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10 CFR 50.82(a)(4)(i)

TM-19-024

April 5, 2019

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

Three Mile Island Nuclear Station, Unit 1
Renewed Facility Operating License No. DPR 50
NRC Docket No. 50 289

Subject: Site-Specific Decommissioning Cost Estimate for Three Mile Island Nuclear Station, Unit 1

- References:
- 1) Letter from J. Bradley Fewell (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "Certification of Permanent Cessation of Power Operations for Three Mile Island Nuclear Station, Unit 1," dated June 20, 2017 (ML17171A151)
 - 2) Letter from Patrick Simpson, (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission - "Report on Status of Decommissioning Funding for Reactors and Independent Spent Fuel Storage Installations," dated April 1, 2019 (ML19091A140)

Pursuant to 10 CFR 50.82(a)(4)(i), Exelon Generation Company, LLC (Exelon) is submitting the site-specific decommissioning cost estimate (DCE) for Three Mile Island Nuclear Station, Unit 1 (TMI-1). On June 20, 2017, in accordance with 10 CFR 50.82(a)(1)(i), Exelon informed the U.S. Nuclear Regulatory Commission (NRC) that TMI-1 will permanently cease power operations on or about September 30, 2019 (Reference 1). In accordance with 10 CFR 50.54(bb) and 10 CFR 50.82(a)(4)(i), Exelon is required to submit a Spent Fuel Management Plan (SFMP), Site Specific Decommissioning Cost Estimate (DCE), and Post-Shutdown Decommissioning Activities Report (PSDAR) within two years of permanent cessation of operations. The TMI-1 PSDAR and SFMP are being submitted under separate cover letters.

Attachment 1 to this letter provides the TMI-1 DCE. The latest Decommissioning Funding Report for TMI was submitted in Reference 2, Attachment 30. The minimum formula cost amount using the formula in 10 CFR 50.75(c) has been calculated assuming the labor, energy, and burial factors described in Attachment 1 of Reference 2. The site-specific cost amount reported in the DCE is greater than the minimum formula cost amount, as required by 10 CFR 50.75(b)(1).

Attachment 2 to this letter contains the projected annual cash flow from the Nuclear Decommissioning Trust Fund (NDTF) for TMI-1 radiological decommissioning. The cost in

Attachment 2 for radiological decommissioning (including decommissioning for the proposed Independent Spent Fuel Storage Installation (ISFSI)) are from Attachment 1, Table 6-2, which have been escalated from June 2018 dollars in Attachment 1, to December 31, 2018 dollars using an escalation rate of 1.42% (which corresponds to an APR of 2.8638%). The NDTF balance as of December 31, 2018 was \$669,617,225. The cash flow analysis conservatively assumes all expenses in a year are incurred at the beginning of year (i.e., beginning of year convention).

Attachment 2 demonstrates that adequate funding is available in the NDTF to complete radiological decommissioning.

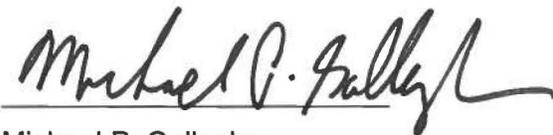
Pursuant to 10 CFR 50.75(f)(1) and 10 CFR 50.82(8)(v) the financial assurance summary report will be updated and submitted to the NRC annually. The cost estimates and financial levels will be adjusted in accordance with Regulatory Guide 1.159, "Assuring the Availability of Funds for Decommissioning Nuclear Reactors" (applicable revision at the time) and will be used to demonstrate funding assurance. If the funding assurance demonstration shows the decommissioning trust fund is not sufficient, then an alternate funding mechanism allowed by 10 CFR 50.75(e) and the guidance provided in the Regulatory Guide, will be put in place at an appropriate time.

The DCE (Attachment 1) and the Decommissioning Annual Cash Flows (Attachment 2) were inputs to the PSDAR, with the PSDAR providing summaries of the conclusions.

This letter contains no new regulatory commitments.

If you have any questions concerning this submittal, please contact Paul Bonnett at (610) 765-5264.

Respectfully,



Michael P. Gallagher
Vice President, License Renewal & Decommissioning
Exelon Generation Company, LLC

Attachment 1: Three Mile Island Nuclear Station – Unit 1 - Site-Specific Decommissioning Cost Estimate

Attachment 2: Three Mile Island Nuclear Station – Unit 1 - Annual Decommissioning Fund Cash Flow

cc: w/Attachment

Regional Administrator - NRC Region I
NRC Senior Resident Inspector – Three Mile Island Nuclear Station – Unit 1
NRC Project Manager, NRR – Three Mile Island Nuclear Station – Unit 1
NRC Project Manager, NMSS/DUWP/RDB – Three Mile Island – Unit 2
Director, Bureau of Radiation Protection - PA Department of Environmental Resources

Attachment 1:

Three Mile Island Nuclear Station – Unit 1

Site-Specific Decommissioning Cost Estimate

DECOMMISSIONING COST ANALYSIS REPORT



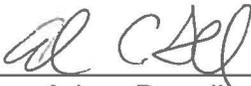
Three Mile Island Nuclear Station Unit 1

April 2019

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APPROVALS

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Three Mile Island Nuclear Station, Unit 1 Decommissioning Cost Analysis Report

EXECUTIVE SUMMARY

This report presents estimates of the cost to decommission the Three Mile Island Nuclear Station, Unit 1 (TMI-1) based on a permanent shut down no later than September 30, 2019. This report constitutes the TMI-1 Site-Specific Decommissioning Cost Estimate (DCE).

The primary objectives of the decommissioning project are to remove the facility from service and reduce residual radioactivity to levels permitting unrestricted release, so that the plant's operating license can be terminated within 60-years after permanent cessation of operations. The costs to restore the site are also included in the DCE.

Exelon evaluated three alternative decommissioning scenarios: DECON, Shortened SAFSTOR, and SAFSTOR. In all three scenarios the spent fuel that is stored in the spent fuel pool is transferred to the Independent Spent Fuel Storage Installation (ISFSI) shortly after shutdown, however the timeframe in which the decommissioning and dismantlement (D&D) begins differs. In the DECON scenario, D&D begins shortly after the spent fuel is transferred to the ISFSI. In the Shortened SAFSTOR scenario, D&D is deferred approximately 30 years after permanent shutdown. In the SAFSTOR scenario, D&D is deferred for as long as possible while still meeting the required 60-year license termination.

The selection of a preferred decommissioning alternative is influenced by numerous factors including the cost of each decommissioning alternative, minimization of occupational radiation exposure, availability of a high-level waste (spent fuel) repository or an interim storage facility, regulatory requirements, and public concerns. Based on these factors the SAFSTOR alternative has been selected.

The cost elements are assigned to one of three subcategories: Radiological Decommissioning (radiological remediation), Spent Fuel Management, or Site Restoration. The Radiological Decommissioning subcategory is used to accumulate costs that are consistent with "decommissioning" as defined by the NRC in its financial assurance regulations (i.e., 10 CFR 50.75). The cost reported for this subcategory is generally sufficient to terminate the unit's operating license, recognizing that there may be some additional cost impact from spent fuel management. The Radiological Decommissioning cost subcategory is further broken down to separately address costs to perform radiological decommissioning of the ISFSI (as required by 10 CFR 72.30).

The methodology used to develop the estimated costs, including financial aspects, is discussed in Section 3, *Cost Estimate Methodology*. Section 4, *Assumptions*, provides a discussion of the assumptions used in developing the various costs elements and considerations; including the cost associated with decontamination and component removal, waste disposal, and labor. These assumptions serve as the foundation in the development of the anticipated cost to decommission TMI-1.

Based on the SAFSTOR alternative the major milestones associated with the decommissioning time periods are discussed in Section 5, *Schedule Estimate*.

The following tables summarize the estimated costs for the SAFSTOR alternative reflecting the various cost elements. Additional detail regarding the estimated costs are provided in Section 6 and in the Appendices of this report.

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SAFSTOR Alternative for TMI-1
(thousands of 2018 dollars)

Cost Element	Total
Decontamination	7,999
Removal	158,354
Packaging	21,793
Transportation	16,436
Waste Disposal	57,647
Off-Site Waste Processing	7,510
Program Management ¹	487,732
Security	193,944
System and Security Modifications	10,350
Spent Fuel Storage and Management ²	123,036
Insurance and Regulatory Fees	52,822
Energy	23,903
Characterization and Licensing Surveys	26,419
Property Taxes	13,243
Miscellaneous Equipment	27,671
Total³	1,228,858

Cost Element	Total
Site Radiological Decommissioning	980,304
ISFSI Radiological Decommissioning	7,207
Spent Fuel Management	156,408
Site Restoration	84,939
Total³	1,228,858

¹ Includes engineering costs.

² Includes costs for the dry storage system components, spent fuel loading and transfer, spent fuel pool operations and maintenance and Emergency Planning fees, but excludes program management costs (staffing), security and other related costs.

³ Columns may not add up due to rounding.

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ACRONYMS

AIF/NESP	Atomic Industrial Forum/National Environmental Studies Project
CFR	Code of Federal Regulations
DCE	Decommissioning Cost Estimate
DOC	Decommissioning Operations Contractor
DOE	Department of Energy
Exelon	Exelon Generation Company
FEMA	Federal Emergency management Agency
GTCC	Greater than Class C [Waste]
ISFSI	Independent Spent Fuel Storage Installation
LLRW	Low Level Radioactive Waste
LSA	Low Specific Activity
LTP	License Termination Plan
MPC	Multi-Purpose Canister
NRC	United States Nuclear Regulatory Commission
NSSS	Nuclear Steam Supply System
NUREG	Nuclear Regulatory Report (NRC)
PSDAR	Post Shutdown Decommissioning Activities Report
PWR	Pressurized Water Reactor
SCO	Surface Contaminated Object
TMI-1	Three Mile Island Nuclear Station, Unit 1
TMI-2	Three Mile Island Nuclear Station, Unit 2
U.S.	United States
WDF	Work Difficulty [Adjustment] Factor

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APPENDIX A:	DETAILED COST ESTIMATE
APPENDIX B:	ISFSI DECOMMISSIONING COST ESTIMATE

Three Mile Island Nuclear Station, Unit 1 Decommissioning Cost Analysis Report

1. OVERVIEW

This report presents estimates of the cost to decommission the Three Mile Island Nuclear Station, Unit 1 (TMI-1) based on a permanent shut down no later than September 30, 2019. TMI-1 is a Babcock & Wilcox pressurized water reactor (PWR), rated at 2568 megawatts-thermal (MWt). This report constitutes the TMI-1 Site-Specific Decommissioning Cost Estimate (DCE).

The primary objectives of the TMI-1 decommissioning project are to remove the facility from service and reduce residual radioactivity to levels permitting unrestricted release, so that the plant's operating license can be terminated within 60-years after permanent cessation of operations. The costs to restore the site are also included in the DCE.

This analysis is not a detailed engineering evaluation, but an estimate prepared in advance of the detailed engineering processes required to carry out the decommissioning of the nuclear unit. It also may not reflect the actual plan to decommission the TMI-1; the plan may differ from the assumptions made in this analysis based on facts that exist at the actual time of decommissioning.

The cost elements are assigned to one of three subcategories:

- (1) **Radiological Decommissioning** – this subcategory is used to accumulate costs that are consistent with “decommissioning” as defined by the Nuclear Regulatory Commission (NRC) in its financial assurance regulations (i.e., 10 CFR 50.75) and separately address the cost of radiological decommissioning as defined by 10 CFR 50.2. The cost reported for this subcategory is generally sufficient to terminate the unit's operating license, recognizing that there may be some additional cost impact from spent fuel management. The Radiological Decommissioning cost subcategory is further broken down to separately address costs to perform radiological decommissioning of the Independent Spent Fuel Storage Installation (ISFSI) (as required by 10 CFR 72.30).
- (2) **Spent Fuel Management** – this subcategory contains costs associated with the containerization and transfer of spent fuel from the wet storage pool to a Department of Energy (DOE) transport cask or to the ISFSI for interim storage, as well as the transfer of the spent fuel in storage at the ISFSI to the DOE. Costs are included for the management of the ISFSI until such time that the transfer is complete. It does not include any spent fuel management expenses unrelated to decommissioning planning incurred prior to the cessation of plant operations, nor does it include any costs related to the final disposal of the spent fuel.
- (3) **Site Restoration** – this subcategory is used to capture costs associated with the dismantling and demolition of buildings and facilities demonstrated to be free from contamination. This includes structures never exposed to radioactive materials, as well as those facilities that have been decontaminated to appropriate levels. Structures are removed to a depth of three feet below grade and backfilled to conform to local surface elevation.

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

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support activity. However, in general, the allocations represent a reasonable accounting of those costs that can be expected to be incurred for the specific subcomponents of the total estimated program cost, if executed as described.

The estimates were developed, and costs are presented in June 2018 dollars. As such, the estimates do not reflect the escalation of costs (due to inflationary and market forces) over the remaining operating life of the station or during the decommissioning period.

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2. DECOMMISSIONING SCENARIO

2.1. DECOMMISSIONING METHODS

Exelon evaluated the following decommissioning scenarios:

- (1) **DECON** – spent fuel is transferred to the ISFSI shortly after shutdown and decommissioning and dismantlement begins shortly after that.
- (2) **Shortened SAFSTOR** – the spent fuel is transferred to the ISFSI and decommissioning is deferred approximately 30 years after permanent shutdown.
- (3) **SAFSTOR** – the spent fuel is transferred to the ISFSI and the plant facility is left intact until the decommissioning starts sometime in the future (dormancy phase), with structures maintained in a sound condition. Decommissioning commences such that license termination is completed within the required 60-years.

The scenarios also recognize that spent fuel will be stored at the site in the spent fuel storage pool and/or in an ISFSI until such time that it can be transferred to a DOE facility. The estimates also include the cost to operate and eventually decommission the ISFSI.

The selection of a preferred decommissioning alternative is influenced by numerous factors at the time of plant shutdown. These factors include the cost of each decommissioning alternative, minimization of occupational radiation exposure, availability of a high-level waste (spent fuel) repository or an interim storage facility, regulatory requirements, and public concerns.

2.2. DECOMMISSIONING METHOD SELECTED - SAFSTOR

The selection of a preferred decommissioning alternative is influenced by numerous factors including the cost of each decommissioning alternative, minimization of occupational radiation exposure, availability of a high-level waste (spent fuel) repository or an interim storage facility, regulatory requirements, and public concerns. Based on these factors the SAFSTOR alternative has been selected.

The conceptual approach that the NRC has described in its regulations divides decommissioning into three phases; 1) the initial phase begins with the permanent shutdown and through the transition to storage or decommissioning activities, 2) the next phase encompasses activities during the storage period or during major decommissioning activities, or a combination of the two; and 3) the final phase pertains to the activities involved in radiological decommissioning and license termination. The decommissioning estimates developed herein 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 and differs from those presented by the NRC.

2.2.1. Period 0 (Pre-Shutdown) and Period 1 (Shutdown through Transition) – Preparations

Prior to the permanent shutdown and defueling, detailed preparations are undertaken to provide a smooth transition from plant operations to site decommissioning. Preparations include revision of technical specifications applicable to the operating conditions and requirements, characterization of the facility and major components, and the development of the Post Shutdown Decommissioning Activities Report (PSDAR).

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Following the final shutdown and defueling, the site will be prepared to minimize operation and maintenance to those systems/components/areas that are required to support the safe handling and management of spent fuel. Those systems/components that will not be required will be isolated and removed from service. Radiation controls will be put in place to reduce radiation and contamination in areas that will need to be accessed to support decommissioning. Areas not needed will have access restricted to minimize radiation/contamination exposure and potential safety hazards. Spent fuel in the spent fuel storage pool may begin to be transferred to the ISFSI, which is being constructed. The security area will be adjusted to reflect protection of equipment and areas necessary to support the safe handling and management of spent fuel.

2.2.2. Period 2 – Dormancy Phase

The second phase identified by the NRC in its rule addresses licensed activities during a storage period and is applicable to the dormancy phase of SAFSTOR. Dormancy activities include a 24-hour security force, preventive and corrective maintenance on security systems, maintenance of necessary area lighting, general building maintenance, heating and ventilation of buildings, routine radiological inspections of contaminated structures, maintenance of structural integrity, and a site environmental and radiation monitoring program. Resident maintenance personnel will perform maintenance and inspection activities to maintain safe conditions. The transfer of the spent fuel from the spent fuel pool to the ISFSI continues during this period until complete. Additionally, the transfer of the spent fuel to a DOE facility occurs during this period.

2.2.3. Period 3 – Site Reactivation and Decommissioning Preparations

Prior to the commencement of decommissioning operations, preparations are undertaken to reactivate site services and prepare for decommissioning. Preparations include engineering and planning, a detailed site characterization, and the assembly of a decommissioning management organization. Final planning for decommissioning activities and the writing of work packages, activity specifications and decommissioning procedures are initiated. The environmental impact associated with the planned decommissioning activities is also considered. If the consequences of a planned decommissioning activity are predicted to be greater than what is bounded by previously evaluated environmental assessments or impact statements, a license amendment would have to be submitted to the NRC for the specific activity and the environmental report would have to be updated.

2.2.4. Period 4 – Decommissioning Operations

This period includes the physical decommissioning activities associated with the removal and disposal of contaminated and activated components and structures. Existing facilities will be modified, and/or temporary facilities will be constructed to support decommissioning, decontamination, and dismantling activities. Components and piping systems will be decontaminated as necessary to control (minimize) worker exposure and facilitate packaging and transportation. Piping and components no longer essential to support decommissioning operations will be removed. The reactor internal and external components will be removed. Some larger Nuclear Steam Supply System (NSSS) components may be decontaminated and sealed in such a manner as to serve as their own shipping/burial containers. The reactor will be segmented, removed and placed in shielded casks. Activated portions of the reactor and other biological shield walls will be demolished by controlled processes.

The License Termination Plan (LTP), which includes the Final Survey Plan, is developed and submitted to the NRC. Once the survey is complete, the results are provided to the NRC for their review and evaluation. Once the NRC approves the LTP the final remediation of site facilities and

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services may start. Subsequently, the NRC independently confirms the radiological site conditions and approves a license amendment that releases the property, inclusive of the ISFSI, for unrestricted use.

2.2.5. Period 5 – Site Restoration

Following completion of decommissioning operations, site restoration activities will begin. Remaining structures are removed, exterior walls and foundations are removed to a nominal depth of three feet below grade, and non-contaminated concrete rubble produced by demolition activities is processed and then used to backfill foundation voids. The plant area is graded and stabilized.

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3. COST ESTIMATE METHODOLOGY

3.1. METHODOLOGY BASES

The systematic approach used herein for assembling decommissioning estimates ensures a high degree of confidence in the reliability of the resulting costs. The costs and schedules follow the general guidance and sequence in Regulatory Guide 1.184, "Decommissioning of Nuclear Power Reactors" (Reference 7.1). The format and content of the estimates is consistent with the recommendations of Regulatory Guide 1.202, "Standard Format and Content of Decommissioning Cost Estimates for Nuclear Power Reactors" (Reference 7.2). 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" (Reference 7.3) and the DOE "Decommissioning Handbook" (Reference 7.4).

The unit cost factors used in this analysis incorporate site-specific costs and the latest available information about worker productivity in decommissioning. The detail provided in the unit cost factors, including activity duration, labor costs (by craft), and equipment and consumable costs, ensures that essential elements have not been omitted. The activity-dependent costs were estimated with the item quantities based on plant drawings and inventory documents. Removal rates and material costs for the conventional disposition of components and structures were based on "Building Construction Cost Data 2017" published by R.S. Means (Reference 7.5) escalated from 2017 \$s to 2018 \$s.

Critical path was used to determine the total decommissioning program schedule and establish carrying costs, which include program management, administration, field engineering, equipment rental, quality assurance, and security.

3.2. FINANCIAL COMPONENTS OF THE COST MODEL

The cost model used provides distinct cost elements, however these distinct cost elements do not comprise the total estimated cost to accomplish the project goal. Additional factors as described below are also taken into consideration.

3.2.1. Contingency

Contingencies are necessary to provide assurance that sufficient funding will be available since the cost elements are based on ideal conditions and maximum efficiency. They are an integral part of the total cost to complete the decommissioning process and are expected to be fully expended. The activity and period dependent costs are combined to develop the total decommissioning cost. A contingency is then applied on a line-item basis. Contingency, in this analysis, does not include price escalation and inflation in the cost of decommissioning over the remaining operating life of the station, or duration of the decommissioning program and dry fuel storage period.

Exelon examined the major activity-related problems (decontamination, segmentation, equipment handling, packaging, transport, and waste disposal) that necessitate a contingency. Individual

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activity contingencies ranged from 8% to 75%, depending on the degree of difficulty judged to be appropriate. 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%
Low-Level Radioactive Waste Processing	15%
Reactor Segmentation	75%
NSSS Component Removal	25%
Reactor Waste Packaging	25%
Reactor Waste Transport	25%
Reactor Vessel Component Disposal	50%
Greater Than Class C 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	10/15%
Spent Fuel Storage (Dry) Systems	8%
Spent Fuel Transfer Costs	15%
Operations and Maintenance Expenses	15%
ISFSI Decommissioning	25%

The contingency values are applied to the appropriate components of the estimate on a line item basis, except where actual budgets were provided or estimates for activities assumed to include contingency.

3.2.2. Financial Risk

This cost study does not include any specific costs for financial risk, since there is insufficient historical data from which to project future liabilities. Consequently, the areas of uncertainty or risk are revisited periodically and addressed through repeated revisions or updates of the base estimates.

3.2.3. Work Difficulty Factors

Work difficulty factor (WDF) adjustments have been applied to account for the inefficiencies in working in a power plant environment. WDFs were assigned to each unique set of unit factors, commensurate with the inefficiencies associated with working in confined and/or hazardous environments. The study applies WDFs to account for use of radiological dose minimization practices (e.g., radiological protection instruction, mock-up training, and use of respiratory

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protection and protective clothing). Changes to worker exposure limits may also impact the decommissioning cost and project schedule.

The factors and their associated range of values were developed in conjunction with the process described in AIF/NESP-036 (Reference 7.3).

3.2.4. Scheduling Program Durations

The WDF adjusted unit factors are applied against the inventory of materials to be removed in the radiologically controlled areas. The resulting work-hours are used to develop the decommissioning program schedule. The scheduling of conventional removal and dismantling activities are based upon productivity information from the RSMeans "Building Construction Cost Data 2017" publication (Reference 7.5).

The program schedule is used to determine the period-dependent costs for program management, administration, field engineering, equipment rental, contracted services, etc. The study relies upon regional or site-specific salary and wage rates for the personnel associated with the intended program.

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4. ASSUMPTIONS

The current cost estimates assume that TMI-1 ceases operations in 2019 and that the shutdown is pre-planned (i.e., there is no delay in transitioning the plant and workforce from operations or in obtaining regulatory relief from operating requirements, etc.). This estimate includes additional resources to support the engineering, planning, and licensing efforts. This estimate assumes the continued operation of the spent fuel building as a wet fuel storage facility for approximately 3.2 years, until the spent fuel is transferred to the ISFSI. The ISFSI is assumed to remain operational until the DOE transfers the spent fuel offsite. The estimates also include the dismantling of non-essential structures and limited restoration of the site.

4.1. GENERAL

4.1.1. Energy

The physical plant is assumed to be de-energized, except for those facilities associated with spent fuel storage. Minimal energy usage is assumed to support remaining plant staffing.

4.1.2. Emergency Planning

Federal Emergency Management Agency (FEMA) fees associated with emergency planning are assumed to continue for approximately 1.3 years following the cessation of operations. After that the FEMA fees are discontinued. State and local fees associated with emergency planning are continued until all spent fuel is transferred out of the spent fuel pool.

4.1.3. Insurance

Costs for continuing coverage (nuclear liability and property insurance) following cessation of plant operations and during decommissioning are included and based upon current operating premiums, and subsequent reductions based on regulatory requirements.

4.1.4. Taxes

Property taxes are included for all decommissioning periods. Tax payments decrease during decommissioning until reaching a minimum property tax payment for the site; this level is maintained for the balance of the decommissioning program.

4.1.5. NRC Fees

NRC charges are included to support the decommissioning program. The license fee is reduced based on the NRC fees for a reactor in a decommissioning (possession-only) status. The charges associated with NRC professional services are based on the NRC hourly rate and the anticipated level of participation commensurate with the decommissioning alternative and schedule.

4.2. LABOR COSTS

For purposes of this analysis, it is assumed that Exelon will hire a Decommissioning Operations Contractor (DOC) to manage the decommissioning. Exelon will provide site security, radiological health and safety, quality assurance and overall site administration during the decommissioning and demolition phases. Contract personnel will provide engineering services, as necessary, under the direction of Exelon.

Average Exelon labor costs were provided by department or work group and include payroll overheads. DOC labor costs were based on utility labor costs with modified markups to account

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for employee benefits, DOC overhead, and profit. Labor costs are incorporated into the Unit Cost factor. A profile of the projected staffing level for decommissioning is provided in Table 4-2.

4.3. TRANSITION ACTIVITIES

Those systems and components that are not needed for the safe storage and handling of spent fuel will be removed from service and deactivated. Hazardous fluids will be drained and removed from retired plant equipment.

Operation and maintenance costs for the spent fuel pool are included within the estimates until the spent fuel has been transferred to the ISFSI.

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.

4.4. NON-RADIOACTIVE WASTE

4.4.1. Processed Water

It is assumed that all water released will meet the state and federal release limits. These estimates assume that processed water which meets state and federal release limits is disposed of without additional cost.

4.4.2. Asbestos Abatement

This estimate assumes that approximately 59,935 cubic feet of asbestos or material containing asbestos will be present at the site at the time of final shutdown. The cost to properly remove and dispose of this material is included in the cost estimate.

4.4.3. Scrap and Salvage

Metallic material generated is processed to the greatest extent possible to reduce the total cost of controlled disposal. Material meeting the regulatory and/or site release criterion, is released as scrap, requiring no further cost consideration.

The existing plant equipment is considered obsolete and suitable for scrap as deadweight quantities only. No credit is taken for salvage value since it would be speculative, and any recovered value would be small in comparison to the overall decommissioning expenses.

4.5. RADIOACTIVE WASTE

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. 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 of radioactive material.

The waste material generated in the decontamination and dismantling of TMI-1 is primarily generated during Period 4, Decommissioning Operations. Material that is considered potentially contaminated is sent to processing facilities in Tennessee for conditioning and disposal. Heavily contaminated components and activated materials are routed for controlled disposal.

The volumes of radioactive waste generated during the various decommissioning activities are calculated based on the container size and are summarized consistent with 10 CFR 61 classifications. Appendix A provides a summary of the expected packaging costs, shipping costs,

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and burial costs by decommissioning activity. Table 4-1 provides the radwaste volumes by class expected to be generated during decommissioning.

4.5.1. Low-Level Radioactive Waste Disposal

A significant portion of the waste material may only be potentially contaminated by radioactive materials. This waste can be analyzed on site or shipped off site to licensed facilities for further analysis, for processing and/or for conditioning/recovery. The estimates reflect the savings from waste recovery/volume reduction.

All options and services currently available to Exelon were taken into consideration regarding the disposition of the various waste streams produced by the decommissioning process. Disposal fees are calculated using representative costs. The disposal costs for Class A, B and C waste were based upon a representative Exelon fleet cost. Class A waste is assumed to be disposed of at the EnergySolutions facility in Clive, Utah. This facility is not licensed to receive Class B and C wastes. Class B and C waste are assumed to be disposed of at Waste Control Specialists (WCS) facility in Andrews, Texas.

The waste volumes are calculated based on the exterior package dimensions for containerized material or a specific calculation for components serving as their own waste containers.

4.5.2. Greater Than Class C Radioactive Waste

The dismantling of the components residing closest to the reactor core generally generates radioactive waste considered unsuitable for shallow-land disposal (i.e., low-level waste with concentrations greater than the NRC limits for Class C waste (i.e., GTCC)). A small quantity of material generated during decommissioning will be GTCC waste; GTCC waste is expected to be a small percentage of the total waste volume. GTCC waste is assumed to be placed in spent fuel storage canisters and disposed of in a similar manner to that envisioned for spent fuel disposal.

The federal government has the responsibility for the disposal of this material. However, the federal government has not identified a cost for disposing of GTCC, a schedule for acceptance, nor acceptance criteria for this material. For purposes of this analysis, the GTCC radioactive waste is assumed to be packaged and disposed of in a similar manner as high-level waste and at a cost equivalent to that envisioned for the spent fuel.

GTCC material is assumed to be shipped directly to a DOE facility as it is generated, since the fuel will have been removed from the site prior to the start of decommissioning. GTCC costs have been segregated and included within the "Radiological Decommissioning" expenditures.

4.5.3. Transportation Methods

The transport of all waste material and components will be by a combination of rail, truck, and/or multi-wheeled transporter. Transportation costs for material requiring controlled disposal or processing are based upon the mileage to the respective disposal or processing site.

4.6. SITE SPECIFIC CONSIDERATIONS

The cost estimates prepared for decommissioning TMI-1 consider the unique features of the site, including the NSSS, power generation systems, support services, site buildings, and ancillary facilities.

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4.6.1. Design Conditions

The curie contents of the reactor vessel and internals are derived from those listed in NUREG/CR-3474, "Long-Lived Activation Products in Reactor Materials," (Reference 7.6) and adjusted for the different mass of the TMI-1 components, projected operating life, and different periods of decay. Additional short-lived isotopes were derived from NUREG/CR-0130, "Technology, Safety and Costs of Decommissioning a Reference Pressurized Water Reactor Power Station," (Reference 7.7) and benchmarked to the long-lived values from NUREG/CR-3474 (Reference 7.6).

Any control rod assemblies (CRAs) in the spent fuel pool at the cessation of operations are assumed to be disposed of along with the spent fuel at no additional cost.

4.6.2. Impact of Decommissioning Multiple Reactor Units

TMI-1 shares the site with an adjacent and shutdown unit (TMI-2). This analysis does not consider any additional costs or savings that might be incurred or achieved in coordinating the decommissioning of the two units, in part, due to the unique decontamination and dismantling requirements for TMI-2.

4.6.3. Staffing Levels

Staffing levels are assigned by sub-period and functional area. The types of positions and staffing levels are adjusted based upon the type of activity occurring in each sub-period.

Utility staffing levels will gradually decrease after completing the removal of physical systems. Staffing levels and management support will vary based upon the amount and type of decommissioning work. Craft labor levels increase during systems removal and structure decontamination and then drop during the license termination survey period. Craft levels increase again during the site restoration period due to the work associated with structures demolition.

Security, while reduced from operating levels, is maintained throughout the decommissioning for access control, material control, and to safeguard the spent fuel. Once the fuel has been transferred to the DOE, the security organization will be further reduced.

A profile of the projected staffing level for decommissioning is provided in Table 4-2.

4.7. COMPONENT REMOVAL

4.7.1. Reactor Vessel and Internal Components

The reactor pressure vessel and internal components are assumed to be segmented for disposal in shielded, reusable transportation casks. Transportation cask specifications and transportation regulations dictate the segmentation and packaging methodology. Due to the uncertainty in the viability of disposing of the reactor vessel and internals as a self-contaminated package, segmentation is assumed as a bounding condition.

4.7.2. System Components

Reactor piping and other NSSS components will be removed. Specialized equipment will be brought in as necessary. With proper closure of all openings, access ways, and penetrations, some larger components may be use as their own shipping and burial containers.

Non-radioactive piping and components will be removed using methods appropriate for their potential contamination level. Non-contaminated piping and components will be removed using conventional dismantlement and removal processes.

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Components will be packaged and readied for transport in accordance with the intended disposition.

4.7.3. Retired Components

The estimates include the cost to dispose of:

- two retired steam generators
- one reactor coolant pump motor, and
- sections of the NSSS piping

These components are expected to be in storage at the site upon the cessation of plant operations. The components are referred to as Legacy Waste in the estimate and are processed for disposal in the same manner as described for the installed units.

4.8. CONTAMINATED CONCRETE AND METAL REMOVAL

Contaminated concrete and metal are considered waste and treated as described in Section 4.5, *Radioactive Waste*.

4.9. SPENT FUEL MANAGEMENT

Since the DOE is ultimately responsible for spent fuel disposal, the cost to dispose of spent fuel is not reflected within the estimates. However, the costs for spent fuel management are included and identified separately as "Spent Fuel Management."

Exelon assumes, for the purposes of this estimate, that the DOE will accept fuel in canisters or the DOE will incur any costs to transfer the fuel to DOE-supplied containers. Once the ISFSI is completed, the spent fuel will be packaged into approximately 46 multi-purpose containers (MPCs) over the first 3.2 years after shutdown. It is assumed that this period provides the necessary cooling for the spent fuel from the final core to meet the transport and/or storage requirements for decay heat. The estimates include the cost for the labor and equipment to transfer and load each MPC and relocate it to the ISFSI. For estimating purposes, an allowance is used to estimate the cost to transfer the fuel containers from the ISFSI onto the transport vehicle.

Given the status of the DOE spent fuel program, Exelon estimates that 2030 will be the most likely year when the DOE begins spent fuel removal from the industry. Exelon assumed that the DOE's repository will have a maximum annual capacity of receiving 3,000 metric tons of uranium from the industry (Reference 7.8) and that the repository will accept spent fuel in the order in which it was removed (oldest fuel first). Additionally, Exelon assumes that it is able to re-assign its DOE spent fuel allocations between its large fleet of units to minimize on-site storage costs.

Based on the above, spent fuel is projected to remain at TMI-1 until 2035, approximately 16.2 years after the termination of operation. Any delay in transfer of fuel to DOE or decrease in the rate of acceptance will result in spent fuel remaining at the site longer.

4.10. INDEPENDENT SPENT FUEL STORAGE INSTALLATION

4.10.1. Construction, Operation and Maintenance

Exelon has entered into a contract with a vendor for construction of an ISFSI and performing pool to pad services. The ISFSI is being constructed to support storage of all spent fuel. It is scheduled to be completed in early 2021. The ISFSI will continue to operate until such time that the transfer

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of spent fuel to the DOE can be completed. Operation and maintenance costs for the ISFSI are included as "Spent Fuel Management" expenditures in the estimates.

4.10.2. ISFSI Decommissioning

The ISFSI site and associated facilities also must have a proposed decommissioning plan. The cost estimate for decommissioning the ISFSI reflects: 1) the cost of an independent contractor performing the decommissioning activities, 2) an adequate contingency factor, and 3) the cost of meeting the criteria for unrestricted use. Appendix B provides the detailed cost estimate for the ISFSI.

4.11. SITE RESTORATION

The cost for the site restoration of non-contaminated structures has been calculated and is separately presented as "Site Restoration" expenditures in this report.

While some structures may be dismantled, and the costs included in the decontamination process, the dismantlement of the remaining site structures are included in the site restoration costs. All structures are assumed to be removed to a nominal depth of three feet below grade and the voids backfilled with clean debris then topped with soil. Bulk excavation of soil and material in the immediate vicinity of the reactor building is included to remove various duct banks, catch basins, and underground utilities that may exist. The site will then be graded to conform to the adjacent landscape and vegetation is established to inhibit erosion.

Site utility and service piping are abandoned in place and manholes are backfilled. Asphalt surfaces and facility roads, except for the site access road, will be broken up and the material used as backfill on site.

This estimate includes an allowance for the remediation of up to 40,011 cubic feet of contaminated soil at the site. The allowance is based on a review of TMI's 10 CFR 50.75(g) log. This portion of the estimate may be affected by continued plant operations and/or future regulatory actions.

4.12. SITE CONDITIONS FOLLOWING DECOMMISSIONING

Once the NRC determines that site remediation has been performed in accordance with the LTP and the final radiation survey demonstrates that the facility is suitable for release, the NRC will terminate the facility license (or amend the license if an ISFSI is still present). Building codes and environmental regulations will dictate the remaining actions in the decommissioning process.

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Table 4-1: Burial Volumes and Weights by Waste Type

Class / Type	Volume (cf)	Mass (lb)
A / Containerized	181,874	12,551,378
A / Bulk	165,902	6,547,422
B	1,252	96,000
C	518	60,743
GTCC	1,773	345,927
Total / Disposal	351,319	19,601,471
A / Processed	260,130	10,533,357

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Table 4-2: Projected Staffing Levels for SAFSTOR

Period	Description	Craft FTEs	Utility FTEs	DOC FTEs	Security FTEs	Other FTEs	Total FTEs
0a	Pre-Shutdown Planning	0.0	19.0	0.0	0.0	0.0	19.0
1a	Shutdown through Transition	0.0	169.0	0.0	136.0	0.0	305.0
1c	Limited D&D Activities	0.4	169.0	0.0	136.0	0.0	305.4
1d	Preparation for Safe Storage	1.7	169.0	0.0	136.0	0.0	306.7
2a	Dormancy with Wet Fuel	0.0	96.0	0.0	109.0	0.0	205.0
2b	Dormancy with Dry Fuel	0.0	28.0	0.0	28.0	0.0	56.0
2d	Fuel Shipping from ISFSI	0.0	28.0	0.0	28.0	0.0	56.0
2f	Dormancy with No Fuel	0.0	8.8	0.0	15.0	0.0	23.8
3a	Reactivate Site	0.0	124.0	0.0	31.3	33.0	188.3
3b	Preparations for D&D	18.2	124.0	56.0	31.2	38.3	267.8
4a	Large Component Removal	145.2	125.0	69.0	31.2	3.1	373.6
4c	Site Decontamination (no wet fuel)	69.6	118.0	67.0	31.3	5.1	291.0
4e	License Termination	78.3	47.5	36.5	12.0	4.0	178.3
5a	Site Restoration	82.9	19.5	34.0	12.0	0.4	148.8

Note: The labor hour basis for this table excludes hours for some activities (e.g., spent fuel loading and transfer) since certain costs were included in the estimate without explicitly separating out labor and other costs.

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5. SCHEDULE ESTIMATE

5.1. SCHEDULE ASSUMPTIONS

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

The work activity durations are based on adjusted actual person-hour estimates. Durations are established between several milestones in each decommissioning 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.

5.2. PROJECT SCHEDULE

The project timeline is provided in Figure 5-1, with milestone dates based on a permanently defueled date of September 30, 2019. The Zirconium Fire window is assumed to end on January 31, 2021. The fuel pool is emptied approximately 3.2 years after shutdown. Decommissioning operations are assumed to commence so that the operating license is terminated within a 60-year period from the cessation of Unit 1 operations. The ISFSI operations continue until the DOE can complete the transfer of storage casks.

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Figure 5-1: Decommissioning Timeline – SAFSTOR

Period	Sub-Period	Description	Start	End	Approx. Duration (years)
0		Pre-Shutdown	1/1/2019	9/30/2019	0.7
	0a	Pre-Shutdown Early Planning	1/1/2019	9/30/2019	0.7
1		Shutdown through Transition	10/1/2019	1/31/2021	1.3
	1a	Shutdown through Transition	10/1/2019	9/30/2020	1.0
	1c	Limited D&D Activities	10/1/2020	12/31/2020	0.2
	1d	Preparation for Safe Storage	1/1/2021	1/31/2021	0.1
2		Dormancy Phase	2/1/2021	8/3/2073	52.5
	2a	Safe Storage Dormancy with Wet Fuel	2/1/2021	12/31/2022	1.9
	2b	Safe Storage Dormancy with Dry Fuel	1/1/2023	8/31/2034	11.7
	2d	Fuel Shipping from ISFSI	9/1/2034	12/30/2035	1.3
	2f	Dormancy without Fuel Onsite	12/31/2035	8/3/2073	37.6
3		Site Reactivation and Decommissioning Preparations	8/4/2073	2/3/2075	1.5
	3a	Reactivate Site	8/4/2073	8/3/2074	1.0
	3b	Preparations for D&D	8/4/2074	2/3/2075	0.5
4		Decommissioning Operations	2/4/2075	9/29/2079	4.7
	4a	Large Component Removal	2/4/2075	6/15/2076	1.4
	4c	Site Decontamination	6/16/2076	12/29/2078	2.5
	4e	License Termination	12/30/2078	9/29/2079	0.7
5		Site Restoration	9/30/2079	9/19/2081	2.0
	5a	Site Restoration	9/30/2079	9/19/2081	2.0

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6. COST ESTIMATE

6.1. COST ESTIMATE RESULTS

The estimates presented in this document reflect the total cost to decontaminate TMI-1, manage the spent fuel until the DOE transfers it to a federal facility, dismantle the plant and restore the site for alternative use. The cost projected to place the station in safe-storage with decommissioning deferred approximately 53.8 years, is estimated to be \$1,229 million (2018 dollars). Approximately 12.9% of the total estimated cost is contingency. Costs are not inflated, escalated, or discounted over the period of expenditure (or projected lifetime of the plant).

The majority of this cost (approximately 80.4%) is associated with the physical decontamination and dismantling of the nuclear plant so that the operating license can be terminated. Another 12.7% is associated with the management, interim storage, and eventual transfer of the spent fuel. The remaining 6.9% is for the demolition of the designated structures and restoration of the site as described Section 4.11.

Table 6-1 summarizes the estimated costs for the SAFSTOR alternative reflecting the various cost elements. Table 6-2 provides yearly expenditures broken down by cost contributor. The detailed Cost Estimate is provided in Appendix A. Appendix B provides a further breakdown of the detailed cost estimate for the ISFSI.

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Table 6-1: SAFSTOR Alternative
(thousands of 2018 dollars)

Cost Element	Total
Decontamination	7,999
Removal	158,354
Packaging	21,793
Transportation	16,436
Waste Disposal	57,647
Off-Site Waste Processing	7,510
Program Management ¹	487,732
Security	193,944
System and Security Modifications	10,350
Spent Fuel Storage and Management ²	123,036
Insurance and Regulatory Fees	52,822
Energy	23,903
Characterization and Licensing Surveys	26,419
Property Taxes	13,243
Miscellaneous Equipment	27,671
Total³	1,228,858

Cost Element	Total
Site Radiological Decommissioning	980,304
ISFSI Radiological Decommissioning	7,207
Spent Fuel Management	156,408
Site Restoration	84,939
Total³	1,228,858

¹ Includes engineering costs.

² Includes costs for the dry storage system components, spent fuel loading and transfer, spent fuel pool operations and maintenance and Emergency Planning fees, but excludes program management costs (staffing), security and other related costs.

³ Columns may not add up due to rounding.

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**Table 6-2:
SAFSTOR Alternative, Unit 1
Total Annual Expenditures
(thousands of 2018 dollars)**

Year	Site Radiological Decommissioning	ISFSI Radiological Decommissioning	Spent Fuel Management	Site Restoration	Total
2019	20,203	0	27,092	0	47,295
2020	65,584	0	30,539	0	96,123
2021	45,005	0	25,039	0	70,045
2022	37,492	0	14,753	0	52,245
2023	9,945	0	121	0	10,066
2024	8,971	0	1,123	0	10,094
2025	5,972	0	4,094	0	10,066
2026	5,972	0	4,094	0	10,066
2027	5,972	0	4,094	0	10,066
2028	5,988	0	4,105	0	10,093
2029	5,972	0	4,094	0	10,066
2030	5,972	0	4,094	0	10,066
2031	5,972	0	4,094	0	10,066
2032	5,988	0	4,105	0	10,093
2033	5,972	0	4,094	0	10,066
2034	5,967	0	7,282	0	13,248
2035	5,955	0	13,591	0	19,546
2036	5,622	0	0	0	5,622
2037	5,607	0	0	0	5,607
2038	5,607	0	0	0	5,607
2039	5,607	0	0	0	5,607
2040	5,622	0	0	0	5,622
2041	5,607	0	0	0	5,607
2042	5,607	0	0	0	5,607
2043	5,607	0	0	0	5,607
2044	5,622	0	0	0	5,622
2045	5,607	0	0	0	5,607
2046	5,607	0	0	0	5,607
2047	5,607	0	0	0	5,607
2048	5,622	0	0	0	5,622
2049	5,607	0	0	0	5,607
2050	5,607	0	0	0	5,607
2051	5,607	0	0	0	5,607
2052	5,622	0	0	0	5,622
2053	5,607	0	0	0	5,607
2054	5,607	0	0	0	5,607

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**Table 6-2 (cont.):
SAFSTOR Alternative, Unit 1
Total Annual Expenditures
(thousands of 2018 dollars)**

Year	Site Radiological Decommissioning	ISFSI Radiological Decommissioning	Spent Fuel Management	Site Restoration	Total
2055	5,607	0	0	0	5,607
2056	5,622	0	0	0	5,622
2057	5,607	0	0	0	5,607
2058	5,607	0	0	0	5,607
2059	5,607	0	0	0	5,607
2060	5,622	0	0	0	5,622
2061	5,607	0	0	0	5,607
2062	5,607	0	0	0	5,607
2063	5,607	0	0	0	5,607
2064	5,622	0	0	0	5,622
2065	5,607	0	0	0	5,607
2066	5,607	0	0	0	5,607
2067	5,607	0	0	0	5,607
2068	5,622	0	0	0	5,622
2069	5,607	0	0	0	5,607
2070	5,607	0	0	0	5,607
2071	5,607	0	0	0	5,607
2072	5,622	0	0	0	5,622
2073	24,363	0	0	323	24,686
2074	60,367	0	0	1,304	61,672
2075	148,194	0	0	2,404	150,598
2076	110,540	1,547	0	1,549	113,637
2077	71,961	2,838	0	793	75,592
2078	71,804	2,822	0	789	75,415
2079	32,353	0	0	10,037	42,390
2080	131*	0	0	39,481	39,612
2081	94*	0	0	28,258	28,352
Total	980,304	7,207	156,408	84,939	1,228,858

*Radiological decommissioning completed in 2079 to meet 60-year requirement in 10 CFR 50.82(a)(3). Costs are administrative expenses associated with submitting the final report to the NRC following license termination.

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7. REFERENCES

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- 7.5. "Building Construction Cost Data with RSMeans Data 2017," (From the Gordian Group), Rockland, Massachusetts
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- 7.8. "Civilian Radioactive Waste Management System Requirements Document, DOE/RW-0406, Revision 8, September 2007

**APPENDIX A:
DETAILED COST ESTIMATE
SAFSTOR
Three Mile Island Nuclear Station
Unit 1**

**Three Mile Island Nuclear Station, Unit 1
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APPENDIX A: DETAILED COST ESTIMATE

Three Mile Island Unit 1 SAFSTOR Decommissioning Cost Estimate (thousands of 2018 dollars)												
Activity Description	Decon Costs	Removal Costs	Packaging Costs	Transport Costs	Waste Disposal Costs	Off-site Waste Processing Costs	Other Costs	Total Costs	Site Radiological Decommissioning Costs	Spent Fuel Management Costs	Site Restoration Costs	ISFSI Radiological Decommissioning Costs
Period 0a - Pre-Shutdown Early Planning												
0a.1.03 - Environmental Report	-	-	-	-	-	-	35	35	35	-	-	-
0a.1.04 - Emergency Plan Calculations	-	-	-	-	-	-	61	61	61	-	-	-
0a.1.05 - Prepare Preliminary Decommissioning Cost Estimate	-	-	-	-	-	-	-	a	-	-	-	-
0a.1.06 - Prepare and Submit PSDAR	-	-	-	-	-	-	-	a	-	-	-	-
0a.1.07 - Perform SER and EA	-	-	-	-	-	-	-	a	-	-	-	-
0a.1.08 - Perform Site-Specific Cost Study	-	-	-	-	-	-	-	a	-	-	-	-
0a.1.09 - Prepare/Submit Defueled Technical Specifications	-	-	-	-	-	-	-	a	-	-	-	-
0a.1.10 - Prepare/Submit ODCM Specifications	-	-	-	-	-	-	-	a	-	-	-	-
0a.1.11 - Prepare/Submit Irradiated Fuel Management Plan	-	-	-	-	-	-	-	a	-	-	-	-
0a.1.12 - Notification of Cessation of Operations	-	-	-	-	-	-	-	a	-	-	-	-
0a.1.13 - Fire Program Engineering and Mod/Abandonment Support	-	-	-	-	-	-	403	403	403	-	-	-
0a.2.06 - ISFSI Pad/Casks & P2P	-	-	-	-	-	-	20,319	20,319	-	20,319	-	-
0a.4.01 - Utility Staff Cost	-	-	-	-	-	-	2,856	2,856	2,856	-	-	-
0a.4.10 - NRC Fees	-	-	-	-	-	-	634	634	634	-	-	-
Total Period 0a Costs	-	-	-	-	-	-	24,308	24,308	3,989	20,319	-	-
Period 0 Costs	-	-	-	-	-	-	24,308	24,308	3,989	20,319	-	-
Period 1a - Shutdown through Transition												
1a.1.01 - SAFSTOR site characterization survey	-	-	-	-	-	-	650	650	650	-	-	-
1a.1.02 - Remove fuel & source material	-	-	-	-	-	-	-	a	-	-	-	-
1a.1.03 - Notification of Permanent Defueling	-	-	-	-	-	-	-	a	-	-	-	-
1a.1.04 - Deactivate plant systems & process waste	-	-	-	-	-	-	-	a	-	-	-	-
1a.1.05 - Review plant dwgs & specs.	-	-	-	-	-	-	-	a	-	-	-	-
1a.1.06 - Perform detailed rad survey	-	-	-	-	-	-	-	a	-	-	-	-
1a.1.07 - Estimate by-product inventory	-	-	-	-	-	-	-	a	-	-	-	-
1a.1.08 - End product description	-	-	-	-	-	-	-	a	-	-	-	-
1a.1.09 - Detailed by-product inventory	-	-	-	-	-	-	-	a	-	-	-	-
1a.1.10 - Define major work sequence	-	-	-	-	-	-	-	a	-	-	-	-
1a.1.16 - Procure vacuum drying system	-	-	-	-	-	-	-	a	-	-	-	-
1a.1.18 - Activity Specifications (SAFSTOR)	-	-	-	-	-	-	-	a	-	-	-	-
1a.1.19 - Detailed Work Procedures	-	-	-	-	-	-	-	a	-	-	-	-
1a.1.20 - Drain/de-energize non-cont. systems	-	-	-	-	-	-	-	a	-	-	-	-
1a.1.21 - Drain & dry NSSS	-	-	-	-	-	-	-	a	-	-	-	-
1a.1.22 - Drain/de-energize contaminated systems	-	-	-	-	-	-	-	a	-	-	-	-

**Three Mile Island Nuclear Station, Unit 1
Decommissioning Cost Analysis Report**

APPENDIX A: DETAILED COST ESTIMATE

Three Mile Island Unit 1 SAFSTOR Decommissioning Cost Estimate (thousands of 2018 dollars)												
Activity Description	Decon Costs	Removal Costs	Packaging Costs	Transport Costs	Waste Disposal Costs	Off-site Waste Processing Costs	Other Costs	Total Costs	Site Radiological Decommissioning Costs	Spent Fuel Management Costs	Site Restoration Costs	ISFSI Radiological Decommissioning Costs
1a.1.23 - Decon/secure contaminated systems	-	-	-	-	-	-	-	a	-	-	-	-
1a.2.03 - Fuel Sipping	-	-	-	-	-	-	1,725	1,725	1,725	-	-	-
1a.2.06 - ISFSI Pad/Casks & P2P	-	-	-	-	-	-	29,677	29,677	-	29,677	-	-
1a.4.01 - Utility Staff Cost	-	-	-	-	-	-	25,379	25,379	25,379	-	-	-
1a.4.02 - Security Staff Cost	-	-	-	-	-	-	13,337	13,337	13,337	-	-	-
1a.4.04 - Independent Corporate Oversight Organization	-	-	-	-	-	-	29	29	29	-	-	-
1a.4.05 - Insurance	-	-	-	-	-	-	1,533	1,533	1,533	-	-	-
1a.4.06 - Property Taxes	-	-	-	-	-	-	1,229	1,229	1,229	-	-	-
1a.4.07 - Plant Energy Budget	-	-	-	-	-	-	3,872	3,872	3,872	-	-	-
1a.4.08 - Heavy Equipment Rental	-	662	-	-	-	-	-	662	662	-	-	-
1a.4.09 - Emergency Planning Fees	-	-	-	-	-	-	2,032	2,032	2,032	-	-	-
1a.4.10 - NRC Fees	-	-	-	-	-	-	1,573	1,573	1,573	-	-	-
1a.4.14 - Spent Fuel Pool O&M	-	-	-	-	-	-	922	922	922	-	-	-
1a.4.15 - Health Physics Supplies	-	662	-	-	-	-	-	662	662	-	-	-
1a.4.17 - Disposal of DAW Generated	-	-	14	3	45	-	-	62	62	-	-	-
1a.4.18 - BSC Services	-	-	-	-	-	-	2,817	2,817	2,817	-	-	-
Total Period 1a Costs	-	1,324	14	3	45	-	84,776	86,161	56,484	29,677	-	-
Period 1c - Limited D&D Activities												
1c.2.02 - System and Security Modifications	-	-	-	-	-	-	10,350	10,350	10,350	-	-	-
1c.2.06 - ISFSI Pad/Casks & P2P	-	-	-	-	-	-	7,635	7,635	-	7,635	-	-
1c.3.03 - Process decommissioning water waste	249	-	107	464	478	-	-	1,298	1,298	-	-	-
1c.3.05 - Small tool allowance	-	176	-	-	-	-	-	176	176	-	-	-
1c.4.01 - Utility Staff Cost	-	-	-	-	-	-	6,393	6,393	6,393	-	-	-
1c.4.02 - Security Staff Cost	-	-	-	-	-	-	3,373	3,373	3,373	-	-	-
1c.4.04 - Independent Corporate Oversight Organization	-	-	-	-	-	-	7	7	7	-	-	-
1c.4.05 - Insurance	-	-	-	-	-	-	385	385	385	-	-	-
1c.4.06 - Property Taxes	-	-	-	-	-	-	309	309	309	-	-	-
1c.4.07 - Plant Energy Budget	-	-	-	-	-	-	973	973	973	-	-	-
1c.4.08 - Heavy Equipment Rental	-	166	-	-	-	-	-	166	166	-	-	-
1c.4.09 - Emergency Planning Fees	-	-	-	-	-	-	511	511	511	-	-	-
1c.4.10 - NRC Fees	-	-	-	-	-	-	182	182	182	-	-	-
1c.4.14 - Spent Fuel Pool O&M	-	-	-	-	-	-	232	232	232	-	-	-
1c.4.15 - Health Physics Supplies	-	854	-	-	-	-	-	854	854	-	-	-
1c.4.17 - Disposal of DAW Generated	-	-	11	3	38	-	-	52	52	-	-	-
1c.4.18 - BSC Services	-	-	-	-	-	-	708	708	708	-	-	-

**Three Mile Island Nuclear Station, Unit 1
Decommissioning Cost Analysis Report**

APPENDIX A: DETAILED COST ESTIMATE

Three Mile Island Unit 1 SAFSTOR Decommissioning Cost Estimate (thousands of 2018 dollars)												
Activity Description	Decon Costs	Removal Costs	Packaging Costs	Transport Costs	Waste Disposal Costs	Off-site Waste Processing Costs	Other Costs	Total Costs	Site Radiological Decommissioning Costs	Spent Fuel Management Costs	Site Restoration Costs	ISFSI Radiological Decommissioning Costs
Total Period 1c Costs	249	1,196	119	466	515	-	31,058	33,604	25,969	7,635	-	-
Period 1d - Preparation for Safe Storage												
1d.1.04 - Secure building accesses	-	-	-	-	-	-	-	a	-	-	-	-
1d.1.05 - Prepare & submit interim report	-	-	-	-	-	-	-	a	-	-	-	-
1d.2.01 - Severance	-	-	-	-	-	-	3,361	3,361	3,361	-	-	-
1d.2.06 - ISFSI Pad/Casks & P2P	-	-	-	-	-	-	2,077	2,077	-	2,077	-	-
1d.3.03 - Process decommissioning water waste	359	-	155	669	689	-	-	1,872	1,872	-	-	-
1d.3.05 - Small tool allowance	-	5	-	-	-	-	-	5	5	-	-	-
1d.4.01 - Utility Staff Cost	-	-	-	-	-	-	2,232	2,232	2,232	-	-	-
1d.4.02 - Security Staff Cost	-	-	-	-	-	-	1,175	1,175	1,175	-	-	-
1d.4.04 - Independent Corporate Oversight Organization	-	-	-	-	-	-	2	2	2	-	-	-
1d.4.05 - Insurance	-	-	-	-	-	-	130	130	130	-	-	-
1d.4.06 - Property Taxes	-	-	-	-	-	-	104	104	104	-	-	-
1d.4.07 - Plant Energy Budget	-	-	-	-	-	-	328	328	328	-	-	-
1d.4.08 - Heavy Equipment Rental	-	56	-	-	-	-	-	56	56	-	-	-
1d.4.09 - Emergency Planning Fees	-	-	-	-	-	-	172	172	172	-	-	-
1d.4.10 - NRC Fees	-	-	-	-	-	-	61	61	61	-	-	-
1d.4.14 - Spent Fuel Pool O&M	-	-	-	-	-	-	78	78	78	-	-	-
1d.4.15 - Health Physics Supplies	-	256	-	-	-	-	-	256	256	-	-	-
1d.4.17 - Disposal of DAW Generated	-	-	3	1	11	-	-	16	16	-	-	-
1d.4.18 - BSC Services	-	-	-	-	-	-	128	128	128	-	-	-
Total Period 1d Costs	359	317	158	670	700	-	9,850	12,055	9,977	2,077	-	-
Period 1 Costs	608	2,837	291	1,139	1,261	-	125,684	131,820	92,430	39,389	-	-
Period 2a - Safe Storage Dormancy with Wet Fuel												
2a.1.01 - Quarterly Inspection	-	-	-	-	-	-	-	a	-	-	-	-
2a.1.02 - Semi-annual environmental survey	-	-	-	-	-	-	-	a	-	-	-	-
2a.1.03 - Prepare reports	-	-	-	-	-	-	-	a	-	-	-	-
2a.1.04 - Bituminous roof replacement	-	-	-	-	-	-	360	360	360	-	-	-
2a.1.05 - Maintenance supplies	-	-	-	-	-	-	306	306	306	-	-	-
2a.2.01 - Severance	-	-	-	-	-	-	5,088	5,088	5,088	-	-	-
2a.2.06 - ISFSI Pad/Casks & P2P	-	-	-	-	-	-	37,483	37,483	-	37,483	-	-
2a.4.01 - Utility Staff Cost	-	-	-	-	-	-	27,952	27,952	27,952	-	-	-
2a.4.02 - Security Staff Cost	-	-	-	-	-	-	21,035	21,035	21,035	-	-	-

**Three Mile Island Nuclear Station, Unit 1
Decommissioning Cost Analysis Report**

APPENDIX A: DETAILED COST ESTIMATE

Three Mile Island Unit 1 SAFSTOR Decommissioning Cost Estimate (thousands of 2018 dollars)												
Activity Description	Decon Costs	Removal Costs	Packaging Costs	Transport Costs	Waste Disposal Costs	Off-site Waste Processing Costs	Other Costs	Total Costs	Site Radiological Decommissioning Costs	Spent Fuel Management Costs	Site Restoration Costs	ISFSI Radiological Decommissioning Costs
2a.4.04 - Independent Corporate Oversight Organization	-	-	-	-	-	-	55	55	55	-	-	-
2a.4.05 - Insurance	-	-	-	-	-	-	1,021	1,021	1,021	-	-	-
2a.4.06 - Property Taxes	-	-	-	-	-	-	1,733	1,733	1,733	-	-	-
2a.4.07 - Plant Energy Budget	-	-	-	-	-	-	5,379	5,379	5,379	-	-	-
2a.4.09 - Emergency Planning Fees	-	-	-	-	-	-	2,576	2,576	2,576	-	-	-
2a.4.10 - NRC Fees	-	-	-	-	-	-	553	553	553	-	-	-
2a.4.12 - ISFSI Operating Costs	-	-	-	-	-	-	232	232	-	232	-	-
2a.4.14 - Spent Fuel Pool O&M	-	-	-	-	-	-	1,760	1,760	1,760	-	-	-
2a.4.15 - Health Physics Supplies	-	1,063	-	-	-	-	-	1,063	1,063	-	-	-
2a.4.17 - Disposal of DAW Generated	-	-	21	5	68	-	-	94	94	-	-	-
2a.4.18 - BSC Services	-	-	-	-	-	-	2,890	2,890	2,890	-	-	-
Total Period 2a Costs	-	1,063	21	5	68	-	108,422	109,579	71,864	37,715	-	-
Period 2b - Safe Storage Dormancy with Dry Fuel												
2b.1.01 - Quarterly Inspection	-	-	-	-	-	-	-	a	-	-	-	-
2b.1.02 - Semi-annual environmental survey	-	-	-	-	-	-	-	a	-	-	-	-
2b.1.03 - Prepare reports	-	-	-	-	-	-	-	a	-	-	-	-
2b.1.04 - Bituminous roof replacement	-	-	-	-	-	-	2,194	2,194	2,194	-	-	-
2b.1.05 - Maintenance supplies	-	-	-	-	-	-	1,866	1,866	1,866	-	-	-
2b.4.01 - Utility Staff Cost	-	-	-	-	-	-	53,583	53,583	25,454	28,129	-	-
2b.4.02 - Security Staff Cost	-	-	-	-	-	-	38,443	38,443	27,150	11,293	-	-
2b.4.04 - Independent Corporate Oversight Organization	-	-	-	-	-	-	335	335	335	-	-	-
2b.4.05 - Insurance	-	-	-	-	-	-	6,223	6,223	6,223	-	-	-
2b.4.06 - Property Taxes	-	-	-	-	-	-	2,103	2,103	2,103	-	-	-
2b.4.07 - Plant Energy Budget	-	-	-	-	-	-	1,230	1,230	1,230	-	-	-
2b.4.10 - NRC Fees	-	-	-	-	-	-	3,201	3,201	3,201	-	-	-
2b.4.12 - ISFSI Operating Costs	-	-	-	-	-	-	1,415	1,415	-	1,415	-	-
2b.4.15 - Health Physics Supplies	-	1,712	-	-	-	-	-	1,712	1,712	-	-	-
2b.4.17 - Disposal of DAW Generated	-	-	33	8	109	-	-	149	149	-	-	-
2b.4.18 - BSC Services	-	-	-	-	-	-	5,054	5,054	5,054	-	-	-
Total Period 2b Costs	-	1,712	33	8	109	-	115,647	117,508	76,671	40,837	-	-
Period 2d - Fuel Shipping from ISFSI												
2d.1.01 - Quarterly Inspection	-	-	-	-	-	-	-	a	-	-	-	-
2d.1.02 - Semi-annual environmental survey	-	-	-	-	-	-	-	a	-	-	-	-

**Three Mile Island Nuclear Station, Unit 1
Decommissioning Cost Analysis Report**

APPENDIX A: DETAILED COST ESTIMATE

Three Mile Island Unit 1 SAFSTOR Decommissioning Cost Estimate (thousands of 2018 dollars)												
Activity Description	Decon Costs	Removal Costs	Packaging Costs	Transport Costs	Waste Disposal Costs	Off-site Waste Processing Costs	Other Costs	Total Costs	Site Radiological Decommissioning Costs	Spent Fuel Management Costs	Site Restoration Costs	ISFSI Radiological Decommissioning Costs
2d.1.03 - Prepare reports	-	-	-	-	-	-	-	a	-	-	-	-
2d.1.04 - Bituminous roof replacement	-	-	-	-	-	-	250	250	250	-	-	-
2d.1.05 - Maintenance supplies	-	-	-	-	-	-	213	213	213	-	-	-
2d.2.01 - Severance	-	-	-	-	-	-	909	909	-	909	-	-
2d.3.01 - Spent Fuel Capital and Transfer	-	-	-	-	-	-	11,788	11,788	-	11,788	-	-
2d.4.01 - Utility Staff Cost	-	-	-	-	-	-	6,112	6,112	2,337	3,774	-	-
2d.4.02 - Security Staff Cost	-	-	-	-	-	-	4,385	4,385	2,869	1,515	-	-
2d.4.04 - Independent Corporate Oversight Organization	-	-	-	-	-	-	38	38	38	-	-	-
2d.4.05 - Insurance	-	-	-	-	-	-	710	710	710	-	-	-
2d.4.06 - Property Taxes	-	-	-	-	-	-	220	220	220	-	-	-
2d.4.07 - Plant Energy Budget	-	-	-	-	-	-	140	140	140	-	-	-
2d.4.10 - NRC Fees	-	-	-	-	-	-	365	365	365	-	-	-
2d.4.12 - ISFSI Operating Costs	-	-	-	-	-	-	161	161	-	161	-	-
2d.4.15 - Health Physics Supplies	-	195	-	-	-	-	-	195	195	-	-	-
2d.4.17 - Disposal of DAW Generated	-	-	4	1	12	-	-	17	17	-	-	-
2d.4.18 - BSC Services	-	-	-	-	-	-	576	576	576	-	-	-
Total Period 2d Costs	-	195	4	1	12	-	25,866	26,079	7,931	18,147	-	-
Period 2f - Dormancy without Fuel Onsite												
2f.1.01 - Quarterly Inspection	-	-	-	-	-	-	-	a	-	-	-	-
2f.1.02 - Semi-annual environmental survey	-	-	-	-	-	-	-	a	-	-	-	-
2f.1.03 - Prepare reports	-	-	-	-	-	-	-	a	-	-	-	-
2f.1.04 - Bituminous roof replacement	-	-	-	-	-	-	7,069	7,069	7,069	-	-	-
2f.1.05 - Maintenance supplies	-	-	-	-	-	-	6,013	6,013	6,013	-	-	-
2f.4.01 - Utility Staff Cost	-	-	-	-	-	-	69,035	69,035	69,035	-	-	-
2f.4.02 - Security Staff Cost	-	-	-	-	-	-	84,756	84,756	84,756	-	-	-
2f.4.05 - Insurance	-	-	-	-	-	-	20,053	20,053	20,053	-	-	-
2f.4.06 - Property Taxes	-	-	-	-	-	-	6,203	6,203	6,203	-	-	-
2f.4.07 - Plant Energy Budget	-	-	-	-	-	-	3,962	3,962	3,962	-	-	-
2f.4.10 - NRC Fees	-	-	-	-	-	-	9,405	9,405	9,405	-	-	-
2f.4.15 - Health Physics Supplies	-	4,070	-	-	-	-	-	4,070	4,070	-	-	-
2f.4.17 - Disposal of DAW Generated	-	-	76	19	253	-	-	348	348	-	-	-
Total Period 2f Costs	-	4,070	76	19	253	-	206,496	210,914	210,914	-	-	-
Period 2 Costs	-	7,041	133	33	442	-	456,431	464,079	367,380	96,699	-	-

**Three Mile Island Nuclear Station, Unit 1
Decommissioning Cost Analysis Report**

APPENDIX A: DETAILED COST ESTIMATE

Three Mile Island Unit 1 SAFSTOR Decommissioning Cost Estimate (thousands of 2018 dollars)												
Activity Description	Decon Costs	Removal Costs	Packaging Costs	Transport Costs	Waste Disposal Costs	Off-site Waste Processing Costs	Other Costs	Total Costs	Site Radiological Decommissioning Costs	Spent Fuel Management Costs	Site Restoration Costs	ISFSI Radiological Decommissioning Costs
Period 3a - Reactivate Site												
3a.1.01 - Prepare preliminary decommissioning cost	-	-	-	-	-	-	215	215	215	-	-	-
3a.1.02 - Review plant dwgs & specs.	-	-	-	-	-	-	759	759	759	-	-	-
3a.1.03 - Perform detailed rad survey	-	-	-	-	-	-	-	a	-	-	-	-
3a.1.04 - End product description	-	-	-	-	-	-	165	165	165	-	-	-
3a.1.05 - Detailed by-product inventory	-	-	-	-	-	-	215	215	215	-	-	-
3a.1.06 - Define major work sequence	-	-	-	-	-	-	1,238	1,238	1,238	-	-	-
3a.1.07 - Perform SER and EA	-	-	-	-	-	-	512	512	512	-	-	-
3a.1.08 - Perform Site-Specific Cost Study	-	-	-	-	-	-	825	825	825	-	-	-
3a.1.11 - Prepare dismantling sequence	-	-	-	-	-	-	396	396	396	-	-	-
3a.1.12 - Plant prep. & temp. svces	-	-	-	-	-	-	3,903	3,903	3,903	-	-	-
3a.1.13 - Design water clean-up system	-	-	-	-	-	-	231	231	231	-	-	-
3a.1.14 - Rigging/Cont. Cntrl Envlp/tooling/etc.	-	-	-	-	-	-	2,645	2,645	2,645	-	-	-
3a.1.15 - Procure casks/liners & containers	-	-	-	-	-	-	203	203	203	-	-	-
3a.1.17 - Activity Specifications	-	-	-	-	-	-	6,565	6,565	5,778	-	786	-
3a.4.01 - Utility Staff Cost	-	-	-	-	-	-	25,995	25,995	25,995	-	-	-
3a.4.02 - Security Staff Cost	-	-	-	-	-	-	4,194	4,194	4,194	-	-	-
3a.4.05 - Insurance	-	-	-	-	-	-	533	533	533	-	-	-
3a.4.06 - Property Taxes	-	-	-	-	-	-	165	165	165	-	-	-
3a.4.07 - Plant Energy Budget	-	-	-	-	-	-	1,587	1,587	1,587	-	-	-
3a.4.08 - Heavy Equipment Rental	-	660	-	-	-	-	-	660	660	-	-	-
3a.4.10 - NRC Fees	-	-	-	-	-	-	385	385	385	-	-	-
3a.4.15 - Health Physics Supplies	-	579	-	-	-	-	-	579	579	-	-	-
3a.4.17 - Disposal of DAW Generated	-	-	11	3	38	-	-	52	52	-	-	-
Total Period 3a Costs	-	1,239	11	3	38	-	50,729	52,020	51,234	-	786	-
Period 3b - Preparations for D&D												
3b.1.01 - Detailed Work Procedures	-	-	-	-	-	-	5,321	5,321	4,289	-	1,032	-
3b.2.02 - Site Characterization	-	-	-	-	-	-	4,657	4,657	4,657	-	-	-
3b.3.02 - Decon Equipment	1,052	-	-	-	-	-	-	1,052	1,052	-	-	-
3b.3.06 - DOC staff relocation expenses	-	-	-	-	-	-	1,762	1,762	1,762	-	-	-
3b.3.07 - Pipe cutting equipment	-	1,380	-	-	-	-	-	1,380	1,380	-	-	-
3b.4.01 - Utility Staff Cost	-	-	-	-	-	-	13,104	13,104	13,104	-	-	-
3b.4.02 - Security Staff Cost	-	-	-	-	-	-	2,114	2,114	2,114	-	-	-
3b.4.03 - DOC Staff Cost	-	-	-	-	-	-	6,606	6,606	6,606	-	-	-
3b.4.05 - Insurance	-	-	-	-	-	-	269	269	269	-	-	-

**Three Mile Island Nuclear Station, Unit 1
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APPENDIX A: DETAILED COST ESTIMATE

Three Mile Island Unit 1 SAFSTOR Decommissioning Cost Estimate (thousands of 2018 dollars)												
Activity Description	Decon Costs	Removal Costs	Packaging Costs	Transport Costs	Waste Disposal Costs	Off-site Waste Processing Costs	Other Costs	Total Costs	Site Radiological Decommissioning Costs	Spent Fuel Management Costs	Site Restoration Costs	ISFSI Radiological Decommissioning Costs
3b.4.06 - Property Taxes	-	-	-	-	-	-	83	83	83	-	-	-
3b.4.07 - Plant Energy Budget	-	-	-	-	-	-	800	800	800	-	-	-
3b.4.08 - Heavy Equipment Rental	-	333	-	-	-	-	-	333	333	-	-	-
3b.4.10 - NRC Fees	-	-	-	-	-	-	194	194	194	-	-	-
3b.4.15 - Health Physics Supplies	-	320	-	-	-	-	-	320	320	-	-	-
3b.4.16 - Decon Supplies	44	-	-	-	-	-	-	44	44	-	-	-
3b.4.17 - Disposal of DAW Generated	-	-	7	2	22	-	-	30	30	-	-	-
Total Period 3b Costs	1,096	2,032	7	2	22	-	34,910	38,069	37,037	-	1,032	-
Period 3 Costs	1,096	3,271	18	4	60	-	85,639	90,088	88,270	-	1,818	-
Period 4a - Large Component Removal												
4a.1.01 - Nuclear Steam Supply System Removal	293	33,713	17,582	8,918	38,965	40	715	100,226	100,226	-	-	-
4a.1.02 - Removal of Major Equipment	-	2,271	269	66	-	386	-	2,993	2,993	-	-	-
4a.1.03 - Scaffolding in support of decommissioning	-	1,266	15	5	5	19	-	1,310	1,310	-	-	-
4a.1.04 - Disposal of Plant Systems	-	12,124	376	886	303	4,601	-	18,289	14,995	-	3,294	-
4a.1.05 - Cascading Costs from Clean Building Demolition	-	919	-	-	-	-	-	919	919	-	-	-
4a.2.02 - Remedial Action Surveys	-	-	-	-	-	-	2,447	2,447	2,447	-	-	-
4a.2.05 - Legacy Waste	69	48	152	88	243	-	-	599	599	-	-	-
4a.2.06 - Turbine Bldg. GIC Waste Disposal	-	-	-	64	-	324	-	388	388	-	-	-
4a.2.08 - Asbestos Abatement	-	9,761	29	915	2,881	-	-	13,585	13,585	-	-	-
4a.3.03 - Process decommissioning water waste	7	-	8	34	35	-	-	84	84	-	-	-
4a.3.05 - Small tool allowance	-	359	-	-	-	-	-	359	323	-	36	-
4a.4.01 - Utility Staff Cost	-	-	-	-	-	-	35,887	35,887	35,887	-	-	-
4a.4.02 - Security Staff Cost	-	-	-	-	-	-	5,723	5,723	5,723	-	-	-
4a.4.03 - DOC Staff Cost	-	-	-	-	-	-	21,668	21,668	21,668	-	-	-
4a.4.04 - Independent Corporate Oversight Organization	-	-	-	-	-	-	39	39	39	-	-	-
4a.4.05 - Insurance	-	-	-	-	-	-	727	727	727	-	-	-
4a.4.06 - Property Taxes	-	-	-	-	-	-	225	225	225	-	-	-
4a.4.07 - Plant Energy Budget	-	-	-	-	-	-	2,057	2,057	2,057	-	-	-
4a.4.08 - Heavy Equipment Rental	-	3,485	-	-	-	-	-	3,485	3,485	-	-	-
4a.4.10 - NRC Fees	-	-	-	-	-	-	859	859	859	-	-	-
4a.4.13 - Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	645	645	645	-	-	-
4a.4.15 - Health Physics Supplies	-	2,875	-	-	-	-	-	2,875	2,875	-	-	-
4a.4.16 - Decon Supplies	121	-	-	-	-	-	-	121	121	-	-	-
4a.4.17 - Disposal of DAW Generated	-	-	103	25	341	-	-	470	470	-	-	-

**Three Mile Island Nuclear Station, Unit 1
Decommissioning Cost Analysis Report**

APPENDIX A: DETAILED COST ESTIMATE

Three Mile Island Unit 1 SAFSTOR Decommissioning Cost Estimate (thousands of 2018 dollars)												
Activity Description	Decon Costs	Removal Costs	Packaging Costs	Transport Costs	Waste Disposal Costs	Off-site Waste Processing Costs	Other Costs	Total Costs	Site Radiological Decommissioning Costs	Spent Fuel Management Costs	Site Restoration Costs	ISFSI Radiological Decommissioning Costs
Total Period 4a Costs	489	66,821	18,534	11,000	42,773	5,371	70,991	215,980	212,650	-	3,330	-
Period 4c - Site Decontamination												
4c.1.01 - Prepare/submit License Termination Plan	-	-	-	-	-	-	676	676	676	-	-	-
4c.1.02 - Receive NRC approval of termination plan	-	-	-	-	-	-	-	a	-	-	-	-
4c.1.03 - Scaffolding in support of decommissioning	-	1,900	23	7	7	29	-	1,966	1,966	-	-	-
4c.1.04 - Disposal of Plant Systems	-	14,425	1,920	2,039	5,649	1,639	-	25,671	23,656	-	2,015	-
4c.1.05 - Decontamination of Site Buildings	3,574	2,046	183	629	1,288	71	-	7,792	7,792	-	-	-
4c.1.06 - Remove spent fuel racks	637	73	182	112	359	-	-	1,364	1,364	-	-	-
4c.2.02 - Remedial Action Surveys	-	-	-	-	-	-	4,555	4,555	4,555	-	-	-
4c.2.03 - Operational Tools & Equipment	-	-	19	49	-	209	-	277	277	-	-	-
4c.2.04 - Contaminated Soil Remediation	-	74	59	257	2,984	-	-	3,375	3,375	-	-	-
4c.2.05 - Underground Services Excavation	-	1,749	-	-	-	-	-	1,749	1,749	-	-	-
4c.2.06 - License Termination Survey Planning	-	-	-	-	-	-	2,753	2,753	2,753	-	-	-
4c.2.07 - License Termination ISFSI	-	162	139	976	2,287	-	3,643	7,207	-	-	-	7,207
4c.3.03 - Process decommissioning water waste	19	-	22	94	97	-	-	232	232	-	-	-
4c.3.05 - Small tool allowance	-	349	-	-	-	-	-	349	349	-	-	-
4c.3.08 - Decommissioning Equipment Disposition	-	-	151	53	48	193	-	445	445	-	-	-
4c.4.01 - Utility Staff Cost	-	-	-	-	-	-	63,315	63,315	63,315	-	-	-
4c.4.02 - Security Staff Cost	-	-	-	-	-	-	10,652	10,652	10,652	-	-	-
4c.4.03 - DOC Staff Cost	-	-	-	-	-	-	39,348	39,348	39,348	-	-	-
4c.4.04 - Independent Corporate Oversight Organization	-	-	-	-	-	-	73	73	73	-	-	-
4c.4.05 - Insurance	-	-	-	-	-	-	1,354	1,354	1,354	-	-	-
4c.4.06 - Property Taxes	-	-	-	-	-	-	419	419	419	-	-	-
4c.4.07 - Plant Energy Budget	-	-	-	-	-	-	3,023	3,023	3,023	-	-	-
4c.4.08 - Heavy Equipment Rental	-	6,671	-	-	-	-	-	6,671	6,671	-	-	-
4c.4.10 - NRC Fees	-	-	-	-	-	-	1,598	1,598	1,598	-	-	-
4c.4.13 - Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	-	1,201	1,201	1,201	-	-	-
4c.4.15 - Health Physics Supplies	-	3,846	-	-	-	-	-	3,846	3,846	-	-	-
4c.4.16 - Decon Supplies	1,576	-	-	-	-	-	-	1,576	1,576	-	-	-
4c.4.17 - Disposal of DAW Generated	-	-	110	27	366	-	-	503	503	-	-	-
Total Period 4c Costs	5,806	31,295	2,810	4,244	13,086	2,139	132,611	191,991	182,769	-	2,015	7,207
Period 4e - License Termination												
4e.1.01 - ORISE confirmatory survey	-	-	-	-	-	-	227	227	227	-	-	-
4e.1.02 - Terminate license	-	-	-	-	-	-	-	a	-	-	-	-

**Three Mile Island Nuclear Station, Unit 1
Decommissioning Cost Analysis Report**

APPENDIX A: DETAILED COST ESTIMATE

Three Mile Island Unit 1 SAFSTOR Decommissioning Cost Estimate (thousands of 2018 dollars)												
Activity Description	Decon Costs	Removal Costs	Packaging Costs	Transport Costs	Waste Disposal Costs	Off-site Waste Processing Costs	Other Costs	Total Costs	Site Radiological Decommissioning Costs	Spent Fuel Management Costs	Site Restoration Costs	ISFSI Radiological Decommissioning Costs
4e.2.01 - Severance	-	-	-	-	-	-	999	999	999	-	-	-
4e.2.02 - License Termination Survey	-	-	-	-	-	-	11,130	11,130	11,130	-	-	-
4e.3.06 - DOC staff relocation expenses	-	-	-	-	-	-	1,762	1,762	1,762	-	-	-
4e.4.01 - Utility Staff Cost	-	-	-	-	-	-	8,251	8,251	8,251	-	-	-
4e.4.02 - Security Staff Cost	-	-	-	-	-	-	1,310	1,310	1,310	-	-	-
4e.4.03 - DOC Staff Cost	-	-	-	-	-	-	6,727	6,727	6,727	-	-	-
4e.4.04 - Independent Corporate Oversight Organization	-	-	-	-	-	-	22	22	22	-	-	-
4e.4.05 - Insurance	-	-	-	-	-	-	400	400	400	-	-	-
4e.4.06 - Property Taxes	-	-	-	-	-	-	124	124	124	-	-	-
4e.4.07 - Plant Energy Budget	-	-	-	-	-	-	238	238	238	-	-	-
4e.4.10 - NRC Fees	-	-	-	-	-	-	473	473	473	-	-	-
4e.4.15 - Health Physics Supplies	-	860	-	-	-	-	-	860	860	-	-	-
4e.4.17 - Disposal of DAW Generated	-	-	8	2	26	-	-	36	36	-	-	-
Total Period 4e Costs	-	860	8	2	26	-	31,662	32,558	32,558	-	-	-
Period 4 Costs	6,295	98,977	21,351	15,246	55,885	7,510	235,265	440,529	427,977	-	5,345	7,207
Period 5a - Site Restoration												
5a.1.01 - Site Closeout Activities	-	1,022	-	-	-	-	257	1,280	257	-	1,022	-
5a.1.05 - Demolition of Remaining Site Buildings	-	22,715	-	-	-	-	-	22,715	-	-	22,715	-
5a.2.02 - Concrete Crushing	-	1,595	-	13	-	-	-	1,608	-	-	1,608	-
5a.2.03 - Construction Debris	-	135	-	-	-	-	-	135	-	-	135	-
5a.2.04 - Demolition and Site Restoration ISFSI	-	2,091	-	-	-	-	323	2,415	-	-	2,415	-
5a.2.05 - Intake Cofferdam	-	425	-	-	-	-	-	425	-	-	425	-
5a.2.07 - Cooling Tower Demolition	-	10,702	-	-	-	-	1,007	11,709	-	-	11,709	-
5a.3.05 - Small tool allowance	-	315	-	-	-	-	-	315	-	-	315	-
5a.4.01 - Utility Staff Cost	-	-	-	-	-	-	8,939	8,939	-	-	8,939	-
5a.4.02 - Security Staff Cost	-	-	-	-	-	-	3,447	3,447	-	-	3,447	-
5a.4.03 - DOC Staff Cost	-	-	-	-	-	-	17,180	17,180	-	-	17,180	-
5a.4.06 - Property Taxes	-	-	-	-	-	-	326	326	-	-	326	-
5a.4.07 - Plant Energy Budget	-	-	-	-	-	-	313	313	-	-	313	-
5a.4.08 - Heavy Equipment Rental	-	7,228	-	-	-	-	-	7,228	-	-	7,228	-
Total Period 5a Costs	-	46,228	-	13	-	-	31,793	78,033	257	-	77,776	-
Period 5 Costs	-	46,228	-	13	-	-	31,793	78,033	257	-	77,776	-

**Three Mile Island Nuclear Station, Unit 1
Decommissioning Cost Analysis Report**

APPENDIX A: DETAILED COST ESTIMATE

Three Mile Island Unit 1 SAFSTOR Decommissioning Cost Estimate (thousands of 2018 dollars)												
Activity Description	Decon Costs	Removal Costs	Packaging Costs	Transport Costs	Waste Disposal Costs	Off-site Waste Processing Costs	Other Costs	Total Costs	Site Radiological Decommissioning Costs	Spent Fuel Management Costs	Site Restoration Costs	ISFSI Radiological Decommissioning Costs
Total Costs to Decommission	7,999	158,354	21,793	16,436	57,647	7,510	959,119	1,228,858	980,304	156,408	84,939	7,207

End Notes:
 All costs are shown in thousands of 2018 \$s
 a – indicates that this activity is performed by decommissioning staff
 A cell containing “-” indicates a zero value

**APPENDIX B:
ISFSI DECOMMISSIONING COST ESTIMATE
Three Mile Island Nuclear Station
Unit 1**

**Three Mile Island Nuclear Station, Unit 1
Decommissioning Cost Analysis Report**

APPENDIX B: ISFSI DECOMMISSIONING COST ESTIMATE

Activity Description	Removal Costs	Packaging Costs	Transport Costs	LLRW Disposal Costs	Other Costs	Total Costs**	Burial Volume Class A (ft ³)	Craft Manhours	Oversight and Contractor Manhours
Decommissioning Contractor									
Planning (characterization, specs, and procedures)					246	246			1,024
Decontamination	129	112	781	1,829	42	2,894	30,626	1,312	
License Termination (radiological surveys)					1,170	1,170		8,824	
Subtotal	129	112	781	1,829	1,458	4,309	30,626	10,136	1,024
Supporting Costs									
NRC and NRC Contractor Fees and Costs					379	379			776
Insurance					68	68			
Property Taxes					338	338			
Plant Energy Budget					47	47			
Security Staff Cost					266	266			4,958
Oversight Staff Cost					358	358			3,761
Subtotal					1,456	1,456			9,495
Total (w/o contingency)	129	112	781	1,829	2,914	5,765	30,626	10,136	10,519
Total (w/25% contingency)	162	139	976	2,287	3,642	7,207			

*Costs in thousands of 2018 dollars

**Total Costs may not add due to rounding

Attachment 2:

Three Mile Island Nuclear Station – Unit 1

Annual Decommissioning Fund Cash Flow

Attachment 2:**Three Mile Island Nuclear Station – Unit 1
Annual Decommissioning Fund Cash Flow**

(December 31, 2018 dollars, thousands)

Year	Radiological Decommissioning Cost	BOY Trust Fund Value^(b)	BOY Trust Fund Value Less Cost	Trust Fund Earnings^(c)	EOY Trust Fund Value
2019	\$20,490	\$669,617	\$649,127	\$12,983	\$662,110
2020	\$66,516	\$662,110	\$595,594	\$11,912	\$607,505
2021	\$45,645	\$607,505	\$561,860	\$11,237	\$573,098
2022	\$38,025	\$573,098	\$535,073	\$10,701	\$545,774
2023	\$10,086	\$545,774	\$535,688	\$10,714	\$546,402
2024	\$9,099	\$546,402	\$537,303	\$10,746	\$548,049
2025	\$6,057	\$548,049	\$541,992	\$10,840	\$552,832
2026	\$6,057	\$552,832	\$546,775	\$10,936	\$557,711
2027	\$6,057	\$557,711	\$551,654	\$11,033	\$562,687
2028	\$6,073	\$562,687	\$556,614	\$11,132	\$567,746
2029	\$6,057	\$567,746	\$561,689	\$11,234	\$572,923
2030	\$6,057	\$572,923	\$566,866	\$11,337	\$578,203
2031	\$6,057	\$578,203	\$572,146	\$11,443	\$583,589
2032	\$6,073	\$583,589	\$577,516	\$11,550	\$589,066
2033	\$6,057	\$589,066	\$583,009	\$11,660	\$594,670
2034	\$6,052	\$594,670	\$588,618	\$11,772	\$600,390
2035	\$6,040	\$600,390	\$594,351	\$11,887	\$606,238
2036	\$5,702	\$606,238	\$600,536	\$12,011	\$612,546
2037	\$5,686	\$612,546	\$606,860	\$12,137	\$618,997
2038	\$5,686	\$618,997	\$613,311	\$12,266	\$625,577
2039	\$5,686	\$625,577	\$619,891	\$12,398	\$632,289
2040	\$5,702	\$632,289	\$626,587	\$12,532	\$639,119
2041	\$5,686	\$639,119	\$633,432	\$12,669	\$646,101
2042	\$5,686	\$646,101	\$640,415	\$12,808	\$653,223
2043	\$5,686	\$653,223	\$647,537	\$12,951	\$660,488
2044	\$5,702	\$660,488	\$654,786	\$13,096	\$667,881
2045	\$5,686	\$667,881	\$662,195	\$13,244	\$675,439
2046	\$5,686	\$675,439	\$669,753	\$13,395	\$683,148
2047	\$5,686	\$683,148	\$677,462	\$13,549	\$691,011
2048	\$5,702	\$691,011	\$685,309	\$13,706	\$699,015
2049	\$5,686	\$699,015	\$693,329	\$13,867	\$707,195
2050	\$5,686	\$707,195	\$701,509	\$14,030	\$715,539
2051	\$5,686	\$715,539	\$709,853	\$14,197	\$724,050

Attachment 2:

**Three Mile Island Nuclear Station – Unit 1
Annual Decommissioning Fund Cash Flow**

(December 31, 2018 dollars, thousands)

Year	Radiological Decommissioning Cost	BOY Trust Fund Value^(b)	BOY Trust Fund Value Less Cost	Trust Fund Earnings^(c)	EOY Trust Fund Value
2052	\$5,702	\$724,050	\$718,348	\$14,367	\$732,715
2053	\$5,686	\$732,715	\$727,029	\$14,541	\$741,570
2054	\$5,686	\$741,570	\$735,883	\$14,718	\$750,601
2055	\$5,686	\$750,601	\$744,915	\$14,898	\$759,813
2056	\$5,702	\$759,813	\$754,111	\$15,082	\$769,193
2057	\$5,686	\$769,193	\$763,507	\$15,270	\$778,777
2058	\$5,686	\$778,777	\$773,091	\$15,462	\$788,553
2059	\$5,686	\$788,553	\$782,866	\$15,657	\$798,524
2060	\$5,702	\$798,524	\$792,822	\$15,856	\$808,678
2061	\$5,686	\$808,678	\$802,992	\$16,060	\$819,052
2062	\$5,686	\$819,052	\$813,366	\$16,267	\$829,633
2063	\$5,686	\$829,633	\$823,947	\$16,479	\$840,426
2064	\$5,702	\$840,426	\$834,724	\$16,694	\$851,418
2065	\$5,686	\$851,418	\$845,732	\$16,915	\$862,647
2066	\$5,686	\$862,647	\$856,960	\$17,139	\$874,100
2067	\$5,686	\$874,100	\$868,413	\$17,368	\$885,782
2068	\$5,702	\$885,782	\$880,080	\$17,602	\$897,681
2069	\$5,686	\$897,681	\$891,995	\$17,840	\$909,835
2070	\$5,686	\$909,835	\$904,149	\$18,083	\$922,232
2071	\$5,686	\$922,232	\$916,545	\$18,331	\$934,876
2072	\$5,702	\$934,876	\$929,174	\$18,583	\$947,758
2073	\$24,709	\$947,758	\$923,049	\$18,461	\$941,510
2074	\$61,226	\$941,510	\$880,284	\$17,606	\$897,890
2075	\$150,301	\$897,890	\$747,589	\$14,952	\$762,541
2076	\$113,681	\$762,541	\$648,859	\$12,977	\$661,837
2077	\$75,862	\$661,837	\$585,975	\$11,719	\$597,694
2078	\$75,687	\$597,694	\$522,007	\$10,440	\$532,447
2079	\$32,813	\$532,447	\$499,634	\$9,993	\$509,626
2080	\$133	\$509,626	\$509,494	\$10,190	\$519,684
2081	\$95	\$519,684	\$519,589	\$10,392	\$529,981
Total^(a)	\$1,001,552				

(a) Cash flows may not add due to rounding

(b) Reflects \$0 annual amount remaining to be collected

(c) A 2% annual real rate of return is used as allowed by 10 CFR 50.75(e)(1)(i)