C or less, based upon the available information regarding the amount of fission products and transuranics present in the buildings, and the quantities of building materials assumed shipped as radioactive waste. This basis should be reexamined if additional characterization information becomes available in the future regarding the quantities of fission products and transuranics in more localized surveys.

No process system containing/handling radioactive substances at the time of decommissioning is presumed to meet material release criteria by decay alone, i.e., systems radioactive in 2013 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 TMI-2 is primarily generated during Period 4 of the defined alternatives.

Disposal fees are calculated using current disposal agreements, with surcharges added for the highly activated components, for example, generated in the segmentation of the reactor vessel. The cost to dispose of the majority of the material generated from the decontamination and dismantling activities is based upon FirstEnergy's disposal agreement with Energy*Solutions* for its facility in Clive, Utah.

Energy*Solutions* is not able to accept the higher activity waste (Class B and C) generated in the decontamination of the reactor vessel and segmentation of the components closest to the core. As such, for this analysis, disposal costs for the Class B and C waste were based upon the preliminary and indicative information on the cost for such from WCS.

FIGURE 5.1

TMI-2 WASTE STREAMS SUMMARY

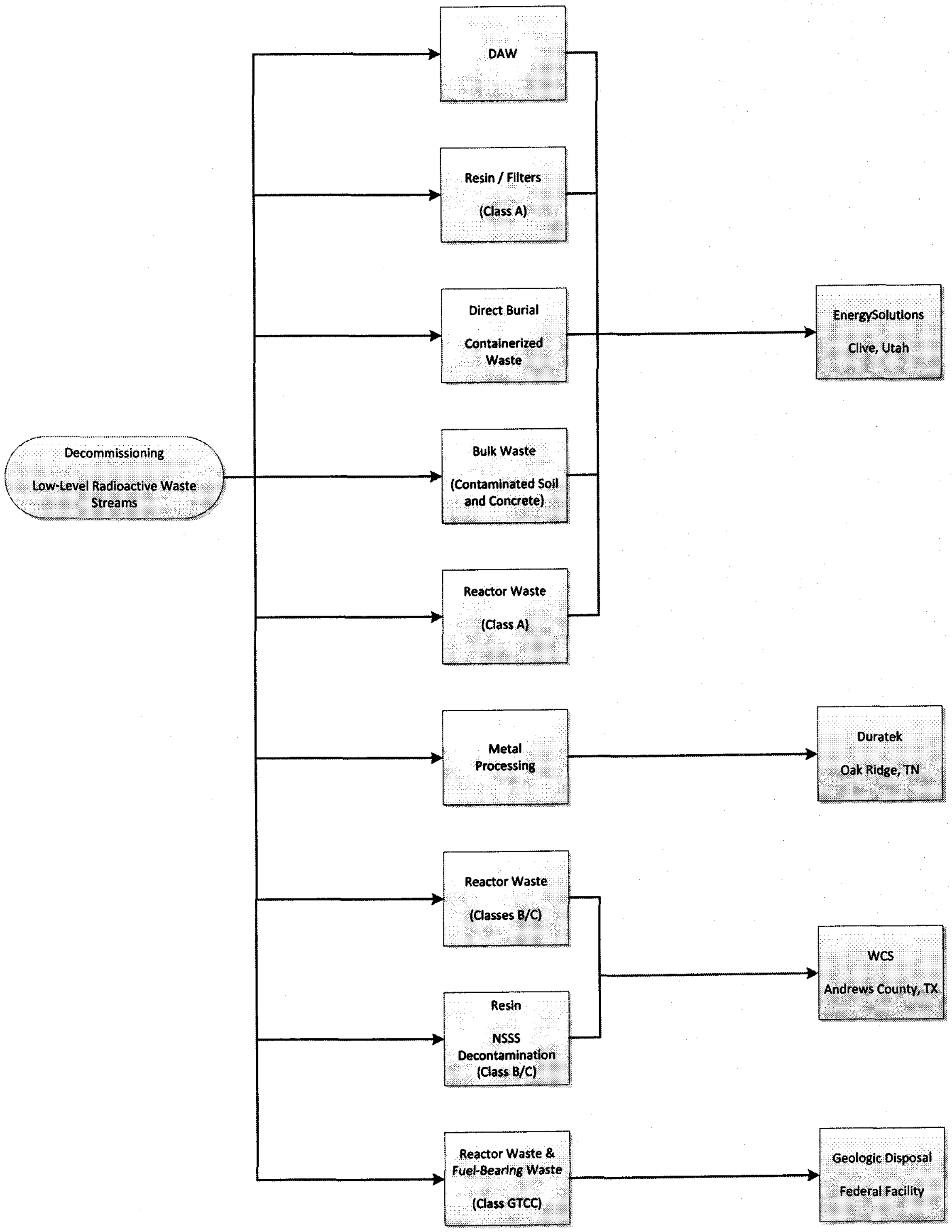


FIGURE 5.2
DECOMMISSIONING WASTE DESTINATIONS
RADIOLOGICAL

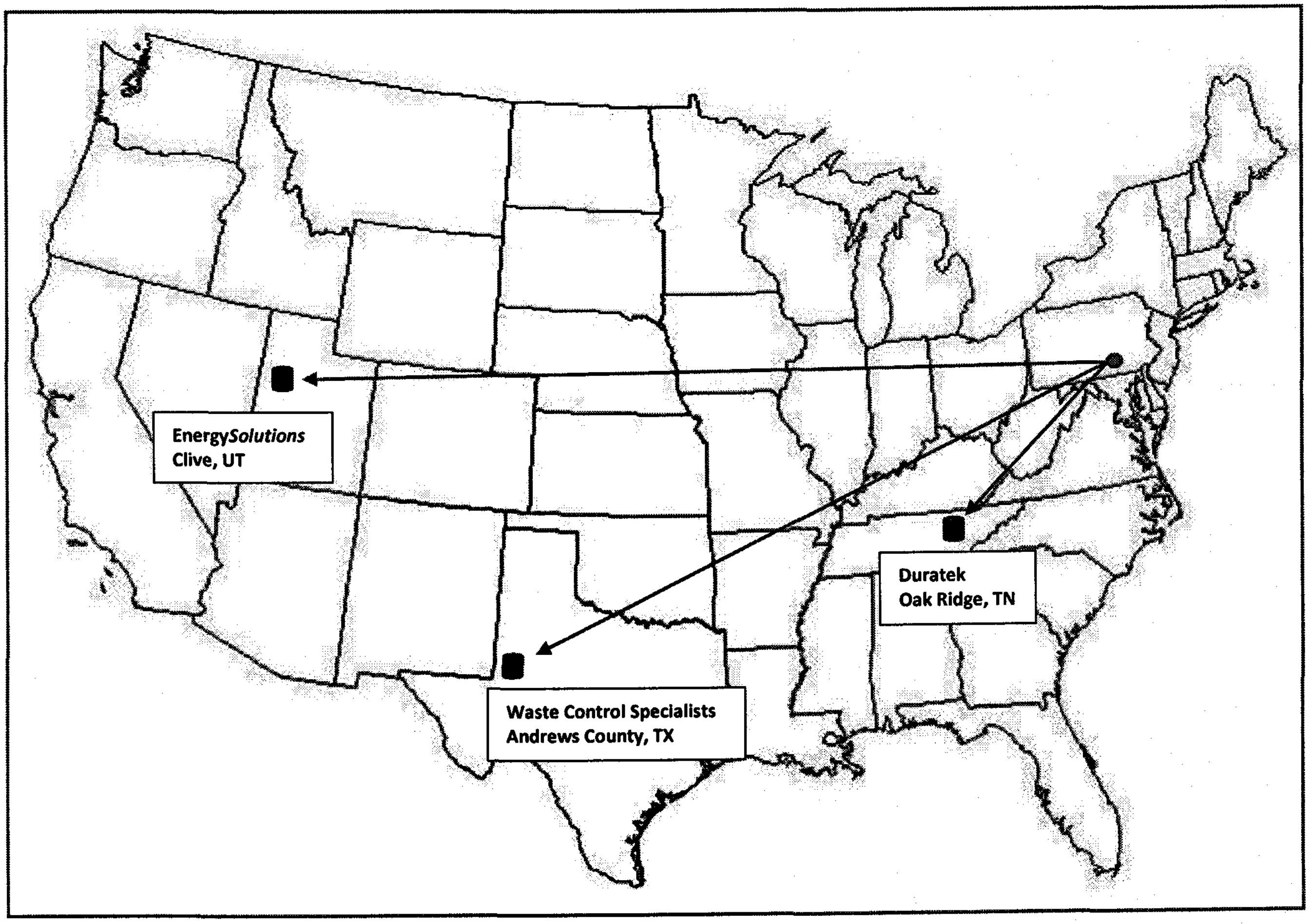


TABLE 5.1
DECON ALTERNATIVE
DECOMMISSIONING WASTE SUMMARY

Waste	Cost Basis	Class [1]	Waste Volume (cubic feet)	Weight (pounds)
Geologic Repository	Spent Fuel	GTCC	2,856	564,685
	Equivalent		357	20,514
Primary waste stream				
	WCS	C	2,734	237,772
	WCS	B	26,918	1,928,673
Secondary waste stream				
	Energy*Solutions*	A	177,759	13,891,318
Tertiary waste stream				
Concrete	Energy*Solutions*	A	613,465	66,003,571
Soil	Energy*Solutions*	A	48,992	3,723,414
DAW	Energy*Solutions*	A	17,010	340,195
Survey & Release			61,736	3,704,137
Processed Waste (Off-Site)	Recycling Vendors		67,958	2,843,938
Total[2]			1,019,785	93,258,217

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

[2] Columns may not add due to rounding

TABLE 5.2
DELAYED DECON ALTERNATIVE
DECOMMISSIONING WASTE SUMMARY

Waste	Cost Basis	Class [1]	Waste Volume (cubic feet)	Weight (pounds)
Geologic Repository	Spent Fuel	GTCC	2,856	564,685
	Equivalent		357	20,514
Primary waste stream				
	WCS	C	2,734	237,772
	WCS	B	26,918	1,928,673
Secondary waste stream				
	Energy*Solutions*	A	177,438	13,872,058
Tertiary waste stream				
Concrete	Energy*Solutions*	A	613,465	66,003,572
Soil	Energy*Solutions*	A	48,992	3,723,414
DAW	Energy*Solutions*	A	18,060	361,194
Survey & Release			61,736	3,704,137
Processed Waste (Off-Site)	Recycling Vendors		67,958	2,843,938
Total[2]			1,020,514	93,259,957

[1] Waste is classified according to the requirements as delineated in Title 10 CFR, Part 61.55
[2] Columns may not add due to rounding

TABLE 5.3
SAFSTOR ALTERNATIVE
DECOMMISSIONING WASTE SUMMARY

Waste	Cost Basis	Class [1]	Waste Volume (cubic feet)	Weight (pounds)
Geologic Repository	Spent Fuel	GTCC	2,856	564,685
	Equivalent		357	20,514
Primary waste stream				
	WCS	C	2,734	237,772
	WCS	B	26,918	1,928,673
Secondary waste stream				
	Energy*Solutions*	A	176,490	13,805,128
Tertiary waste stream				
Concrete	Energy*Solutions*	A	613,465	66,003,568
Soil	Energy*Solutions*	A	48,992	3,723,414
DAW	Energy*Solutions*	A	21,415	428,298
Survey & Release			61,736	3,704,137
Processed Waste (Off-Site)	Recycling Vendors		68,950	2,895,277
Total[2]			1,023,913	93,311,466

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

[2] Columns may not add due to rounding.

6. RESULTS

The analysis to estimate the costs to decommission TMI-2 relied upon the site-specific, technical information developed in 1995-96 and last updated in 2008. While not an engineering study, the estimates provide FirstEnergy with sufficient information to assess its financial obligations, as they pertain to the eventual decommissioning of the nuclear station.

The estimates described in this report are based on numerous fundamental assumptions, including regulatory requirements, project contingencies, radioactive waste disposal options, and site remediation requirements. The decommissioning scenarios assume that the remainder of the spent fuel (less than 1%), which is dispersed throughout the reactor coolant and support systems, is packaged, shipped and buried as radioactive waste. Some of the waste that is generated is assumed to be GTCC. This waste is assumed to be transferred to the DOE at the time that it is processed and collected during the decommissioning. No costs have been included for the temporary storage of GTCC material.

The cost projected to decommission TMI-2, i.e., by the DECON alternative, is estimated to be $1.19 billion. The majority of this cost (approximately 97%) is associated with the physical decontamination and dismantling of the nuclear unit so that the license can be terminated. The remaining 3% is for the demolition of the designated structures and limited restoration of the site. The costs for the other decommission alternatives, Delayed DECON and SAFSTOR, are estimated at $1.18 billion and $1.24 billion, respectively.

The primary cost contributors, identified in Tables 6.1 through 6.3, are either labor-related or associated with the management and disposition of the radioactive waste. Program management is the largest single contributor to the overall cost. The magnitude of the expense is a function of both the size of the organization required to manage the decommissioning, as well as the duration of the program. It is assumed, for purposes of this analysis, that FirstEnergy will oversee the decommissioning program, using a DOC to manage the decommissioning labor force and the associated subcontractors. The size and composition of the management organization varies with the decommissioning phase and associated site activities. However, once the license is terminated, the staff is substantially reduced for the conventional demolition and restoration of the site.

The cost for waste disposal includes only those costs associated with the controlled disposition of the 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, is at the Energy*Solutions* facility. The more highly radioactive waste is sent to Waste Control Specialists in Texas. Highly contaminated components, requiring additional isolation from the environment, are packaged for geologic disposal.

Removal costs reflect the labor-intensive nature of the decommissioning process, as well as the management controls required to ensure a safe and successful program. Decontamination and packaging costs also have a large labor component that is based upon prevailing union wages. Non-radiological demolition is a natural extension of the decommissioning process. The methods employed in decontamination and dismantling are generally destructive and indiscriminate in inflicting collateral damage. With a work force mobilized to support decommissioning operations, non-radiological demolition can be an integrated activity and a logical expansion of the work being performed in the process of terminating the license.

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.

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

The remaining costs include allocations for heavy equipment and temporary services, as well as for other expenses such as regulatory fees and the premiums for nuclear insurance.

TABLE 6.1
DECON ALTERNATIVE
DECOMMISSIONING COST ELEMENTS
(thousands of 2013 dollars)

Cost Element	Total	Percentage
Decontamination	35,403	3.0
Removal	189,064	15.9
Packaging	28,008	2.4
Transportation	26,427	2.2
Waste Disposal	276,112	23.2
Off-site Waste Processing	11,053	0.9
Program Management [1]	484,509	40.8
Security	55,590	4.7
Insurance and Regulatory Fees	15,766	1.3
Energy	18,061	1.5
Characterization and Licensing Surveys	10,844	0.9
Property Taxes	0	0.0
Miscellaneous Equipment	23,851	2.0
Site O&M	4,968	0.4
PDMS Monitoring	8,908	0.8
Total [2]	1,188,564	100.0

Cost Element	Total	Percentage
License Termination	1,149,098	96.7
Site Restoration	39,467	3.3
Total [2]	1,188,564	100.0

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

TABLE 6.2
DELAYED DECON ALTERNATIVE
DECOMMISSIONING COST ELEMENTS
(thousands of 2013 dollars)

Cost Element	Total [1]	Percentage
Decontamination	35,321	3.0
Removal	190,858	16.2
Packaging	28,007	2.4
Transportation	26,310	2.2
Waste Disposal	276,022	23.4
Off-site Waste Processing	11,053	0.9
Program Management [2]	472,755	40.2
Security	46,850	4.0
Insurance and Regulatory Fees	21,899	1.9
Energy	19,459	1.7
Characterization and Licensing Surveys	10,844	0.9
Property Taxes	0	0.0
Miscellaneous Equipment	26,259	2.2
Site O&M	4,968	0.4
PDMS Monitoring	6,949	0.6
Total [3]	1,177,554	100.0

Cost Element	Total	Percentage
License Termination	1,139,536	96.8
Site Restoration	38,018	3.2
Total [3]	1,177,554	100.0

[1] Includes dormancy costs following TMI-1 shutdown in 2034
[2] Includes engineering costs
[3] Columns may not add due to rounding

TABLE 6.3
SAFSTOR ALTERNATIVE
DECOMMISSIONING COST ELEMENTS
(thousands of 2013 dollars)

Cost Element	Total [1]	Percentage
Decontamination	35,286	2.9
Removal	196,595	15.9
Packaging	28,065	2.3
Transportation	26,298	2.1
Waste Disposal	275,884	22.3
Off-site Waste Processing	11,206	0.9
Program Management [2]	482,930	39.0
Security	56,699	4.6
Insurance and Regulatory Fees	41,497	3.4
Energy	28,227	2.3
Characterization and Licensing Surveys	10,844	0.9
Property Taxes	0	0.0
Miscellaneous Equipment	33,617	2.7
Site O&M	4,968	0.4
PDMS Monitoring	6,949	0.6
Total [3]	1,239,065	100.0

Cost Element	Total	Percentage
License Termination	1,201,047	96.9
Site Restoration	38,018	3.1
Total [3]	1,239,065	100.0

[1] Includes dormancy costs following TMI-1 shutdown in 2034
[2] Includes engineering costs
[3] Columns may not add due to rounding

7. REFERENCES

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2. "Decommissioning Cost Estimate for Three Mile Island Unit 2," Document No. F07-1601-002, TLG Services, Inc., January 2009

3. 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

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

5. 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

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

7. 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

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

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

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

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

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

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23. "Building Construction Cost Data 2013," Robert Snow Means Company, Inc., Kingston, Massachusetts

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

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APPENDIX A

UNIT COST FACTOR DEVELOPMENT

APPENDIX A
UNIT COST FACTOR DEVELOPMENT

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

1. SCOPE

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

2. CALCULATIONS

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

Duration adjustment(s):	
+ Respiratory protection adjustment (25% of critical duration)	64
+ Radiation/ALARA adjustment (25% of critical duration)	64
Adjusted work duration	383
+ Protective clothing adjustment (30% of adjusted duration)	115
Productive work duration	498
+ Work break adjustment (8.33 % of productive duration)	42
Total work duration (minutes)	540

***** Total duration = 9.000 hr *****

* alpha designators indicate activities that can be performed in parallel

APPENDIX A
(continued)

3. LABOR REQUIRED

Crew	Number	Duration (hours)	Rate ($/hr)	Cost ($)
Laborers	3.00	9.000	33.92	$915.84
Craftsmen	2.00	9.000	59.98	1,079.64
Foreman	1.00	9.000	61.79	556.11
General Foreman	0.25	9.000	65.28	146.88
Fire Watch	0.05	9.000	33.92	15.26
Health Physics Technician	1.00	9.000	48.84	439.56
Total Labor Cost				$3,153.29

4. EQUIPMENT & CONSUMABLES COSTS

Equipment Costs	none
Consumables/Materials Costs	
- Universal Sorbent 50 @ $0.49 sq ft {1}	$24.50
- Tarpaulins (oil resistant/fire retardant) 50 @ $0.22/sq ft {2}	$11.00
-Gas torch consumables 1 @ $13.49/hr x 1 hr {3}	$13.49
Subtotal cost of equipment and materials	$48.99
Overhead & profit on equipment and materials @ 16.00 %	$7.84
Total costs, equipment & material	$56.83

TOTAL COST:

Removal of contaminated heat exchanger <3000 pounds:	**$3,210.12**
Total labor cost:	$3,153.29
Total equipment/material costs:	$56.83
Total craft labor man-hours required per unit:	65.700

5. NOTES AND REFERENCES

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

- References for equipment & consumables costs:

  1. www.mcmaster.com online catalog, McMaster Carr Spill Control (7193T88)
  2. R.S. Means (2013) Division 01 56, Section 13.60-0600, page 22
  3. R.S. Means (2013) Division 01 54 33, Section 40-6360, page 688

- Material and consumable costs were adjusted using the regional indices for Harrisburg, Pennsylvania.

APPENDIX B

UNIT COST FACTOR LISTING
(SAFSTOR: 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	0.65
Removal of clean pipe 0.25 to 2 inches diameter, $/linear foot	5.73
Removal of clean pipe >2 to 4 inches diameter, $/linear foot	8.28
Removal of clean pipe >4 to 8 inches diameter, $/linear foot	18.21
Removal of clean pipe >8 to 14 inches diameter, $/linear foot	32.80
Removal of clean pipe >14 to 20 inches diameter, $/linear foot	42.69
Removal of clean pipe >20 to 36 inches diameter, $/linear foot	62.52
Removal of clean pipe >36 inches diameter, $/linear foot	74.66
Removal of clean valve >2 to 4 inches	122.01
Removal of clean valve >4 to 8 inches	182.14
Removal of clean valve >8 to 14 inches	328.02
Removal of clean valve >14 to 20 inches	426.90
Removal of clean valve >20 to 36 inches	625.24
Removal of clean valve >36 inches	746.63
Removal of clean pipe hanger for small bore piping	41.06
Removal of clean pipe hanger for large bore piping	128.91
Removal of clean pump, <300 pound	307.22
Removal of clean pump, 300-1000 pound	837.90
Removal of clean pump, 1000-10,000 pound	2,992.23
Removal of clean pump, >10,000 pound	5,785.54
Removal of clean pump motor, 300-1000 pound	358.40
Removal of clean pump motor, 1000-10,000 pound	1,246.71
Removal of clean pump motor, >10,000 pound	2,802.79
Removal of clean heat exchanger <3000 pound	1,685.84
Removal of clean heat exchanger >3000 pound	4,237.90
Removal of clean feedwater heater/deaerator	11,387.33
Removal of clean moisture separator/reheater	22,925.30
Removal of clean tank, <300 gallons	395.46
Removal of clean tank, 300-3000 gallon	1,240.33
Removal of clean tank, >3000 gallons, $/square foot surface area	10.06

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of clean electrical equipment, <300 pound	172.57
Removal of clean electrical equipment, 300-1000 pound	578.96
Removal of clean electrical equipment, 1000-10,000 pound	1,148.82
Removal of clean electrical equipment, >10,000 pound	2,659.64
Removal of clean electrical transformer < 30 tons	1,878.11
Removal of clean electrical transformer > 30 tons	5,319.28
Removal of clean standby diesel generator, <100 kW	1,888.50
Removal of clean standby diesel generator, 100 kW to 1 MW	4,212.30
Removal of clean standby diesel generator, >1 MW	8,718.57
Removal of clean electrical cable tray, $/linear foot	15.55
Removal of clean electrical conduit, $/linear foot	6.65
Removal of clean mechanical equipment, <300 pound	172.57
Removal of clean mechanical equipment, 300-1000 pound	578.96
Removal of clean mechanical equipment, 1000-10,000 pound	1,148.82
Removal of clean mechanical equipment, >10,000 pound	2,659.64
Removal of clean HVAC equipment, <300 pound	201.26
Removal of clean HVAC equipment, 300-1000 pound	680.14
Removal of clean HVAC equipment, 1000-10,000 pound	1,360.00
Removal of clean HVAC equipment, >10,000 pound	2,659.64
Removal of clean HVAC ductwork, $/pound	0.69
Removal of contaminated instrument and sampling tubing, $/linear foot	1.10
Removal of contaminated pipe 0.25 to 2 inches diameter, $/linear foot	15.52
Removal of contaminated pipe >2 to 4 inches diameter, $/linear foot	26.14
Removal of contaminated pipe >4 to 8 inches diameter, $/linear foot	43.62
Removal of contaminated pipe >8 to 14 inches diameter, $/linear foot	83.77
Removal of contaminated pipe >14 to 20 inches diameter, $/linear foot	100.79
Removal of contaminated pipe >20 to 36 inches diameter, $/linear foot	138.62
Removal of contaminated pipe >36 inches diameter, $/linear foot	164.58
Removal of contaminated valve >2 to 4 inches	329.26
Removal of contaminated valve >4 to 8 inches	398.41

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of contaminated valve >8 to 14 inches	796.48
Removal of contaminated valve >14 to 20 inches	1,012.72
Removal of contaminated valve >20 to 36 inches	1,345.01
Removal of contaminated valve >36 inches	1,604.65
Removal of contaminated pipe hanger for small bore piping	106.09
Removal of contaminated pipe hanger for large bore piping	326.47
Removal of contaminated pump, <300 pound	696.25
Removal of contaminated pump, 300-1000 pound	1,655.34
Removal of contaminated pump, 1000-10,000 pound	5,414.54
Removal of contaminated pump, >10,000 pound	13,160.39
Removal of contaminated pump motor, 300-1000 pound	711.77
Removal of contaminated pump motor, 1000-10,000 pound	2,199.17
Removal of contaminated pump motor, >10,000 pound	4,965.06
Removal of contaminated heat exchanger <3000 pound	3,210.12
Removal of contaminated heat exchanger >3000 pound	9,308.12
Removal of contaminated tank, <300 gallons	1,162.67
Removal of contaminated tank, >300 gallons, $/square foot	23.76
Removal of contaminated electrical equipment, <300 pound	545.67
Removal of contaminated electrical equipment, 300-1000 pound	1,339.76
Removal of contaminated electrical equipment, 1000-10,000 pound	2,573.65
Removal of contaminated electrical equipment, >10,000 pound	5,210.82
Removal of contaminated electrical cable tray, $/linear foot	26.68
Removal of contaminated electrical conduit, $/linear foot	12.65
Removal of contaminated mechanical equipment, <300 pound	614.05
Removal of contaminated mechanical equipment, 300-1000 pound	1,514.27
Removal of contaminated mechanical equipment, 1000-10,000 pound	2,913.58
Removal of contaminated mechanical equipment, >10,000 pound	5,210.82
Removal of contaminated HVAC equipment, <300 pound	614.05
Removal of contaminated HVAC equipment, 300-1000 pound	1,514.27
Removal of contaminated HVAC equipment, 1000-10,000 pound	2,913.58

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of contaminated HVAC equipment, >10,000 pound	5,210.82
Removal of contaminated HVAC ductwork, $/pound	1.57
Removal/plasma arc cut of contaminated thin metal components, $/linear in.	3.03
Additional decontamination of surface by washing, $/square foot	5.90
Additional decontamination of surfaces by hydrolasing, $/square foot	29.59
Decontamination rig hook up and flush, $/ 250 foot length	5,166.38
Chemical flush of components/systems, $/gallon	15.07
Removal of clean standard reinforced concrete, $/cubic yard	161.72
Removal of grade slab concrete, $/cubic yard	204.76
Removal of clean concrete floors, $/cubic yard	384.77
Removal of sections of clean concrete floors, $/cubic yard	1,172.57
Removal of clean heavily rein concrete w/#9 rebar, $/cubic yard	246.65
Removal of contaminated heavily rein concrete w/#9 rebar, $/cubic yard	1,631.53
Removal of clean heavily rein concrete w/#18 rebar, $/cubic yard	312.17
Removal of contaminated heavily rein concrete w/#18 rebar, $/cubic yard	2,151.28
Removal heavily rein concrete w/#18 rebar & steel embedments, $/cubic yard	472.38
Removal of below-grade suspended floors, $/cubic yard	384.77
Removal of clean monolithic concrete structures, $/cubic yard	970.85
Removal of contaminated monolithic concrete structures, $/cubic yard	1,625.26
Removal of clean foundation concrete, $/cubic yard	773.12
Removal of contaminated foundation concrete, $/cubic yard	1,512.45
Explosive demolition of bulk concrete, $/cubic yard	34.41
Removal of clean hollow masonry block wall, $/cubic yard	127.29
Removal of contaminated hollow masonry block wall, $/cubic yard	225.66
Removal of clean solid masonry block wall, $/cubic yard	127.29
Removal of contaminated solid masonry block wall, $/cubic yard	225.66
Backfill of below-grade voids, $/cubic yard	29.40
Removal of subterranean tunnels/voids, $/linear foot	140.98
Placement of concrete for below-grade voids, $/cubic yard	106.48
Excavation of clean material, $/cubic yard	3.72

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Excavation of contaminated material, $/cubic yard	32.49
Removal of clean concrete rubble (tipping fee included), $/cubic yard	23.55
Removal of contaminated concrete rubble, $/cubic yard	22.75
Removal of building by volume, $/cubic foot	0.34
Removal of clean building metal siding, $/square foot	1.67
Removal of contaminated building metal siding, $/square foot	2.95
Removal of standard asphalt roofing, $/square foot	2.60
Removal of transite panels, $/square foot	2.56
Scarifying contaminated concrete surfaces (drill & spall), $/square foot	9.36
Scabbling contaminated concrete floors, $/square foot	5.46
Scabbling contaminated concrete walls, $/square foot	14.71
Scabbling contaminated ceilings, $/square foot	50.37
Scabbling structural steel, $/square foot	4.69
Removal of clean overhead crane/monorail < 10 ton capacity	850.33
Removal of contaminated overhead crane/monorail < 10 ton capacity	1,454.77
Removal of clean overhead crane/monorail >10-50 ton capacity	2,042.99
Removal of contaminated overhead crane/monorail >10-50 ton capacity	3,473.58
Removal of polar crane > 50 ton capacity	7,581.02
Removal of gantry crane > 50 ton capacity	30,668.72
Removal of structural steel, $/pound	0.24
Removal of clean steel floor grating, $/square foot	6.17
Removal of contaminated steel floor grating, $/square foot	10.94
Removal of clean free standing steel liner, $/square foot	15.27
Removal of contaminated free standing steel liner, $/square foot	27.59
Removal of clean concrete-anchored steel liner, $/square foot	7.55
Removal of contaminated concrete-anchored steel liner, $/square foot	32.10
Placement of scaffolding in clean areas, $/square foot	13.55
Placement of scaffolding in contaminated areas, $/square foot	18.24
Landscaping with topsoil, $/acre	21,312.72
Cost of CPC B-88 LSA box & preparation for use	1,727.27

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Cost of CPC B-25 LSA box & preparation for use	1,584.45
Cost of CPC B-12V 12 gauge LSA box & preparation for use	1,301.09
Cost of CPC B-144 LSA box & preparation for use	8,595.11
Cost of LSA drum & preparation for use	192.13
Cost of cask liner for CNSI 8 120A cask (resins)	7,110.93
Cost of cask liner for CNSI 8 120A cask (filters)	6,993.18
Decontamination of surfaces with vacuuming, $/square foot	0.96

APPENDIX C

DETAILED COST ANALYSIS

DECON

Table C
Three Mile Island Unit 2
DECON Decommissioning Cost Estimate
(Thousands of 2013 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
PERIOD 0a - PDMS Monitoring																					
Period 0a Collateral Costs																					
0a.3.1	PDMS Monitoring	-	-	-	-	-	-	7,746	1,162	8,908	8,908	-	-	-	-	-	-	-	-	-	-
0a.3	Subtotal Period 0a Collateral Costs	-	-	-	-	-	-	7,746	1,162	8,908	8,908	-	-	-	-	-	-	-	-	-	-
Period 0a Period-Dependent Costs																					
0a.4.1	Insurance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0a.4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0a.4.3	Plant energy budget	-	-	-	-	-	-	5,318	798	6,116	6,116	-	-	-	-	-	-	-	-	-	-
0a.4.4	Utility Staff Cost	-	-	-	-	-	-	59,059	8,859	67,918	67,918	-	-	-	-	-	-	-	-	-	284,886
0a.4	Subtotal Period 0a Period-Dependent Costs	-	-	-	-	-	-	64,377	9,657	74,033	74,033	-	-	-	-	-	-	-	-	-	284,886
0a.0	TOTAL PERIOD 0a COST	-	-	-	-	-	-	72,123	10,818	82,942	82,942	-	-	-	-	-	-	-	-	-	284,886
PERIOD 3a - Reactivate Site Following SAFSTOR Dormancy																					
Period 3a Direct Decommissioning Activities																					
3a.1.1	Prepare preliminary decommissioning cost	-	-	-	-	-	-	257	39	296	296	-	-	-	-	-	-	-	-	-	1,950
3a.1.2	Review plant dwgs & specs.	-	-	-	-	-	-	1,213	182	1,395	1,395	-	-	-	-	-	-	-	-	-	9,200
3a.1.3	Perform detailed rad survey									a											
3a.1.4	End product description	-	-	-	-	-	-	264	40	303	303	-	-	-	-	-	-	-	-	-	2,000
3a.1.5	Detailed by-product inventory	-	-	-	-	-	-	686	103	788	788	-	-	-	-	-	-	-	-	-	5,200
3a.1.6	Define major work sequence	-	-	-	-	-	-	1,977	297	2,274	2,274	-	-	-	-	-	-	-	-	-	15,000
3a.1.7	Perform SER and EA	-	-	-	-	-	-	8,226	1,234	9,460	9,460	-	-	-	-	-	-	-	-	-	62,400
3a.1.8	Perform Site-Specific Cost Study	-	-	-	-	-	-	1,318	198	1,516	1,516	-	-	-	-	-	-	-	-	-	10,000
3a.1.9	Prepare/submit License Termination Plan	-	-	-	-	-	-	2,162	324	2,486	2,486	-	-	-	-	-	-	-	-	-	16,400
3a.1.10	Receive NRC approval of termination plan									a											
Activity Specifications																					
3a.1.11.1	Re-activate plant & temporary facilities	-	-	-	-	-	-	1,457	219	1,676	1,508	-	168	-	-	-	-	-	-	-	11,055
3a.1.11.2	Plant systems	-	-	-	-	-	-	1,099	165	1,263	1,137	-	126	-	-	-	-	-	-	-	8,333
3a.1.11.3	Reactor internals	-	-	-	-	-	-	1,872	281	2,153	2,153	-	-	-	-	-	-	-	-	-	14,200
3a.1.11.4	Reactor vessel	-	-	-	-	-	-	1,285	193	1,478	1,478	-	-	-	-	-	-	-	-	-	9,750
3a.1.11.5	Biological shield	-	-	-	-	-	-	66	10	76	76	-	-	-	-	-	-	-	-	-	500
3a.1.11.6	Steam generators	-	-	-	-	-	-	1,645	247	1,892	1,892	-	-	-	-	-	-	-	-	-	12,480
3a.1.11.7	Reinforced concrete	-	-	-	-	-	-	422	63	485	243	-	243	-	-	-	-	-	-	-	3,200
3a.1.11.8	Main Turbine	-	-	-	-	-	-	53	8	61	-	-	61	-	-	-	-	-	-	-	400
3a.1.11.9	Main Condensers	-	-	-	-	-	-	53	8	61	-	-	61	-	-	-	-	-	-	-	400
3a.1.11.10	Plant structures & buildings	-	-	-	-	-	-	411	62	473	237	-	237	-	-	-	-	-	-	-	3,120
3a.1.11.11	Waste management	-	-	-	-	-	-	2,426	364	2,790	2,790	-	-	-	-	-	-	-	-	-	18,400
3a.1.11.12	Facility & site closeout	-	-	-	-	-	-	119	18	136	68	-	68	-	-	-	-	-	-	-	900
3a.1.11	Total	-	-	-	-	-	-	10,907	1,636	12,544	11,581	-	963	-	-	-	-	-	-	-	82,738
Planning & Site Preparations																					
3a.1.12	Prepare dismantling sequence	-	-	-	-	-	-	633	95	728	728	-	-	-	-	-	-	-	-	-	4,800
3a.1.13	Plant prep. & temp. svces	-	-	-	-	-	-	2,900	435	3,335	3,335	-	-	-	-	-	-	-	-	-	-
3a.1.14	Design water clean-up system	-	-	-	-	-	-	738	111	849	849	-	-	-	-	-	-	-	-	-	5,600
3a.1.15	Rigging/Cont. Cntrl Envlps/tooling/etc.	-	-	-	-	-	-	2,200	330	2,530	2,530	-	-	-	-	-	-	-	-	-	-
3a.1.16	Procure casks/liners & containers	-	-	-	-	-	-	324	49	373	373	-	-	-	-	-	-	-	-	-	2,460
3a.1	Subtotal Period 3a Activity Costs	-	-	-	-	-	-	33,806	5,071	38,877	37,914	-	963	-	-	-	-	-	-	-	217,748
Period 3a Additional Costs																					
3a.2.1	Railroad Track Refurbishment	-	-	-	-	-	-	330	50	380	380	-	-	-	-	-	-	-	-	-	-
3a.2.2	Equipment Airlock Refurbishment	-	-	-	-	-	-	1,290	194	1,484	1,484	-	-	-	-	-	-	-	-	-	-
3a.2.3	RB Polar Crane Refurbishment	-	-	-	-	-	-	6,450	968	7,418	7,418	-	-	-	-	-	-	-	-	-	-
3a.2.4	RB Cask Handling System	-	-	-	-	-	-	1,290	194	1,484	1,484	-	-	-	-	-	-	-	-	-	-
3a.2	Subtotal Period 3a Additional Costs	-	-	-	-	-	-	9,360	1,404	10,764	10,764	-	-	-	-	-	-	-	-	-	-
Period 3a Collateral Costs																					
3a.3	Subtotal Period 3a Collateral Costs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C
Three Mile Island Unit 2
DECON Decommissioning Cost Estimate
(Thousands of 2013 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Period 3a Period-Dependent Costs																					
3a.4.1	Insurance	-	-	-	-	-	-	206	21	226	226	-	-	-	-	-	-	-	-	-	-
3a.4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3a.4.3	Health physics supplies	-	623	-	-	-	-	-	156	779	779	-	-	-	-	-	-	-	-	-	-
3a.4.4	Heavy equipment rental	-	430	-	-	-	-	-	64	494	494	-	-	-	-	-	-	-	-	-	-
3a.4.5	Disposal of DAW generated	-	-	9	8	-	25	-	8	50	50	-	-	-	490	-	-	-	9,793	22	-
3a.4.6	Plant energy budget	-	-	-	-	-	-	976	146	1,122	1,122	-	-	-	-	-	-	-	-	-	-
3a.4.7	NRC Fees	-	-	-	-	-	-	1,275	127	1,402	1,402	-	-	-	-	-	-	-	-	-	-
3a.4.8	Site O&M	-	-	-	-	-	-	322	48	371	371	-	-	-	-	-	-	-	-	-	-
3a.4.9	Security Staff Cost	-	-	-	-	-	-	3,689	553	4,242	4,242	-	-	-	-	-	-	-	-	-	61,007
3a.4.10	DOC Staff Cost	-	-	-	-	-	-	11,762	1,764	13,527	13,527	-	-	-	-	-	-	-	-	-	189,800
3a.4.11	Utility Staff Cost	-	-	-	-	-	-	2,623	393	3,017	3,017	-	-	-	-	-	-	-	-	-	26,071
3a.4	Subtotal Period 3a Period-Dependent Costs	-	1,053	9	8	-	25	20,853	3,282	25,230	25,230	-	-	-	490	-	-	-	9,793	22	276,879
3a.0	TOTAL PERIOD 3a COST	-	1,053	9	8	-	25	64,018	9,757	74,870	73,908	-	963	-	490	-	-	-	9,793	22	494,627
PERIOD 3b - Decommissioning Preparations																					
Period 3b Direct Decommissioning Activities																					
Detailed Work Procedures																					
3b.1.1.1	Plant systems	-	-	-	-	-	-	1,248	187	1,435	1,292	-	144	-	-	-	-	-	-	-	9,466
3b.1.1.2	Reactor internals	-	-	-	-	-	-	659	99	758	758	-	-	-	-	-	-	-	-	-	5,000
3b.1.1.3	Remaining buildings	-	-	-	-	-	-	178	27	205	51	-	153	-	-	-	-	-	-	-	1,350
3b.1.1.4	CRD cooling assembly	-	-	-	-	-	-	198	30	227	227	-	-	-	-	-	-	-	-	-	1,500
3b.1.1.5	CRD housings & ICI tubes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3b.1.1.6	Incore instrumentation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3b.1.1.7	Reactor vessel	-	-	-	-	-	-	718	108	825	825	-	-	-	-	-	-	-	-	-	5,445
3b.1.1.8	Facility closeout	-	-	-	-	-	-	158	24	182	91	-	91	-	-	-	-	-	-	-	1,200
3b.1.1.9	Missile shields	-	-	-	-	-	-	59	9	68	68	-	-	-	-	-	-	-	-	-	450
3b.1.1.10	Biological shield	-	-	-	-	-	-	158	24	182	182	-	-	-	-	-	-	-	-	-	1,200
3b.1.1.11	Steam generators	-	-	-	-	-	-	2,426	364	2,790	2,790	-	-	-	-	-	-	-	-	-	18,400
3b.1.1.12	Reinforced concrete	-	-	-	-	-	-	132	20	152	76	-	76	-	-	-	-	-	-	-	1,000
3b.1.1.13	Main Turbine	-	-	-	-	-	-	206	31	237	-	-	237	-	-	-	-	-	-	-	1,560
3b.1.1.14	Main Condensers	-	-	-	-	-	-	206	31	237	-	-	237	-	-	-	-	-	-	-	1,560
3b.1.1.15	Auxiliary building	-	-	-	-	-	-	720	108	828	745	-	83	-	-	-	-	-	-	-	5,460
3b.1.1.16	Reactor building	-	-	-	-	-	-	720	108	828	745	-	83	-	-	-	-	-	-	-	5,460
3b.1.1	Total	-	-	-	-	-	-	7,785	1,168	8,952	7,850	-	1,102	-	-	-	-	-	-	-	59,051
3b.1	Subtotal Period 3b Activity Costs	-	-	-	-	-	-	7,785	1,168	8,952	7,850	-	1,102	-	-	-	-	-	-	-	59,051
Period 3b Additional Costs																					
3b.2.1	Lead Sheilding Disposal	-	740	225	611	-	5,474	-	1,668	8,717	8,717	-	-	-	2,511	-	-	-	1,418,084	14,333	-
3b.2.2	Stored Defueling Equipment Disposition	-	588	63	104	-	884	-	390	2,029	2,029	-	-	-	3,568	-	-	-	249,505	12,077	-
3b.2	Subtotal Period 3b Additional Costs	-	1,328	288	715	-	6,358	-	2,057	10,746	10,746	-	-	-	6,079	-	-	-	1,667,589	26,410	-
Period 3b Collateral Costs																					
3b.3.1	Decon equipment	712	-	-	-	-	-	-	107	819	819	-	-	-	-	-	-	-	-	-	-
3b.3.2	DOC staff relocation expenses	-	-	-	-	-	-	1,385	208	1,593	1,593	-	-	-	-	-	-	-	-	-	-
3b.3.3	Small tool allowance	-	18	-	-	-	-	-	3	21	21	-	-	-	-	-	-	-	-	-	-
3b.3.4	Pipe cutting equipment	-	1,100	-	-	-	-	-	165	1,265	1,265	-	-	-	-	-	-	-	-	-	-
3b.3	Subtotal Period 3b Collateral Costs	712	1,118	-	-	-	-	1,385	482	3,698	3,698	-	-	-	-	-	-	-	-	-	-
Period 3b Period-Dependent Costs																					
3b.4.1	Decon supplies	22	-	-	-	-	-	-	6	28	28	-	-	-	-	-	-	-	-	-	-
3b.4.2	Insurance	-	-	-	-	-	-	104	10	115	115	-	-	-	-	-	-	-	-	-	-
3b.4.3	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3b.4.4	Health physics supplies	-	537	-	-	-	-	-	134	672	672	-	-	-	-	-	-	-	-	-	-
3b.4.5	Heavy equipment rental	-	218	-	-	-	-	-	33	251	251	-	-	-	-	-	-	-	-	-	-
3b.4.6	Disposal of DAW generated	-	-	5	5	-	15	-	5	29	29	-	-	-	289	-	-	-	5,783	13	-
3b.4.7	Plant energy budget	-	-	-	-	-	-	495	74	569	569	-	-	-	-	-	-	-	-	-	-
3b.4.8	NRC Fees	-	-	-	-	-	-	646	65	711	711	-	-	-	-	-	-	-	-	-	-
3b.4.9	Site O&M	-	-	-	-	-	-	163	24	188	188	-	-	-	-	-	-	-	-	-	-
3b.4.10	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	201	30	231	231	-	-	-	-	-	-	-	-	-	-
3b.4.11	Security Staff Cost	-	-	-	-	-	-	1,870	280	2,150	2,150	-	-	-	-	-	-	-	-	-	30,921
3b.4.12	DOC Staff Cost	-	-	-	-	-	-	12,643	1,897	14,540	14,540	-	-	-	-	-	-	-	-	-	167,134
3b.4.13	Utility Staff Cost	-	-	-	-	-	-	1,323	198	1,521	1,521	-	-	-	-	-	-	-	-	-	13,214
3b.4	Subtotal Period 3b Period-Dependent Costs	22	755	5	5	-	15	17,445	2,757	21,004	21,004	-	-	-	289	-	-	-	5,783	13	211,270

Table C
Three Mile Island Unit 2
DECON Decommissioning Cost Estimate
(Thousands of 2013 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	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
3b.0	TOTAL PERIOD 3b COST	734	3,202	293	720	-	6,372	26,615	6,464	44,400	43,298	-	1,102	-	6,368	-	-	-	1,673,372	26,423	270,321
PERIOD 3 TOTALS		734	4,255	301	728	-	6,397	90,634	16,222	119,271	117,206	-	2,065	-	6,858	-	-	-	1,683,165	26,446	764,948
PERIOD 4a - Large Component Removal																					
Period 4a Direct Decommissioning Activities																					
Nuclear Steam Supply System Removal																					
4a.1.1.1	Reactor Coolant Piping	22	88	15	27	-	387	-	135	674	674	-	-	-	877	-	-	-	100,307	2,285	-
4a.1.1.2	Pressurizer Relief Tank	3	12	3	6	-	80	-	26	131	131	-	-	-	188	-	-	-	20,849	315	-
4a.1.1.3	Reactor Coolant Pumps & Motors	-	1,267	883	130	-	3,155	-	1,213	6,648	6,648	-	-	-	10,752	-	-	-	1,124,474	31,482	-
4a.1.1.4	Pressurizer	-	1,333	757	177	-	776	-	630	3,673	3,673	-	-	-	2,644	-	-	-	462,726	4,152	-
4a.1.1.5	Steam Generators	34	6,660	1,196	3,129	-	31,918	-	10,251	53,188	53,188	-	-	-	24,692	7,262	-	-	2,396,266	149,491	-
4a.1.1.6	CRDMs/ICIs/Service Structure Removal	12	55	175	64	-	185	-	93	584	584	-	-	-	1,454	-	-	-	47,869	1,312	-
4a.1.1.7	Reactor Vessel Internals	82	12,878	9,889	957	-	934	671	12,979	38,390	38,390	-	-	-	2,504	-	-	-	235,955	48,160	2,871
4a.1.1.8	Vessel & Internals GTCC Disposal	-	-	-	-	-	13,703	-	2,055	15,758	15,758	-	-	-	-	-	-	2,856	564,685	-	-
4a.1.1.9	Reactor Vessel	-	10,832	2,802	522	-	2,824	671	10,468	28,119	28,119	-	-	-	9,626	-	-	-	979,373	48,160	2,871
4a.1.1	Totals	154	33,125	15,719	5,014	-	53,962	1,341	37,850	147,165	147,165	-	-	-	52,738	7,262	-	2,856	5,932,504	285,357	5,741
Removal of Major Equipment																					
4a.1.2	Main Turbine/Generator	-	278	93	23	615	-	-	175	1,184	1,184	-	-	5,298	-	-	-	-	238,394	5,389	-
4a.1.3	Main Condensers	-	1,271	103	25	680	-	-	434	2,514	2,514	-	-	5,860	-	-	-	-	263,690	25,162	-
Cascading Costs from Clean Building Demolition																					
4a.1.4.1	Control & Service	-	166	-	-	-	-	-	25	191	191	-	-	-	-	-	-	-	-	2,080	-
4a.1.4	Totals	-	166	-	-	-	-	-	25	191	191	-	-	-	-	-	-	-	-	2,080	-
Disposal of Plant Systems																					
4a.1.5.1	Decay Heat Closed Cooling Water	-	280	34	60	697	348	-	274	1,693	1,693	-	-	6,656	1,363	-	-	-	360,509	5,823	-
4a.1.5.2	Decay Heat Removal (RCA)	-	200	55	74	263	664	-	272	1,527	1,527	-	-	2,511	2,597	-	-	-	273,893	4,350	-
4a.1.5.3	Decay Heat Removal (Yard)	-	140	-	-	-	-	-	21	161	-	-	161	-	-	-	-	-	-	2,863	-
4a.1.5.4	Demineralized Water (RCA)	-	142	8	11	57	92	-	70	381	381	-	-	547	362	-	-	-	46,162	2,899	-
4a.1.5.5	Domestic Water (Clean)	-	6	-	-	-	-	-	1	7	-	-	7	-	-	-	-	-	-	148	-
4a.1.5.6	Domestic Water (RCA)	-	21	1	2	7	14	-	10	54	54	-	-	63	54	-	-	-	6,162	420	-
4a.1.5.7	Electrical (Clean)	-	9	-	-	-	-	-	1	11	-	-	11	-	-	-	-	-	-	191	-
4a.1.5.8	Emergency Feedwater (RCA)	-	65	5	6	43	51	-	37	206	206	-	-	407	198	-	-	-	29,642	1,332	-
4a.1.5.9	Fire Protection (Clean)	-	54	-	-	-	-	-	8	62	-	-	62	-	-	-	-	-	-	1,167	-
4a.1.5.10	Fire Protection (RCA)	-	48	3	4	15	31	-	23	123	123	-	-	146	122	-	-	-	14,013	991	-
4a.1.5.11	Gaseous Waste Disposal System (RCA)	-	208	8	10	60	84	-	84	454	454	-	-	568	332	-	-	-	44,866	4,497	-
4a.1.5.12	HVAC - Auxiliary Building	-	525	15	26	181	195	-	213	1,155	1,155	-	-	1,725	765	-	-	-	120,641	11,076	-
4a.1.5.13	HVAC - Control Building	-	59	3	9	186	17	-	49	323	323	-	-	1,780	67	-	-	-	76,715	1,131	-
4a.1.5.14	HVAC - Miscellaneous	-	35	-	-	-	-	-	5	40	-	-	40	-	-	-	-	-	-	719	-
4a.1.5.15	HVAC - Service Building	-	76	2	5	108	11	-	39	240	240	-	-	1,029	41	-	-	-	44,512	1,435	-
4a.1.5.16	Hydrogen Purge - Rad Monitoring	-	18	0	0	0	2	-	5	26	26	-	-	4	8	-	-	-	669	413	-
4a.1.5.17	Industrial Waste Treatment System	-	221	-	-	-	-	-	33	254	-	-	254	-	-	-	-	-	-	4,899	-
4a.1.5.18	Instrument Air (RCA)	-	116	8	8	28	75	-	54	290	290	-	-	271	294	-	-	-	30,495	2,374	-
4a.1.5.19	Intermediate Closed Cooling Water (RCA)	-	95	14	21	60	190	-	85	463	463	-	-	568	742	-	-	-	72,199	1,958	-
4a.1.5.20	Main Condensate (RCA)	-	202	8	20	430	38	-	128	826	826	-	-	4,101	154	-	-	-	176,354	4,077	-
4a.1.5.21	Main Reheat & Steam (RCA)	-	62	5	8	67	59	-	42	244	244	-	-	643	232	-	-	-	41,516	1,275	-
4a.1.5.22	Nuclear Services Closed Cycle Cooling	-	848	147	216	1,349	1,718	-	891	5,169	5,169	-	-	12,877	6,801	-	-	-	968,028	17,553	-
4a.1.5.23	Nuclear Services River Water (Clean)	-	78	-	-	-	-	-	12	90	-	-	90	-	-	-	-	-	-	1,764	-
4a.1.5.24	Nuclear Services River Water (RCA)	-	1,287	80	115	460	1,010	-	669	3,621	3,621	-	-	4,392	3,955	-	-	-	440,046	28,724	-
4a.1.5.25	Reactor Building Normal Cooling (Clean)	-	14	-	-	-	-	-	2	16	-	-	16	-	-	-	-	-	-	300	-
4a.1.5.26	Reactor Building Normal Cooling (RCA)	-	264	36	54	182	490	-	228	1,254	1,254	-	-	1,739	1,920	-	-	-	197,600	5,738	-
4a.1.5.27	SG Secondary Side Vents & Drains	-	71	5	5	-	56	-	33	170	170	-	-	-	218	-	-	-	14,436	1,522	-
4a.1.5.28	Sampling Nuclear System	-	231	15	17	-	175	-	106	544	544	-	-	-	692	-	-	-	45,402	4,992	-
4a.1.5.29	Sewage Treatment Plant (RCA)	-	4	0	0	4	1	-	2	11	11	-	-	35	4	-	-	-	1,662	82	-
4a.1.5.30	Station Service Air	-	260	10	10	15	95	-	93	483	483	-	-	139	372	-	-	-	30,363	5,863	-
4a.1.5.31	Sump Systems (RCA)	-	145	5	6	17	55	-	54	282	282	-	-	161	215	-	-	-	20,756	3,215	-
4a.1.5.32	Turbine Plant Sample (RCA)	-	17	1	1	6	8	-	8	41	41	-	-	61	32	-	-	-	4,590	339	-
4a.1.5	Totals	-	5,802	469	687	4,235	5,480	-	3,550	20,223	19,581	-	641	40,423	21,541	-	-	-	3,061,230	124,129	-
4a.1.6	Scaffolding in support of decommissioning	-	1,202	16	5	93	18	-	321	1,655	1,655	-	-	804	71	-	-	-	40,854	29,290	-
4a.1	*Subtotal Period 4a Activity Costs*	154	41,843	16,400	5,754	5,624	59,460	1,341	42,354	172,931	172,290	-	641	52,384	74,351	7,262	-	2,856	9,536,673	471,407	5,741

Table C
Three Mile Island Unit 2
DECON Decommissioning Cost Estimate
(Thousands of 2013 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Period 4a Additional Costs																					
4a.2.1	Reactor Building Basement Dose Reduction	-	17	126	3,478	-	45,624	-	11,945	61,189	61,189	-	-	-	-	11,393	1,252	-	1,217,965	282	-
4a.2.2	Containment Basement Liner Removal	-	123	273	521	-	13,552	-	3,524	17,992	17,992	-	-	-	-	3,756	-	-	129,709	2,286	-
4a.2.3	Reactor Building SNF & HOT Systems Removal	-	-	67	297	-	4,065	-	1,068	5,497	5,497	-	-	-	-	1,127	-	-	75,706	358	-
4a.2.4	Fuel Handling / Auxiliary SNF & HOT Systems Removal	2,517	1,901	171	558	-	2,384	700	2,535	10,765	10,765	-	-	-	10,293	-	-	28	679,443	84,140	-
4a.2.5	NSSS Component Surface Decontamination	7,614	-	1,127	41	-	-	9,071	5,287	23,140	23,140	-	-	-	-	-	-	329	19,751	46,920	-
4a.2.6	Core Flood Tanks Removal	70	427	62	75	-	397	-	258	1,289	1,289	-	-	-	1,716	-	-	-	124,165	10,059	-
4a.2.7	FHAB AX-004 Decontamination	-	151	201	953	-	12,196	377	3,306	17,185	17,185	-	-	-	-	3,380	-	-	228,566	4,638	-
4a.2.8	Legacy waste stored at INEEL	-	-	-	-	-	-	650	98	748	748	-	-	-	-	-	-	-	-	-	-
4a.2	Subtotal Period 4a Additional Costs	10,200	2,618	2,027	5,923	-	78,219	10,797	28,020	137,805	137,805	-	-	-	12,009	19,657	1,252	357	2,475,308	148,683	-
Period 4a Collateral Costs																					
4a.3.1	Process decommissioning water waste	40	-	16	99	-	103	-	62	318	318	-	-	-	264	-	-	-	15,838	69	-
4a.3.2	Process decommissioning chemical flush waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4a.3.3	Small tool allowance	-	431	-	-	-	-	-	65	495	446	-	50	-	-	-	-	-	-	-	-
4a.3	Subtotal Period 4a Collateral Costs	40	431	16	99	-	103	-	126	814	764	-	50	-	264	-	-	-	15,838	69	-
Period 4a Period-Dependent Costs																					
4a.4.1	Decon supplies	211	-	-	-	-	-	-	53	264	264	-	-	-	-	-	-	-	-	-	-
4a.4.2	Insurance	-	-	-	-	-	-	998	100	1,098	1,098	-	-	-	-	-	-	-	-	-	-
4a.4.3	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4a.4.4	Health physics supplies	-	7,790	-	-	-	-	-	1,947	9,737	9,737	-	-	-	-	-	-	-	-	-	-
4a.4.5	Heavy equipment rental	-	7,991	-	-	-	-	-	1,199	9,190	9,190	-	-	-	-	-	-	-	-	-	-
4a.4.6	Disposal of DAW generated	-	-	159	150	-	457	-	153	919	919	-	-	-	9,052	-	-	-	181,033	413	-
4a.4.7	Plant energy budget	-	-	-	-	-	-	4,734	710	5,444	5,444	-	-	-	-	-	-	-	-	-	-
4a.4.8	NRC Fees	-	-	-	-	-	-	4,813	481	5,294	5,294	-	-	-	-	-	-	-	-	-	-
4a.4.9	Site O&M	-	-	-	-	-	-	1,564	235	1,798	1,798	-	-	-	-	-	-	-	-	-	-
4a.4.10	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	1,926	289	2,215	2,215	-	-	-	-	-	-	-	-	-	-
4a.4.11	Security Staff Cost	-	-	-	-	-	-	19,272	2,891	22,163	22,163	-	-	-	-	-	-	-	-	-	316,250
4a.4.12	DOC Staff Cost	-	-	-	-	-	-	133,912	20,087	153,999	153,999	-	-	-	-	-	-	-	-	-	1,817,552
4a.4.13	Utility Staff Cost	-	-	-	-	-	-	12,664	1,900	14,564	14,564	-	-	-	-	-	-	-	-	-	126,500
4a.4	Subtotal Period 4a Period-Dependent Costs	211	15,781	159	150	-	457	179,884	30,044	226,686	226,686	-	-	-	9,052	-	-	-	181,033	413	2,260,302
4a.0	TOTAL PERIOD 4a COST	10,605	60,673	18,602	11,926	5,624	138,239	192,023	100,544	538,236	537,545	-	691	52,384	95,675	26,918	1,252	3,214	12,208,850	620,572	2,266,043
PERIOD 4b - Site Decontamination																					
Period 4b Direct Decommissioning Activities																					
4b.1.1	Remove spent fuel racks	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Disposal of Plant Systems																					
4b.1.2.1	Decay Heat Removal (RB)	-	241	32	39	-	401	-	170	882	882	-	-	-	1,570	-	-	-	103,970	5,262	-
4b.1.2.2	Electrical (Contaminated - RB)	-	43	3	4	-	42	-	22	114	114	-	-	-	165	-	-	-	10,890	895	-
4b.1.2.3	Electrical (Contaminated - RCA)	-	285	10	26	570	52	-	175	1,120	1,120	-	-	5,443	205	-	-	-	234,606	5,745	-
4b.1.2.4	Feedwater (RB)	-	38	8	12	-	123	-	43	224	224	-	-	-	483	-	-	-	31,951	835	-
4b.1.2.5	Fire Protection (RB)	-	21	2	2	-	21	-	11	56	56	-	-	-	82	-	-	-	5,416	451	-
4b.1.2.6	Fuel Handling (RB)	-	4	1	1	-	7	-	3	15	15	-	-	-	26	-	-	-	1,751	86	-
4b.1.2.7	Fuel Handling (RCA)	-	308	22	32	-	330	-	166	858	858	-	-	-	1,292	-	-	-	85,392	6,306	-
4b.1.2.8	Gaseous Waste Disposal System (RB)	-	4	0	0	-	3	-	2	10	10	-	-	-	12	-	-	-	829	84	-
4b.1.2.9	HVAC - Fuel Handling Building	-	218	6	11	115	67	-	91	506	506	-	-	1,097	262	-	-	-	61,848	4,591	-
4b.1.2.10	HVAC - Reactor Building	-	810	76	103	-	1,064	-	491	2,543	2,543	-	-	-	4,166	-	-	-	275,559	17,022	-
4b.1.2.11	Instrument Air (RB)	-	27	2	2	-	20	-	12	64	64	-	-	-	79	-	-	-	5,215	590	-
4b.1.2.12	Intermediate Closed Cooling Water (RB)	-	81	8	9	-	95	-	46	240	240	-	-	-	373	-	-	-	24,689	1,744	-
4b.1.2.13	Nitrogen for Nuclear Radwaste Sys (RB)	-	8	1	2	-	18	-	7	35	35	-	-	-	69	-	-	-	4,572	171	-
4b.1.2.14	Nuclear Services River Water (RB)	-	88	15	20	-	205	-	78	407	407	-	-	-	804	-	-	-	53,208	1,943	-
4b.1.2.15	OTSG Chemical Cleaning System	-	19	2	2	-	25	-	12	60	60	-	-	-	99	-	-	-	6,552	403	-
4b.1.2.16	Sewage Treatment Plant (Clean)	-	8	-	-	-	-	-	1	10	-	-	10	-	-	-	-	-	-	180	-
4b.1.2.17	Spent Fuel Cooling	-	436	26	33	47	328	-	206	1,077	1,077	-	-	452	1,286	-	-	-	103,430	9,612	-
4b.1.2.18	Spent Fuel Cooling (RB)	-	24	2	3	-	28	-	14	71	71	-	-	-	110	-	-	-	7,258	525	-
4b.1.2.19	Sump Systems (RB)	-	37	3	4	-	39	-	20	103	103	-	-	-	152	-	-	-	10,098	809	-
4b.1.2	Totals	-	2,699	220	304	733	2,869	-	1,569	8,394	8,384	-	10	6,991	11,234	-	-	-	1,027,234	57,253	-
4b.1.3	Scaffolding in support of decommissioning	-	1,802	23	8	140	27	-	482	2,483	2,483	-	-	1,206	106	-	-	-	61,281	43,935	-

Table C
Three Mile Island Unit 2
DECON Decommissioning Cost Estimate
(Thousands of 2013 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Decontamination of Site Buildings																					
4b.1.4.1	Reactor	10,224	4,077	1,624	1,474	-	15,272	-	10,333	43,004	43,004	-	-	-	59,647	-	-	-	3,956,465	262,541	-
4b.1.4.2	Auxiliary	476	864	20	198	34	402	-	591	2,584	2,584	-	-	323	5,686	-	-	-	485,670	26,229	-
4b.1.4.3	BWST & CST Tank Pads	-	176	60	1,039	-	1,663	-	622	3,560	3,560	-	-	-	28,651	-	-	-	2,482,650	2,674	-
4b.1.4.4	Control & Service	22	6	0	4	0	6	-	15	54	54	-	-	2	112	-	-	-	9,763	562	-
4b.1.4.5	Control Building Area	86	43	2	24	26	38	-	71	290	290	-	-	249	628	-	-	-	64,322	2,532	-
4b.1.4.6	Fuel Handling	670	951	47	137	84	579	-	756	3,225	3,225	-	-	803	4,270	-	-	-	364,809	30,747	-
4b.1.4.7	Turbine	65	4	0	1	-	2	-	34	106	106	-	-	-	29	-	-	-	2,532	1,451	-
4b.1.4	Totals	11,544	6,121	1,753	2,877	144	17,963	-	12,421	52,823	52,823	-	-	1,377	99,023	-	-	-	7,366,210	326,735	-
4b.1	Subtotal Period 4b Activity Costs	11,544	10,622	1,997	3,189	1,017	20,859	-	14,472	63,699	63,689	-	10	9,574	110,364	-	-	-	8,454,725	427,924	-
Period 4b Additional Costs																					
4b.2.1	Bioshield & D-Ring Removal	-	4,624	766	1,526	-	9,141	-	3,747	19,804	19,804	-	-	-	155,795	-	-	-	18,695,440	60,693	-
4b.2.2	RB Exterior Concrete & Basemat Removal	-	8,677	262	520	-	3,117	-	3,053	15,629	15,629	-	-	-	53,132	-	-	-	6,375,849	120,240	-
4b.2.3	Underground Piping & Yard Soil	-	722	123	1,639	-	2,874	250	1,196	6,804	6,804	-	-	-	48,992	-	-	-	3,723,414	8,942	-
4b.2.4	Process NSSS decon & segmentation liquid inventory	-	-	72	269	-	5,348	659	1,484	7,832	7,832	-	-	-	-	-	1,482	-	126,837	-	779
4b.2.5	Auxiliary Building Total Removal	-	8,841	370	973	-	5,843	-	3,854	19,881	19,881	-	-	-	99,586	-	-	-	11,950,340	113,205	-
4b.2.6	Fuel Handling Building Total Removal	-	6,151	83	675	-	4,027	-	2,654	13,589	13,589	-	-	-	68,634	-	-	-	8,236,080	73,213	-
4b.2.7	On-site survey & release of concrete	-	2,512	-	969	-	11,688	1,800	3,965	20,935	20,935	-	-	-	199,217	-	-	-	17,531,090	25,319	-
4b.2.8	Defueling fuel canister racks	24	21	2	75	-	2,527	-	660	3,309	3,309	-	-	-	10,913	-	-	-	98,706	961	-
4b.2.9	License Termination Survey Planning	-	-	-	-	-	-	1,990	597	2,587	2,587	-	-	-	-	-	-	-	-	-	12,480
4b.2	Subtotal Period 4b Additional Costs	24	31,549	1,679	6,646	-	44,565	4,699	21,208	110,370	110,370	-	-	-	636,269	-	1,482	-	66,737,760	402,574	13,259
Period 4b Collateral Costs																					
4b.3.1	Process decommissioning water waste	48	-	21	131	-	136	-	80	416	416	-	-	-	350	-	-	-	21,021	91	-
4b.3.2	Process decommissioning chemical flush waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4b.3.3	Small tool allowance	-	551	-	-	-	-	-	83	633	633	-	-	-	-	-	-	-	-	-	-
4b.3.4	Decommissioning Equipment Disposition	-	-	116	45	697	135	-	157	1,149	1,149	-	-	6,000	529	-	-	-	304,968	123	-
4b.3	Subtotal Period 4b Collateral Costs	48	551	137	175	697	271	-	319	2,198	2,198	-	-	6,000	879	-	-	-	325,989	215	-
Period 4b Period-Dependent Costs																					
4b.4.1	Decon supplies	1,023	-	-	-	-	-	-	256	1,279	1,279	-	-	-	-	-	-	-	-	-	-
4b.4.2	Insurance	-	-	-	-	-	-	1,090	109	1,199	1,199	-	-	-	-	-	-	-	-	-	-
4b.4.3	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4b.4.4	Health physics supplies	-	9,348	-	-	-	-	-	2,337	11,685	11,685	-	-	-	-	-	-	-	-	-	-
4b.4.5	Heavy equipment rental	-	8,635	-	-	-	-	-	1,295	9,930	9,930	-	-	-	-	-	-	-	-	-	-
4b.4.6	Disposal of DAW generated	-	-	121	114	-	347	-	116	697	697	-	-	-	6,863	-	-	-	137,260	313	-
4b.4.7	Plant energy budget	-	-	-	-	-	-	3,858	579	4,437	4,437	-	-	-	-	-	-	-	-	-	-
4b.4.8	NRC Fees	-	-	-	-	-	-	4,389	439	4,828	4,828	-	-	-	-	-	-	-	-	-	-
4b.4.9	Site O&M	-	-	-	-	-	-	1,707	256	1,963	1,963	-	-	-	-	-	-	-	-	-	-
4b.4.10	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	2,103	315	2,418	2,418	-	-	-	-	-	-	-	-	-	-
4b.4.11	Security Staff Cost	-	-	-	-	-	-	21,035	3,155	24,190	24,190	-	-	-	-	-	-	-	-	-	345,179
4b.4.12	DOC Staff Cost	-	-	-	-	-	-	114,909	17,236	132,146	132,146	-	-	-	-	-	-	-	-	-	1,612,674
4b.4.13	Utility Staff Cost	-	-	-	-	-	-	13,823	2,073	15,896	15,896	-	-	-	-	-	-	-	-	-	138,071
4b.4	Subtotal Period 4b Period-Dependent Costs	1,023	17,983	121	114	-	347	162,913	28,167	210,667	210,667	-	-	-	6,863	-	-	-	137,260	313	2,095,924
4b.0	TOTAL PERIOD 4b COST	12,639	60,705	3,933	10,124	1,713	66,042	167,612	64,166	386,934	386,924	-	10	15,574	754,376	-	1,482	-	75,655,730	831,026	2,109,183
PERIOD 4f - License Termination																					
Period 4f Direct Decommissioning Activities																					
4f.1.1	ORISE confirmatory survey	-	-	-	-	-	-	161	48	209	209	-	-	-	-	-	-	-	-	-	-
4f.1.2	Terminate license									a											
4f.1	Subtotal Period 4f Activity Costs	-	-	-	-	-	-	161	48	209	209	-	-	-	-	-	-	-	-	-	-
Period 4f Additional Costs																					
4f.2.1	License Termination Survey	-	-	-	-	-	-	6,191	1,857	8,048	8,048	-	-	-	-	-	-	-	-	109,198	6,240
4f.2	Subtotal Period 4f Additional Costs	-	-	-	-	-	-	6,191	1,857	8,048	8,048	-	-	-	-	-	-	-	-	109,198	6,240
Period 4f Collateral Costs																					
4f.3.1	DOC staff relocation expenses	-	-	-	-	-	-	1,385	208	1,593	1,593	-	-	-	-	-	-	-	-	-	-
4f.3	Subtotal Period 4f Collateral Costs	-	-	-	-	-	-	1,385	208	1,593	1,593	-	-	-	-	-	-	-	-	-	-

Table C
Three Mile Island Unit 2
DECON Decommissioning Cost Estimate
(Thousands of 2013 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
	Period 4f Period-Dependent Costs																				
4f.4.1	Insurance	-	-	-	-	-	-	154	15	170	170	-	-	-	-	-	-	-	-	-	-
4f.4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4f.4.3	Health physics supplies	-	875	-	-	-	-	-	219	1,094	1,094	-	-	-	-	-	-	-	-	-	-
4f.4.4	Disposal of DAW generated	-	-	6	5	-	16	-	5	32	32	-	-	-	316	-	-	-	6,325	14	-
4f.4.5	Plant energy budget	-	-	-	-	-	-	195	29	225	225	-	-	-	-	-	-	-	-	-	-
4f.4.6	NRC Fees	-	-	-	-	-	-	452	45	497	497	-	-	-	-	-	-	-	-	-	-
4f.4.7	Site O&M	-	-	-	-	-	-	242	36	278	278	-	-	-	-	-	-	-	-	-	-
4f.4.8	Security Staff Cost	-	-	-	-	-	-	1,061	159	1,220	1,220	-	-	-	-	-	-	-	-	-	17,223
4f.4.9	DOC Staff Cost	-	-	-	-	-	-	4,529	679	5,209	5,209	-	-	-	-	-	-	-	-	-	58,323
4f.4.10	Utility Staff Cost	-	-	-	-	-	-	1,540	231	1,771	1,771	-	-	-	-	-	-	-	-	-	14,874
4f.4	Subtotal Period 4f Period-Dependent Costs	-	875	6	5	-	16	8,174	1,420	10,496	10,496	-	-	-	316	-	-	-	6,325	14	90,420
4f.0	TOTAL PERIOD 4f COST	-	875	6	5	-	16	15,911	3,533	20,345	20,345	-	-	-	316	-	-	-	6,325	109,212	96,660
PERIOD 4 TOTALS		23,244	122,253	22,540	22,054	7,337	204,297	375,545	168,244	945,515	944,815	-	700	67,958	850,367	26,918	2,734	3,214	87,870,900	1,560,810	4,471,887
PERIOD 5b - Site Restoration																					
	Period 5b Direct Decommissioning Activities																				
	Demolition of Remaining Site Buildings																				
5b.1.1.1	Air Intake Tunnel	-	161	-	-	-	-	-	24	185	-	-	185	-	-	-	-	-	-	2,314	-
5b.1.1.2	Circulating Water Chlorinator	-	73	-	-	-	-	-	11	84	-	-	84	-	-	-	-	-	-	1,131	-
5b.1.1.3	Circulating Water Intake Flume	-	64	-	-	-	-	-	10	74	-	-	74	-	-	-	-	-	-	915	-
5b.1.1.4	Circulating Water Pumphouse	-	187	-	-	-	-	-	28	215	-	-	215	-	-	-	-	-	-	3,205	-
5b.1.1.5	Coagulator	-	54	-	-	-	-	-	8	62	-	-	62	-	-	-	-	-	-	937	-
5b.1.1.6	Control & Service	-	3,165	-	-	-	-	-	475	3,640	-	-	3,640	-	-	-	-	-	-	39,585	-
5b.1.1.7	Control Building Area	-	891	-	-	-	-	-	134	1,024	-	-	1,024	-	-	-	-	-	-	10,651	-
5b.1.1.8	Emergency Diesel Generator	-	737	-	-	-	-	-	111	847	-	-	847	-	-	-	-	-	-	9,313	-
5b.1.1.9	Main & Aux Transformer Foundations	-	87	-	-	-	-	-	13	100	-	-	100	-	-	-	-	-	-	1,387	-
5b.1.1.10	Mechanical Draft Cooling Towers	-	85	-	-	-	-	-	13	98	-	-	98	-	-	-	-	-	-	1,074	-
5b.1.1.11	Miscellaneous Yard Foundations	-	20	-	-	-	-	-	3	23	-	-	23	-	-	-	-	-	-	284	-
5b.1.1.12	River Water Pumphouse	-	1,862	-	-	-	-	-	279	2,141	-	-	2,141	-	-	-	-	-	-	21,756	-
5b.1.1.13	Turbine	-	1,599	-	-	-	-	-	240	1,838	-	-	1,838	-	-	-	-	-	-	26,752	-
5b.1.1.14	Turbine Generator Pedestal	-	737	-	-	-	-	-	111	847	-	-	847	-	-	-	-	-	-	8,464	-
5b.1.1	Totals	-	9,721	-	-	-	-	-	1,458	11,179	-	-	11,179	-	-	-	-	-	-	127,770	-
	Site Closeout Activities																				
5b.1.2	Grade & landscape site	-	146	-	-	-	-	-	22	168	-	-	168	-	-	-	-	-	-	770	-
5b.1.3	Final report to NRC	-	-	-	-	-	-	411	62	473	473	-	-	-	-	-	-	-	-	-	3,120
5b.1	Subtotal Period 5b Activity Costs	-	9,867	-	-	-	-	411	1,542	11,820	473	-	11,347	-	-	-	-	-	-	128,540	3,120
	Period 5b Additional Costs																				
5b.2.1	River Water Pump House Cofferdam	-	214	-	-	-	-	-	32	246	-	-	246	-	-	-	-	-	-	2,116	-
5b.2.2	Concrete Processing	-	496	-	-	-	-	9	76	580	-	-	580	-	-	-	-	-	-	2,760	-
5b.2.3	Survey & Release of scrap materials	-	-	889	60	2,274	-	-	439	3,663	3,663	-	-	61,736	-	-	-	-	3,704,137	3,704	-
5b.2.4	Backfill Site	-	925	-	-	-	-	-	139	1,064	-	-	1,064	-	-	-	-	-	-	6,952	-
5b.2.5	Cooling Tower Demolition	-	4,383	-	-	-	-	-	657	5,040	-	-	5,040	-	-	-	-	-	-	24,392	-
5b.2	Subtotal Period 5b Additional Costs	-	6,017	889	60	2,274	-	9	1,343	10,592	3,663	-	6,930	61,736	-	-	-	-	3,704,137	39,924	-
	Period 5b Collateral Costs																				
5b.3.1	Small tool allowance	-	121	-	-	-	-	-	18	139	-	-	139	-	-	-	-	-	-	-	-
5b.3	Subtotal Period 5b Collateral Costs	-	121	-	-	-	-	-	18	139	-	-	139	-	-	-	-	-	-	-	-

Table C
Three Mile Island Unit 2
DECON Decommissioning Cost Estimate
(Thousands of 2013 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Period 5b Period-Dependent Costs																					
5b.4.1	Insurance	-	-	-	-	-	-	206	21	226	-	-	226	-	-	-	-	-	-	-	-
5b.4.2	*Property taxes*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5b.4.3	Heavy equipment rental	-	2,329	-	-	-	-	-	349	2,678	-	-	2,678	-	-	-	-	-	-	-	-
5b.4.4	Plant energy budget	-	-	-	-	-	-	130	20	150	-	-	150	-	-	-	-	-	-	-	-
5b.4.5	Site O&M	-	-	-	-	-	-	322	48	371	-	-	371	-	-	-	-	-	-	-	-
5b.4.6	Security Staff Cost	-	-	-	-	-	-	1,413	212	1,625	-	-	1,625	-	-	-	-	-	-	-	22,943
5b.4.7	DOC Staff Cost	-	-	-	-	-	-	9,506	1,426	10,932	-	-	10,932	-	-	-	-	-	-	-	112,629
5b.4.8	Utility Staff Cost	-	-	-	-	-	-	2,003	300	2,304	-	-	2,304	-	-	-	-	-	-	-	20,336
5b.4	Subtotal Period 5b Period-Dependent Costs	-	2,329	-	-	-	-	13,580	2,376	18,285	-	-	18,285	-	-	-	-	-	-	-	155,907
5b.0	TOTAL PERIOD 5b COST	-	18,334	889	60	2,274	-	14,000	5,279	40,837	4,136	-	36,701	61,736	-	-	-	-	3,704,137	168,465	159,027
PERIOD 5 TOTALS		-	18,334	889	60	2,274	-	14,000	5,279	40,837	4,136	-	36,701	61,736	-	-	-	-	3,704,137	168,465	159,027
TOTAL COST TO DECOMMISSION		**23,976**	**144,842**	**23,781**	**22,843**	**9,612**	**210,694**	**552,302**	**200,563**	**1,188,564**	**1,149,098**	**-**	**39,467**	**129,694**	**857,225**	**26,918**	**2,734**	**3,214**	**93,258,210**	**1,755,720**	**5,680,747**

TOTAL COST TO DECOMMISSION WITH 20.3% CONTINGENCY:	**$1,188,564**	**thousands of 2013 dollars**
TOTAL NRC LICENSE TERMINATION COST IS 96.68% OR:	**$1,149,098**	**thousands of 2013 dollars**
NON-NUCLEAR DEMOLITION COST IS 3.32% OR:	**$39,467**	**thousands of 2013 dollars**
TOTAL LOW-LEVEL RADIOACTIVE WASTE VOLUME BURIED (EXCLUDING GTCC):	**886,877**	**cubic feet**
TOTAL GREATER THAN CLASS C RADWASTE VOLUME GENERATED:	**3,214**	**Cubic Feet**
TOTAL SCRAP METAL REMOVED:	**19,201**	**Tons**
TOTAL CRAFT LABOR REQUIREMENTS:	**1,755,720**	**Man-hours**

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

APPENDIX D

DETAILED COST ANALYSIS

DELAYED DECON

Table D
Three Mile Island Unit 2
Delayed DECON Decommissioning Cost Estimate
(Thousands of 2013 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
PERIOD 0a - PDMS Monitoring & SAFSTOR Storage																					
Period 0a Direct Decommissioning Activities																					
Period 0a Collateral Costs																					
0a.3.1	PDMS Monitoring	-	-	-	-	-	-	6,042	906	6,949	6,949	-	-	-	-	-	-	-	-	-	-
0a.3	*Subtotal Period 0a Collateral Costs*	-	-	-	-	-	-	6,042	906	6,949	6,949	-	-	-	-	-	-	-	-	-	-
Period 0a Period-Dependent Costs																					
0a.4.1	Insurance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0a.4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0a.4.3	Plant energy budget	-	-	-	-	-	-	4,148	622	4,770	4,770	-	-	-	-	-	-	-	-	-	-
0a.4.4	Utility Staff Cost	-	-	-	-	-	-	46,069	6,910	52,979	52,979	-	-	-	-	-	-	-	-	-	222,229
0a.4	Subtotal Period 0a Period-Dependent Costs	-	-	-	-	-	-	50,217	7,533	57,750	57,750	-	-	-	-	-	-	-	-	-	222,229
0a.0	TOTAL PERIOD 0a COST	-	-	-	-	-	-	56,260	8,439	64,699	64,699	-	-	-	-	-	-	-	-	-	222,229
PERIOD 2c - SAFSTOR Dormancy without Spent Fuel Storage																					
Period 2c Direct Decommissioning Activities																					
2c.1.1	Quarterly Inspection									a											
2c.1.2	Semi-annual environmental survey									a											
2c.1.3	Prepare reports									a											
2c.1.4	Bituminous roof replacement	-	-	-	-	-	-	392	59	450	450	-	-	-	-	-	-	-	-	-	-
2c.1.5	Maintenance supplies	-	-	-	-	-	-	1,566	392	1,958	1,958	-	-	-	-	-	-	-	-	-	-
2c.1	Subtotal Period 2c Activity Costs	-	-	-	-	-	-	1,958	450	2,408	2,408	-	-	-	-	-	-	-	-	-	-
Period 2c Collateral Costs																					
2c.3	Subtotal Period 2c Collateral Costs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Period 2c Period-Dependent Costs																					
2c.4.1	Insurance	-	-	-	-	-	-	2,336	234	2,570	2,570	-	-	-	-	-	-	-	-	-	-
2c.4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2c.4.3	Health physics supplies	-	1,436	-	-	-	-	-	359	1,795	1,795	-	-	-	-	-	-	-	-	-	-
2c.4.4	Disposal of DAW generated	-	-	18	17	-	53	-	18	107	107	-	-	-	1,050	-	-	-	20,999	48	-
2c.4.5	Plant energy budget	-	-	-	-	-	-	2,386	358	2,744	2,744	-	-	-	-	-	-	-	-	-	-
2c.4.6	NRC Fees	-	-	-	-	-	-	3,239	324	3,563	3,563	-	-	-	-	-	-	-	-	-	-
2c.4.7	Security Staff Cost	-	-	-	-	-	-	2,785	418	3,202	3,202	-	-	-	-	-	-	-	-	-	47,371
2c.4.8	Utility Staff Cost	-	-	-	-	-	-	2,769	415	3,184	3,184	-	-	-	-	-	-	-	-	-	23,686
2c.4	Subtotal Period 2c Period-Dependent Costs	-	1,436	18	17	-	53	13,515	2,126	17,165	17,165	-	-	-	1,050	-	-	-	20,999	48	71,057
2c.0	TOTAL PERIOD 2c COST	-	1,436	18	17	-	53	15,472	2,575	19,573	19,573	-	-	-	1,050	-	-	-	20,999	48	71,057
PERIOD 2 TOTALS		-	1,436	18	17	-	53	15,472	2,575	19,573	19,573	-	-	-	1,050	-	-	-	20,999	48	71,057
PERIOD 3a - Reactivate Site Following SAFSTOR Dormancy																					
Period 3a Direct Decommissioning Activities																					
3a.1.1	Prepare preliminary decommissioning cost	-	-	-	-	-	-	257	39	296	296	-	-	-	-	-	-	-	-	-	1,950
3a.1.2	Review plant dwgs & specs.	-	-	-	-	-	-	1,213	182	1,395	1,395	-	-	-	-	-	-	-	-	-	9,200
3a.1.3	Perform detailed rad survey									a											
3a.1.4	End product description	-	-	-	-	-	-	264	40	303	303	-	-	-	-	-	-	-	-	-	2,000
3a.1.5	Detailed by-product inventory	-	-	-	-	-	-	686	103	788	788	-	-	-	-	-	-	-	-	-	5,200
3a.1.6	Define major work sequence	-	-	-	-	-	-	1,977	297	2,274	2,274	-	-	-	-	-	-	-	-	-	15,000
3a.1.7	Perform SER and EA	-	-	-	-	-	-	8,226	1,234	9,460	9,460	-	-	-	-	-	-	-	-	-	62,400
3a.1.8	Perform Site-Specific Cost Study	-	-	-	-	-	-	1,318	198	1,516	1,516	-	-	-	-	-	-	-	-	-	10,000
3a.1.9	Prepare/submit License Termination Plan	-	-	-	-	-	-	2,162	324	2,486	2,486	-	-	-	-	-	-	-	-	-	16,400
3a.1.10	Receive NRC approval of termination plan									a											
Activity Specifications																					
3a.1.11.1	Re-activate plant & temporary facilities	-	-	-	-	-	-	1,457	219	1,676	1,508	-	168	-	-	-	-	-	-	-	11,055
3a.1.11.2	Plant systems	-	-	-	-	-	-	1,099	165	1,263	1,137	-	126	-	-	-	-	-	-	-	8,333
3a.1.11.3	Reactor internals	-	-	-	-	-	-	1,872	281	2,153	2,153	-	-	-	-	-	-	-	-	-	14,200
3a.1.11.4	Reactor vessel	-	-	-	-	-	-	1,285	193	1,478	1,478	-	-	-	-	-	-	-	-	-	9,750
3a.1.11.5	Biological shield	-	-	-	-	-	-	66	10	76	76	-	-	-	-	-	-	-	-	-	500
3a.1.11.6	Steam generators	-	-	-	-	-	-	1,645	247	1,892	1,892	-	-	-	-	-	-	-	-	-	12,480
3a.1.11.7	Reinforced concrete	-	-	-	-	-	-	422	63	485	243	-	243	-	-	-	-	-	-	-	3,200

Table D
Three Mile Island Unit 2
Delayed DECON Decommissioning Cost Estimate
(Thousands of 2013 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Activity Specifications (continued)																					
3a.1.11.8	Main Turbine	-	-	-	-	-	-	53	8	61	-	-	61	-	-	-	-	-	-	-	400
3a.1.11.9	Main Condensers	-	-	-	-	-	-	53	8	61	-	-	61	-	-	-	-	-	-	-	400
3a.1.11.10	Plant structures & buildings	-	-	-	-	-	-	411	62	473	237	-	237	-	-	-	-	-	-	-	3,120
3a.1.11.11	Waste management	-	-	-	-	-	-	2,426	364	2,790	2,790	-	-	-	-	-	-	-	-	-	18,400
3a.1.11.12	Facility & site closeout	-	-	-	-	-	-	119	18	136	68	-	68	-	-	-	-	-	-	-	900
3a.1.11	Total	-	-	-	-	-	-	10,907	1,636	12,544	11,581	-	963	-	-	-	-	-	-	-	82,738
Planning & Site Preparations																					
3a.1.12	Prepare dismantling sequence	-	-	-	-	-	-	633	95	728	728	-	-	-	-	-	-	-	-	-	4,800
3a.1.13	Plant prep. & temp. svces	-	-	-	-	-	-	2,900	435	3,335	3,335	-	-	-	-	-	-	-	-	-	-
3a.1.14	Design water clean-up system	-	-	-	-	-	-	738	111	849	849	-	-	-	-	-	-	-	-	-	5,600
3a.1.15	Rigging/Cont. Cntrl Envlps/tooling/etc.	-	-	-	-	-	-	2,200	330	2,530	2,530	-	-	-	-	-	-	-	-	-	-
3a.1.16	Procure casks/liners & containers	-	-	-	-	-	-	324	49	373	373	-	-	-	-	-	-	-	-	-	2,460
3a.1	Subtotal Period 3a Activity Costs	-	-	-	-	-	-	33,606	5,071	38,877	37,914	-	963	-	-	-	-	-	-	-	217,748
Period 3a Additional Costs																					
3a.2.1	*Railroad Track Refurbishment*	-	-	-	-	-	-	330	50	380	380	-	-	-	-	-	-	-	-	-	-
3a.2.2	Equipment Airlock Refurbishment	-	-	-	-	-	-	1,290	194	1,484	1,484	-	-	-	-	-	-	-	-	-	-
3a.2.3	RB Polar Crane Refurbishment	-	-	-	-	-	-	6,450	968	7,418	7,418	-	-	-	-	-	-	-	-	-	-
3a.2.4	RB Cask Handling System	-	-	-	-	-	-	1,290	194	1,484	1,484	-	-	-	-	-	-	-	-	-	-
3a.2	Subtotal Period 3a Additional Costs	-	-	-	-	-	-	9,360	1,404	10,764	10,764	-	-	-	-	-	-	-	-	-	-
Period 3a Collateral Costs																					
3a.3	Subtotal Period 3a Collateral Costs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Period 3a Period-Dependent Costs																					
3a.4.1	Insurance	-	-	-	-	-	-	206	21	226	226	-	-	-	-	-	-	-	-	-	-
3a.4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3a.4.3	Health physics supplies	-	623	-	-	-	-	-	156	779	779	-	-	-	-	-	-	-	-	-	-
3a.4.4	Heavy equipment rental	-	430	-	-	-	-	-	64	494	494	-	-	-	-	-	-	-	-	-	-
3a.4.5	Disposal of DAW generated	-	-	9	8	-	25	-	8	50	50	-	-	-	490	-	-	-	9,793	22	-
3a.4.6	Plant energy budget	-	-	-	-	-	-	976	146	1,122	1,122	-	-	-	-	-	-	-	-	-	-
3a.4.7	NRC Fees	-	-	-	-	-	-	1,275	127	1,402	1,402	-	-	-	-	-	-	-	-	-	-
3a.4.8	Site O&M	-	-	-	-	-	-	322	48	371	371	-	-	-	-	-	-	-	-	-	-
3a.4.9	Security Staff Cost	-	-	-	-	-	-	3,689	553	4,242	4,242	-	-	-	-	-	-	-	-	-	61,007
3a.4.10	DOC Staff Cost	-	-	-	-	-	-	11,762	1,764	13,527	13,527	-	-	-	-	-	-	-	-	-	189,800
3a.4.11	Utility Staff Cost	-	-	-	-	-	-	2,623	393	3,017	3,017	-	-	-	-	-	-	-	-	-	26,071
3a.4	Subtotal Period 3a Period-Dependent Costs	-	1,053	9	8	-	25	20,853	3,282	25,230	25,230	-	-	-	490	-	-	-	9,793	22	276,879
3a.0	TOTAL PERIOD 3a COST	-	1,053	9	8	-	25	64,018	9,757	74,870	73,908	-	963	-	490	-	-	-	9,793	22	494,627
PERIOD 3b - Decommissioning Preparations																					
Period 3b Direct Decommissioning Activities																					
Detailed Work Procedures																					
3b.1.1.1	Plant systems	-	-	-	-	-	-	1,248	187	1,435	1,292	-	144	-	-	-	-	-	-	-	9,466
3b.1.1.2	Reactor internals	-	-	-	-	-	-	659	99	758	758	-	-	-	-	-	-	-	-	-	5,000
3b.1.1.3	Remaining buildings	-	-	-	-	-	-	178	27	205	51	-	153	-	-	-	-	-	-	-	1,350
3b.1.1.4	CRD cooling assembly	-	-	-	-	-	-	198	30	227	227	-	-	-	-	-	-	-	-	-	1,500
3b.1.1.5	CRD housings & ICI tubes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3b.1.1.6	Incore instrumentation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3b.1.1.7	Reactor vessel	-	-	-	-	-	-	718	108	825	825	-	-	-	-	-	-	-	-	-	5,445
3b.1.1.8	Facility closeout	-	-	-	-	-	-	158	24	182	91	-	91	-	-	-	-	-	-	-	1,200
3b.1.1.9	Missile shields	-	-	-	-	-	-	59	9	68	68	-	-	-	-	-	-	-	-	-	450
3b.1.1.10	Biological shield	-	-	-	-	-	-	158	24	182	182	-	-	-	-	-	-	-	-	-	1,200
3b.1.1.11	Steam generators	-	-	-	-	-	-	2,426	364	2,790	2,790	-	-	-	-	-	-	-	-	-	18,400
3b.1.1.12	Reinforced concrete	-	-	-	-	-	-	132	20	152	76	-	76	-	-	-	-	-	-	-	1,000
3b.1.1.13	Main Turbine	-	-	-	-	-	-	206	31	237	-	-	237	-	-	-	-	-	-	-	1,560
3b.1.1.14	Main Condensers	-	-	-	-	-	-	206	31	237	-	-	237	-	-	-	-	-	-	-	1,560
3b.1.1.15	Auxiliary building	-	-	-	-	-	-	720	108	828	745	-	83	-	-	-	-	-	-	-	5,460
3b.1.1.16	Reactor building	-	-	-	-	-	-	720	108	828	745	-	83	-	-	-	-	-	-	-	5,460
3b.1.1	Total	-	-	-	-	-	-	7,785	1,168	8,952	7,850	-	1,102	-	-	-	-	-	-	-	59,051
3b.1	Subtotal Period 3b Activity Costs	-	-	-	-	-	-	7,785	1,168	8,952	7,850	-	1,102	-	-	-	-	-	-	-	59,051

Table D
Three Mile Island Unit 2
Delayed DECON Decommissioning Cost Estimate
(Thousands of 2013 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Period 3b Additional Costs																					
3b.2.1	Lead Sheilding Disposal	-	740	225	611	-	5,474	-	1,668	8,717	8,717	-	-	-	2,511	-	-	-	1,418,084	14,333	-
3b.2.2	Stored Defueling Equipment Disposition	-	588	63	104	-	884	-	390	2,029	2,029	-	-	-	3,568	-	-	-	249,505	12,077	-
3b.2	Subtotal Period 3b Additional Costs	-	1,328	288	715	-	6,358	-	2,057	10,746	10,746	-	-	-	6,079	-	-	-	1,667,589	26,410	-
Period 3b Collateral Costs																					
3b.3.1	Decon equipment	712	-	-	-	-	-	-	107	819	819	-	-	-	-	-	-	-	-	-	-
3b.3.2	DOC staff relocation expenses	-	-	-	-	-	-	1,385	208	1,593	1,593	-	-	-	-	-	-	-	-	-	-
3b.3.3	Small tool allowance	-	18	-	-	-	-	-	3	21	21	-	-	-	-	-	-	-	-	-	-
3b.3.4	Pipe cutting equipment	-	1,100	-	-	-	-	-	165	1,265	1,265	-	-	-	-	-	-	-	-	-	-
3b.3	Subtotal Period 3b Collateral Costs	712	1,118	-	-	-	-	1,385	482	3,698	3,698	-	-	-	-	-	-	-	-	-	-
Period 3b Period-Dependent Costs																					
3b.4.1	Decon supplies	22	-	-	-	-	-	-	6	28	28	-	-	-	-	-	-	-	-	-	-
3b.4.2	Insurance	-	-	-	-	-	-	104	10	115	115	-	-	-	-	-	-	-	-	-	-
3b.4.3	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3b.4.4	Health physics supplies	-	537	-	-	-	-	-	134	672	672	-	-	-	-	-	-	-	-	-	-
3b.4.5	Heavy equipment rental	-	218	-	-	-	-	-	33	251	251	-	-	-	-	-	-	-	-	-	-
3b.4.6	Disposal of DAW generated	-	-	5	5	-	15	-	5	29	29	-	-	-	289	-	-	-	5,783	13	-
3b.4.7	Plant energy budget	-	-	-	-	-	-	495	74	569	569	-	-	-	-	-	-	-	-	-	-
3b.4.8	NRC Fees	-	-	-	-	-	-	646	65	711	711	-	-	-	-	-	-	-	-	-	-
3b.4.9	Site O&M	-	-	-	-	-	-	163	24	188	188	-	-	-	-	-	-	-	-	-	-
3b.4.10	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	201	30	231	231	-	-	-	-	-	-	-	-	-	-
3b.4.11	Security Staff Cost	-	-	-	-	-	-	1,870	280	2,150	2,150	-	-	-	-	-	-	-	-	-	30,921
3b.4.12	DOC Staff Cost	-	-	-	-	-	-	12,643	1,897	14,540	14,540	-	-	-	-	-	-	-	-	-	167,134
3b.4.13	Utility Staff Cost	-	-	-	-	-	-	1,323	198	1,521	1,521	-	-	-	-	-	-	-	-	-	13,214
3b.4	Subtotal Period 3b Period-Dependent Costs	22	755	5	5	-	15	17,445	2,757	21,004	21,004	-	-	-	289	-	-	-	5,783	13	211,270
3b.0	TOTAL PERIOD 3b COST	734	3,202	293	720	-	6,372	26,615	6,464	44,400	43,298	-	1,102	-	6,368	-	-	-	1,673,372	26,423	270,321
PERIOD 3 TOTALS		734	4,255	301	728	-	6,397	90,634	16,222	119,271	117,206	-	2,065	-	6,858	-	-	-	1,683,165	26,446	764,948
PERIOD 4a - Large Component Removal																					
Period 4a Direct Decommissioning Activities																					
Nuclear Steam Supply System Removal																					
4a.1.1.1	Reactor Coolant Piping	22	88	15	27	-	387	-	135	674	674	-	-	-	877	-	-	-	100,307	2,285	-
4a.1.1.2	Pressurizer Relief Tank	3	12	3	6	-	80	-	26	131	131	-	-	-	188	-	-	-	20,849	315	-
4a.1.1.3	Reactor Coolant Pumps & Motors	-	1,267	883	130	-	3,155	-	1,213	6,648	6,648	-	-	-	10,752	-	-	-	1,124,474	31,482	-
4a.1.1.4	Pressurizer	-	1,333	757	177	-	776	-	630	3,673	3,673	-	-	-	2,644	-	-	-	462,726	4,152	-
4a.1.1.5	Steam Generators	34	6,660	1,196	3,129	-	31,918	-	10,251	53,188	53,188	-	-	-	24,692	7,262	-	-	2,396,266	149,491	-
4a.1.1.6	CRDMs/ICIs/Service Structure Removal	12	55	175	64	-	185	-	93	584	584	-	-	-	1,454	-	-	-	47,869	1,312	-
4a.1.1.7	Reactor Vessel Internals	82	12,878	9,889	957	-	934	671	12,979	38,390	38,390	-	-	-	2,504	-	-	-	235,955	48,160	2,871
4a.1.1.8	Vessel & Internals GTCC Disposal	-	-	-	-	-	13,703	-	2,055	15,758	15,758	-	-	-	-	-	-	2,856	564,685	-	-
4a.1.1.9	Reactor Vessel	-	10,832	2,802	522	-	2,824	671	10,468	28,119	28,119	-	-	-	9,626	-	-	-	979,373	48,160	2,871
4a.1.1	Totals	154	*33,125*	*15,719*	*5,014*	-	53,962	1,341	37,850	147,165	147,165	-	-	-	52,738	7,262	-	2,856	5,932,504	285,357	5,741
Removal of Major Equipment																					
4a.1.2	Main Turbine/Generator	-	278	93	23	615	-	-	175	1,184	1,184	-	-	5,298	-	-	-	-	238,394	5,389	-
4a.1.3	Main Condensers	-	1,271	103	25	680	-	-	434	2,514	2,514	-	-	5,860	-	-	-	-	263,690	25,162	-
Cascading Costs from Clean Building Demolition																					
4a.1.4.1	Control & Service	-	166	-	-	-	-	-	25	191	191	-	-	-	-	-	-	-	-	2,080	-
4a.1.4	Totals	-	166	-	-	-	-	-	25	191	191	-	-	-	-	-	-	-	-	2,080	-
Disposal of Plant Systems																					
4a.1.5.1	Decay Heat Closed Cooling Water	-	280	34	60	697	348	-	274	1,693	1,693	-	-	6,656	1,363	-	-	-	360,509	5,823	-
4a.1.5.2	Decay Heat Removal (RCA)	-	200	55	74	263	664	-	272	1,527	1,527	-	-	2,511	2,597	-	-	-	273,893	4,350	-
4a.1.5.3	Decay Heat Removal (Yard)	-	140	-	-	-	-	-	21	161	-	-	161	-	-	-	-	-	-	2,863	-
4a.1.5.4	Demineralized Water (RCA)	-	142	8	11	57	92	-	70	381	381	-	-	547	362	-	-	-	46,162	2,899	-
4a.1.5.5	Domestic Water (Clean)	-	6	-	-	-	-	-	1	7	-	-	7	-	-	-	-	-	-	148	-
4a.1.5.6	Domestic Water (RCA)	-	21	1	2	7	14	-	10	54	54	-	-	63	54	-	-	-	6,162	420	-
4a.1.5.7	Electrical (Clean)	-	9	-	-	-	-	-	1	11	-	-	11	-	-	-	-	-	-	191	-
4a.1.5.8	Emergency Feedwater (RCA)	-	65	5	6	43	51	-	37	206	206	-	-	407	198	-	-	-	29,642	1,332	-
4a.1.5.9	Fire Protection (Clean)	-	54	-	-	-	-	-	8	62	-	-	62	-	-	-	-	-	-	1,167	-
4a.1.5.10	Fire Protection (RCA)	-	48	3	4	15	31	-	23	123	123	-	-	146	122	-	-	-	14,013	991	-
4a.1.5.11	Gaseous Waste Disposal System (RCA)	-	208	8	10	60	84	-	84	454	454	-	-	568	332	-	-	-	44,866	4,497	-

Table D
Three Mile Island Unit 2
Delayed DECON Decommissioning Cost Estimate
(Thousands of 2013 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Disposal of Plant Systems (continued)																					
4a.1.5.12	HVAC - Auxiliary Building	-	525	15	26	181	195	-	213	1,155	1,155	-	-	1,725	765	-	-	-	120,641	11,076	-
4a.1.5.13	HVAC - Control Building	-	59	3	9	186	17	-	49	323	323	-	-	1,780	67	-	-	-	76,715	1,131	-
4a.1.5.14	HVAC - Miscellaneous	-	35	-	-	-	-	-	5	40	-	-	40	-	-	-	-	-	-	719	-
4a.1.5.15	HVAC - Service Building	-	76	2	5	108	11	-	39	240	240	-	-	1,029	41	-	-	-	44,512	1,435	-
4a.1.5.16	Hydrogen Purge - Rad Monitoring	-	18	0	0	0	2	-	5	26	26	-	-	4	8	-	-	-	669	413	-
4a.1.5.17	Industrial Waste Treatment System	-	221	-	-	-	-	-	33	254	-	-	254	-	-	-	-	-	-	4,899	-
4a.1.5.18	Instrument Air (RCA)	-	116	8	8	28	75	-	54	290	290	-	-	271	294	-	-	-	30,495	2,374	-
4a.1.5.19	Intermediate Closed Cooling Water (RCA)	-	95	14	21	60	190	-	85	463	463	-	-	568	742	-	-	-	72,199	1,958	-
4a.1.5.20	Main Condensate (RCA)	-	202	8	20	430	38	-	128	826	826	-	-	4,101	154	-	-	-	176,354	4,077	-
4a.1.5.21	Main Reheat & Steam (RCA)	-	62	5	8	67	59	-	42	244	244	-	-	643	232	-	-	-	41,516	1,275	-
4a.1.5.22	Nuclear Services Closed Cycle Cooling	-	848	147	216	1,349	1,718	-	891	5,169	5,169	-	-	12,877	6,801	-	-	-	968,028	17,553	-
4a.1.5.23	Nuclear Services River Water (Clean)	-	78	-	-	-	-	-	12	90	-	-	90	-	-	-	-	-	-	1,764	-
4a.1.5.24	Nuclear Services River Water (RCA)	-	1,287	80	115	460	1,010	-	669	3,621	3,621	-	-	4,392	3,965	-	-	-	440,046	28,724	-
4a.1.5.25	Reactor Building Normal Cooling (Clean)	-	14	-	-	-	-	-	2	16	-	-	16	-	-	-	-	-	-	300	-
4a.1.5.26	Reactor Building Normal Cooling (RCA)	-	264	36	54	182	490	-	228	1,254	1,254	-	-	1,739	1,920	-	-	-	197,600	5,738	-
4a.1.5.27	SG Secondary Side Vents & Drains	-	71	5	5	-	56	-	33	170	170	-	-	-	218	-	-	-	14,436	1,522	-
4a.1.5.28	Sampling Nuclear System	-	231	15	17	-	175	-	106	544	544	-	-	-	692	-	-	-	45,402	4,992	-
4a.1.5.29	Sewage Treatment Plant (RCA)	-	4	0	0	4	1	-	2	11	11	-	-	35	4	-	-	-	1,662	82	-
4a.1.5.30	Station Service Air	-	260	10	10	15	95	-	93	483	483	-	-	139	372	-	-	-	30,363	5,863	-
4a.1.5.31	Sump Systems (RCA)	-	145	5	6	17	55	-	54	282	282	-	-	161	215	-	-	-	20,756	3,215	-
4a.1.5.32	Turbine Plant Sample (RCA)	-	17	1	1	6	8	-	8	41	41	-	-	61	32	-	-	-	4,590	339	-
4a.1.5	Totals	-	5,802	469	687	4,235	5,480	-	3,550	20,223	19,581	-	641	40,423	21,541	-	-	-	3,061,230	124,129	-
4a.1.6	Scaffolding in support of decommissioning	-	1,202	16	5	93	18	-	321	1,655	1,655	-	-	804	71	-	-	-	40,854	29,290	-
4a.1	Subtotal Period 4a Activity Costs	154	41,843	16,400	5,754	5,624	59,460	1,341	42,354	172,931	172,290	-	641	52,384	74,351	7,262	-	2,856	9,536,673	471,407	5,741
Period 4a Additional Costs																					
4a.2.1	Reactor Building Basement Dose Reduction	-	17	126	3,478	-	45,624	-	11,945	61,189	61,189	-	-	-	-	11,393	1,252	-	1,217,965	282	-
4a.2.2	Containment Basement Liner Removal	-	123	273	521	-	13,552	-	3,524	17,992	17,992	-	-	-	-	3,756	-	-	129,709	2,286	-
4a.2.3	Reactor Building SNF & HOT Systems Removal	-	-	67	297	-	4,065	-	1,068	5,497	5,497	-	-	-	-	1,127	-	-	75,708	358	-
4a.2.4	Fuel Handling / Auxiliary SNF & HOT Systems Removal	2,517	1,901	171	558	-	2,384	700	2,535	10,765	10,765	-	-	-	10,293	-	-	28	679,443	84,140	-
4a.2.5	NSSS Component Surface Decontamination	7,614	-	1,127	41	-	-	9,071	5,287	23,140	23,140	-	-	-	-	-	-	329	19,751	46,920	-
4a.2.6	Core Flood Tanks Removal	70	427	62	75	-	397	-	258	1,289	1,289	-	-	-	1,716	-	-	-	124,165	10,059	-
4a.2.7	FHAB AX-004 Decontamination	-	151	201	953	-	12,196	377	3,306	17,185	17,185	-	-	-	-	3,380	-	-	228,566	4,638	-
4a.2.8	Legacy waste stored at INEEL	-	-	-	-	-	-	650	98	748	748	-	-	-	-	-	-	-	-	-	-
4a.2	Subtotal Period 4a Additional Costs	10,200	2,618	2,027	5,923	-	78,219	10,797	28,020	137,805	137,805	-	-	-	12,009	19,657	1,252	357	2,475,308	148,683	-
Period 4a Collateral Costs																					
4a.3.1	Process decommissioning water waste	13	-	7	41	-	43	-	24	129	129	-	-	-	111	-	-	-	6,668	29	-
4a.3.2	Process decommissioning chemical flush waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4a.3.3	Small tool allowance	-	431	-	-	-	-	-	65	495	446	-	50	-	-	-	-	-	-	-	-
4a.3	Subtotal Period 4a Collateral Costs	13	431	7	41	-	43	-	89	625	575	-	50	-	111	-	-	-	6,668	29	-
Period 4a Period-Dependent Costs																					
4a.4.1	Decon supplies	211	-	-	-	-	-	-	53	264	264	-	-	-	-	-	-	-	-	-	-
4a.4.2	Insurance	-	-	-	-	-	-	998	100	1,098	1,098	-	-	-	-	-	-	-	-	-	-
4a.4.3	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4a.4.4	Health physics supplies	-	7,789	-	-	-	-	-	1,947	9,737	9,737	-	-	-	-	-	-	-	-	-	-
4a.4.5	Heavy equipment rental	-	7,991	-	-	-	-	-	1,199	9,190	9,190	-	-	-	-	-	-	-	-	-	-
4a.4.6	Disposal of DAW generated	-	-	159	150	-	457	-	153	919	919	-	-	-	9,052	-	-	-	181,033	413	-
4a.4.7	Plant energy budget	-	-	-	-	-	-	4,734	710	5,444	5,444	-	-	-	-	-	-	-	-	-	-
4a.4.8	NRC Fees	-	-	-	-	-	-	4,813	481	5,294	5,294	-	-	-	-	-	-	-	-	-	-
4a.4.9	Site O&M	-	-	-	-	-	-	1,564	235	1,798	1,798	-	-	-	-	-	-	-	-	-	-
4a.4.10	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	1,926	289	2,215	2,215	-	-	-	-	-	-	-	-	-	-
4a.4.11	Security Staff Cost	-	-	-	-	-	-	19,272	2,891	22,163	22,163	-	-	-	-	-	-	-	-	-	316,250
4a.4.12	DOC Staff Cost	-	-	-	-	-	-	133,912	20,087	153,999	153,999	-	-	-	-	-	-	-	-	-	1,817,552
4a.4.13	Utility Staff Cost	-	-	-	-	-	-	12,664	1,900	14,564	14,564	-	-	-	-	-	-	-	-	-	126,500
4a.4	Subtotal Period 4a Period-Dependent Costs	211	15,781	159	150	-	457	179,884	30,044	226,685	226,685	-	-	-	9,052	-	-	-	181,033	413	2,260,302
4a.0	TOTAL PERIOD 4a COST	10,579	60,673	18,593	11,869	5,624	138,179	192,023	100,507	538,046	537,355	-	691	52,384	95,523	26,918	1,252	3,214	12,199,680	620,532	2,266,043
PERIOD 4b - Site Decontamination																					
Period 4b Direct Decommissioning Activities																					
4b.1.1	Remove spent fuel racks	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table D
Three Mile Island Unit 2
Delayed DECON Decommissioning Cost Estimate
(Thousands of 2013 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Disposal of Plant Systems																					
4b.1.2.1	Decay Heat Removal (RB)	-	241	32	39	-	401	-	170	882	882	-	-	-	1,570	-	-	-	103,970	5,262	-
4b.1.2.2	Electrical (Contaminated - RB)	-	43	3	4	-	42	-	22	114	114	-	-	-	165	-	-	-	10,890	895	-
4b.1.2.3	Electrical (Contaminated - RCA)	-	285	10	26	570	52	-	175	1,120	1,120	-	-	5,443	205	-	-	-	234,606	5,745	-
4b.1.2.4	Feedwater (RB)	-	38	8	12	-	123	-	43	224	224	-	-	-	483	-	-	-	31,951	835	-
4b.1.2.5	Fire Protection (RB)	-	21	2	2	-	21	-	11	56	56	-	-	-	82	-	-	-	5,416	451	-
4b.1.2.6	Fuel Handling (RB)	-	4	1	1	-	7	-	3	15	15	-	-	-	26	-	-	-	1,751	86	-
4b.1.2.7	Fuel Handling (RCA)	-	308	22	32	-	330	-	166	858	858	-	-	-	1,292	-	-	-	85,392	6,306	-
4b.1.2.8	Gaseous Waste Disposal System (RB)	-	4	0	0	-	3	-	2	10	10	-	-	-	12	-	-	-	829	84	-
4b.1.2.9	*HVAC - Fuel Handling Building*	-	218	6	11	115	67	-	91	506	506	-	-	1,097	262	-	-	-	61,848	4,591	-
4b.1.2.10	HVAC - Reactor Building	-	810	76	103	-	1,064	-	491	2,543	2,543	-	-	-	4,166	-	-	-	275,559	17,022	-
4b.1.2.11	Instrument Air (RB)	-	27	2	2	-	20	-	12	64	64	-	-	-	79	-	-	-	5,215	590	-
4b.1.2.12	Intermediate Closed Cooling Water (RB)	-	81	8	9	-	95	-	46	240	240	-	-	-	373	-	-	-	24,689	1,744	-
4b.1.2.13	Nitrogen for Nuclear Radwaste Sys (RB)	-	8	1	2	-	18	-	7	35	35	-	-	-	69	-	-	-	4,572	171	-
4b.1.2.14	Nuclear Services River Water (RB)	-	88	15	20	-	205	-	78	407	407	-	-	-	804	-	-	-	53,208	1,943	-
4b.1.2.15	OTSG Chemical Cleaning System	-	19	2	2	-	25	-	12	60	60	-	-	-	99	-	-	-	6,552	403	-
4b.1.2.16	Sewage Treatment Plant (Clean)	-	8	-	-	-	-	-	1	10	-	-	10	-	-	-	-	-	-	180	-
4b.1.2.17	Spent Fuel Cooling	-	436	26	33	47	328	-	206	1,077	1,077	-	-	452	1,286	-	-	-	103,430	9,612	-
4b.1.2.18	Spent Fuel Cooling (RB)	-	24	2	3	-	28	-	14	71	71	-	-	-	110	-	-	-	7,258	525	-
4b.1.2.19	Sump Systems (RB)	-	37	3	4	-	39	-	20	103	103	-	-	-	152	-	-	-	10,098	809	-
4b.1.2	Totals	-	2,699	220	304	733	2,869	-	1,569	8,394	8,384	-	10	6,991	11,234	-	-	-	1,027,234	67,253	-
4b.1.3	Scaffolding in support of decommissioning	-	1,802	23	8	140	27	-	482	2,483	2,483	-	-	1,206	106	-	-	-	61,281	43,935	-
Decontamination of Site Buildings																					
4b.1.4.1	Reactor	10,224	4,077	1,624	1,474	-	15,272	-	10,333	43,004	43,004	-	-	-	59,647	-	-	-	3,956,465	262,541	-
4b.1.4.2	Auxiliary	476	864	20	198	34	402	-	591	2,584	2,584	-	-	323	5,686	-	-	-	485,670	26,229	-
4b.1.4.3	BWST & CST Tank Pads	-	176	60	1,039	-	1,663	-	622	3,560	3,560	-	-	-	28,651	-	-	-	2,482,650	2,674	-
4b.1.4.4	Control & Service	22	6	0	4	0	6	-	15	54	54	-	-	2	112	-	-	-	9,763	562	-
4b.1.4.5	Control Building Area	86	43	2	24	26	38	-	71	290	290	-	-	249	628	-	-	-	64,322	2,532	-
4b.1.4.6	Fuel Handling	670	951	47	137	84	579	-	756	3,225	3,225	-	-	803	4,270	-	-	-	364,809	30,747	-
4b.1.4.7	Turbine	65	4	0	1	-	2	-	34	106	106	-	-	-	29	-	-	-	2,532	1,451	-
4b.1.4	Totals	11,544	6,121	1,753	2,877	144	17,963	-	12,421	52,823	52,823	-	-	1,377	99,023	-	-	-	7,366,210	326,735	-
4b.1	Subtotal Period 4b Activity Costs	11,544	10,622	1,997	3,189	1,017	20,859	-	14,472	63,699	63,689	-	10	9,574	110,364	-	-	-	8,454,725	427,924	-
Period 4b Additional Costs																					
4b.2.1	Bioshield & D-Ring Removal	-	4,624	766	1,526	-	9,141	-	3,747	19,804	19,804	-	-	-	155,795	-	-	-	18,695,440	60,693	-
4b.2.2	RB Exterior Concrete & Basemat Removal	-	8,677	262	520	-	3,117	-	3,053	15,629	15,629	-	-	-	53,132	-	-	-	6,375,849	120,240	-
4b.2.3	Underground Piping & Yard Soil	-	722	123	1,639	-	2,874	250	1,195	6,804	6,804	-	-	-	48,992	-	-	-	3,723,414	8,942	-
4b.2.4	Process NSSS decon & segmentation liquid inventory	-	-	72	269	-	5,348	659	1,484	7,832	7,832	-	-	-	-	-	1,482	-	126,837	-	779
4b.2.5	Auxiliary Building Total Removal	-	8,841	370	973	-	5,843	-	3,854	19,881	19,881	-	-	-	99,586	-	-	-	11,950,340	113,205	-
4b.2.6	*Fuel Handling Building Total Removal*	-	6,151	83	675	-	4,027	-	2,654	13,589	13,589	-	-	-	68,634	-	-	-	8,236,080	73,213	-
4b.2.7	On-site survey & release of concrete	-	2,512	-	969	-	11,688	1,800	3,965	20,935	20,935	-	-	-	199,217	-	-	-	17,531,090	25,319	-
4b.2.8	Defueling fuel canister racks	24	21	2	75	-	2,527	-	660	3,309	3,309	-	-	-	10,913	-	-	-	98,706	961	-
4b.2.9	License Termination Survey Planning	-	-	-	-	-	-	1,990	597	2,587	2,587	-	-	-	-	-	-	-	-	-	12,480
4b.2	Subtotal Period 4b Additional Costs	24	31,549	1,679	6,646	-	44,565	4,699	21,208	110,370	110,370	-	-	-	636,269	-	1,482	-	66,737,760	402,574	13,259
Period 4b Collateral Costs																					
4b.3.1	Process decommissioning water waste	19	-	11	68	-	71	-	39	208	208	-	-	-	182	-	-	-	10,939	48	-
4b.3.2	Process decommissioning chemical flush waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4b.3.3	Small tool allowance	-	551	-	-	-	-	-	83	633	633	-	-	-	-	-	-	-	-	-	-
4b.3.4	Decommissioning Equipment Disposition	-	-	116	45	697	135	-	157	1,149	1,149	-	-	6,000	529	-	-	-	304,968	123	-
4b.3	*Subtotal Period 4b Collateral Costs*	19	551	127	113	697	206	-	278	1,990	1,990	-	-	6,000	711	-	-	-	315,907	171	-

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Period 4b Period-Dependent Costs																					
4b.4.1	Decon supplies	1,023	-	-	-	-	-	-	256	1,279	1,279	-	-	-	-	-	-	-	-	-	-
4b.4.2	Insurance	-	-	-	-	-	-	1,090	109	1,199	1,199	-	-	-	-	-	-	-	-	-	-
4b.4.3	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4b.4.4	Health physics supplies	-	9,348	-	-	-	-	-	2,337	11,685	11,685	-	-	-	-	-	-	-	-	-	-
4b.4.5	Heavy equipment rental	-	8,635	-	-	-	-	-	1,295	9,930	9,930	-	-	-	-	-	-	-	-	-	-
4b.4.6	Disposal of DAW generated	-	-	121	114	-	347	-	116	697	697	-	-	-	6,863	-	-	-	137,260	313	-
4b.4.7	Plant energy budget	-	-	-	-	-	-	3,858	579	4,437	4,437	-	-	-	-	-	-	-	-	-	-
4b.4.8	NRC Fees	-	-	-	-	-	-	4,389	439	4,828	4,828	-	-	-	-	-	-	-	-	-	-
4b.4.9	Site O&M	-	-	-	-	-	-	1,707	256	1,963	1,963	-	-	-	-	-	-	-	-	-	-
4b.4.10	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	2,103	315	2,418	2,418	-	-	-	-	-	-	-	-	-	-
4b.4.11	Security Staff Cost	-	-	-	-	-	-	12,303	1,845	14,148	14,148	-	-	-	-	-	-	-	-	-	203,020
4b.4.12	DOC Staff Cost	-	-	-	-	-	-	114,909	17,236	132,146	132,146	-	-	-	-	-	-	-	-	-	1,612,674
4b.4.13	Utility Staff Cost	-	-	-	-	-	-	13,823	2,073	15,896	15,896	-	-	-	-	-	-	-	-	-	138,071
4b.4	Subtotal Period 4b Period-Dependent Costs	1,023	17,983	121	114	-	347	154,181	26,857	200,625	200,625	-	-	-	6,863	-	-	-	137,260	313	1,953,766
4b.0	TOTAL PERIOD 4b COST	12,610	60,704	3,923	10,061	1,713	65,977	158,880	62,815	376,684	376,674	-	10	15,574	754,208	-	1,482	-	75,645,650	830,982	1,967,025
PERIOD 4f - License Termination																					
Period 4f Direct Decommissioning Activities																					
4f.1.1	ORISE confirmatory survey	-	-	-	-	-	-	161	48	209	209	-	-	-	-	-	-	-	-	-	-
4f.1.2	Terminate license									a											
4f.1	Subtotal Period 4f Activity Costs	-	-	-	-	-	-	161	48	209	209	-	-	-	-	-	-	-	-	-	-
Period 4f Additional Costs																					
4f.2.1	License Termination Survey	-	-	-	-	-	-	6,191	1,857	8,048	8,048	-	-	-	-	-	-	-	-	109,198	6,240
4f.2	Subtotal Period 4f Additional Costs	-	-	-	-	-	-	6,191	1,857	8,048	8,048	-	-	-	-	-	-	-	-	109,198	6,240
Period 4f Collateral Costs																					
4f.3.1	DOC staff relocation expenses	-	-	-	-	-	-	1,385	208	1,593	1,593	-	-	-	-	-	-	-	-	-	-
4f.3	Subtotal Period 4f Collateral Costs	-	-	-	-	-	-	1,385	208	1,593	1,593	-	-	-	-	-	-	-	-	-	-
Period 4f Period-Dependent Costs																					
4f.4.1	Insurance	-	-	-	-	-	-	154	15	170	170	-	-	-	-	-	-	-	-	-	-
4f.4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4f.4.3	Health physics supplies	-	875	-	-	-	-	-	219	1,094	1,094	-	-	-	-	-	-	-	-	-	-
4f.4.4	Disposal of DAW generated	-	-	6	5	-	16	-	5	32	32	-	-	-	316	-	-	-	6,325	14	-
4f.4.5	Plant energy budget	-	-	-	-	-	-	195	29	225	225	-	-	-	-	-	-	-	-	-	-
4f.4.6	NRC Fees	-	-	-	-	-	-	452	45	497	497	-	-	-	-	-	-	-	-	-	-
4f.4.7	Site O&M	-	-	-	-	-	-	242	36	278	278	-	-	-	-	-	-	-	-	-	-
4f.4.8	Security Staff Cost	-	-	-	-	-	-	668	100	769	769	-	-	-	-	-	-	-	-	-	11,743
4f.4.9	DOC Staff Cost	-	-	-	-	-	-	4,529	679	5,209	5,209	-	-	-	-	-	-	-	-	-	58,323
4f.4.10	Utility Staff Cost	-	-	-	-	-	-	1,540	231	1,771	1,771	-	-	-	-	-	-	-	-	-	14,874
4f.4	Subtotal Period 4f Period-Dependent Costs	-	875	6	5	-	16	7,782	1,361	10,044	10,044	-	-	-	316	-	-	-	6,325	14	84,940
4f.0	TOTAL PERIOD 4f COST	-	875	6	5	-	16	15,518	3,474	19,894	19,894	-	-	-	316	-	-	-	6,325	109,212	91,180
PERIOD 4 TOTALS		23,189	122,252	22,521	21,935	7,337	204,172	366,421	166,796	934,624	933,924	-	700	67,958	850,046	26,918	2,734	3,214	87,851,660	1,560,726	4,324,248
PERIOD 5b - Site Restoration																					
Period 5b Direct Decommissioning Activities																					
Demolition of Remaining Site Buildings																					
5b.1.1.1	Air Intake Tunnel	-	161	-	-	-	-	-	24	185	-	-	185	-	-	-	-	-	-	2,314	-
5b.1.1.2	Circulating Water Chlorinator	-	73	-	-	-	-	-	11	84	-	-	84	-	-	-	-	-	-	1,131	-
5b.1.1.3	Circulating Water Intake Flume	-	64	-	-	-	-	-	10	74	-	-	74	-	-	-	-	-	-	915	-
5b.1.1.4	Circulating Water Pumphouse	-	187	-	-	-	-	-	28	215	-	-	215	-	-	-	-	-	-	3,205	-
5b.1.1.5	Coagulator	-	54	-	-	-	-	-	8	62	-	-	62	-	-	-	-	-	-	937	-
5b.1.1.6	Control & Service	-	3,165	-	-	-	-	-	475	3,640	-	-	3,640	-	-	-	-	-	-	39,585	-
5b.1.1.7	Control Building Area	-	891	-	-	-	-	-	134	1,024	-	-	1,024	-	-	-	-	-	-	10,651	-
5b.1.1.8	Emergency Diesel Generator	-	737	-	-	-	-	-	111	847	-	-	847	-	-	-	-	-	-	9,313	-
5b.1.1.9	Main & Aux Transformer Foundations	-	87	-	-	-	-	-	13	100	-	-	100	-	-	-	-	-	-	1,387	-
5b.1.1.10	Mechanical Draft Cooling Towers	-	85	-	-	-	-	-	13	98	-	-	98	-	-	-	-	-	-	1,074	-

Table D
Three Mile Island Unit 2
Delayed DECON Decommissioning Cost Estimate
(Thousands of 2013 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
	Demolition of Remaining Site Buildings (continued)																				
5b.1.1.11	Miscellaneous Yard Foundations	-	20	-	-	-	-	-	3	23	-	-	23	-	-	-	-	-	-	284	-
5b.1.1.12	River Water Pumphouse	-	1,862	-	-	-	-	-	279	2,141	-	-	2,141	-	-	-	-	-	-	21,756	-
5b.1.1.13	Turbine	-	1,599	-	-	-	-	-	240	1,838	-	-	1,838	-	-	-	-	-	-	26,752	-
5b.1.1.14	Turbine Generator Pedestal	-	737	-	-	-	-	-	111	847	-	-	847	-	-	-	-	-	-	8,464	-
5b.1.1	Totals	-	9,721	-	-	-	-	-	1,458	11,179	-	-	11,179	-	-	-	-	-	-	127,770	-
	Site Closeout Activities																				
5b.1.2	Grade & landscape site	-	146	-	-	-	-	-	22	168	-	-	168	-	-	-	-	-	-	770	-
5b.1.3	Final report to NRC	-	-	-	-	-	-	411	62	473	473	-	-	-	-	-	-	-	-	-	3,120
5b.1	Subtotal Period 5b Activity Costs	-	9,867	-	-	-	-	411	1,542	11,820	473	-	11,347	-	-	-	-	-	-	128,540	3,120
	Period 5b Additional Costs																				
5b.2.1	River Water Pump House Cofferdam	-	214	-	-	-	-	-	32	246	-	-	246	-	-	-	-	-	-	2,116	-
5b.2.2	Concrete Processing	-	496	-	-	-	-	9	76	580	-	-	580	-	-	-	-	-	-	2,760	-
5b.2.3	Survey & Release of scrap materials	-	-	889	60	2,274	-	-	439	3,663	3,663	-	-	61,736	-	-	-	-	3,704,137	3,704	-
5b.2.4	Backfill Site	-	925	-	-	-	-	-	139	1,064	-	-	1,064	-	-	-	-	-	-	6,952	-
5b.2.5	Cooling Tower Demolition	-	4,383	-	-	-	-	-	657	5,040	-	-	5,040	-	-	-	-	-	-	24,392	-
5b.2	Subtotal Period 5b Additional Costs	-	6,017	889	60	2,274	-	9	1,343	10,592	3,663	-	6,930	61,736	-	-	-	-	3,704,137	39,924	-
	Period 5b Collateral Costs																				
5b.3.1	Small tool allowance	-	121	-	-	-	-	-	18	139	-	-	139	-	-	-	-	-	-	-	-
5b.3	Subtotal Period 5b Collateral Costs	-	121	-	-	-	-	-	18	139	-	-	139	-	-	-	-	-	-	-	-
	Period 5b Period-Dependent Costs																				
5b.4.1	Insurance	-	-	-	-	-	-	206	21	226	-	-	226	-	-	-	-	-	-	-	-
5b.4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5b.4.3	Heavy equipment rental	-	2,329	-	-	-	-	-	349	2,678	-	-	2,678	-	-	-	-	-	-	-	-
5b.4.4	Plant energy budget	-	-	-	-	-	-	130	20	150	-	-	150	-	-	-	-	-	-	-	-
5b.4.5	Site O&M	-	-	-	-	-	-	322	48	371	-	-	371	-	-	-	-	-	-	-	-
5b.4.6	Security Staff Cost	-	-	-	-	-	-	153	23	176	-	-	176	-	-	-	-	-	-	-	2,607
5b.4.7	DOC Staff Cost	-	-	-	-	-	-	9,506	1,426	10,932	-	-	10,932	-	-	-	-	-	-	-	112,629
5b.4.8	Utility Staff Cost	-	-	-	-	-	-	2,003	300	2,304	-	-	2,304	-	-	-	-	-	-	-	20,336
5b.4	Subtotal Period 5b Period-Dependent Costs	-	2,329	-	-	-	-	12,320	2,187	16,836	-	-	16,836	-	-	-	-	-	-	-	135,571
5b.0	TOTAL PERIOD 5b COST	-	18,334	889	60	2,274	-	12,740	5,090	39,388	4,136	-	35,253	61,736	-	-	-	-	3,704,137	168,465	138,691
	PERIOD 5 TOTALS	-	18,334	889	60	2,274	-	12,740	5,090	39,388	4,136	-	35,253	61,736	-	-	-	-	3,704,137	168,465	138,691
	TOTAL COST TO DECOMMISSION	**23,923**	**146,278**	**23,730**	**22,740**	**9,612**	**210,622**	**541,527**	**199,122**	**1,177,554**	**1,139,536**	-	**38,018**	**129,694**	**857,984**	**26,918**	**2,734**	**3,214**	**98,239,950**	**1,755,685**	**5,521,173**

TOTAL COST TO DECOMMISSION WITH 20.35% CONTINGENCY:	$1,177,554	thousands of 2013 dollars
TOTAL NRC LICENSE TERMINATION COST IS 96.77% OR:	$1,139,536	thousands of 2013 dollars
NON-NUCLEAR DEMOLITION COST IS 3.23% OR:	$38,018	thousands of 2013 dollars
TOTAL LOW-LEVEL RADIOACTIVE WASTE VOLUME BURIED (EXCLUDING GTCC):	887,607	cubic feet
TOTAL GREATER THAN CLASS C RADWASTE VOLUME GENERATED:	3,214	Cubic Feet
TOTAL SCRAP METAL REMOVED:	19,201	Tons
TOTAL CRAFT LABOR REQUIREMENTS:	1,755,685	Man-hours

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

APPENDIX E

DETAILED COST ANALYSIS

SAFSTOR

Table E
Three Mile Island Unit 2
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2013 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
PERIOD 0a - PDMS Monitoring & SAFSTOR Storage																					
Period 0a Direct Decommissioning Activities																					
Period 0a Collateral Costs																					
0a.3.1	PDMS Monitoring	-	-	-	-	-	-	6,042	906	6,949	6,949	-	-	-	-	-	-	-	-	-	-
0a.3	Subtotal Period 0a Collateral Costs	-	-	-	-	-	-	6,042	906	6,949	6,949	-	-	-	-	-	-	-	-	-	-
Period 0a Period-Dependent Costs																					
0a.4.1	Insurance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0a.4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0a.4.3	Plant energy budget	-	-	-	-	-	-	4,148	622	4,770	4,770	-	-	-	-	-	-	-	-	-	-
0a.4.4	Utility Staff Cost	-	-	-	-	-	-	46,069	6,910	52,979	52,979	-	-	-	-	-	-	-	-	-	222,229
0a.4	Subtotal Period 0a Period-Dependent Costs	-	-	-	-	-	-	50,217	7,533	57,750	57,750	-	-	-	-	-	-	-	-	-	222,229
0a.0	TOTAL PERIOD 0a COST	-	-	-	-	-	-	56,260	8,439	64,699	64,699	-	-	-	-	-	-	-	-	-	222,229
PERIOD 2c - SAFSTOR Dormancy without Spent Fuel Storage																					
Period 2c Direct Decommissioning Activities																					
2c.1.1	Quarterly Inspection									a											
2c.1.2	Semi-annual environmental survey									a											
2c.1.3	Prepare reports									a											
2c.1.4	Bituminous roof replacement	-	-	-	-	-	-	1,350	203	1,553	1,553	-	-	-	-	-	-	-	-	-	-
2c.1.5	Maintenance supplies	-	-	-	-	-	-	6,571	1,643	8,213	8,213	-	-	-	-	-	-	-	-	-	-
2c.1	Subtotal Period 2c Activity Costs	-	-	-	-	-	-	7,921	1,846	9,766	9,766	-	-	-	-	-	-	-	-	-	-
Period 2c Collateral Costs																					
2c.3	Subtotal Period 2c Collateral Costs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Period 2c Period-Dependent Costs																					
2c.4.1	Insurance	-	-	-	-	-	-	9,803	980	10,783	10,783	-	-	-	-	-	-	-	-	-	-
2c.4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2c.4.3	Health physics supplies	-	6,026	-	-	-	-	-	1,506	7,532	7,532	-	-	-	-	-	-	-	-	-	-
2c.4.4	Disposal of DAW generated	-	-	77	73	-	223	-	74	447	447	-	-	-	4,405	-	-	-	88,103	201	-
2c.4.5	Plant energy budget	-	-	-	-	-	-	10,010	1,502	11,512	11,512	-	-	-	-	-	-	-	-	-	-
2c.4.6	NRC Fees	-	-	-	-	-	-	13,589	1,359	14,948	14,948	-	-	-	-	-	-	-	-	-	-
2c.4.7	Security Staff Cost	-	-	-	-	-	-	11,683	1,752	13,435	13,435	-	-	-	-	-	-	-	-	-	198,754
2c.4.8	Utility Staff Cost	-	-	-	-	-	-	11,617	1,743	13,360	13,360	-	-	-	-	-	-	-	-	-	99,377
2c.4	Subtotal Period 2c Period-Dependent Costs	-	6,026	77	73	-	223	56,702	8,916	72,017	72,017	-	-	-	4,405	-	-	-	88,103	201	298,131
2c.0	TOTAL PERIOD 2c COST	-	6,026	77	73	-	223	64,623	10,762	81,783	81,783	-	-	-	4,405	-	-	-	88,103	201	298,131
PERIOD 2 TOTALS		-	6,026	77	73	-	223	64,623	10,762	81,783	81,783	-	-	-	4,405	-	-	-	88,103	201	298,131
PERIOD 3a - Reactivate Site Following SAFSTOR Dormancy																					
Period 3a Direct Decommissioning Activities																					
3a.1.1	Prepare preliminary decommissioning cost	-	-	-	-	-	-	257	39	296	296	-	-	-	-	-	-	-	-	-	1,950
3a.1.2	Review plant dwgs & specs.	-	-	-	-	-	-	1,213	182	1,395	1,395	-	-	-	-	-	-	-	-	-	9,200
3a.1.3	Perform detailed rad survey									a											
3a.1.4	End product description	-	-	-	-	-	-	264	40	303	303	-	-	-	-	-	-	-	-	-	2,000
3a.1.5	Detailed by-product inventory	-	-	-	-	-	-	686	103	788	788	-	-	-	-	-	-	-	-	-	5,200
3a.1.6	Define major work sequence	-	-	-	-	-	-	1,977	297	2,274	2,274	-	-	-	-	-	-	-	-	-	15,000
3a.1.7	Perform SER and EA	-	-	-	-	-	-	8,226	1,234	9,460	9,460	-	-	-	-	-	-	-	-	-	62,400
3a.1.8	Perform Site-Specific Cost Study	-	-	-	-	-	-	1,318	198	1,516	1,516	-	-	-	-	-	-	-	-	-	10,000
3a.1.9	Prepare/submit License Termination Plan	-	-	-	-	-	-	2,162	324	2,486	2,486	-	-	-	-	-	-	-	-	-	16,400
3a.1.10	Receive NRC approval of termination plan									a											
Activity Specifications																					
3a.1.11.1	Re-activate plant & temporary facilities	-	-	-	-	-	-	1,457	219	1,676	1,508	-	168	-	-	-	-	-	-	-	11,055
3a.1.11.2	Plant systems	-	-	-	-	-	-	1,099	165	1,263	1,137	-	126	-	-	-	-	-	-	-	8,333
3a.1.11.3	Reactor internals	-	-	-	-	-	-	1,872	281	2,153	2,153	-	-	-	-	-	-	-	-	-	14,200
3a.1.11.4	Reactor vessel	-	-	-	-	-	-	1,285	193	1,478	1,478	-	-	-	-	-	-	-	-	-	9,750
3a.1.11.5	Biological shield	-	-	-	-	-	-	66	10	76	76	-	-	-	-	-	-	-	-	-	500
3a.1.11.6	Steam generators	-	-	-	-	-	-	1,645	247	1,892	1,892	-	-	-	-	-	-	-	-	-	12,480
3a.1.11.7	Reinforced concrete	-	-	-	-	-	-	422	63	485	243	-	243	-	-	-	-	-	-	-	3,200
3a.1.11.8	Main Turbine	-	-	-	-	-	-	53	8	61	-	-	61	-	-	-	-	-	-	-	400

Table E
Three Mile Island Unit 2
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2013 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Activity Specifications (continued)																					
3a.1.11.9	Main Condensers	-	-	-	-	-	-	53	8	61	-	-	61	-	-	-	-	-	-	-	400
3a.1.11.10	Plant structures & buildings	-	-	-	-	-	-	411	62	473	237	-	237	-	-	-	-	-	-	-	3.120
3a.1.11.11	Waste management	-	-	-	-	-	-	2,426	364	2,790	2,790	-	-	-	-	-	-	-	-	-	18,400
3a.1.11.12	Facility & site closeout	-	-	-	-	-	-	119	18	136	68	-	68	-	-	-	-	-	-	-	900
3a.1.11	Total	-	-	-	-	-	-	10,907	1,636	12,544	11,581	-	963	-	-	-	-	-	-	-	82,738
Planning & Site Preparations																					
3a.1.12	Prepare dismantling sequence	-	-	-	-	-	-	633	95	728	728	-	-	-	-	-	-	-	-	-	4,800
3a.1.13	Plant prep. & temp. svces	-	-	-	-	-	-	2,900	435	3,335	3,335	-	-	-	-	-	-	-	-	-	-
3a.1.14	Design water clean-up system	-	-	-	-	-	-	738	111	849	849	-	-	-	-	-	-	-	-	-	5,600
3a.1.15	Rigging/Cont. Cntrl Envlps/tooling/etc.	-	-	-	-	-	-	2,200	330	2,530	2,530	-	-	-	-	-	-	-	-	-	-
3a.1.16	Procure casks/liners & containers	-	-	-	-	-	-	324	49	373	373	-	-	-	-	-	-	-	-	-	2,460
3a.1	Subtotal Period 3a Activity Costs	-	-	-	-	-	-	33,806	5,071	38,877	37,914	-	963	-	-	-	-	-	-	-	217,748
Period 3a Additional Costs																					
3a.2.1	Railroad Track Refurbishment	-	-	-	-	-	-	330	50	380	380	-	-	-	-	-	-	-	-	-	-
3a.2.2	Equipment Airlock Refurbishment	-	-	-	-	-	-	1,290	194	1,484	1,484	-	-	-	-	-	-	-	-	-	-
3a.2.3	RB Polar Crane Refurbishment	-	-	-	-	-	-	6,450	968	7,418	7,418	-	-	-	-	-	-	-	-	-	-
3a.2.4	RB Cask Handling System	-	-	-	-	-	-	1,290	194	1,484	1,484	-	-	-	-	-	-	-	-	-	-
3a.2	Subtotal Period 3a Additional Costs	-	-	-	-	-	-	9,360	1,404	10,764	10,764	-	-	-	-	-	-	-	-	-	-
Period 3a Collateral Costs																					
3a.3	Subtotal Period 3a Collateral Costs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Period 3a Period-Dependent Costs																					
3a.4.1	Insurance	-	-	-	-	-	-	206	21	226	226	-	-	-	-	-	-	-	-	-	-
3a.4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3a.4.3	Health physics supplies	-	623	-	-	-	-	-	156	779	779	-	-	-	-	-	-	-	-	-	-
3a.4.4	Heavy equipment rental	-	430	-	-	-	-	-	64	494	494	-	-	-	-	-	-	-	-	-	-
3a.4.5	Disposal of DAW generated	-	-	9	8	-	25	-	8	50	50	-	-	-	490	-	-	-	9,793	22	-
3a.4.6	Plant energy budget	-	-	-	-	-	-	976	146	1,122	1,122	-	-	-	-	-	-	-	-	-	-
3a.4.7	NRC Fees	-	-	-	-	-	-	1,275	127	1,402	1,402	-	-	-	-	-	-	-	-	-	-
3a.4.8	Site O&M	-	-	-	-	-	-	322	48	371	371	-	-	-	-	-	-	-	-	-	-
3a.4.9	Security Staff Cost	-	-	-	-	-	-	3,689	553	4,242	4,242	-	-	-	-	-	-	-	-	-	61,007
3a.4.10	DOC Staff Cost	-	-	-	-	-	-	11,762	1,764	13,527	13,527	-	-	-	-	-	-	-	-	-	189,800
3a.4.11	Utility Staff Cost	-	-	-	-	-	-	2,623	393	3,017	3,017	-	-	-	-	-	-	-	-	-	26,071
3a.4	Subtotal Period 3a Period-Dependent Costs	-	1,053	9	8	-	25	20,853	3,282	25,230	25,230	-	-	-	490	-	-	-	9,793	22	276,879
3a.0	TOTAL PERIOD 3a COST	-	1,053	9	8	-	25	64,018	9,757	74,870	73,908	-	963	-	490	-	-	-	9,793	22	494,627
PERIOD 3b - Decommissioning Preparations																					
Period 3b Direct Decommissioning Activities																					
Detailed Work Procedures																					
3b.1.1.1	Plant systems	-	-	-	-	-	-	1,248	187	1,435	1,292	-	144	-	-	-	-	-	-	-	9,466
3b.1.1.2	Reactor internals	-	-	-	-	-	-	659	99	758	758	-	-	-	-	-	-	-	-	-	5,000
3b.1.1.3	Remaining buildings	-	-	-	-	-	-	178	27	205	51	-	153	-	-	-	-	-	-	-	1,350
3b.1.1.4	CRD cooling assembly	-	-	-	-	-	-	198	30	227	227	-	-	-	-	-	-	-	-	-	1,500
3b.1.1.5	CRD housings & ICI tubes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3b.1.1.6	Incore instrumentation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3b.1.1.7	Reactor vessel	-	-	-	-	-	-	718	108	825	825	-	-	-	-	-	-	-	-	-	5,445
3b.1.1.8	Facility closeout	-	-	-	-	-	-	158	24	182	91	-	91	-	-	-	-	-	-	-	1,200
3b.1.1.9	Missile shields	-	-	-	-	-	-	59	9	68	68	-	-	-	-	-	-	-	-	-	450
3b.1.1.10	Biological shield	-	-	-	-	-	-	158	24	182	182	-	-	-	-	-	-	-	-	-	1,200
3b.1.1.11	Steam generators	-	-	-	-	-	-	2,426	364	2,790	2,790	-	-	-	-	-	-	-	-	-	18,400
3b.1.1.12	Reinforced concrete	-	-	-	-	-	-	132	20	152	76	-	76	-	-	-	-	-	-	-	1,000
3b.1.1.13	Main Turbine	-	-	-	-	-	-	206	31	237	-	-	237	-	-	-	-	-	-	-	1,560
3b.1.1.14	Main Condensers	-	-	-	-	-	-	206	31	237	-	-	237	-	-	-	-	-	-	-	1,560
3b.1.1.15	Auxiliary building	-	-	-	-	-	-	720	108	828	745	-	83	-	-	-	-	-	-	-	5,460
3b.1.1.16	Reactor building	-	-	-	-	-	-	720	108	828	745	-	83	-	-	-	-	-	-	-	5,460
3b.1.1	Total	-	-	-	-	-	-	7,785	1,168	8,952	7,850	-	1,102	-	-	-	-	-	-	-	59,051
3b.1	Subtotal Period 3b Activity Costs	-	-	-	-	-	-	7,785	1,168	8,952	7,850	-	1,102	-	-	-	-	-	-	-	59,051

Table E
Three Mile Island Unit 2
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2013 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Period 3b Additional Costs																					
3b.2.1	Lead Sheilding Disposal	-	740	225	611	-	5,474	-	1,668	8,717	8,717	-	-	-	2,511	-	-	-	1,418,084	14,333	-
3b.2.2	Stored Defueling Equipment Disposition	-	588	63	104	-	884	-	390	2,029	2,029	-	-	-	3,568	-	-	-	249,505	12,077	-
3b.2	Subtotal Period 3b Additional Costs	-	1,328	288	715	-	6,358	-	2,057	10,746	10,746	-	-	-	6,079	-	-	-	1,667,589	26,410	-
Period 3b Collateral Costs																					
3b.3.1	Decon equipment	712	-	-	-	-	-	-	107	819	819	-	-	-	-	-	-	-	-	-	-
3b.3.2	DOC staff relocation expenses	-	-	-	-	-	-	1,385	208	1,593	1,593	-	-	-	-	-	-	-	-	-	-
3b.3.3	Small tool allowance	-	18	-	-	-	-	-	3	21	21	-	-	-	-	-	-	-	-	-	-
3b.3.4	Pipe cutting equipment	-	1,100	-	-	-	-	-	165	1,265	1,265	-	-	-	-	-	-	-	-	-	-
3b.3	Subtotal Period 3b Collateral Costs	712	1,118	-	-	-	-	1,385	482	3,698	3,698	-	-	-	-	-	-	-	-	-	-
Period 3b Period-Dependent Costs																					
3b.4.1	Decon supplies	22	-	-	-	-	-	-	6	28	28	-	-	-	-	-	-	-	-	-	-
3b.4.2	Insurance	-	-	-	-	-	-	104	10	115	115	-	-	-	-	-	-	-	-	-	-
3b.4.3	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3b.4.4	Health physics supplies	-	537	-	-	-	-	-	134	672	672	-	-	-	-	-	-	-	-	-	-
3b.4.5	Heavy equipment rental	-	218	-	-	-	-	-	33	251	251	-	-	-	-	-	-	-	-	-	-
3b.4.6	Disposal of DAW generated	-	-	5	5	-	15	-	5	29	29	-	-	-	289	-	-	-	5,783	13	-
3b.4.7	Plant energy budget	-	-	-	-	-	-	495	74	569	569	-	-	-	-	-	-	-	-	-	-
3b.4.8	NRC Fees	-	-	-	-	-	-	646	65	711	711	-	-	-	-	-	-	-	-	-	-
3b.4.9	Site O&M	-	-	-	-	-	-	163	24	188	188	-	-	-	-	-	-	-	-	-	-
3b.4.10	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	201	30	231	231	-	-	-	-	-	-	-	-	-	-
3b.4.11	Security Staff Cost	-	-	-	-	-	-	1,870	280	2,150	2,150	-	-	-	-	-	-	-	-	-	30,921
3b.4.12	DOC Staff Cost	-	-	-	-	-	-	12,643	1,897	14,540	14,540	-	-	-	-	-	-	-	-	-	167,134
3b.4.13	Utility Staff Cost	-	-	-	-	-	-	1,323	198	1,521	1,521	-	-	-	-	-	-	-	-	-	13,214
3b.4	Subtotal Period 3b Period-Dependent Costs	22	755	5	5	-	15	17,445	2,757	21,004	21,004	-	-	-	289	-	-	-	5,783	13	211,270
3b.0	TOTAL PERIOD 3b COST	734	3,202	293	720	-	6,372	26,615	6,464	44,400	43,298	-	1,102	-	6,368	-	-	-	1,673,372	26,423	270,321
PERIOD 3 TOTALS		734	4,255	301	728	-	6,397	90,634	16,222	119,271	117,206	-	2,065	-	6,858	-	-	-	1,683,165	26,446	764,948
PERIOD 4a - Large Component Removal																					
Period 4a Direct Decommissioning Activities																					
Nuclear Steam Supply System Removal																					
4a.1.1.1	Reactor Coolant Piping	22	88	15	25	24	348	-	129	651	651	-	-	83	790	-	-	-	99,483	2,285	-
4a.1.1.2	Pressurizer Relief Tank	3	12	3	6	5	72	-	25	127	127	-	-	19	169	-	-	-	20,849	315	-
4a.1.1.3	Reactor Coolant Pumps & Motors	-	1,267	883	130	-	3,155	-	1,213	6,648	6,648	-	-	-	10,752	-	-	-	1,124,474	31,482	-
4a.1.1.4	Pressurizer	-	1,333	757	177	-	776	-	630	3,673	3,673	-	-	-	2,644	-	-	-	462,726	4,152	-
4a.1.1.5	Steam Generators	34	6,660	1,196	3,129	-	31,918	-	10,251	53,188	53,188	-	-	-	24,692	7,262	-	-	2,396,266	149,491	-
4a.1.1.6	CRDMs/ICIs/Service Structure Removal	12	55	175	64	-	185	-	93	584	584	-	-	-	1,454	-	-	-	47,869	1,312	-
4a.1.1.7	Reactor Vessel Internals	82	12,878	9,889	957	-	934	671	12,979	38,390	38,390	-	-	-	2,504	-	-	-	235,955	48,160	2,871
4a.1.1.8	Vessel & Internals GTCC Disposal	-	-	-	-	-	13,703	-	2,055	15,758	15,758	-	-	-	-	-	-	2,856	564,685	-	-
4a.1.1.9	Reactor Vessel	-	10,832	2,802	522	-	2,824	671	10,468	28,119	28,119	-	-	-	9,626	-	-	-	979,373	48,160	2,871
4a.1.1	Totals	154	33,125	15,719	5,011	29	53,915	1,341	37,842	147,137	147,137	-	-	102	52,632	7,262	-	2,856	5,931,680	285,357	5,741
Removal of Major Equipment																					
4a.1.2	Main Turbine/Generator	-	278	93	23	615	-	-	175	1,184	1,184	-	-	5,298	-	-	-	-	238,394	5,389	-
4a.1.3	Main Condensers	-	1,271	103	25	680	-	-	434	2,514	2,514	-	-	5,860	-	-	-	-	263,690	25,162	-
Cascading Costs from Clean Building Demolition																					
4a.1.4.1	Control & Service	-	166	-	-	-	-	-	25	191	191	-	-	-	-	-	-	-	-	2,080	-
4a.1.4	Totals	-	166	-	-	-	-	-	25	191	191	-	-	-	-	-	-	-	-	2,080	-
Disposal of Plant Systems																					
4a.1.5.1	Decay Heat Closed Cooling Water	-	280	34	60	697	348	-	274	1,693	1,693	-	-	6,656	1,363	-	-	-	360,509	5,823	-
4a.1.5.2	Decay Heat Removal (RCA)	-	200	55	74	263	664	-	272	1,527	1,527	-	-	2,511	2,597	-	-	-	273,893	4,350	-
4a.1.5.3	Decay Heat Removal (Yard)	-	140	-	-	-	-	-	21	161	-	-	161	-	-	-	-	-	-	2,863	-
4a.1.5.4	Demineralized Water (RCA)	-	142	8	11	57	92	-	70	381	381	-	-	547	362	-	-	-	46,162	2,899	-
4a.1.5.5	Domestic Water (Clean)	-	6	-	-	-	-	-	1	7	-	-	7	-	-	-	-	-	-	148	-
4a.1.5.6	Domestic Water (RCA)	-	21	1	2	7	14	-	10	54	54	-	-	63	54	-	-	-	6,162	420	-
4a.1.5.7	Electrical (Clean)	-	9	-	-	-	-	-	1	11	-	-	11	-	-	-	-	-	-	191	-
4a.1.5.8	Emergency Feedwater (RCA)	-	65	5	6	43	51	-	37	206	206	-	-	407	198	-	-	-	29,642	1,332	-
4a.1.5.9	Fire Protection (Clean)	-	54	-	-	-	-	-	8	62	-	-	62	-	-	-	-	-	-	1,167	-
4a.1.5.10	Fire Protection (RCA)	-	48	3	4	15	31	-	23	123	123	-	-	146	122	-	-	-	14,013	991	-
4a.1.5.11	Gaseous Waste Disposal System (RCA)	-	208	8	10	60	84	-	84	454	454	-	-	568	332	-	-	-	44,866	4,497	-

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Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Disposal of Plant Systems (continued)																					
4a.1.5.12	HVAC - Auxiliary Building	-	525	15	26	181	195	-	213	1,155	1,155	-	-	1,725	765	-	-	-	120,641	11,076	-
4a.1.5.13	HVAC - Control Building	-	59	3	9	186	17	-	49	323	323	-	-	1,780	67	-	-	-	76,715	1,131	-
4a.1.5.14	HVAC - Miscellaneous	-	35	-	-	-	-	-	5	40	-	-	40	-	-	-	-	-	-	719	-
4a.1.5.15	HVAC - Service Building	-	76	2	5	108	11	-	39	240	240	-	-	1,029	41	-	-	-	44,512	1,435	-
4a.1.5.16	Hydrogen Purge - Rad Monitoring	-	18	0	0	0	2	-	5	26	26	-	-	4	8	-	-	-	669	413	-
4a.1.5.17	Industrial Waste Treatment System	-	221	-	-	-	-	-	33	254	-	-	254	-	-	-	-	-	-	4,899	-
4a.1.5.18	Instrument Air (RCA)	-	116	8	8	28	75	-	54	290	290	-	-	271	294	-	-	-	30,495	2,374	-
4a.1.5.19	Intermediate Closed Cooling Water (RCA)	-	95	14	21	60	190	-	85	463	463	-	-	568	742	-	-	-	72,199	1,958	-
4a.1.5.20	Main Condensate (RCA)	-	202	8	20	430	38	-	128	826	826	-	-	4,101	154	-	-	-	176,354	4,077	-
4a.1.5.21	Main Reheat & Steam (RCA)	-	62	5	8	67	59	-	42	244	244	-	-	643	232	-	-	-	41,516	1,275	-
4a.1.5.22	Nuclear Services Closed Cycle Cooling	-	848	147	216	1,349	1,718	-	891	5,169	5,169	-	-	12,877	6,801	-	-	-	968,028	17,553	-
4a.1.5.23	Nuclear Services River Water (Clean)	-	78	-	-	-	-	-	12	90	-	-	90	-	-	-	-	-	-	1,764	-
4a.1.5.24	Nuclear Services River Water (RCA)	-	1,287	80	115	460	1,010	-	669	3,621	3,621	-	-	4,392	3,955	-	-	-	440,046	28,724	-
4a.1.5.25	Reactor Building Normal Cooling (Clean)	-	14	-	-	-	-	-	2	16	-	-	16	-	-	-	-	-	-	300	-
4a.1.5.26	Reactor Building Normal Cooling (RCA)	-	264	36	54	182	490	-	228	1,254	1,254	-	-	1,739	1,920	-	-	-	197,600	5,738	-
4a.1.5.27	SG Secondary Side Vents & Drains	-	71	5	5	-	56	-	33	170	170	-	-	-	218	-	-	-	14,436	1,522	-
4a.1.5.28	Sampling Nuclear System	-	231	15	17	-	175	-	106	544	544	-	-	-	692	-	-	-	45,402	4,992	-
4a.1.5.29	Sewage Treatment Plant (RCA)	-	4	0	0	4	1	-	2	11	11	-	-	35	4	-	-	-	1,662	82	-
4a.1.5.30	Station Service Air	-	260	10	10	15	95	-	93	483	483	-	-	139	372	-	-	-	30,363	5,863	-
4a.1.5.31	Sump Systems (RCA)	-	145	5	6	17	55	-	54	282	282	-	-	161	215	-	-	-	20,756	3,215	-
4a.1.5.32	Turbine Plant Sample (RCA)	-	17	1	1	6	8	-	8	41	41	-	-	61	32	-	-	-	4,590	339	-
4a.1.5	Totals	-	5,802	469	687	4,235	5,480	-	3,550	20,223	19,581	-	641	40,423	21,541	-	-	-	3,061,230	124,129	-
4a.1.6	Scaffolding in support of decommissioning	-	1,202	16	4	104	-	-	318	1,643	1,643	-	-	893	-	-	-	-	40,189	29,290	-
4a.1	Subtotal Period 4a Activity Costs	154	41,843	16,401	5,750	5,664	59,395	1,341	42,343	172,891	172,250	-	641	52,575	74,173	7,262	-	2,856	9,535,183	471,407	5,741
Period 4a Additional Costs																					
4a.2.1	Reactor Building Basement Dose Reduction	-	17	126	3,478	-	45,624	-	11,945	61,189	61,189	-	-	-	-	11,393	1,252	-	1,217,965	282	-
4a.2.2	Containment Basement Liner Removal	-	123	273	521	-	13,552	-	3,524	17,992	17,992	-	-	-	-	3,756	-	-	129,709	2,286	-
4a.2.3	Reactor Building SNF & HOT Systems Removal	-	-	67	297	-	4,065	-	1,068	5,497	5,497	-	-	-	-	1,127	-	-	75,708	358	-
4a.2.4	Fuel Handling / Auxiliary SNF & HOT Systems Removal	2,517	1,901	171	558	-	2,384	700	2,535	10,765	10,765	-	-	-	10,293	-	-	28	679,443	84,140	-
4a.2.5	NSSS Component Surface Decontamination	7,614	-	1,127	41	-	-	9,071	5,287	23,140	23,140	-	-	-	-	-	-	329	19,751	46,920	-
4a.2.6	Core Flood Tanks Removal	70	427	62	75	-	397	-	258	1,289	1,289	-	-	-	1,716	-	-	-	124,165	10,059	-
4a.2.7	FHAB AX-004 Decontamination	-	151	201	953	-	12,196	377	3,306	17,185	17,185	-	-	-	-	3,380	-	-	228,566	4,638	-
4a.2.8	Legacy waste stored at INEEL	-	-	-	-	-	-	650	98	748	748	-	-	-	-	-	-	-	-	-	-
4a.2	Subtotal Period 4a Additional Costs	10,200	2,618	2,027	5,923	-	78,219	10,797	28,020	137,805	137,805	-	-	-	12,009	19,657	1,252	357	2,475,308	148,683	-
Period 4a Collateral Costs																					
4a.3.1	Process decommissioning water waste	3	-	3	19	-	20	-	10	56	56	-	-	-	52	-	-	-	3,121	14	-
4a.3.2	Process decommissioning chemical flush waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4a.3.3	Small tool allowance	-	431	-	-	-	-	-	65	495	446	-	50	-	-	-	-	-	-	-	-
4a.3	Subtotal Period 4a Collateral Costs	3	431	3	19	-	20	-	75	551	502	-	50	-	52	-	-	-	3,121	14	-
Period 4a Period-Dependent Costs																					
4a.4.1	Decon supplies	211	-	-	-	-	-	-	53	264	264	-	-	-	-	-	-	-	-	-	-
4a.4.2	Insurance	-	-	-	-	-	-	998	100	1,098	1,098	-	-	-	-	-	-	-	-	-	-
4a.4.3	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4a.4.4	Health physics supplies	-	7,789	-	-	-	-	-	1,947	9,737	9,737	-	-	-	-	-	-	-	-	-	-
4a.4.5	Heavy equipment rental	-	7,991	-	-	-	-	-	1,199	9,190	9,190	-	-	-	-	-	-	-	-	-	-
4a.4.6	Disposal of DAW generated	-	-	159	150	-	457	-	153	919	919	-	-	-	9,052	-	-	-	181,033	413	-
4a.4.7	Plant energy budget	-	-	-	-	-	-	4,734	710	5,444	5,444	-	-	-	-	-	-	-	-	-	-
4a.4.8	NRC Fees	-	-	-	-	-	-	4,813	481	5,294	5,294	-	-	-	-	-	-	-	-	-	-
4a.4.9	Site O&M	-	-	-	-	-	-	1,564	235	1,798	1,798	-	-	-	-	-	-	-	-	-	-
4a.4.10	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	1,926	289	2,215	2,215	-	-	-	-	-	-	-	-	-	-
4a.4.11	Security Staff Cost	-	-	-	-	-	-	19,272	2,891	22,163	22,163	-	-	-	-	-	-	-	-	-	316,250
4a.4.12	DOC Staff Cost	-	-	-	-	-	-	133,912	20,087	153,999	153,999	-	-	-	-	-	-	-	-	-	1,817,552
4a.4.13	Utility Staff Cost	-	-	-	-	-	-	12,664	1,900	14,564	14,564	-	-	-	-	-	-	-	-	-	126,500
4a.4	Subtotal Period 4a Period-Dependent Costs	211	15,780	159	150	-	457	179,884	30,043	226,685	226,685	-	-	-	9,052	-	-	-	181,033	413	2,260,302
4a.0	*TOTAL PERIOD 4a COST*	10,568	60,673	18,590	11,843	5,664	138,091	192,023	100,482	537,933	537,242	-	691	52,575	95,286	26,918	1,252	3,214	12,194,650	620,517	2,266,043
PERIOD 4b - Site Decontamination																					
Period 4b Direct Decommissioning Activities																					
4b.1.1	Remove spent fuel racks	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table E
Three Mile Island Unit 2
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2013 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Disposal of Plant Systems																					
4b.1.2.1	Decay Heat Removal (RB)	-	241	32	39	-	401	-	170	882	882	-	-	-	1,570	-	-	-	103,970	5,262	-
4b.1.2.2	Electrical (Contaminated - RB)	-	43	3	4	-	42	-	22	114	114	-	-	-	165	-	-	-	10,890	895	-
4b.1.2.3	Electrical (Contaminated - RCA)	-	285	10	26	570	52	-	175	1,120	1,120	-	-	5,443	205	-	-	-	234,606	5,745	-
4b.1.2.4	Feedwater (RB)	-	38	8	12	-	123	-	43	224	224	-	-	-	483	-	-	-	31,951	835	-
4b.1.2.5	Fire Protection (RB)	-	21	2	2	-	21	-	11	56	56	-	-	-	82	-	-	-	5,416	451	-
4b.1.2.6	Fuel Handling (RB)	-	4	1	1	-	7	-	3	15	15	-	-	-	26	-	-	-	1,751	86	-
4b.1.2.7	Fuel Handling (RCA)	-	308	22	32	-	330	-	166	858	858	-	-	-	1,292	-	-	-	85,392	6,306	-
4b.1.2.8	Gaseous Waste Disposal System (RB)	-	4	0	0	-	3	-	2	10	10	-	-	-	12	-	-	-	829	84	-
4b.1.2.9	HVAC - Fuel Handling Building	-	218	6	11	115	67	-	91	506	506	-	-	1,097	262	-	-	-	61,848	4,591	-
4b.1.2.10	HVAC - Reactor Building	-	810	76	103	-	1,064	-	491	2,543	2,543	-	-	-	4,166	-	-	-	275,559	17,022	-
4b.1.2.11	Instrument Air (RB)	-	27	2	2	-	20	-	12	64	64	-	-	-	79	-	-	-	5,215	590	-
4b.1.2.12	Intermediate Closed Cooling Water (RB)	-	81	8	9	-	95	-	46	240	240	-	-	-	373	-	-	-	24,689	1,744	-
4b.1.2.13	Nitrogen for Nuclear Radwaste Sys (RB)	-	8	1	2	-	18	-	7	35	35	-	-	-	69	-	-	-	4,572	171	-
4b.1.2.14	Nuclear Services River Water (RB)	-	88	15	20	-	205	-	78	407	407	-	-	-	804	-	-	-	53,208	1,943	-
4b.1.2.15	OTSG Chemical Cleaning System	-	19	2	2	-	25	-	12	60	60	-	-	-	99	-	-	-	6,552	403	-
4b.1.2.16	Sewage Treatment Plant (Clean)	-	8	-	-	-	-	-	1	10	-	-	10	-	-	-	-	-	-	180	-
4b.1.2.17	Spent Fuel Cooling	-	436	26	33	47	328	-	206	1,077	1,077	-	-	452	1,286	-	-	-	103,430	9,612	-
4b.1.2.18	Spent Fuel Cooling (RB)	-	24	2	3	-	28	-	14	71	71	-	-	-	110	-	-	-	7,258	525	-
4b.1.2.19	Sump Systems (RB)	-	37	3	4	-	39	-	20	103	103	-	-	-	152	-	-	-	10,098	809	-
4b.1.2	Totals	-	2,699	220	304	733	2,869	-	1,569	8,394	8,384	-	10	6,991	11,234	-	-	-	1,027,234	57,253	-
4b.1.3	Scaffolding in support of decommissioning	-	1,802	24	6	156	-	-	477	2,465	2,465	-	-	1,340	-	-	-	-	60,283	43,935	-
Decontamination of Site Buildings																					
4b.1.4.1	Reactor	10,224	4,077	1,624	1,474	-	15,272	-	10,333	43,004	43,004	-	-	-	59,647	-	-	-	3,956,465	262,541	-
4b.1.4.2	Auxiliary	476	864	20	198	34	402	-	591	2,584	2,584	-	-	323	5,686	-	-	-	485,670	26,229	-
4b.1.4.3	BWST & CST Tank Pads	-	176	60	1,039	-	1,663	-	622	3,560	3,560	-	-	-	28,651	-	-	-	2,482,650	2,674	-
4b.1.4.4	Control & Service	22	6	0	4	0	6	-	15	54	54	-	-	2	112	-	-	-	9,763	562	-
4b.1.4.5	Control Building Area	86	43	2	24	26	38	-	71	290	290	-	-	249	628	-	-	-	64,322	2,532	-
4b.1.4.6	Fuel Handling	670	951	47	137	84	579	-	756	3,225	3,225	-	-	803	4,270	-	-	-	364,809	30,747	-
4b.1.4.7	Turbine	65	4	0	1	-	2	-	34	106	106	-	-	-	29	-	-	-	2,532	1,451	-
4b.1.4	Totals	11,544	6,121	1,753	2,877	144	17,963	-	12,421	52,823	52,823	-	-	1,377	99,023	-	-	-	7,366,210	326,735	-
4b.1	Subtotal Period 4b Activity Costs	11,544	10,622	1,997	3,187	1,032	20,832	-	14,467	63,681	63,671	-	10	9,708	110,258	-	-	-	8,453,726	427,924	-
Period 4b Additional Costs																					
4b.2.1	Bioshield & D-Ring Removal	-	4,624	766	1,526	-	9,141	-	3,747	19,804	19,804	-	-	-	155,795	-	-	-	18,695,440	60,693	-
4b.2.2	RB Exterior Concrete & Basemat Removal	-	8,677	262	520	-	3,117	-	3,053	15,629	15,629	-	-	-	53,132	-	-	-	6,375,849	120,240	-
4b.2.3	Underground Piping & Yard Soil	-	722	123	1,639	-	2,874	250	1,195	6,804	6,804	-	-	-	48,992	-	-	-	3,723,414	8,942	-
4b.2.4	Process NSSS decon & segmentation liquid inventory	-	-	72	269	-	5,348	659	1,484	7,832	7,832	-	-	-	-	-	1,482	-	126,837	-	779
4b.2.5	Auxiliary Building Total Removal	-	8,841	370	973	-	5,843	-	3,854	19,881	19,881	-	-	-	99,586	-	-	-	11,950,340	113,205	-
4b.2.6	Fuel Handling Building Total Removal	-	6,151	83	675	-	4,027	-	2,654	13,589	13,589	-	-	-	68,634	-	-	-	8,236,080	73,213	-
4b.2.7	On-site survey & release of concrete	-	2,512	-	969	-	11,688	1,800	3,965	20,935	20,935	-	-	-	199,217	-	-	-	17,531,090	25,319	-
4b.2.8	Defueling fuel canister racks	24	21	2	75	-	2,527	-	660	3,309	3,309	-	-	-	10,913	-	-	-	98,706	961	-
4b.2.9	License Termination Survey Planning	-	-	-	-	-	-	1,990	597	2,587	2,587	-	-	-	-	-	-	-	-	-	12,480
4b.2	Subtotal Period 4b Additional Costs	24	31,549	1,679	6,646	-	44,565	4,699	21,208	110,370	110,370	-	-	-	636,269	-	1,482	-	66,737,760	402,574	13,259
Period 4b Collateral Costs																					
4b.3.1	Process decommissioning water waste	6	-	6	39	-	41	-	20	113	113	-	-	-	106	-	-	-	6,345	28	-
4b.3.2	Process decommissioning chemical flush waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4b.3.3	Small tool allowance	-	551	-	-	-	-	-	83	633	633	-	-	-	-	-	-	-	-	-	-
4b.3.4	Decommissioning Equipment Disposition	-	-	117	35	774	-	-	133	1,060	1,060	-	-	6,667	-	-	-	-	300,000	123	-
4b.3	Subtotal Period 4b Collateral Costs	6	551	124	75	774	41	-	236	1,806	1,806	-	-	6,667	106	-	-	-	306,345	151	-
Period 4b Period-Dependent Costs																					
4b.4.1	Decon supplies	1,023	-	-	-	-	-	-	256	1,279	1,279	-	-	-	-	-	-	-	-	-	-
4b.4.2	Insurance	-	-	-	-	-	-	1,090	109	1,199	1,199	-	-	-	-	-	-	-	-	-	-
4b.4.3	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4b.4.4	Health physics supplies	-	9,348	-	-	-	-	-	2,337	11,685	11,685	-	-	-	-	-	-	-	-	-	-
4b.4.5	Heavy equipment rental	-	8,635	-	-	-	-	-	1,295	9,930	9,930	-	-	-	-	-	-	-	-	-	-
4b.4.6	Disposal of DAW generated	-	-	121	114	-	347	-	116	697	697	-	-	-	6,863	-	-	-	137,260	313	-
4b.4.7	Plant energy budget	-	-	-	-	-	-	3,858	579	4,437	4,437	-	-	-	-	-	-	-	-	-	-
4b.4.8	NRC Fees	-	-	-	-	-	-	4,389	439	4,828	4,828	-	-	-	-	-	-	-	-	-	-

Table E
Three Mile Island Unit 2
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2013 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
	Period 4b Period-Dependent Costs (continued)																				
4b.4.9	Site O&M	-	-	-	-	-	-	1,707	256	1,963	1,963	-	-	-	-	-	-	-	-	-	-
4b.4.10	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	2,103	315	2,418	2,418	-	-	-	-	-	-	-	-	-	-
4b.4.11	Security Staff Cost	-	-	-	-	-	-	11,969	1,795	13,764	13,764	-	-	-	-	-	-	-	-	-	203,020
4b.4.12	DOC Staff Cost	-	-	-	-	-	-	114,909	17,236	132,146	132,146	-	-	-	-	-	-	-	-	-	1,612,674
4b.4.13	Utility Staff Cost	-	-	-	-	-	-	13,823	2,073	15,896	15,896	-	-	-	-	-	-	-	-	-	138,071
4b.4	Subtotal Period 4b Period-Dependent Costs	1,023	17,982	121	114	-	347	153,847	26,807	200,240	200,240	-	-	-	6,863	-	-	-	137,260	313	1,953,766
4b.0	TOTAL PERIOD 4b COST	12,597	60,704	3,920	10,021	1,806	65,785	158,546	62,718	376,097	376,088	-	10	16,375	753,496	-	1,482	-	75,635,090	830,962	1,967,025
	PERIOD 4f - License Termination																				
	Period 4f Direct Decommissioning Activities																				
4f.1.1	ORISE confirmatory survey	-	-	-	-	-	-	161	48	209	209	-	-	-	-	-	-	-	-	-	-
4f.1.2	Terminate license									a											
4f.1	Subtotal Period 4f Activity Costs	-	-	-	-	-	-	161	48	209	209	-	-	-	-	-	-	-	-	-	-
	Period 4f Additional Costs																				
4f.2.1	License Termination Survey	-	-	-	-	-	-	6,191	1,857	8,048	8,048	-	-	-	-	-	-	-	-	109,198	6,240
4f.2	Subtotal Period 4f Additional Costs	-	-	-	-	-	-	6,191	1,857	8,048	8,048	-	-	-	-	-	-	-	-	109,198	6,240
	Period 4f Collateral Costs																				
4f.3.1	DOC staff relocation expenses	-	-	-	-	-	-	1,385	208	1,593	1,593	-	-	-	-	-	-	-	-	-	-
4f.3	Subtotal Period 4f Collateral Costs	-	-	-	-	-	-	1,385	208	1,593	1,593	-	-	-	-	-	-	-	-	-	-
	Period 4f Period-Dependent Costs																				
4f.4.1	Insurance	-	-	-	-	-	-	154	15	170	170	-	-	-	-	-	-	-	-	-	-
4f.4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4f.4.3	Health physics supplies	-	875	-	-	-	-	-	219	1,094	1,094	-	-	-	-	-	-	-	-	-	-
4f.4.4	Disposal of DAW generated	-	-	6	5	-	16	-	5	32	32	-	-	-	316	-	-	-	6,325	14	-
4f.4.5	Plant energy budget	-	-	-	-	-	-	195	29	225	225	-	-	-	-	-	-	-	-	-	-
4f.4.6	NRC Fees	-	-	-	-	-	-	452	45	497	497	-	-	-	-	-	-	-	-	-	-
4f.4.7	Site O&M	-	-	-	-	-	-	242	36	278	278	-	-	-	-	-	-	-	-	-	-
4f.4.8	Security Staff Cost	-	-	-	-	-	-	668	100	769	769	-	-	-	-	-	-	-	-	-	10,960
4f.4.9	DOC Staff Cost	-	-	-	-	-	-	4,529	679	5,209	5,209	-	-	-	-	-	-	-	-	-	58,323
4f.4.10	Utility Staff Cost	-	-	-	-	-	-	1,540	231	1,771	1,771	-	-	-	-	-	-	-	-	-	14,874
4f.4	Subtotal Period 4f Period-Dependent Costs	-	875	6	5	-	16	7,782	1,361	10,044	10,044	-	-	-	316	-	-	-	6,325	14	84,157
4f.0	TOTAL PERIOD 4f COST	-	875	6	5	-	16	15,518	3,474	19,894	19,894	-	-	-	316	-	-	-	6,325	109,212	90,397
	PERIOD 4 TOTALS	23,166	122,252	22,515	21,869	7,470	203,893	366,087	166,674	933,925	933,224	-	700	68,950	849,098	26,918	2,734	3,214	87,836,060	1,560,691	4,323,465
	PERIOD 5b - Site Restoration																				
	Period 5b Direct Decommissioning Activities																				
	Demolition of Remaining Site Buildings																				
5b.1.1.1	Air Intake Tunnel	-	161	-	-	-	-	-	24	185	-	-	185	-	-	-	-	-	-	2,314	-
5b.1.1.2	Circulating Water Chlorinator	-	73	-	-	-	-	-	11	84	-	-	84	-	-	-	-	-	-	1,131	-
5b.1.1.3	Circulating Water Intake Flume	-	64	-	-	-	-	-	10	74	-	-	74	-	-	-	-	-	-	915	-
5b.1.1.4	Circulating Water Pumphouse	-	187	-	-	-	-	-	28	215	-	-	215	-	-	-	-	-	-	3,205	-
5b.1.1.5	Coagulator	-	54	-	-	-	-	-	8	62	-	-	62	-	-	-	-	-	-	937	-
5b.1.1.6	Control & Service	-	3,165	-	-	-	-	-	475	3,640	-	-	3,640	-	-	-	-	-	-	39,585	-
5b.1.1.7	Control Building Area	-	891	-	-	-	-	-	134	1,024	-	-	1,024	-	-	-	-	-	-	10,651	-
5b.1.1.8	Emergency Diesel Generator	-	737	-	-	-	-	-	111	847	-	-	847	-	-	-	-	-	-	9,313	-
5b.1.1.9	Main & Aux Transformer Foundations	-	87	-	-	-	-	-	13	100	-	-	100	-	-	-	-	-	-	1,387	-
5b.1.1.10	Mechanical Draft Cooling Towers	-	85	-	-	-	-	-	13	98	-	-	98	-	-	-	-	-	-	1,074	-
5b.1.1.11	Miscellaneous Yard Foundations	-	20	-	-	-	-	-	3	23	-	-	23	-	-	-	-	-	-	284	-
5b.1.1.12	River Water Pumphouse	-	1,862	-	-	-	-	-	279	2,141	-	-	2,141	-	-	-	-	-	-	21,756	-
5b.1.1.13	Turbine	-	1,599	-	-	-	-	-	240	1,838	-	-	1,838	-	-	-	-	-	-	26,752	-
5b.1.1.14	Turbine Generator Pedestal	-	737	-	-	-	-	-	111	847	-	-	847	-	-	-	-	-	-	8,464	-
5b.1.1	Totals	-	9,721	-	-	-	-	-	1,458	11,179	-	-	11,179	-	-	-	-	-	-	127,770	-
	Site Closeout Activities																				
5b.1.2	Grade & landscape site	-	146	-	-	-	-	-	22	168	-	-	168	-	-	-	-	-	-	770	-
5b.1.3	Final report to NRC	-	-	-	-	-	-	411	62	473	473	-	-	-	-	-	-	-	-	-	3,120
5b.1	Subtotal Period 5b Activity Costs	-	9,867	-	-	-	-	411	1,542	11,820	473	-	11,347	-	-	-	-	-	-	128,540	3,120

Table E
Three Mile Island Unit 2
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2013 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Period 5b Additional Costs																					
5b.2.1	River Water Pump House Cofferdam	-	214	-	-	-	-	-	32	246	-	-	246	-	-	-	-	-	-	2,116	-
5b.2.2	Concrete Processing	-	496	-	-	-	-	9	76	580	-	-	580	-	-	-	-	-	-	2,760	-
5b.2.3	*Survey & Release of scrap materials*	-	-	889	60	2,274	-	-	439	3,663	3,663	-	-	61,736	-	-	-	-	3,704,137	3,704	-
5b.2.4	Backfill Site	-	925	-	-	-	-	-	139	1,064	-	-	1,064	-	-	-	-	-	-	6,952	-
5b.2.5	Cooling Tower Demolition	-	4,383	-	-	-	-	-	657	5,040	-	-	5,040	-	-	-	-	-	-	24,392	-
5b.2	Subtotal Period 5b Additional Costs	-	6,017	889	60	2,274	-	9	1,343	10,592	3,663	-	6,930	61,736	-	-	-	-	3,704,137	39,924	-
Period 5b Collateral Costs																					
5b.3.1	Small tool allowance	-	121	-	-	-	-	-	18	139	-	-	139	-	-	-	-	-	-	-	-
5b.3	Subtotal Period 5b Collateral Costs	-	121	-	-	-	-	-	18	139	-	-	139	-	-	-	-	-	-	-	-
Period 5b Period-Dependent Costs																					
5b.4.1	Insurance	-	-	-	-	-	-	206	21	226	-	-	226	-	-	-	-	-	-	-	-
5b.4.2	Property taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5b.4.3	Heavy equipment rental	-	2,329	-	-	-	-	-	349	2,678	-	-	2,678	-	-	-	-	-	-	-	-
5b.4.4	Plant energy budget	-	-	-	-	-	-	130	20	150	-	-	150	-	-	-	-	-	-	-	-
5b.4.5	Site O&M	-	-	-	-	-	-	322	48	371	-	-	371	-	-	-	-	-	-	-	-
5b.4.6	Security Staff Cost	-	-	-	-	-	-	153	23	176	-	-	176	-	-	-	-	-	-	-	2,607
5b.4.7	DOC Staff Cost	-	-	-	-	-	-	9,506	1,426	10,932	-	-	10.932	-	-	-	-	-	-	-	112,629
5b.4.8	Utility Staff Cost	-	-	-	-	-	-	2,003	300	2,304	-	-	2,304	-	-	-	-	-	-	-	20,336
5b.4	Subtotal Period 5b Period-Dependent Costs	-	2,329	-	-	-	-	12,320	2,187	16,836	-	-	16.836	-	-	-	-	-	-	-	135,571
5b.0	TOTAL PERIOD 5b COST	-	18,334	889	60	2,274	-	12,740	5,090	39,388	4,136	-	35,253	61,736	-	-	-	-	3,704,137	168,465	138,691
PERIOD 5 TOTALS		-	18,334	889	60	2,274	-	12,740	5,090	39,388	4,136	-	35,253	61,736	-	-	-	-	3,704,137	168,465	138,691
TOTAL COST TO DECOMMISSION		**23,899**	**150,867**	**23,783**	**22,780**	**9,744**	**210,512**	**590,348**	**207,186**	**1,239,065**	**1,201,047**	-	**38,018**	**130,686**	**860,361**	**26,918**	**2,734**	**3,214**	**93,311,460**	**1,755,802**	**5,747,465**

TOTAL COST TO DECOMMISSION WITH 20.08% CONTINGENCY:	**$1,239,065**	**thousands of 2013 dollars**
TOTAL NRC LICENSE TERMINATION COST IS 96.93% OR:	**$1,201,047**	**thousands of 2013 dollars**
NON-NUCLEAR DEMOLITION COST IS 3.07% OR:	**$38,018**	**thousands of 2013 dollars**
TOTAL LOW-LEVEL RADIOACTIVE WASTE VOLUME BURIED (EXCLUDING GTCC):	**890,013**	**cubic feet**
TOTAL GREATER THAN CLASS C RADWASTE VOLUME GENERATED:	**3,214**	**Cubic Feet**
TOTAL SCRAP METAL REMOVED:	**19,201**	**Tons**
TOTAL CRAFT LABOR REQUIREMENTS:	**1,755,802**	**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

Enclosure B
TMI-15-036

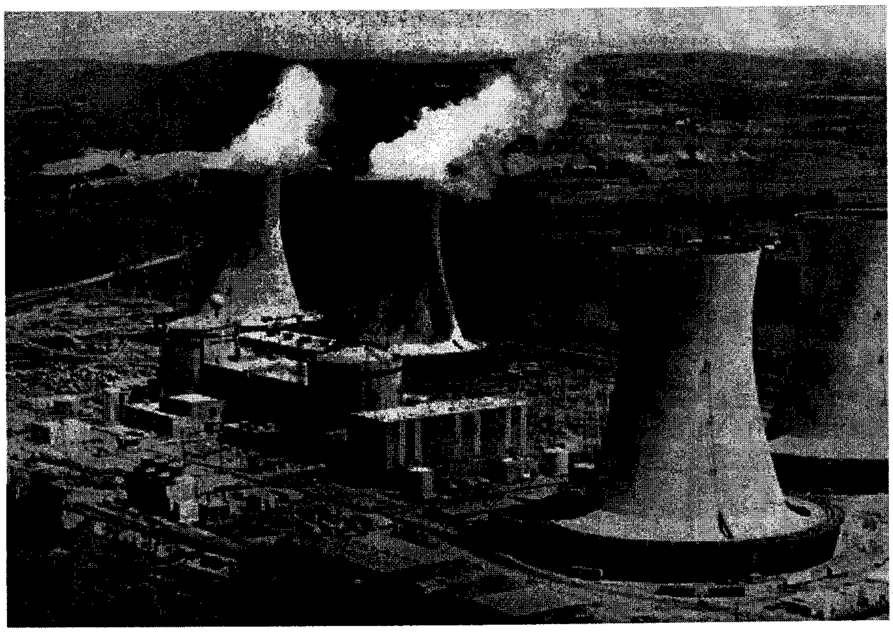
Escalation Analysis for Three Mile Island Unit 2
2013 Site-Specific Decommissioning Cost Estimate
February 2015
(15 pages follow)

Document F07-1676-003, Rev. 0

ESCALATION ANALYSIS

for

THREE MILE ISLAND UNIT 2
2013 SITE-SPECIFIC DECOMMISSIONING COST ESTIMATE



prepared for

FirstEnergy Corporation

prepared by

TLG Services, Inc.
Bridgewater, Connecticut

February 2015

APPROVALS

Project Manager	**Francis W. Seymore**	2/18/15 **Date**
Technical Manager	**Geoffrey M. Griffiths**	2/18/2015 **Date**

REVISION LOG

No.	Date	Item Revised	Reason for Revision
0	2-18-2015		Original Issue

DECOMMISSIONING COST ESCALATION STUDY

Purpose

This report presents escalated costs for the estimates of the costs to decommission Three Mile Island Unit 2 (TMI-2) for the selected decommissioning scenarios. The estimates, escalated to the year of expenditure dollars, are designed to provide FirstEnergy Corporation (FirstEnergy), with the information to assess its current decommissioning liability, as it relates to TMI-2.

Basis

This escalation analysis is based upon the recent decommissioning cost analysis performed for Three Mile Island Unit 2.[1] Explanatory information from this report is provided below.

Three decommissioning scenarios were evaluated for Three Mile Island Unit 2 (TMI-2). The scenarios selected are representative of alternatives available to the owners and are defined as follows:

1. **DECON** The adjacent TMI-1 is promptly decommissioned upon the scheduled cessation of operations in 2034. TMI-2 transitions from a Post-Defueling Monitored Storage (PDMS) status to decommissioning in 2040. The decommissioning program for TMI-2 commences after TMI-1 shutdown and is managed independently from the TMI-1 decommissioning effort; license termination of Unit 2 occurs in 2053, approximately 60 years after TMI-2 first entered PDMS.

2. **Delayed DECON** Decommissioning of TMI-2 commences upon the removal of TMI-1's spent fuel from the site in 2051. The decommissioning program for TMI-2 runs concurrently with the TMI-1 decommissioning effort and concludes with the termination of both licenses.

3. **SAFSTOR** TMI-1 is placed into safe-storage with decommissioning deferred 60 years. TMI-2 remains in storage with decommissioning deferred until it can be sequenced with TMI-1. The decommissioning program for TMI-2 runs concurrently with the TMI-1 decommissioning effort and concludes with the termination of both licenses.

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1 "Decommissioning Cost Analysis for Three Mile Island Unit 2," Document F07-1676-001, Rev. 0, TLG Services, Inc., December 2014.

The site-specific cost estimate was prepared by TLG Services, Inc. (TLG) in year 2013 (i.e., nominal) dollars. Because the actual decommissioning will not occur for many years and may continue for decades, the nominal-dollar estimates must be escalated into the year of expenditure. That is, we must determine the dollar value of each year's expenditure at the time it is expected to be incurred. Those escalated dollars then provide the basis for financial planning and asset management. Because many of the decommissioning activities occur long in the future, small fluctuations in escalation on the cost side, and investment earnings on the trust balance side, have an exponential impact on the resources required over the long periods of time typically associated with decommissioning scenarios.

In this analysis, TLG reviewed each applicable cost component separately to determine the rate by which each component was expected to escalate annually. Using an accepted aggregation methodology TLG determined the overall average rate the decommissioning costs were expected to escalate annually for each unit and each scenario. The average rates are provided in the results section.

The following narrative describes the methodology used to escalate the schedule of decommissioning expenditures.

Background

TLG developed the cost to decommission TMI-2 in year 2013 dollars; the mathematics to transform those costs to the year in which they will actually be incurred is relatively straightforward. The key to the analysis is selecting the appropriate forecasting indices for each of the major cost components. For that, TLG has relied upon guidance from the Nuclear Regulatory Commission (NRC) and the industry-wide recognized expertise of IHS Global Insight.

The NRC divides its reference costs for decommissioning into categories of labor, energy, and Low Level Radioactive Waste (LLRW) disposal. To provide guidance to operators and regulators and promote uniformity, the NRC periodically reissues NUREG-1307, "Report on Waste Burial Charges." NUREG-1307 is helpful in that it identifies the appropriate indices that should be used to escalate the labor and energy cost components and provides historical changes in low level radioactive waste disposal costs.

TLG also allocates its costs for decommissioning into categories, with the NRC's labor category further subdivided into "labor" and "equipment and materials," and an "other" category added for regulatory fees, property taxes and other unique or one-time expenditures.

Consistent with standards defined in the Financial Accounting Standards Board (FASB) Accounting Standards Codification (ASC), Topic 410-20,[2] TLG develops future cash flows by escalating four of the cost categories (labor, equipment and materials, energy and other) with indices provided by IHS Global Insight of Lexington, MA. IHS Global Insight is a privately held company which acquired Global Insight in 2008. The combined company includes well-known businesses such as Cambridge Energy Research Associates (CERA), Jane's Information Group, and IHS Herold; it also includes the former companies known as DRI (Data Resources, Inc.) and WEFA (Wharton Econometric Forecasting Associates). Since Global Insight has no direct index for escalation of low level radioactive waste disposal costs, the escalation rate for LLRW disposal has been established using a broad-based inflation index (CPI, Services) combined with a comparative retrospective LLRW disposal cost escalation analysis.

The timeframe of decommissioning typically exceeds that of the published indices; therefore for years beyond the published index, the inflation factor is determined using a "moving-average" method, averaging the most recent 25 years of indices to determine the future year index. This is a well-accepted methodology for determining longer-term projections and one that has been reviewed and deemed appropriate by IHS Global Insight as well.

Assumptions and Methodology

The base year (2013) costs were extracted from the "Decommissioning Cost Analysis for Three Mile Island Unit 2," issued in December 2014, specifically the Total costs cash flows from Tables 3.1 through 3.3.

The decommissioning cost analysis analyzed the DECON, Delayed DECON and SAFSTOR scenarios. The primary objectives of the TMI-2 decommissioning project are to remove the facility from service, reduce residual radioactivity to levels permitting unrestricted release, restore the site, perform this work safely, and complete the work in a cost effective manner. The selection of a preferred decommissioning alternative is influenced by a number of factors. These factors include the cost of each decommissioning alternative, minimization of occupational radiation exposure, availability of low-level waste disposal facilities, regulatory requirements, and public concerns. In addition, the existing agreement between FirstEnergy and the NRC requires decommissioning to be completed within 60 years of the beginning of the Post-Defueling Monitored Storage period, which began in 1993. The DECON scenario in the cost estimate meets this requirement.

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2 Accounting Standards Codification, Topic 410-20, Financial Accounting Standards Board, July 2009. ASC 410-20-55-14 states: "It is expected that uncertainties about the amount and timing of future cash flows can be accommodated by using the expected present value technique and therefore will not prevent the determination of a reasonable estimate of fair value."

Under the agreement with the owners of the adjacent Unit 1, TMI-2 will not begin decommissioning prior to the final shutdown of Unit 1. The Delayed DECON and SAFSTOR methodology coordinates the Unit 1 and Unit 2 decommissioning operations to a limited extent for cost sharing. The DECON methodology assumes that TMI-2 decommissions independent of Unit 1 activities. Contaminated materials are removed, packaged, shipped and disposed of offsite. Clean materials are surveyed for radioactive contamination and released as scrap metal or construction debris. In accordance with 10 CFR 50.82(a)(9), a license termination plan will be developed and submitted for NRC approval at least two years prior to termination of the license. Following the license termination survey and termination of the NRC license, all remaining site structures are removed to three foot below grade elevation, and the subgrade voids backfilled with concrete rubble and structural fill. The site is finally graded to conform to the surrounding area, and native vegetation placed for erosion control.

Under the SAFSTOR methodology, the facility is placed in a safe and stable condition and maintained in that state, allowing levels of radioactivity to decrease through radioactive decay, followed by decontamination and dismantlement. After the safe storage period, the facility will be decontaminated and dismantled to levels that permit license termination, similar to the DECON methodology.

Decommissioning costs were divided into the five escalation categories, for which future rate of inflation factors were established. The five categories are:

Labor	Wages, fringes and benefits for craft, salaries and benefits for professional workers, clerical, administrative, service, contract workers, as well as for certain trades
Equipment & Material	Heavy equipment, specialty tooling, packaging, small tools, construction materials, consumables, rental equipment and temporary construction facilities (trailers)
Energy	Electrical power purchases (as a large industrial customer) to support site operations
LLRW Disposal	Costs for the processing of low-level radioactive waste as well as for the controlled disposal of material that cannot be recovered (released for unrestricted use)
Other	Site operating costs (not already accounted for), for example, taxes, fees, and costs for specialized services and project support activities (may include unspecified contributions from labor, equipment and materials, and

transportation), and payments for one-time disposal services (e.g., Greater-than-Class-C radioactive waste, or GTCC)

The currently projected total costs (in thousands of 2013 dollars) to decommission the nuclear station, with the two scenarios analyzed, are as follows:

DECON	$1,188,564
Delayed DECON	$1,177,554
SAFSTOR	$1,239,065

The costs include the monies anticipated to be spent for operating license termination (radiological remediation) and site restoration activities. The costs are based on several key assumptions in areas of regulation, component characterization, high-level radioactive waste management, low-level radioactive waste disposal, performance uncertainties (contingency) and site remediation and restoration requirements.

The following table reflects the percentage of each cost component relative to the total costs to decommission TMI-2:

	DECON		Delayed DECON		SAFSTOR	
Escalation Category	**Costs (Thousands of 2013$)**	**% of Total Cost**	**Costs (Thousands of 2013$)**	**% of Total Cost**	**Costs (Thousands of 2013$)**	**% of Total Cost**
Labor	671,323	56.5	651,122	55.3	671,870	54.2
Equipment & Material	137,959	11.6	141,727	12.0	153,977	12.4
Energy	18,061	1.5	19,459	1.7	28,227	2.3
LLRW Disposal	258,232	21.7	258,143	21.9	258,157	20.8
Other Items	102,989	8.7	107,103	9.1	126,834	10.2

Escalation

The following escalation indices were established for each of the five cost categories. The escalation indices for Labor, Equipment and Material, Energy and Other were provided by IHS Global Insight Company via their DataInsight-Web online service. The indices used show the last update as 13 October 2014. Global Insight does not provide historical or projected costs for disposal of radioactive waste. As such, a TLG-developed LLRW Disposal/Recycling index was used in this escalation analysis. This index is a combination of historical information through 2014 from NRC publications for disposal site rates and projections using the Consumer Price Index, Services information provided by Global Insight as discussed previously.

Forecast data for labor, equipment/ materials, energy, and general inflation were available through 2039. In order to extrapolate beyond the available Global Insight data, TLG calculated a 25-year moving average inflation factor to extend the Global Insight indices through 2095, the end point of the TMI-2 decommissioning scenarios.

Index Selection

The following table identifies the Global Insight forecast data sets used for the four cost categories (exclusive of LLRW disposal). Consistent with the NRC's guidance, TLG escalates the labor component of its decommissioning cost estimates using an Employment Cost Index (ECI) and the energy cost component with a Producer Price Index (PPI).

Use of the Consumer Price Index, Services (CUSASNS) for general services, site operating costs and one-time expenditures is consistent with the intent of the index (the measure of the average change in prices over time of goods and services).

Global Insight Forecast Database	TLG Cost Category
ECI Total Compensation (ECIPCTNS)	Labor Expenditures Inflation
Producer Price Index, Machinery & Equipment (WPIP11)	Equipment/Material Expenditures Inflation
Producer Price Index, Fuels and Related Products and Power (WPIP05)	Energy Expenditures Inflation
Consumer Price Index, Services (CUSASNS)	Other Items Expenditures Inflation
TLG-Developed LLRW Disposal Price Index [Historical data based upon Barnwell published tariffs; forecast data based upon the Consumer Price Index, Services (CUSASNS) plus 1% additional to reflect above-inflation increases observed at the Barnwell burial site]	LLRW Disposal / Recycling

Labor

The decommissioning process is labor intensive, with labor representing more than half of the total cost. The estimates for TMI-2 include the cost of the craft labor performing field activities, the field supervision and support services, project management, administration, security, and costs for specialty contractors. The Employment Cost Index (ECI) is a measure of changes in labor costs. It is one of the principal economic indicators used by the Federal Reserve Bank. The index shows changes in wages and salaries and benefit costs, as well as changes in total compensation. The ECIPCTNS index, provided by Global Insight, is a forecast of future changes in the cost of labor, defined as compensation per employee hour worked. The self-employed, owners-managers, and unpaid family workers are excluded from coverage. The ECI is designed as a fixed-weight index at the occupational level, thus eliminating the effects of employment shifts among occupations. Both components of compensation, wages/salaries, and benefits, are covered.

In addition to TLG's judgment, IHS Global Insight has confirmed that the selected index is appropriate to use in determining the rate at which the labor costs will escalate over time.

Equipment and Material

Equipment and material costs in the decommissioning estimates include small tools and consumables as well as the heavy construction equipment involved in the dismantling, demolition and movement of materials around the site. The Producer Price Indexes (PPI) measures monthly average changes in selling prices received by domestic producers for their output. Most of the information used in the PPI is obtained by sampling of industries in the mining and manufacturing sectors of the economy. The indexes reflect price trends for a constant set of goods and services representing the total output of an industry.

TLG uses a broad-based escalation index, the Producer Price Index for Machinery and Equipment (WPIP11).

In addition to TLG's judgment, IHS Global Insight has confirmed that the selected index is appropriate to use in determining the rate at which the equipment and material costs will escalate over time.

Energy

Energy costs in the decommissioning estimate include only direct energy purchases, primarily electric power and fuel oil for heating. TLG uses a broad-based power escalation index, the Producer Price Index for Fuels and Related Products and Power (WPIP05). While the WPIP05 index has some volatility (since it tracks in part the price of oil), the cost of energy in the decommissioning estimates is a small percentage and therefore has little effect on the overall escalation rate for decommissioning cost.

In addition to TLG's judgment, IHS Global Insight has confirmed that the selected index is appropriate to use in determining the rate at which energy costs will escalate over time.

Low Level Radioactive Waste Disposal

The inflation index used for radioactive waste burial costs is the Global Insight Consumer Price Index, Services (CUSASNS), with an additional 1% per year to account for differences observed (over the past 14 years) between low-level waste disposal rates reported in NRC NUREG-1307 documents and general services inflation rate (CUUR0000SAS) reported by the Bureau of Labor Statistics.

Other

"Other" costs in the decommissioning estimates include such items as licensing fees, taxes, special services (for example, a fee for the geologic disposal of GTCC waste), as well as labor-intensive activities such as radiological surveys that include costs for off-site analytical services. Because the "Other" costs contain this variety of cost components, TLG uses a Consumer Price Index to project future expenditures. The CPI, Services index (CUSASNS) measures changes in the prices of goods and services. It is therefore more representative of the non-labor cost elements included in the decommissioning estimates. Accordingly, the use of the CPI for "Other" costs reflects more accurately the cost components with the "Other" category than the use of the "Labor" escalation factor as a proxy.

In addition to TLG's judgment, IHS Global Insight has confirmed that the selected index is appropriate to use in determining the rate at which the "other" costs will escalate over time.

Results

With the proper escalation indices identified, TLG escalated the cost per year for the five escalation categories using the Global Insight index corresponding to that year and escalation category. Tables 1 through 3 provide escalated schedules of annual expenditures for the DECON, Delayed DECON and SAFSTOR scenarios for TMI-2. The schedules detail each of the five escalation categories through to the end of each scenario's decommissioning period for Total Costs, as well as the cost categories of License Termination and Site Restoration.

No discounting of the escalated dollars was performed.

Using the escalated cash flows for each unit, TLG determined the single-value yearly escalation rate which yielded the same sum of escalated dollars for each of the four tables. The rate, referred to as a composite average annual escalation rate, is tabulated for the four decommissioning cost cash flows as follows:

DECON	2.77%
Delayed DECON	2.78%
SAFSTOR	2.85%

In a similar fashion, the composite average annual escalation rates for each of the five escalation categories can be developed. The following table details the composite annual average rates for the three decommissioning scenarios.

	Composite Average Annual Rate (%)		
Escalation Category	**DECON**	**Delayed DECON**	**SAFSTOR**
Labor	2.713	2.707	2.687
Equipment/ & Material	1.146	1.153	1.176
Energy	2.200	2.193	2.149
LLRW Disposal	3.599	3.607	3.632
Other Items	2.628	2.631	2.644
Overall	2.774	2.784	2.853

Similarly, the composite average annual escalation rates for the three cost categories identified in the decommissioning cost estimate can also be developed. The values for the three decommissioning scenarios are provided in the following table.

	Composite Average Annual Rate (%)		
Escalation Category	**DECON**	**Delayed DECON**	**SAFSTOR**
License Termination	2.795	2.805	2.871
Site Restoration	2.331	2.324	2.381
Overall	2.774	2.784	2.853

Table 1
DECON Unit 2
Decommissioning following Unit 1 Shutdown

ESCALATION ANALYSIS OF CASHFLOWS

Source Documentation for Estimate:	Decommissioning Cost Analysis for Three Mile Island Unit 2
Souce Document Number:	F07-1676-001 Rev. 0 Table 3.1
Unit Identification	Financial Escalation Analysis-2013 Update-Three Mile Island Unit 2
Estimate basis year:	2013
Decommissioning Scenario:	DECON
Operating Lifetime	Decommissioning following Unit 1 Shutdown

Single Value Escalation % by Major Cost Categories

Single value escalations:	Single-value	Total Costs	
Cost Category	Yearly Escal,	2013 $	Escalated $
Total Costs	2.774%	1,188,564	2,835,592
License Termination Costs	2.795%	1,149,097	2,738,652
Site Restoration Costs	2.331%	39,467	96,938
Labor Costs	2.713%	671,323	1,557,508
Equipment & Material Costs	1.146%	137,959	201,462
Energy Costs	2.200%	18,061	32,520
LLRW Disposal Costs	3.599%	258,232	816,375
Other Costs	2.628%	102,969	227,727

Financial Escalation Analysis-2013 Update-Three Mile Island Unit 2
DECON Cash Flows by Category - Decommissioning following Unit 1 Shutdown
Total Costs - Thousands of Year of Expenditure Dollars

Year	Labor	Equipment & Materials	Energy	LLRW Disposal	Other	Yearly Totals
2013	2,486	0	224	0	326	3,036
2014	2,538	0	230	0	335	3,103
2015	2,606	0	227	0	344	3,177
2016	2,690	0	229	0	353	3,272
2017	2,768	0	232	0	361	3,361
2018	2,855	0	241	0	371	3,467
2019	2,942	0	247	0	380	3,569
2020	3,036	0	255	0	390	3,681
2021	3,116	0	264	0	399	3,779
2022	3,204	0	274	0	409	3,887
2023	3,295	0	285	0	419	3,999
2024	3,399	0	300	0	432	4,131
2025	3,482	0	307	0	442	4,231
2026	3,572	0	312	0	454	4,338
2027	3,663	0	317	0	466	4,446
2028	3,767	0	322	0	480	4,569
2029	3,852	0	327	0	491	4,670
2030	3,951	0	333	0	505	4,789
2031	4,053	0	337	0	518	4,908
2032	4,169	0	343	0	533	5,045
2033	4,265	0	349	0	546	5,160
2034	4,376	0	355	0	560	5,291
2035	4,491	0	362	0	576	5,429
2036	4,623	0	371	0	593	5,587
2037	4,732	0	378	0	607	5,717
2038	4,858	0	385	0	623	5,866
2039	4,989	0	391	0	640	6,020
2040	86,962	1,779	1,526	56	18,240	108,563
2041	122,495	9,445	2,050	38,984	16,513	189,487
2042	109,311	21,049	2,099	93,563	22,927	248,949
2043	112,285	21,297	2,149	96,961	23,530	256,222
2044	115,631	21,608	2,205	100,756	24,215	264,415
2045	118,415	21,803	2,250	104,137	24,787	271,392
2046	115,350	18,840	2,101	88,371	20,522	245,184
2047	106,276	12,882	1,757	53,132	11,484	185,531
2048	109,402	13,071	1,801	55,226	11,822	191,322
2049	111,995	13,192	1,834	57,091	12,103	196,215
2050	114,950	13,350	1,870	59,180	12,425	201,775
2051	115,222	12,967	1,843	58,158	12,269	200,459
2052	68,892	7,605	591	3,243	3,006	83,337
2053	52,544	12,574	247	7,517	1,331	74,213
Totals	1,557,508	201,462	32,520	816,375	227,727	2,835,592
	-1	3	0	0	0	2

Financial Escalation Analysis-2013 Update-Three Mile Island Unit 2
DECON Cash Flows by Category - Decommissioning following Unit 1 Shutdown
License Termination Costs - Thousands of Year of Expenditure Dollars

Year	Labor	Equipment & Materials	Energy	LLRW Disposal	Other	Yearly Totals
2013	2,486	0	224	0	326	3,036
2014	2,538	0	230	0	335	3,103
2015	2,606	0	227	0	344	3,177
2016	2,690	0	229	0	353	3,272
2017	2,768	0	232	0	361	3,361
2018	2,855	0	241	0	371	3,467
2019	2,942	0	247	0	380	3,569
2020	3,036	0	255	0	390	3,681
2021	3,116	0	264	0	399	3,779
2022	3,204	0	274	0	409	3,887
2023	3,295	0	285	0	419	3,999
2024	3,399	0	300	0	432	4,131
2025	3,482	0	307	0	442	4,231
2026	3,572	0	312	0	454	4,338
2027	3,663	0	317	0	466	4,446
2028	3,767	0	322	0	480	4,569
2029	3,852	0	327	0	491	4,670
2030	3,951	0	333	0	505	4,789
2031	4,053	0	337	0	518	4,908
2032	4,169	0	343	0	533	5,045
2033	4,265	0	349	0	546	5,160
2034	4,376	0	355	0	560	5,291
2035	4,491	0	362	0	576	5,429
2036	4,623	0	371	0	593	5,587
2037	4,732	0	378	0	607	5,717
2038	4,858	0	385	0	623	5,866
2039	4,989	0	391	0	640	6,020
2040	85,570	1,779	1,526	56	18,240	107,171
2041	119,498	9,441	2,050	38,984	16,513	186,486
2042	109,029	21,031	2,099	93,563	22,927	248,649
2043	111,996	21,279	2,149	96,961	23,530	255,915
2044	115,333	21,589	2,205	100,756	24,215	264,098
2045	118,109	21,785	2,250	104,137	24,787	271,068
2046	115,143	18,828	2,101	88,371	20,522	244,965
2047	106,272	12,882	1,757	53,132	11,484	185,527
2048	109,398	13,071	1,801	55,226	11,822	191,318
2049	111,990	13,192	1,834	57,091	12,103	196,210
2050	114,945	13,350	1,870	59,180	12,425	201,770
2051	115,218	12,967	1,843	58,158	12,269	200,455
2052	47,596	2,272	485	3,243	2,497	56,093
2053	2,522	224	0	7,517	136	10,399
Totals	1,480,397	183,690	32,167	816,375	226,023	2,738,652

Financial Escalation Analysis-2013 Update-Three Mile Island Unit 2
DECON Cash Flows by Category - Decommissioning following Unit 1 Shutdown
Site Restoration Costs - Year of Expenditure Dollars

Year	Labor	Equipment & Materials	Energy	LLRW Disposal	Other	Yearly Totals
2013	0	0	0	0	0	0
2014	0	0	0	0	0	0
2015	0	0	0	0	0	0
2016	0	0	0	0	0	0
2017	0	0	0	0	0	0
2018	0	0	0	0	0	0
2019	0	0	0	0	0	0
2020	0	0	0	0	0	0
2021	0	0	0	0	0	0
2022	0	0	0	0	0	0
2023	0	0	0	0	0	0
2024	0	0	0	0	0	0
2025	0	0	0	0	0	0
2026	0	0	0	0	0	0
2027	0	0	0	0	0	0
2028	0	0	0	0	0	0
2029	0	0	0	0	0	0
2030	0	0	0	0	0	0
2031	0	0	0	0	0	0
2032	0	0	0	0	0	0
2033	0	0	0	0	0	0
2034	0	0	0	0	0	0
2035	0	0	0	0	0	0
2036	0	0	0	0	0	0
2037	0	0	0	0	0	0
2038	0	0	0	0	0	0
2039	0	0	0	0	0	0
2040	1,392	0	0	0	0	1,392
2041	2,997	3	0	0	0	3,000
2042	282	18	0	0	0	300
2043	290	18	0	0	0	308
2044	298	18	0	0	0	316
2045	305	18	0	0	0	323
2046	207	12	0	0	0	219
2047	4	0	0	0	0	4
2048	5	0	0	0	0	5
2049	5	0	0	0	0	5
2050	5	0	0	0	0	5
2051	5	0	0	0	0	5
2052	21,296	5,332	106	0	509	27,243
2053	50,021	12,350	247	0	1,195	63,813
Totals	77,112	17,769	353	0	1,704	96,938

ESCALATION ANALYSIS OF CASHFLOWS

Table 2
Delayed DECON Unit 2
Decommissioning Concurrent with Unit 1 Delayed DECON

Source Documentation for Estimate:	Decommissioning Cost Analysis for Three Mile Island Unit 2
Souce Document Number:	F07-1676-001 Rev. 0
	Table 3.2
Unit Identification	Financial Escalation Analysis-2013 Update-Three Mile Island Unit 2
Estimate basis year:	2013
Decommissioning Scenario:	Delayed DECON
Operating Lifetime	Decommissioning Concurrent with Unit 1 Delayed DECON

Single Value Escalation % by Major Cost Categories

Single value escalations:	Single-value	Total Costs	
Cost Category	Yearly Escal.	2013 $	Escalated $
Total Costs	2.784%	1,177,554	3,240,984
License Termination Costs	2.805%	1,139,536	3,135,759
Site Restoration Costs	2.324%	38,018	105,226
Labor Costs	2.707%	651,122	1,726,358
Equipment & Material Costs	1.153%	141,727	219,719
Energy Costs	2.193%	19,459	38,059
LLRW Disposal Costs	3.607%	258,143	988,500
Other Costs	2.631%	107,103	268,348

Financial Escalation Analysis-2013 Update-Three Mile Island Unit 2
Delayed DECON Cash Flows by Category - Decommissioning Concurrent with Unit 1 Delayed DECON
Total Costs - Thousands of Year of Expenditure Dollars

Year	Labor	Equipment & Materials	Energy	LLRW Disposal	Other	Yearly Totals
2013	2,486	0	224	0	326	3,036
2014	2,538	0	230	0	335	3,103
2015	2,606	0	227	0	344	3,177
2016	2,690	0	229	0	353	3,272
2017	2,768	0	232	0	361	3,361
2018	2,855	0	241	0	371	3,467
2019	2,942	0	247	0	380	3,569
2020	3,036	0	255	0	390	3,681
2021	3,116	0	264	0	399	3,779
2022	3,204	0	274	0	409	3,887
2023	3,295	0	285	0	419	3,999
2024	3,399	0	300	0	432	4,131
2025	3,482	0	307	0	442	4,231
2026	3,572	0	312	0	454	4,338
2027	3,663	0	317	0	466	4,446
2028	3,767	0	322	0	480	4,569
2029	3,852	0	327	0	491	4,670
2030	3,951	0	333	0	504	4,788
2031	4,052	0	337	0	518	4,907
2032	4,169	0	343	0	533	5,045
2033	4,265	0	349	0	546	5,160
2034	2,024	302	375	9	828	3,538
2035	1,063	434	391	13	965	2,866
2036	1,094	441	401	13	994	2,943
2037	1,120	446	408	14	1,018	3,006
2038	1,150	451	415	14	1,045	3,075
2039	1,181	457	423	15	1,074	3,150
2040	1,216	464	433	15	1,105	3,233
2041	1,246	468	442	16	1,130	3,302
2042	1,280	473	452	16	1,160	3,381
2043	1,315	479	463	17	1,191	3,465
2044	1,354	486	475	18	1,225	3,558
2045	50,487	1,273	1,113	46	11,240	64,159
2046	143,790	5,203	2,302	18,039	22,787	192,121
2047	128,496	20,424	2,354	102,868	23,646	277,788
2048	128,506	22,635	2,412	116,246	26,856	296,655
2049	131,551	22,844	2,456	120,171	27,495	304,517
2050	135,023	23,118	2,505	124,569	28,227	313,442
2051	138,590	23,395	2,554	129,128	28,978	322,645
2052	116,048	13,694	1,950	63,704	13,093	208,489
2053	118,796	13,821	1,984	65,855	13,405	213,861
2054	121,944	13,989	2,024	68,266	13,762	219,985
2055	125,189	14,158	2,065	70,764	14,128	226,304
2056	128,872	14,369	2,113	73,555	14,543	233,452
2057	90,809	6,558	1,170	22,173	7,149	127,859
2058	81,076	18,539	408	12,404	2,260	114,687
2059	3,430	798	16	551	92	4,887
Totals	1,726,358	219,719	38,059	988,499	268,349	3,240,984
	0	-1	0	0	0	-1

Financial Escalation Analysis-2013 Update-Three Mile Island Unit 2
Delayed DECON Cash Flows by Category - Decommissioning Concurrent with Unit 1 Delayed DECON
License Termination Costs - Thousands of Year of Expenditure Dollars

Year	Labor	Equipment & Materials	Energy	LLRW Disposal	Other	Yearly Totals
2013	2,486	0	224	0	326	3,036
2014	2,538	0	230	0	335	3,103
2015	2,606	0	227	0	344	3,177
2016	2,690	0	229	0	353	3,272
2017	2,768	0	232	0	361	3,361
2018	2,855	0	241	0	371	3,467
2019	2,942	0	247	0	380	3,569
2020	3,036	0	255	0	390	3,681
2021	3,116	0	264	0	399	3,779
2022	3,204	0	274	0	409	3,887
2023	3,295	0	285	0	419	3,999
2024	3,399	0	300	0	432	4,131
2025	3,482	0	307	0	442	4,231
2026	3,572	0	312	0	454	4,338
2027	3,663	0	317	0	466	4,446
2028	3,767	0	322	0	480	4,569
2029	3,852	0	327	0	491	4,670
2030	3,951	0	333	0	504	4,788
2031	4,052	0	337	0	518	4,907
2032	4,169	0	343	0	533	5,045
2033	4,265	0	349	0	546	5,160
2034	2,024	302	375	9	828	3,538
2035	1,063	434	391	13	965	2,866
2036	1,094	441	401	13	994	2,943
2037	1,120	446	408	14	1,018	3,006
2038	1,150	451	415	14	1,045	3,075
2039	1,181	457	423	15	1,074	3,150
2040	1,216	464	433	15	1,105	3,233
2041	1,246	468	442	16	1,130	3,302
2042	1,280	473	452	16	1,160	3,381
2043	1,315	479	463	17	1,191	3,465
2044	1,354	486	475	18	1,225	3,558
2045	49,679	1,273	1,113	46	11,240	63,351
2046	140,415	5,203	2,302	18,039	22,787	188,746
2047	127,408	20,408	2,354	102,868	23,646	276,684
2048	128,175	22,616	2,412	116,246	26,856	296,305
2049	131,212	22,825	2,456	120,171	27,495	304,159
2050	134,675	23,099	2,505	124,569	28,227	313,075
2051	138,232	23,375	2,554	129,128	28,978	322,267
2052	116,043	13,694	1,950	63,704	13,093	208,484
2053	118,791	13,821	1,984	65,855	13,405	213,856
2054	121,938	13,989	2,024	68,266	13,762	219,979
2055	125,184	14,158	2,065	70,764	14,128	226,299
2056	128,867	14,369	2,113	73,555	14,543	233,447
2057	90,807	6,558	1,170	22,173	7,149	127,857
2058	7,085	466	32	12,404	382	20,369
2059	174	14	0	551	9	748
Totals	1,642,436	200,769	37,667	988,499	266,388	3,135,759

Financial Escalation Analysis-2013 Update-Three Mile Island Unit 2
Delayed DECON Cash Flows by Category - Decommissioning Concurrent with Unit 1 Delayed DECON
Site Restoration Costs - Year of Expenditure Dollars

Year	Labor	Equipment & Materials	Energy	LLRW Disposal	Other	Yearly Totals
2013	0	0	0	0	0	0
2014	0	0	0	0	0	0
2015	0	0	0	0	0	0
2016	0	0	0	0	0	0
2017	0	0	0	0	0	0
2018	0	0	0	0	0	0
2019	0	0	0	0	0	0
2020	0	0	0	0	0	0
2021	0	0	0	0	0	0
2022	0	0	0	0	0	0
2023	0	0	0	0	0	0
2024	0	0	0	0	0	0
2025	0	0	0	0	0	0
2026	0	0	0	0	0	0
2027	0	0	0	0	0	0
2028	0	0	0	0	0	0
2029	0	0	0	0	0	0
2030	0	0	0	0	0	0
2031	0	0	0	0	0	0
2032	0	0	0	0	0	0
2033	0	0	0	0	0	0
2034	0	0	0	0	0	0
2035	0	0	0	0	0	0
2036	0	0	0	0	0	0
2037	0	0	0	0	0	0
2038	0	0	0	0	0	0
2039	0	0	0	0	0	0
2040	0	0	0	0	0	0
2041	0	0	0	0	0	0
2042	0	0	0	0	0	0
2043	0	0	0	0	0	0
2044	0	0	0	0	0	0
2045	808	0	0	0	0	808
2046	3,375	0	0	0	0	3,375
2047	1,088	16	0	0	0	1,104
2048	331	19	0	0	0	350
2049	339	19	0	0	0	358
2050	348	20	0	0	0	368
2051	358	20	0	0	0	378
2052	5	0	0	0	0	5
2053	5	0	0	0	0	5
2054	5	0	0	0	0	5
2055	5	0	0	0	0	5
2056	6	0	0	0	0	6
2057	2	0	0	0	0	2
2058	73,991	18,073	376	0	1,878	94,318
2059	3,256	784	16	0	83	4,139
Totals	83,922	18,951	392	0	1,961	105,226

Table 3
SAFSTOR Unit 2
Decommissioning Concurrent with Unit 1 SAFSTOR

ESCALATION ANALYSIS OF CASHFLOWS

Source Documentation for Estimate:	Decommissioning Cost Analysis for Three Mile Island Unit 2
Souce Document Number:	F07-1676-001 Rev. 0
	Table 3.3
Unit Identification	Financial Escalation Analysis-2013 Update-Three Mile Island Unit 2
Estimate basis year:	2013
Decommissioning Scenario:	SAFSTOR
Operating Lifetime	Decommissioning Concurrent with Unit 1 SAFSTOR

Single Value Escalation % by Major Cost Categories

Single value escalations:	Single-value	Total Costs	
Cost Category	Yearly Escal.	2013 $	Escalated $
Total Costs	2.853%	1,239,066	9,255,252
License Termination Costs	2.871%	1,201,047	9,002,023
Site Restoration Costs	2.381%	38,018	253,230
Labor Costs	2.687%	871,870	4,428,803
Equipment & Material Costs	1.176%	153,977	358,186
Energy Costs	2.149%	28,227	94,807
LLRW Disposal Costs	3.632%	258,157	3,636,958
Other Costs	2.644%	126,834	736,499

Financial Escalation Analysis-2013 Update-Three Mile Island Unit 2
SAFSTOR Cash Flows by Category - Decommissioning Concurrent with Unit 1 SAFSTOR
Total Costs - Thousands of Year of Expenditure Dollars

Year	Labor	Equipment & Materials	Energy	LLRW Disposal	Other	Yearly Totals
2013	2,486	0	224	0	326	3,036
2014	2,538	0	230	0	335	3,103
2015	2,606	0	227	0	344	3,177
2016	2,690	0	229	0	353	3,272
2017	2,768	0	232	0	361	3,361
2018	2,855	0	241	0	371	3,467
2019	2,942	0	247	0	380	3,569
2020	3,036	0	256	0	390	3,681
2021	3,116	0	264	0	399	3,779
2022	3,204	0	274	0	409	3,887
2023	3,296	0	285	0	419	3,999
2024	3,399	0	300	0	432	4,131
2025	3,482	0	307	0	442	4,231
2026	3,572	0	312	0	454	4,338
2027	3,663	0	317	0	466	4,446
2028	3,767	0	322	0	480	4,569
2029	3,852	0	327	0	491	4,670
2030	3,951	0	333	0	504	4,788
2031	4,052	0	337	0	518	4,907
2032	4,169	0	343	0	533	5,045
2033	4,265	0	349	0	546	5,160
2034	2,018	301	375	9	827	3,530
2035	1,065	432	391	13	964	2,865
2036	1,086	439	401	13	992	2,931
2037	1,111	444	408	14	1,016	2,993
2038	1,141	449	415	14	1,044	3,063
2039	1,171	456	423	15	1,072	3,136
2040	1,207	462	433	15	1,103	3,220
2041	1,237	466	442	16	1,129	3,290
2042	1,270	471	452	16	1,158	3,367
2043	1,305	477	463	17	1,189	3,451
2044	1,344	484	475	18	1,223	3,544
2045	1,376	488	485	18	1,252	3,619
2046	1,413	494	496	19	1,285	3,707
2047	1,451	500	507	19	1,320	3,797
2048	1,493	507	519	20	1,358	3,897
2049	1,529	512	529	21	1,391	3,982
2050	1,569	518	539	22	1,428	4,076
2051	1,611	524	550	22	1,466	4,173
2052	1,658	532	562	23	1,509	4,284
2053	1,697	537	572	24	1,545	4,375
2054	1,742	543	584	25	1,586	4,480
2055	1,788	550	595	26	1,628	4,587
2056	1,841	558	609	27	1,676	4,711
2057	1,885	563	620	28	1,716	4,812
2058	1,935	570	633	29	1,762	4,929
2059	1,987	577	647	30	1,808	5,049
2060	2,045	586	662	31	1,862	5,186
2061	2,094	591	674	32	1,906	5,297
2062	2,150	598	688	33	1,957	5,426
2063	2,207	605	703	35	2,008	5,558
2064	2,273	614	720	36	2,067	5,710
2065	2,327	620	733	37	2,116	5,833
2066	2,389	627	749	38	2,172	5,975
2067	2,453	635	765	40	2,230	6,123
2068	2,526	644	784	41	2,295	6,290
2069	2,586	650	798	43	2,350	6,427
2070	2,655	658	815	44	2,412	6,584
2071	2,725	666	832	46	2,477	6,746
2072	2,805	676	852	48	2,549	6,930
2073	2,872	682	867	49	2,610	7,080
2074	2,949	690	885	51	2,680	7,255
2075	3,027	698	904	53	2,751	7,433
2076	3,116	709	925	55	2,832	7,637
2077	3,190	715	942	57	2,899	7,803
2078	3,275	724	961	59	2,976	7,995
2079	3,363	733	982	61	3,055	8,194
2080	3,462	743	1,005	64	3,145	8,419
2081	35,652	1,058	1,360	92	9,739	47,899
2082	368,780	5,152	4,852	16,962	72,570	468,316
2083	347,585	26,290	4,955	317,220	49,713	745,763
2084	331,011	34,799	5,073	423,577	69,023	863,483
2085	338,918	35,120	5,166	437,881	70,665	887,750
2086	347,966	35,540	5,275	453,906	72,545	915,232
2087	357,256	35,967	5,386	470,519	74,475	943,602
2088	317,018	25,143	4,488	300,023	45,019	691,691
2089	305,843	21,243	4,193	239,681	34,408	605,368
2090	314,007	21,498	4,282	248,453	35,323	623,563
2091	322,392	21,756	4,372	257,546	36,262	642,328
2092	331,907	22,077	4,476	267,704	37,329	663,493
2093	273,727	14,648	3,257	154,120	25,799	471,551
2094	205,539	22,021	1,066	32,816	7,113	268,575
2095	66,086	9,158	260	14,992	1,767	92,263
Totals	4,428,803	358,185	94,807	3,636,958	736,499	9,255,252
	-1	1	0	0	-1	-1

Financial Escalation Analysis-2013 Update-Three Mile Island Unit 2
SAFSTOR Cash Flows by Category - Decommissioning Concurrent with Unit 1 SAFSTOR
License Termination Costs - Thousands of Year of Expenditure Dollars

Year	Labor	Equipment & Materials	Energy	LLRW Disposal	Other	Yearly Totals
2013	2,486	0	224	0	326	3,036
2014	2,538	0	230	0	335	3,103
2015	2,606	0	227	0	344	3,177
2016	2,690	0	229	0	353	3,272
2017	2,768	0	232	0	361	3,361
2018	2,855	0	241	0	371	3,467
2019	2,942	0	247	0	380	3,569
2020	3,036	0	256	0	390	3,681
2021	3,116	0	264	0	399	3,779
2022	3,204	0	274	0	409	3,887
2023	3,296	0	285	0	419	3,999
2024	3,399	0	300	0	432	4,131
2025	3,482	0	307	0	442	4,231
2026	3,572	0	312	0	454	4,338
2027	3,663	0	317	0	466	4,446
2028	3,767	0	322	0	480	4,569
2029	3,852	0	327	0	491	4,670
2030	3,951	0	333	0	504	4,788
2031	4,052	0	337	0	518	4,907
2032	4,169	0	343	0	533	5,045
2033	4,265	0	349	0	546	5,160
2034	2,018	301	375	9	827	3,530
2035	1,056	432	391	13	964	2,856
2036	1,086	439	401	13	992	2,931
2037	1,111	444	408	14	1,016	2,993
2038	1,141	449	415	14	1,044	3,063
2039	1,171	456	423	15	1,072	3,136
2040	1,207	462	433	15	1,103	3,220
2041	1,237	466	442	16	1,129	3,290
2042	1,270	471	452	16	1,158	3,367
2043	1,305	477	463	17	1,189	3,451
2044	1,344	484	475	18	1,223	3,544
2045	1,376	488	485	18	1,252	3,619
2046	1,413	494	496	19	1,285	3,707
2047	1,451	500	507	19	1,320	3,797
2048	1,493	507	519	20	1,358	3,897
2049	1,529	512	529	21	1,391	3,982
2050	1,569	518	539	22	1,428	4,076
2051	1,611	524	550	22	1,466	4,173
2052	1,658	532	562	23	1,509	4,284
2053	1,697	537	572	24	1,545	4,375
2054	1,742	543	584	25	1,586	4,480
2055	1,788	550	595	26	1,628	4,587
2056	1,841	558	609	27	1,676	4,711
2057	1,885	563	620	28	1,716	4,812
2058	1,935	570	633	29	1,762	4,929
2059	1,987	577	647	30	1,808	5,049
2060	2,045	586	662	31	1,862	5,186
2061	2,094	591	674	32	1,906	5,297
2062	2,150	598	688	33	1,957	5,426
2063	2,207	605	703	35	2,008	5,558
2064	2,273	614	720	36	2,067	5,710
2065	2,327	620	733	37	2,116	5,833
2066	2,389	627	749	38	2,172	5,975
2067	2,453	635	765	40	2,230	6,123
2068	2,526	644	784	41	2,295	6,290
2069	2,586	650	798	43	2,350	6,427
2070	2,655	658	815	44	2,412	6,584
2071	2,725	666	832	46	2,477	6,746
2072	2,805	676	852	48	2,549	6,930
2073	2,872	682	867	49	2,610	7,080
2074	2,949	690	885	51	2,680	7,255
2075	3,027	698	904	53	2,751	7,433
2076	3,116	709	925	55	2,832	7,637
2077	3,190	715	942	57	2,899	7,803
2078	3,275	724	961	59	2,976	7,995
2079	3,363	733	982	61	3,055	8,194
2080	3,462	743	1,005	64	3,145	8,419
2081	35,124	1,058	1,360	92	9,739	47,371
2082	362,097	5,152	4,852	16,962	72,570	461,633
2083	341,305	26,273	4,955	317,220	49,713	739,466
2084	330,157	34,769	5,073	423,577	69,023	862,599
2085	338,044	35,090	5,166	437,881	70,665	886,846
2086	347,069	35,510	5,275	453,906	72,545	914,305
2087	356,334	35,937	5,386	470,519	74,475	942,651
2088	316,757	25,135	4,488	300,023	45,019	691,422
2089	305,829	21,243	4,193	239,681	34,408	605,354
2090	313,993	21,498	4,282	248,453	35,323	623,549
2091	322,377	21,756	4,372	257,546	36,262	642,313
2092	331,893	22,077	4,476	267,704	37,329	663,479
2093	273,719	14,648	3,257	154,120	25,799	471,543
2094	67,529	1,943	510	32,816	3,623	106,421
2095	3,360	163	0	14,992	181	18,696
Totals	4,210,704	328,967	93,971	3,636,958	731,423	9,002,023

Financial Escalation Analysis-2013 Update-Three Mile Island Unit 2
SAFSTOR Cash Flows by Category - Decommissioning Concurrent with Unit 1 SAFSTOR
Site Restoration Costs - Year of Expenditure Dollars

Year	Labor	Equipment & Materials	Energy	LLRW Disposal	Other	Yearly Totals
2013	0	0	0	0	0	0
2014	0	0	0	0	0	0
2015	0	0	0	0	0	0
2016	0	0	0	0	0	0
2017	0	0	0	0	0	0
2018	0	0	0	0	0	0
2019	0	0	0	0	0	0
2020	0	0	0	0	0	0
2021	0	0	0	0	0	0
2022	0	0	0	0	0	0
2023	0	0	0	0	0	0
2024	0	0	0	0	0	0
2025	0	0	0	0	0	0
2026	0	0	0	0	0	0
2027	0	0	0	0	0	0
2028	0	0	0	0	0	0
2029	0	0	0	0	0	0
2030	0	0	0	0	0	0
2031	0	0	0	0	0	0
2032	0	0	0	0	0	0
2033	0	0	0	0	0	0
2034	0	0	0	0	0	0
2035	0	0	0	0	0	0
2036	0	0	0	0	0	0
2037	0	0	0	0	0	0
2038	0	0	0	0	0	0
2039	0	0	0	0	0	0
2040	0	0	0	0	0	0
2041	0	0	0	0	0	0
2042	0	0	0	0	0	0
2043	0	0	0	0	0	0
2044	0	0	0	0	0	0
2045	0	0	0	0	0	0
2046	0	0	0	0	0	0
2047	0	0	0	0	0	0
2048	0	0	0	0	0	0
2049	0	0	0	0	0	0
2050	0	0	0	0	0	0
2051	0	0	0	0	0	0
2052	0	0	0	0	0	0
2053	0	0	0	0	0	0
2054	0	0	0	0	0	0
2055	0	0	0	0	0	0
2056	0	0	0	0	0	0
2057	0	0	0	0	0	0
2058	0	0	0	0	0	0
2059	0	0	0	0	0	0
2060	0	0	0	0	0	0
2061	0	0	0	0	0	0
2062	0	0	0	0	0	0
2063	0	0	0	0	0	0
2064	0	0	0	0	0	0
2065	0	0	0	0	0	0
2066	0	0	0	0	0	0
2067	0	0	0	0	0	0
2068	0	0	0	0	0	0
2069	0	0	0	0	0	0
2070	0	0	0	0	0	0
2071	0	0	0	0	0	0
2072	0	0	0	0	0	0
2073	0	0	0	0	0	0
2074	0	0	0	0	0	0
2075	0	0	0	0	0	0
2076	0	0	0	0	0	0
2077	0	0	0	0	0	0
2078	0	0	0	0	0	0
2079	0	0	0	0	0	0
2080	0	0	0	0	0	0
2081	528	0	0	0	0	528
2082	6,683	0	0	0	0	6,683
2083	6,280	17	0	0	0	6,297
2084	854	29	0	0	0	883
2085	874	30	0	0	0	904
2086	898	30	0	0	0	928
2087	922	30	0	0	0	952
2088	261	8	0	0	0	269
2089	13	0	0	0	0	13
2090	14	0	0	0	0	14
2091	14	0	0	0	0	14
2092	15	0	0	0	0	15
2093	8	0	0	0	0	8
2094	138,010	20,078	576	0	3,491	162,155
2095	62,726	8,995	260	0	1,586	73,567
Totals	218,100	29,217	836	0	5,077	253,230