Entergy

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BVY 14-078

10 CFR 50.82(a)(4)

December 19, 2014

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

SUBJECT: Post Shutdown Decommissioning Activities Report
Vermont Yankee Nuclear Power Station
Docket No. 50-271
License No. DPR-28

REFERENCE: 1. Letter, Entergy Nuclear Operations, Inc. to USNRC, "Notification of Permanent Cessation of Power Operations," BVY 13-079, dated September 23, 2013 (ML13273A204)

Dear Sir or Madam:

Pursuant to 10 CFR 50.82(a)(4)(i), Entergy Nuclear Operations, Inc. (Entergy) is submitting a post-shutdown decommissioning activities report (PSDAR) for Vermont Yankee Nuclear Power Station (VY). By letter dated September 23, 2013 (Reference 1), Entergy notified NRC of its intention to permanently cease power operations at VY at the end of the current operating cycle, which is expected to occur in the fourth quarter of 2014.

The Enclosure to this letter provides the VY PSDAR. The PSDAR has been developed consistent with Regulatory Guide 1.185, Revision 1, "Standard Format and Content for Post-Shutdown Decommissioning Activities Report." The VY PSDAR includes a description of the planned decommissioning activities, a schedule for their accomplishment, a site specific decommissioning cost estimate and a discussion that provides the basis for concluding that the environmental impacts associated with site-specific decommissioning activities will be bounded by appropriate, previously issued, environmental impact statements. The PSDAR also includes a discussion of the schedule and costs associated with the management of spent fuel and site restoration. Funding for irradiated fuel management will be addressed in a separate submittal as an update to the Irradiated Fuel Management Plan pursuant to 10 CFR 50.54(bb).

In accordance with 10 CFR 50.82(a)(4)(i), a copy of the VY PSDAR is being provided to the States of Vermont, New Hampshire and Massachusetts by transmitting a copy of this letter and its attachments to the designated State Officials.

Should you have any questions regarding this submittal, please contact Mr. Coley Chappell at (802) 451-3374.

Attachment 1 of this letter contains new regulatory commitments.

Sincerely,

CJW /plc

Attachment: 1. List of Regulatory Commitments

Enclosure: Vermont Yankee Nuclear Power Station Post Shutdown Decommissioning Activities Report

cc: Mr. Daniel H. Dorman
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cc list cont'd:

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Mr. John Giarrusso, Jr., Nuclear Preparedness Manager
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Attachment 1

Vermont Yankee Nuclear Power Station

List of Regulatory Commitments

List of Regulatory Commitments

This table identifies actions discussed in this letter for which Entergy commits to perform. Any other actions discussed in this submittal are described for the NRC's information and are **not** commitments.

COMMITMENT	TYPE (Check one)		SCHEDULED COMPLETION DATE (If Required)
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
In the event that additional financial assurance beyond the amounts contained in the remaining trust fund for VYNPS is required pursuant to NRC regulations to complete radiological decommissioning and spent fuel management at VYNPS, Entergy will provide or (if already existing) increase a parent company guarantee to provide a total in parental assurance of up to 10% of the remaining trust fund balance or $40 million, whichever is less. 1. Any parent company guarantee provided pursuant to this commitment will comply with applicable NRC requirements in 10 CFR 50.75(e)(1)(iii) and Appendix A to 10 CFR Part 30. 2. Entergy will not modify or withdraw this commitment without prior written NRC consent.		x	As stated in the commitment

Vermont Yankee Nuclear Power Station

Post Shutdown Decommissioning Activities Report

Prepared by TLG Services

12/2/2014

Acronyms

AIF	Atomic Industrial Forum
ALARA	As Low As Reasonably Achievable
BMP	Best Management Practices
BWR	Boiling Water Reactor
CFR	Code of Federal Regulations
DCE	Decommissioning Cost Estimate
DOE	Department of Energy
DSEIS	Draft Supplemental Environmental Impact Statement (NUREG-1437)
ENO	Entergy Nuclear Operations, Inc.
ENVY	Entergy Vermont Yankee, LLC
ENTERGY	Entergy Corporation
EPA	Environmental Protection Agency
FSAR	Final Safety Analysis Report
GEIS	Generic Environmental Impact Statement (NUREG-0586)
GTCC	Greater than Class C
GW	Groundwater
ISFSI	Independent Spent Fuel Storage Installation
LLRW	Low-Level Radioactive Waste
LTP	License Termination Plan
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MWt	Megawatt-thermal
NEI	Nuclear Energy Institute
NESP	National Environmental Studies Project
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
PSDAR	Post-Shutdown Decommissioning Activities Report
SEIS	Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NUREG-1437), Supplement 30 "Regarding Vermont Yankee Nuclear Power Station"
SFP	Spent Fuel Pool
SSCs	Structures, Systems and Components
UFSAR	Updated Final Safety Analysis Report
VTDEC	Vermont Department of Environmental Conservation
VYNPS	Vermont Yankee Nuclear Power Station

1.0 INTRODUCTION AND SUMMARY

1.1 Introduction

In accordance with the requirements of Title 10 of the Code of Federal Regulations (CFR) 50.82, "Termination of license," paragraph (a)(4)(i), this report constitutes the Post-Shutdown Decommissioning Activities Report (PSDAR) for the Vermont Yankee Nuclear Power Station (VYNPS). This PSDAR contains the following:

1. A description of the planned decommissioning activities along with a schedule for their accomplishment.
2. A discussion that provides the reasons for concluding that the environmental impacts associated with site-specific decommissioning activities will be bounded by appropriate previously issued environmental impact statements.
3. A site-specific decommissioning cost estimate (DCE), including the projected cost of managing irradiated fuel and the post-decommissioning site restoration cost.
4. A settlement agreement between ENO, ENVY and the State of Vermont.

The PSDAR has been developed consistent with Regulatory Guide 1.185, "Standard Format and Content for Post-Shutdown Decommissioning Activities Report," (Reference 1). This report is based on currently available information and the plans discussed herein may be modified as additional information becomes available or conditions change. As required by 10 CFR 50.82(a)(7), ENVY will notify the Nuclear Regulatory Commission (NRC) in writing, with copies sent to the affected State(s), before performing any decommissioning activity inconsistent with, or making any significant schedule change from, those actions and schedules described in the PSDAR, including changes that significantly increase the decommissioning cost.

1.2 Background

The VYNPS site is located in the town of Vernon, Vermont, in Windham County on the west shore of the Connecticut River immediately upstream of the Vernon Hydroelectric Station. VYNPS employs a General Electric boiling water reactor nuclear steam supply system licensed to generate 1,912 megawatts - thermal (Mwth). The current facility operating license for VYNPS expires at midnight, March 21, 2032. The principal structures at VYNPS include a reactor building, primary containment, control building, radwaste building, intake and discharge structures, turbine building, cooling towers and main stack.

A brief history of the major milestones related to VYNPS construction and operational history is as follows:

- Construction Permit Issued: December 11, 1967
- Operating License Issued: March 21, 1972
- Commercial Operation: November 30, 1972
- Initial Operating License Expiration: March 21, 2012
- Renewed Operating License Expiration: March 21, 2032

By letter dated September 23, 2013 (Reference 2), ENO notified the NRC that it intended to permanently cease power operations of VYNPS at the end of the current operating cycle, which is expected to occur during the fourth quarter of 2014. ENO will submit a supplement to this letter certifying the date on which operations have ceased, or will cease, in accordance with 10 CFR 50.82(a)(1)(i) and 10 CFR 50.4(b)(8). Upon docketing of the certifications required by 10 CFR 50.82(a)(1)(i) and 10 CFR 50.82(a)(1)(ii), pursuant to 10 CFR 50.82(a)(2), the 10 CFR Part 50 license for VYNPS will no longer authorize operation of the reactor or emplacement or retention of fuel in the reactor vessel.

Pursuant to 10 CFR 50.51(b), "Continuation of license," the license for a facility that has permanently ceased operations continues in effect beyond the expiration date to authorize ownership and possession of the utilization facility until the Commission notifies the licensee in writing that the license has been terminated.

During the period that the license remains in effect, 10 CFR 50.51(b) requires that ENVY:

1. Take actions necessary to decommission and decontaminate the facility and continue to maintain the facility including storage, control, and maintenance of the spent fuel in a safe condition.
2. Conduct activities in accordance with all other restrictions applicable to the facility in accordance with NRC regulations and the 10 CFR 50 facility license.

10 CFR 50.82(a)(9) states that power reactor licensees must submit an application for termination of the license at least two years prior to the license termination date and that the application must be accompanied or preceded by a license termination plan to be submitted for NRC approval.

On December 23, 2013, Entergy Nuclear Vermont Yankee (ENVY), and Entergy Nuclear Operations (ENO) entered into a Settlement Agreement (the "Settlement Agreement") with the Vermont Public Service Department (PSD), the Vermont Agency of Natural Resources (ANR), and the Vermont Department of Health (VDH), with the Vermont Office of the Attorney General and Entergy Corporation agreeing to certain provisions of that agreement. In the Settlement Agreement ENVY committed to reflect ENVY's commitments in that agreement in the Vermont Yankee PSDAR and to include the Settlement Agreement with the PSDAR. The Settlement Agreement is provided as Attachment 2 of this PSDAR. The key commitments in the Settlement Agreement relevant to decommissioning, including site restoration after radiological decommissioning has been completed, are:

- To prepare and provide to PSD, ANR and VDH a site assessment study of the costs and tasks of radiological decommissioning, SNF management, and site restoration of the VY Station, including a prompt decontamination and dismantlement scenario and a full assessment of non-radiological conditions at the VY Station site;
- To review the site assessment study with PSD, ANR and VDH and to consider any comments from these agencies for inclusion in the PSDAR;
- To make appropriate filings with the NRC to obtain authority to begin radiological decommissioning within 120 days after ENVY has made a reasonable determination that the funds in the Nuclear Decommissioning Trust for the VY Station are adequate to complete decommissioning and remaining SNF management activities that the federal government has not yet agreed or been ordered to reimburse;
- Once NRC approval or non-opposition is received, to promptly commence, pursue and complete as soon as reasonably possible radiological decontamination and dismantlement activities;
- To acknowledge state jurisdiction over site restoration after radiological decommissioning is complete and to work in good faith with PSD, ANR and VDH to determine in a timely and cost effective manner overall site restoration standards (including removal of structures and level of radiological exposure) that are to be applicable after radiological decontamination has been completed to the satisfaction of the NRC, that are necessary to support use of the site property without limitation (excluding any ISFSI and perimeter related to it), and that do not include the demolition of above-grade decontaminated concrete into rubble that is buried on the site;
- To commence site restoration in accordance with agreed standards promptly after completing radiological decommissioning;
- To establish a trust specifically and solely dedicated to funding site restoration at the VY Station with deposits totaling $25 million through 2017;
- To conduct all activities in Vermont, including at the VY Station site, in accordance with federal and state laws, including VDH's Radiological Health Rule;
- To agree to seek from NRC the release of portions of the site for reuse as appropriate.

1.3 Summary of Decommissioning Alternatives

The NRC has evaluated the environmental impacts of three general methods for decommissioning power reactor facilities in NUREG-0586, "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors," (GEIS) (Reference 3). The three general methods evaluated are summarized as follows:

- DECON: The equipment, structures and portions of the facility and site that contain radioactive contaminants are promptly removed or decontaminated to a level that permits termination of the license shortly after cessation of operations.
- SAFSTOR: After the plant is shut down and defueled, the facility is placed in a safe, stable condition and maintained in that state (safe storage). The facility is decontaminated and dismantled at the end of the storage period to levels that permit

license termination. During SAFSTOR, a facility is left intact or may be partially dismantled, but the fuel is removed from the reactor vessel and radioactive liquids are drained from systems and components and then processed. Radioactive decay occurs during the SAFSTOR period, thereby reducing the quantity of contamination and radioactivity that must be disposed of during decontamination and dismantlement.

- ENTOMB: Radioactive structures, systems and components (SSCs) are encased in a structurally long-lived substance, such as concrete. The entombed structure is appropriately maintained, and continued surveillance is carried out until the radioactivity decays to a level that permits termination of the license.

The decommissioning approach that has been selected by ENVY for VYNPS is the SAFSTOR method. The primary objectives of the VYNPS 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 at the time of plant shutdown. These factors include the cost of each decommissioning alternative, minimization of occupational radiation exposure, availability of low-level waste disposal facilities, availability of a high-level waste (spent fuel) repository or a Department of Energy (DOE) interim storage facility, regulatory requirements, and public concerns. In addition, 10 CFR 50.82(a)(3) requires decommissioning to be completed within 60 years of permanent cessation of operations[1].

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. 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.

The decommissioning approach for VYNPS is described in the following sections.

- Section 2.0 describes the planned decommissioning activities and the general timing of their implementation.
- Section 3.0 describes the overall decommissioning schedule, including the spent fuel management activities.
- Section 4.0 provides an analysis of expected decommissioning costs, including the costs associated with spent fuel management and site restoration.

[1] As noted in section 3.0, "ENVY intends to pursue the decommissioning of VYNPS utilizing a SAFSTOR methodology subject to its commitment in the Settlement Agreement (Attachment 2) to make appropriate filings with the NRC to obtain authority to begin radiological decommissioning within 120 days after ENVY has made a reasonable determination that the funds in the Nuclear Decommissioning Trust for the VY Station are adequate to complete decommissioning and remaining SNF management activities that the federal government has not yet agreed or been ordered to reimburse. "

- Section 5.0 describes the basis for concluding that the environmental impacts associated with decommissioning VYNPS are bounded by the NRC generic environmental impact statement related to decommissioning.
- Section 6.0 is a list of references.

2.0 DESCRIPTION OF PLANNED DECOMMISSIONING ACTIVITIES

ENVY is currently planning to decommission VYNPS using a SAFSTOR method. SAFSTOR is broadly defined in Section 1.3 of this report. Use of the SAFSTOR method will require the management of spent fuel because of the DOE's failure to perform its spent fuel removal obligations under its contract with ENVY. To explain the basis for projecting the cost of managing SNF, a discussion of spent fuel management activities for the site is included herein.

The initial decommissioning activities to be performed after plant shutdown will entail preparing the plant for a period of safe-storage (also referred to as dormancy). This will entail de-fueling the reactor and transferring the fuel into the spent fuel pool, draining of fluids and de-energizing systems, and reconfiguring the electrical distribution, ventilation, heating, and fire protection systems. Systems temporarily needed for continued operation of the spent fuel pool will be reconfigured for operational efficiency. An additional ISFSI pad will be added, in close proximity to the existing ISFSI pad, to expand the ISFSI and allow for dry storage of all spent fuel assemblies and GTCC waste generated during the plant operations.

During dormancy the VYNPS will be staffed with personnel that will monitor, maintain and provide security for the ISFSI and plant facilities. Staffing and configuration requirements are expected to change during the period of dormancy, principally dependent upon the status of the spent fuel being stored on-site. This can be characterized as one of three spent fuel conditions, as follows:

- Wet and dry storage of spent fuel
- On-site dry storage of all spent fuel
- All spent fuel removed from the site

Spent fuel will remain in the spent fuel pool (SFP) until it meets the criteria for transfer, the existing ISFSI is expanded and the spent fuel can be transferred in an efficient manner to the expanded ISFSI. After all fuel has been transferred to the ISFSI, the pool and supporting systems will be in a drained and de-energized condition for the remainder of the dormancy period. The spent fuel will be stored in the ISFSI until transfer to the Department of Energy (DOE).

After the final spent fuel transfer to the ISFSI, the plant will remain in dormancy until the start of dismantling and decontamination (D&D) activities. D&D activities will be scheduled to commence in accordance with the commitments regarding the commencement of radiological decommissioning in the Settlement Agreement and to enable the license to be terminated within 60 years after permanent cessation of operations[2]. Following completion of the D&D activities and termination of the NRC license, site restoration will be performed in accordance with the commitments in the Settlement Agreement.

For the purposes of a current decommissioning cost estimate, it is assumed that remaining structures are to be demolished to three-feet below grade and the excavations backfilled.

[2] Ibid., p.4

Decommissioning activities will be performed in accordance with written, reviewed and approved site procedures. There are no identified or anticipated decommissioning activities that are unique to the VYNPS site outside the bounds considered in the GEIS.

Radiological and environmental programs will be maintained throughout the decommissioning process to ensure occupational, public health and safety, and environmental compliance. Radiological programs will be conducted in accordance with the facility's revised Technical Specifications, Operating License, Updated Final Safety Analysis Report (UFSAR), Radiological Environmental Monitoring Program, and the Offsite Dose Calculation Manual. Non-radiological Environmental Programs will be conducted in accordance with applicable requirements and permits.

Tables 2-1 and 2-2 provide summaries of the schedule / plant status and costs for decommissioning VYNPS. The major decommissioning activities and the general sequence of activities are discussed in more detail in the sections that follow.

Table 2.1
Decommissioning Schedule and Plant Status Summary

Decommissioning Activities / Plant Status	Start	End	Approximate Duration (years)
Pre-Shutdown Planning	August 2013	December 2014	1.3
Transition from Operations			
Plant Shutdown	December 29, 2014	--------	--------
Preparations for SAFSTOR Dormancy	December 29, 2014	April 30, 2016	1.3
SAFSTOR Dormancy[3]			
Dormancy w/Wet Fuel Storage	2016	2020	4.2
Dormancy w/Dry Fuel Storage	2020	2052	32.5
Dormancy w/No Fuel Storage	2053	2067	15
Preparations for Dismantling & Decontamination (D&D)[3]			
Preparations for D&D	2068	2069	1.5
Dismantling & Decontamination (D&D)[3]			
Large Component Removal	2069	2070	1.3
Plant Systems Removal and Building Decontamination	2070	2073	2.5
License Termination	2073	2073	0.7
Site Restoration[3]			
Site Restoration	2073	2075	1.5
Total from Shutdown to Completion of License Termination	---------	--------	59

[3] "Subject to the commitments regarding the commencement of radiological decommissioning in the Settlement Agreement (Section 1.2)."

Table 2.2
Decommissioning Cost Summary
(Thousands of 2014 dollars)

Decommissioning Periods	License Termination	Spent Fuel Management	Site Restoration
Planning and Preparations	$119,981	$23,068	na
Dormancy w/Wet Fuel Storage	$45,746	$217,244	na
Dormancy w/Dry Fuel Storage	$137,229	$128,035	na
Dormancy w/No Fuel Storage	$54,016	na	na
Site Reactivation	$43,277	na	$578
Decommissioning Preparation	$36,283	na	$456
Large Component Removal	$141,032	na	$25
Plant Systems Removal and Building Remediation	$208,167	na	$4,118
License Termination	$30,668	na	na
Site Restoration	$823	na	$51,968
Total [a]	$817,219	$368,347	$57,145

[a] Columns may not add due to rounding

2.1 Discussion of Decommissioning Activities

The following narrative describes the basic activities associated with decommissioning the VYNPS. The site specific DCE (detailed in Attachment 1) is divided into phases or periods based upon major milestones within the project or significant changes in the annual projected expenditures. The following sub-sections correspond to the five major decommissioning periods within the estimate.

2.1.1 Preparations For Dormancy:

The NRC defines SAFSTOR as, "A method of decommissioning in which a nuclear facility is placed and maintained in a condition that allows the facility to be safely stored and subsequently decontaminated (deferred decontamination) to levels that permit release for unrestricted use." The facility is left intact (during the dormancy period), with structures maintained in a stable condition. Systems that are not required to support the spent fuel, HVAC, Emergency Plan or site security are drained, de-energized, and secured. Minimal cleaning/removal of loose contamination and/or fixation and sealing of remaining contamination is performed. Access to

contaminated areas is maintained secure to provide controlled access for inspection and maintenance.

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

- Creation of an organizational structure to support the decommissioning plan and evolving emergency planning and site security requirements.
- Revision of technical specifications, plans and operating procedures appropriate to the operating conditions and requirements.
- Characterization of the facility and major components as may be necessary to plan and prepare for the dormancy phase.
- Isolation of the spent fuel pool and reconfiguring fuel pool support systems so that draining and de-energizing may commence in other areas of the plant.
- Design and construction of an ISFSI pad expansion.
- Deactivation (de-energizing and /or draining) of systems that are no longer required during the dormancy period.
- Processing and disposal of water and water filter and treatment media not required to support dormancy operation.
- Disposition of incidental waste that may be present prior to the start of the dormancy period, such as excess tools and equipment and waste produced while deactivating systems and preparing the facility for dormancy.
- Reconfiguration of power, lighting, heating, ventilation, fire protection, and any other services needed to support long-term storage and periodic plant surveillance and maintenance.
- Stabilization by fixing or removing loose incidental surface contamination to facilitate future building access and plant maintenance. Decontamination of high-dose areas is not anticipated.
- Performance of interim radiation surveys of the plant, posting caution signs and establishing access requirements, where appropriate.
- Maintenance of appropriate barriers for contaminated and radiation areas.
- Reconfiguration of security boundaries and surveillance systems, as required.

The following is a general discussion of the planned reconfiguration expected after plant shutdown.

Electrical Systems

The electrical system will undergo a series of reconfigurations between shutdown and the time all spent fuel has been transferred to dry storage. The reconfigurations will be performed to reduce operating and maintenance expenses, while maintaining adequate power for station loads,

and backup power for Spent Fuel Pool-related systems and critical security equipment. The expansion of the ISFSI pad requires the removal of a diesel generator currently located where the ISFSI expansion will be built which supports security and other plant equipment. In connection with the expansion a new diesel generator (DG) unit and a new Uninterruptable Power Supply (UPS) unit will be installed.

Mechanical Systems

Following shutdown, as applicable, fluid filled systems will be drained and abandoned, and resins removed based on an evaluation of system category, functionality, and plant configuration. System categories include: 1) Balance of Plant (BOP), 2) Emergency Core Cooling System (ECCS), 3) Nuclear Steam Safety System (NSSS), 4) Spent Fuel Pool Cooling (SFPC), and 5) Dry Fuel Storage (DFS). Plant configurations include: 1) Post-shutdown (fuel in the reactor), 2) Post-defuel (no fuel in the reactor); 3) Post-gates in (no fuel in reactor, spent fuel pool is physically isolated from the reactor); 4) Reactor vessel drained; 5) Reduced risk of zirconium fire (spent fuel is in the spent fuel pool); and 6) Post-dry fuel storage (all spent fuel in dry fuel storage). The plant configuration and functionality of each system within the plant configuration as it evolves will determine when a system can be drained and abandoned.

Ventilation and Heating Systems

Ventilation will be reconfigured for the Turbine Building (TB) and Reactor Building (RB) to support remaining systems and habitability. Fluid filled systems in the TB will either be drained or freeze protection installed, and the heating steam secured. The RB ventilation system will be reconfigured to maintain building temperature to support habitability and the functioning of Fuel Pool Cooling systems, Fire Protection systems, and Dry Fuel Storage systems. RB ventilation to the stack will be maintained.

Fire Protection Systems

Fire Protection (FP) systems will be reconfigured based on a fire hazards analysis. The fire hazards analysis provides a comprehensive evaluation of the facility's fire hazards, the fire protection capability relative to the identified hazards, and the ability to protect spent fuel and other radioactive materials from potential fire-induced releases. The fire hazards analysis will be reevaluated and revised as necessary to reflect the unique or different fire protection issues and strategies associated with decommissioning. It is expected that as the plant's systems are drained and the combustible loading footprint shrinks, the FP requirements will be reduced.

Maintenance of Systems Critical to Decommissioning

It has been determined that there are no mechanical systems that will be critical to the final decommissioning process. As such, mechanical systems will be abandoned after all spent fuel has been transferred to Dry Fuel Storage, with the exception of systems required to maintain habitability during dormancy. The site power distribution system will be abandoned with the possible exception of Motor Control Centers that are required to support ventilation and lighting.

The ISFSI pads and security will have a stand-alone power system (off-site feed backed up by a diesel generator.)

The organization responsible for the final dismantlement will be expected to establish temporary services, including electrical and cranes.

2.1.2 Dormancy

Activities required during the early dormancy period while spent fuel is stored in the fuel pool will be substantially different than those activities required during dry fuel or no fuel storage.

Early activities include operating and maintaining the spent fuel pool and its associated systems, expanding the ISFSI, and transferring spent fuel from the pool to the ISFSI. Assuming the timely receipt of the required state regulatory approvals, the ISFSI expansion is estimated to be completed in 2017. Spent fuel transfer is expected to be complete by mid 2020. After the fuel transfer is completed, the pool and systems will be drained and de-energized for long-term storage.

Dormancy activities will include a 24-hour security force, preventive and corrective maintenance on security systems, area lighting, general building maintenance, freeze protection heating, ventilation of buildings for periodic habitability, routine radiological inspections of contaminated structures, maintenance of structural integrity, and a site environmental and radiation monitoring program. A fire protection program will be maintained.

Security during the dormancy period will be conducted primarily to safeguard the spent fuel on site and prevent unauthorized entry. A security barrier, sensors, alarms, and other surveillance equipment will be maintained as required to provide security.

An environmental surveillance program will be carried out during the dormancy period to monitor for radioactive material in the environment. Appropriate procedures will be established and initiated for potential releases that exceed prescribed limits. The environmental surveillance program will consist of a version of the program in effect during normal plant operations that will be modified to reflect the plant's conditions and risks at the time.

Late in dormancy, activities will include transferring the spent fuel from the ISFSI to the DOE. For planning purposes, ENVY's current spent fuel management plan for the VYNPS spent fuel is based, in general, upon the following projections: 1) a 2025 start date for the DOE initiating transfer of commercial spent fuel to a federal facility, 2) a corresponding 2026 date for beginning to remove spent fuel from VYNPS, and 3) a 2052 completion date for removal of all VYNPS spent fuel. Transfer could occur earlier if the DOE is successful in implementing its current strategy for the management and acceptance of spent fuel.[4] The ISFSI pad and facilities will be

[4] DOE's repository program assumes that spent fuel is accepted for disposal from the nation's commercial nuclear plants in the order ("queue") in which it was removed from service ("oldest fuel first"). The contracts that U.S. generators have with the DOE provide mechanisms for altering the oldest fuel first allocation scheme, including emergency deliveries, exchanges of allocations amongst generators, and the option of providing priority acceptance from permanently shutdown nuclear reactors. Given DOE's failure to accept fuel under its contracts, it is unclear

decommissioned at the time of plant decommissioning or after DOE has removed all spent fuel from the site.

2.1.3 Preparations for Decommissioning

Assuming a 2 percent real rate of return on the NDT balance, VYNPS would be expected to have to remain in safe-storage dormancy while sufficient funds accumulate to complete decommissioning and SNF management activities until ~ mid-2060s, at which time preparations for decommissioning would commence. Assuming the NDT balance grows at a higher rate, ENVY will seek authority from the NRC to commence preparations for decommissioning and to begin D&D activities sooner in accordance with ENVY's commitments regarding the commencement of radiological decommissioning in the Settlement Agreement. The duration of safe-storage dormancy period will depend on the available financial resources, fund growth and the cost to complete decommissioning and plant dismantlement as well as remaining SNF management costs that will not be reimbursed by DOE.

Prior to the commencement of decommissioning operations, preparations will be undertaken to reactivate site services and prepare for decommissioning. Preparations include engineering and planning, a site characterization, and the assembly of a decommissioning management organization. This would likely include the development of work plans, specifications and procedures.

2.1.4 Decommissioning (Dismantling and Decontamination)

Following the preparations for decommissioning, physical decommissioning activities will take place. This includes the removal and disposal of contaminated and activated components and structures, leading to the termination of the 10 CFR 50 operating license. Although much of the radioactivity will decrease during the dormancy period due to decay of ^{60}Co and other short-lived radionuclides, the internal components of the reactor vessel will still exhibit radiation dose rates that will likely require remote sectioning under water due to the presence of long-lived radionuclides such as ^{94}Nb, ^{59}Ni, and ^{63}Ni. Portions of the biological shield wall may also be radioactive due to the presence of activated trace elements with longer half-lives (such as ^{152}Eu and ^{154}Eu). It is assumed that radioactive contamination on structures, systems, and component surfaces will not have decayed to levels that will permit unrestricted release. These surfaces will be surveyed and items dispositioned in accordance with the existing radioactive release criteria.

Significant decommissioning activities in this phase include:

- Reconfiguration and modification of site structures and facilities, as needed, to support decommissioning operations. Modifications may also be required to the reactor or other buildings to facilitate movement of equipment and materials, support the segmentation of the reactor vessel and reactor vessel internals, and for large component removal.

how these mechanisms will operate once DOE begins accepting spent fuel from commercial reactors. Accordingly, this PSDAR assumes that DOE will accept spent fuel in an oldest fuel first order.

- Design and fabrication of temporary and longer-term shielding to support removal and transportation activities, construction of contamination control envelopes, and the procurement of specialty tooling.
- Procurement or leasing of shipping cask, cask liners, and industrial packages for the disposition of low-level radioactive waste (LLRW).
- Decontamination of components and piping systems, as required, to control (minimize) worker exposure.
- Disposition of the turbine, condenser, main steam piping, and associated equipment; with appropriate dispositioning based upon radiological surveys.
- Disposition of systems and components.
- Removal of the recirculation pumps and associated piping for controlled disposal.
- Contaminated material will be characterized and segregated for additional offsite processing (disassembly, chemical cleaning, volume reduction, and waste treatment), and/or packaged for controlled disposal at a low-level radioactive waste disposal facility.
- Disposition of control rod blades.
- Disassembly and segmentation of the reactor vessel internals. This will likely involve use of remotely operated equipment within the reactor cavity, covered with a contamination control envelope. The cavity water level will likely need to be maintained just below the cut to maintain the working area dose rates ALARA. Some of this material may exceed Class C disposal requirements. This will be packaged for transfer to the DOE.
- Segmentation of the reactor vessel. Similar to the internals some of this work may involve the use of remotely operated equipment.
- Removal of the steel liners from the drywell, torus, refueling pool and spent fuel pool, disposing of the activated and/or contaminated sections as radioactive waste.
- Disposition of the activated and contaminated portions of the concrete biological shield and contaminated concrete surfaces that exceed the material release criteria.
- Material likely to be free of contamination may be surveyed and released for unrestricted disposition, e.g., as scrap, recycle, or general disposal, or sent to an off-site NRC / Agreement State licensed processor for radiological evaluation and appropriate disposition.
- Remediation of contaminated surface soil or sub-surface media will be performed as necessary to meet the unrestricted use criteria in 10 CFR 20.1402.
- Underground piping (or similar items) and associated soil will be removed as necessary to meet license termination criteria.

At least two years prior to the anticipated date of license termination, a License Termination Plan (LTP) will be submitted to the NRC. That plan will include: a site characterization, description of the remaining dismantling / removal activities, plans for remediation of remaining radioactive materials, developed site-specific Derived Concentration Guideline Levels (DCGLs), plans for the final status (radiation) survey (FSS), designation of the end use of the site, an updated cost estimate to complete the decommissioning, and associated environmental concerns.

The FSS plan will identify the radiological surveys to be performed once the decontamination activities are completed and will be developed using the guidance provided in the "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)." This document incorporates statistical approaches to survey design and data evaluation. 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 FSS is complete, the results will be submitted to the NRC, along with a request for termination of the NRC license.

Per the Settlement Agreement with the State of Vermont (Attachment 2), ENVY may release unaffected portions of the site on a partial site release basis, as they become available, before all site decommissioning work has been completed.

2.1.5 Site Restoration

After the NRC terminates the license, site restoration activities will be performed. Subject to the development of site restoration standards pursuant to the Settlement Agreement, ENVY currently assumes that remaining clean structures will be removed to a nominal depth of three feet below the surrounding grade level. Affected area(s) would then be backfilled with suitable fill materials, graded, and appropriate erosion controls established.

Non-contaminated concrete rubble produced by the demolition activities will be transported to an offsite area for appropriate disposal as construction debris.

2.2 General Decommissioning Considerations

2.2.1 Major Decommissioning Activities

As defined in 10 CFR 50.2, "definitions," a "major decommissioning activity" is "any activity that results in permanent removal of major radioactive components, permanently modifies the structure of the containment, or results in dismantling components for shipment containing greater than class C waste in accordance with § 61.55." The following discussion provides a summary of the major decommissioning activities currently planned for VYNPS. These activities are envisioned to occur in Dismantling and Decontamination Period. The schedule may be modified as conditions dictate.

Prior to starting a major decommissioning activity, the affected components will be surveyed and decontaminated, as required, in order to minimize worker exposure, and a plan will be developed for the activity. Shipping casks and other equipment necessary to conduct major decommissioning activities will be procured.

The initial major decommissioning activity inside the reactor building will be the removal, packaging, and disposal of systems and components attached to the reactor.

Following reactor vessel and cavity re-flood, the reactor vessel internals will be removed from the reactor vessel and segmented, if necessary, for packaging, transport and disposal, or to separate greater than Class C (GTCC) waste. Internals classified as GTCC waste will be segmented and packaged into containers similar to spent fuel canisters for transfer to the DOE. Removal of the reactor vessel follows the removal of the reactor internals. While industry experience indicates that there may be several options available for the removal and disposal of the reactor vessel (i.e., segmentation or disposal as an intact package) intact removal may not be a viable option due to transportation size and weight restrictions. If segmented it is likely that the work would be performed remotely in-air, using a contamination control envelope.

Other major decommissioning activities that would be conducted include the removal and disposal of the turbine, condenser, recirculation pumps, main steam piping, feed water piping, pumps and heaters, liners (from the spent fuel pool, drywell and reactor cavity), the torus, spent fuel storage racks and neutron activated / contaminated concrete materials. The disposition of the drywell structure would be undertaken as part of the reactor building demolition.

2.2.2 Other Decommissioning Activities

In addition to the reactor and large components discussed above, all other plant components will be removed from the Reactor, Turbine and associated buildings, radiologically surveyed and dispositioned appropriately.

2.2.3 Decontamination and Dismantlement Activities

The overall objective of D&D is to ensure that radioactively contaminated or activated materials will be removed from the site to allow the site to be released for unrestricted use. This is achieved by radioactive decay during the SAFSTOR period which will significantly reduce the quantity of contamination and radioactivity that must be disposed of during decontamination and dismantlement. The disposition of remaining radioactive materials will be accomplished by the decontamination and/or dismantlement of contaminated structures. This may be accomplished by decontamination in place, off-site processing of the materials, or direct disposal of the materials as radioactive waste. A combination of these methods may be utilized. The methods chosen will be those deemed most appropriate for the particular circumstances.

Low-level radioactive waste (LLRW) will be managed in accordance with approved procedures and commercial disposal facility requirements. This includes characterizing contaminated materials, packaging, transporting and disposal at a licensed LLRW disposal facility.

2.2.4 Radioactive Waste Management

A major component of the decommissioning work scope for VYNPS is the packaging, transportation and disposing of primarily contaminated / activated equipment, piping, concrete, and soil. A waste management plan will be developed to incorporate the most cost effective disposal strategy, consistent with regulatory requirements and disposal / processing options for each waste type at the time of the D&D activities. Being located in Vermont, the VYNPS is subject to the Texas-Vermont waste compact agreement. As such, VYNPS wastes may be

disposed of at the Waste Control Specialists site in Andrews County, Texas. If out of compact or other licensed LLRW facilities become available in the future, ENVY may apply for export permits to use them. LLRW from VYNPS will be transported by licensed transporters. The waste management plan will be based on the evaluation of available methods and strategies for processing, packaging, and transporting radioactive waste in conjunction with the available disposal facility options and associated waste acceptance criteria.

2.2.5 Removal of Mixed Wastes

If mixed wastes are generated they will be managed in accordance with applicable Federal and State regulations.

Mixed wastes from VYNPS will be transported by authorized and licensed transporters and shipped to authorized and licensed facilities. If technology, resources, and approved processes are available, the processes will be evaluated to render the mixed waste non-hazardous.

2.2.6 Site Characterization

During the decommissioning process, site characterization will be performed in which radiological, regulated, and hazardous wastes will be identified, categorized, and quantified. Surveys will be conducted to establish the contamination and radiation levels throughout the plant. This information will be used in developing procedures to ensure that hazardous, regulated, and radiologically contaminated areas are remediated and to ensure that worker exposure is controlled. As decontamination and dismantlement work proceeds, surveys will be conducted to maintain a current site characterization and to ensure that decommissioning activities are adjusted accordingly.

As part of the site characterization process, a neutron activation analysis calculation study of the reactor internals, the reactor vessel, and the biological shield wall was performed. Using the results of this analysis (along with benchmarking surveys), neutron irradiated components will be classified (projected for the future D&D time-frame) in accordance with 10 CFR 61, "Licensing requirements for land disposal of radioactive waste." The results of the analysis will form the basis of the plans for removal, segmentation, packaging and disposal.

2.2.7 Groundwater Protection and Radiological Decommissioning Records Program

A groundwater (GW) protection program currently exists at VYNPS in accordance with the Nuclear Energy Institute (NEI) Technical Report 07-07, "Industry Groundwater Protection Initiative - Final Guidance Document." A site hydrology study was completed as part of this initiative. 30 GW monitoring wells were installed around the plant to identify any leakage and transport of radiological contaminants. Measurable amounts of tritium, attributed to a line leak, were detected in some of the GW monitoring wells samples collected from late in the year 2009 until the present time. These positive detections were in samples collected from wells located on the east side of the plant. Historically, GW monitoring well GZ-15 had registered the highest levels of tritium. As of August, 2014, however, GZ-14d had the highest concentration (measured at 11,714 pCi/ L). All of the other groundwater wells were well below this value and less than

the 20,000 pCi/L drinking water limit for tritium in 40 CFR 141.66. This measured tritium concentration in monitoring well GZ-14d corresponds to approximately 59% of the EPA drinking water limit.

Given this concentration and a half-life of 12.3 years, no tritium remediation is expected to be required at the end of the SAFSTOR period. The GW protection program is directed by procedures and will continue during decommissioning.

ENVY will also continue to maintain the existing radiological decommissioning records program required by 10 CFR 50.75(g). The program is directed by procedures. None of the events noted in 10 CFR 50.75(g) indicate the presence of long-lived radionuclides in sufficient concentrations to preclude unrestricted release under 10 CFR 20.1402, "Radiological criteria for unrestricted use," at the end of the SAFSTOR period.

2.2.8 Changes to Management and Staffing

Throughout the decommissioning process, plant management and staffing levels will be adjusted to reflect the ongoing transition of the site organization. Staffing levels and qualifications of personnel used to monitor and maintain the plant during the various periods after plant shutdown will be subject to appropriate Technical Specification and Emergency Plan requirements. These staffing levels do not include contractor staffing which would likely be used to carry out the future fuel movements, plant modifications in preparation for SAFSTOR, and the D&D / license termination / site restoration work. Contractors may also be used to provide general services, staff augmentation or replace permanent staff. The monitoring and maintenance staff will be comprised of radiation protection, REMP, plant engineering and craft workers as appropriate for the anticipated work activities.

3.0 SCHEDULE OF PLANNED DECOMMISSIONING ACTIVITIES

ENVY intends to pursue the decommissioning of VYNPS utilizing a SAFSTOR methodology subject to its commitment in the Settlement Agreement (Attachment 2) to make appropriate filings with the NRC to obtain authority to begin radiological decommissioning within 120 days after ENVY has made a reasonable determination that the funds in the Nuclear Decommissioning Trust for the VY Station are adequate to complete decommissioning and remaining SNF management activities that the federal government has not yet agreed or been ordered to reimburse. The SAFSTOR method involves removal of radioactively contaminated or activated material from the site following an extended period of dormancy. Work activities associated with the planning and preparation period began before the plant was permanently shut down and will continue into 2016. The schedule of spent fuel management and major decommissioning activities is provided in Table 2-1. Additional detail is provided in Attachment 1, the DCE.

The schedule accounts for spent fuel being stored in the ISFSI until the assumed date of transfer to the DOE.

4.0 ESTIMATE OF EXPECTED DECOMMISSIONING AND SPENT FUEL MANAGEMENT COSTS

10 CFR 50.82(a)(4)(i) requires the submission of a PSDAR within two years following permanent cessation of operations that contains a site-specific DCE, including the projected cost of managing irradiated fuel.

TLG Services, Inc. has prepared a site-specific decommissioning cost analysis for VYNPS, which also provides projected costs of managing spent fuel, as well as non-radiological decommissioning and site restoration costs, accounted for separately. The site-specific DCE is provided in Attachment 1 and fulfills the requirements of 10 CFR 50.82(a)(4)(i) and 10 CFR 50.82(a)(8)(iii). A summary of the site-specific DCE, including the projected cost of managing spent fuel is provided in Table 2-2. The site-specific DCE, from which this table was derived, is provided as Attachment 1.

The methodology used by TLG Services, Inc. to develop the site-specific DCE follows the basic approach originally advanced by the Atomic Industrial Forum (AIF) in its program to develop a standardized model for decommissioning cost estimates. The results of this program were published as AIF/NESP-036, "A Guideline for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates," (Reference 4). The AIF document presents a unit cost factor method for estimating direct activity costs, simplifying the estimating process. The unit cost factors used in the study reflect the latest available data, at the time of the study, concerning worker productivity during decommissioning.

Under NRC regulations (10 CFR § 50.82(a)(8)), a licensee must provide reasonable assurance that funds will be available (or "financial assurance") for decommissioning (i.e., license termination) costs. The regulations also describe the acceptable methods a licensee can use to demonstrate financial assurance. Most licensees do this by funding a nuclear decommissioning trust (NDT). The NRC methodology limits the projected growth rate of the funds in the NDT to 2% per year (real, not nominal).

ENVY uses an NDT for this purpose. The trust was transferred with the liability as part of the sale transaction when Entergy acquired the plant. The trustee is Mellon Bank, N.A. The trust had a balance of $653 million as of the end of August 2014.

10 CFR 50.82(a)(6)(iii) states that, "Licensees shall not perform any decommissioning activities," as defined in 10 CFR 50.2 that, "Result in there no longer being reasonable assurance that adequate funds will be available for decommissioning." ENVY does not intend to perform any decommissioning activities that result in there no longer being reasonable assurance that adequate funds will be available for decommissioning.

10 CFR 50.82(a)(8)(iv) states that, "For decommissioning activities that delay completion of decommissioning by including a period of storage or surveillance, the licensee shall provide a means of adjusting cost estimates and associated funding levels over the storage or surveillance period."

4.1 Means of Adjusting Cost Estimates

Costs (excluding low-level waste disposal) are inflated using IHS Global Insight's Index for CPI, Services (CUSASNS). Low-level waste disposal costs are inflated using the IHS Global Insight's Index for CPI, All Urban, All Items (CPI). This index is consistent with the escalation clause in Entergy Corporation's (Entergy) waste disposal contracts with Energy*Solutions* and Waste Control Specialists. A moving average is used for escalation beyond the available forecasts.

Consistent with Regulatory Guide 1.159 (Reference 5), ENVY will update the VYNPS DCE as required. In calculating projected earnings, ENVY will apply a compounded 2% real rate of return on the trust fund.

4.2 Means of Adjusting Associated Funding Levels

In the event that additional financial assurance beyond the amounts contained in the remaining trust fund for VYNPS is required pursuant to NRC regulations to complete radiological decommissioning and spent fuel management at VYNPS, Entergy will provide or (if already existing) increase a parent company guarantee to provide a total in parental assurance of up to 10% of the remaining trust fund balance or $40 million, whichever is less.

1. Any parent company guarantee provided pursuant to this commitment will comply with applicable NRC requirements in 10 CFR 50.75(e)(1)(iii) and Appendix A to 10 CFR Part 30.
2. Entergy will not modify or withdraw this commitment without prior written NRC consent.

ENVY reserves the right to seek approval to use alternative funding mechanisms acceptable to the NRC.

5.0 ENVIRONMENTAL IMPACTS

ENVY has concluded that the environmental impacts associated with planned VYNPS site-specific decommissioning activities are less than and bounded by the impacts addressed by previously issued environmental impact statements. 10 CFR 50.82(a)(4)(i) requires that the PSDAR include, "...a discussion that provides the reasons for concluding that the environmental impacts associated with site-specific decommissioning activities will be bounded by appropriate previously issued environmental impact statements." The following discussion provides the reasons for reaching this conclusion and is based on two previously issued environmental impact statements:

1. NUREG-0586, Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors (Reference 3) (Referred to as the GEIS).

2. NUREG-1496, Generic Environmental Impact Statement in Support of Rulemaking on Radiological Criteria for License Termination of NRC-Licensed Nuclear Facilities (Reference 6).

In evaluating whether the impacts in these previously issued environmental impact statements are bounding, information from NUREG-1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 30, Regarding Vermont Yankee Nuclear Power Station (Reference 7) was also considered.

5.1 Environmental Impact of VYNPS Decommissioning

The following is a summary of the reasons for reaching the conclusion that the environmental impacts of decommissioning Vermont Yankee Nuclear Power Station (VYNPS) are bounded by the GEIS. Each environmental impact standard in the GEIS is listed along with an explanation as to why ENVY concludes the GEIS analysis bounds the impacts of VYNPS decommissioning on that standard. As a general matter, VYNPS is smaller than the reference boiling water reactor used in the GEIS to evaluate the environmental impacts of decommissioning, and is therefore bounded by those assessments. Further, no unique site-specific features or unique aspects of the planned decommissioning have been identified.

5.1.1 Onsite/Offsite Land Use

Section 4.3.1 of the GEIS concluded that the impacts on land use are not detectable or small for facilities having only onsite land use changes as a result of large component removal, structure dismantlement, and low-level waste packaging and storage. VYNPS has sufficient area onsite that has been previously disturbed (due to construction or operations activities) upon which to conduct all of these decommissioning activities. Any construction activities that would disturb

one acre or greater of soil would require a storm water permit from the Vermont Department of Environmental Conservation (VTDEC) prior to proceeding with the activity. The storm water permit would contain best management practices (BMPs) to control sediment and erosion effect on water courses and wetlands.

Based on the GEIS, the experience of plants that are being decommissioned has not included any needs for additional land offsite. Consistent with this determination, ENVY does not anticipate any changes in land use beyond the site boundary during decommissioning. Therefore, Entergy concludes that the impacts of VYNPS decommissioning on onsite/offsite land use are bounded by the GEIS.

5.1.2 Water Use

After plant shutdown, the operational demand for cooling water and makeup water will dramatically decrease. Additionally, after the plant is shut down and defueled, the amount of water used by the service water system will be much less than during normal operation of the plant. The need for cooling water will continue to decrease as the heat load of spent fuel in the spent fuel pool declines due to radioactive decay and as spent fuel is relocated from the spent fuel pool to the ISFSI. During plant shutdown, the use of potable water will decrease commensurate with the expected decrease in plant staffing levels. For these reasons, Section 4.3.2 of the GEIS concluded that water use at decommissioning nuclear reactor facilities is significantly smaller than water use during operation.

The GEIS also concluded that water use during the decontamination and dismantlement phase will be greater than that during the storage phase. However, there are no unique aspects associated with the decommissioning of VYNPS and water use for such activities as flushing piping, high pressure water washing, dust abatement, etc. Consequently, VYNPS water use impacts were addressed by the evaluation of the reference facility in the GEIS.

Therefore, ENVY concludes that the impacts of VYNPS decommissioning on water use are bounded by the GEIS.

5.1.3 Water Quality

This section considers water quality impacts of nonradioactive material for both surface and groundwater during the decommissioning process. Table E-3 of the GEIS identifies decommissioning activities that may affect water quality. These activities include system deactivation activities (draining, flushing, and liquid processing) as well as facility decontamination and dismantlement activities (water spraying and rubblization). The GEIS also emphasizes the need to minimize water infiltration during the SAFSTOR period.

ENVY has chosen to decommission VYNPS using the SAFSTOR method. During the SAFSTOR planning and actual storage periods, storm water runoff and drainage paths will be maintained in their current configuration. Regulatory mandated programs and processes designed to minimize, detect, and contain spills will be maintained throughout the decommissioning process. Federal, state and local regulations and permits pertaining to water quality will also remain in effect and no significant changes to water supply reliability are expected. In addition to the National Pollutant Discharge Elimination System (NPDES) permit, which regulates surface water discharges from the site (Reference 8), the following permits will remain in place:

- Indirect Discharge Permit ID-9-0036-2 which regulates indirect discharges of treated domestic sewage and other wastes to the groundwater and indirect discharges to the Connecticut River (Reference 9).

- Solid Waste Management Facility Certification F9906-A1 which regulates land application of septage (Reference 10).

- Public Water System Permits 8332 and 20738 which regulates groundwater withdrawal for drinking and plant purposes (References 11 and 12).

Therefore, ENVY concludes that the impacts of VYNPS decommissioning on water quality are bounded by the GEIS.

5.1.4 Air Quality

Air Contaminant Source Registration Certificate WM2335 was issued by the VTDEC and regulates air emission sources at VYNPS (Reference 13). This certificate will remain in place during decommissioning. If new sources of air emissions are added or changed at the facility to support this process, the certificate will be modified as required. As new regulations are issued that impact these sources, these requirements will be addressed at the station. In addition, there are various other air quality regulations that will govern activities involving hazardous air pollutants and indoor air quality.

There are many types of decommissioning activities listed in Section 4.3.4 of the GEIS that have the potential to affect air quality. For those activities applicable to the SAFSTOR option, ENVY does not anticipate any activities beyond those listed in the GEIS that could potentially affect air quality. In addition, federal, state and local regulations pertaining to air quality will remain in effect to regulate emissions associated with fugitive dust, criteria air pollutants, hazardous air pollutants, and ozone-depleting gases. Therefore, ENVY concludes that the impacts of VYNPS decommissioning on air quality are bounded by the GEIS.

5.1.5 Aquatic Ecology

Aquatic ecology encompasses the plants and animals in the Connecticut River and wetlands near VYNPS. Aquatic ecology also includes the interaction of those organisms with each other and the environment. Section 4.3.5 of the GEIS evaluates both the direct and indirect impacts from decommissioning on aquatic ecology.

Direct impacts can result from activities such as the removal of shoreline structures or the active dredging of canals. VYNPS's shoreline structures are similar to the plants listed in Table E-2 of the GEIS, and there are no apparent discriminators based on the salient characteristics (size and location) listed in Table E-5 of the GEIS. Removal of the intake and discharge facilities as well as other shoreline structures will be conducted in accordance with BMPs outlined in permits issued by the VTDEC and if necessary, the U. S. Army Corps of Engineers. Intake canal dredging should no longer be required due to the diminished residual heat removal requirements, and the eventual relocation of the spent fuel to the ISFSI.

As previously discussed in Section 5.1.2, the amount of cooling water withdrawn from the Connecticut River will significantly decrease thus reducing the potential impacts from impingement and entrainment of aquatic species. Additionally, any significant potential for sediment runoff or erosion on disturbed areas will be controlled in accordance with BMPs outlined in the storm water permit. ENVY does not anticipate disturbance of lands beyond the current operational areas of the plant, so there should not be any new impacts to aquatic ecology from runoff associated with land disturbance activities.

Therefore, ENVY concludes that the impacts of VYNPS decommissioning on aquatic ecology are bounded by the GEIS.

5.1.6 Terrestrial Ecology

Terrestrial ecology considers the plants and animals in the vicinity of VYNPS as well as the interaction of those organisms with each other and the environment. Evaluations of impacts to terrestrial ecology are usually directed at important habitats and species, including plant and animals that are important to industry, recreational activities, the area ecosystems, and those protected by endangered species regulations and legislation. Section 4.3.6 of the GEIS evaluates the potential impacts from both direct and indirect disturbance of terrestrial ecology.

Direct impacts can result from activities such as clearing native vegetation or filling a wetland. ENVY does not anticipate any decommissioning activities, including ISFSI expansion, will disturb habitat beyond the operational areas of the plant. All dismantlement, demolition, and waste staging activities are envisioned to be conducted within the industrial area of the site. Also the VTDEC controls significant impacts to the environment through regulation of construction activities.

There is a nesting box on the plant main stack that was installed by VYNPS in 2009 to attract peregrine falcons at the request of the Audubon Society. There have been two consecutive years of four young born and successfully fledged since 2012. Since the peregrine falcon is protected under the Migratory Bird Treaty Act, a Migratory Bird Depredation permit from the U.S. Fish and Wildlife Service (USFWS) will be required to remove the nest prior to dismantlement of the main stack. Since this activity will be under the oversight of the USFWS, impacts are not expected to destabilize or noticeably alter this species population.

Indirect impacts may result from effects such as erosional runoff, dust or noise. Any construction activities that would disturb one acre or greater of soil would require a storm water permit from the VTDEC prior to proceeding with the activity. The storm water permit would contain BMPs to control sediment and the effects of erosion associated with the construction activity. Fugitive dust emissions will be controlled through the judicious use of water spraying. The basis for concluding that the environmental impacts of noise are bounded by the GEIS is discussed in Section 5.1.16 below.

Section 4.3.6 of the GEIS concludes that if BMPs are used to control indirect disturbances and habitat disturbance is limited to operational areas, the potential impacts to terrestrial ecology are small. As discussed above, there are no unique disturbances to the terrestrial ecology anticipated during the decommissioning of VYNPS. Therefore, ENVY concludes that the impacts of VYNPS decommissioning on terrestrial ecology are bounded by the GEIS.

5.1.7 Threatened and Endangered Species

Based on the SEIS (Reference 7), there were two federally-listed endangered aquatic species that were reported to inhabit the Connecticut River: dwarf wedge mussel and short nose sturgeon. These two same species were also state-listed as endangered. In addition, the brook floater was also state-listed as an endangered aquatic species, but the species is currently known only from the West River. It was determined in the SEIS that none of these federally-and state-listed species occurred within the vicinity (6-mile radius) of VYNPS, and that no designated critical habitat for the species existed within the vicinity of VYNPS.

The SEIS also identified three federally-listed endangered terrestrial species with the potential to occur within the vicinity of VYNPS: Jessup's milk-vetch, northeastern bulrush, and Indiana bat. The bald eagle was listed in the SEIS as a federally-listed threatened species but this species has since been delisted. These same species, including the bald eagle, are state-listed as endangered or threatened. It was determined in the SEIS that no designated critical habitat for these species exists within the vicinity of VYNPS. The SEIS also listed an additional 29 state-listed terrestrial species (21 plants and 8 animals) as threatened, endangered, or species of special concern that could potentially occur in the vicinity of the VYNPS site. Of the terrestrial species, only the state-listed bald eagle (endangered) is known to occur in the vicinity of the VYNPS site.

Section 4.3.7 of the GEIS does not make a generic determination on the impact of decommissioning on threatened and endangered species. Rather it concludes that the adverse impacts and associated significance of the impacts must be determined on a site-specific basis.

With respect to the threatened and endangered aquatic species, the environmental impacts during decommissioning are expected to be minimal. Removal of the intake and discharge facilities as well as other shoreline structures will be conducted in accordance with BMPs outlined in permits issued by the VTDEC and if necessary, the U. S. Army Corps of Engineers. Intake canal dredging is no longer expected to occur due to the diminished heat load. As previously discussed in Section 5.1.2, the amount of cooling water withdrawn from the Connecticut River will significantly decrease thus reducing the potential impacts of impingement, entrainment, and thermal discharges on aquatic species. One potential adverse impact would be the elimination of the thermal refuge for aquatic species in the discharge area which are preyed upon by the bald eagle, similar to when VYNPS is not operating in the winter months.

The environmental impacts during decommissioning are expected to be minimal on threatened and endangered terrestrial species. ENVY does not anticipate disturbing habitat beyond the operational areas of the plant for decommissioning and construction activities. Construction activities that disturb one acre or greater of soil are permitted by the VTDEC and BMPs are required to be implemented to control sediment and the effects of erosion. Additionally, VYNPS has procedural administrative controls in place which require that significant project activities undergo an environmental review prior to the activity occurring to ensure that impacts are minimized through implementation of BMPs. Federal and state regulations pertaining to listed species will also remain in effect, which will further ensure that impacts to listed species and their habitats are minimized.

Section 4.3.7 of the GEIS also suggests that care be exercised in conducting decommissioning activities after an extended SAFSTOR period because there is a greater potential for rare species to colonize the disturbed portion of the site. However as previously discussed, procedural administrative controls and federal and state regulations that will remain in effect would ensure that mitigation measures are implemented as appropriate to protect wildlife.

Based on the above, the planned decommissioning of VYNPS will not result in a direct mortality or otherwise jeopardize the local population of any threatened or endangered species.

5.1.8 Radiological

The GEIS considered radiological doses to workers and members of the public when evaluating the potential consequences of decommissioning activities.

Occupational Dose

The occupational radiation exposure to VYNPS plant personnel will be maintained As Low As Reasonably Achievable (ALARA) and below the occupational dose limits in 10 CFR Part 20 during decommissioning. The need for plant personnel to routinely enter radiological areas to conduct maintenance, calibration, inspection, and other activities associated with an operating plant will be reduced, thus it is expected that the occupational dose to plant personnel will significantly decrease after the plant is shut down and defueled. The station ALARA program will be maintained during dormancy and the D&D periods to ensure that occupational dose is maintained ALARA and well within 10 CFR Part 20 limits.

ENVY has elected to decommission VYNPS using the SAFSTOR alternative. It is expected that the occupational dose required to complete the decommissioning activities at VYNPS would be reduced significantly by radioactive decay during the SAFSTOR period. ENVY estimates that the occupation radiation exposure would be 1,215, 378 and 317 person-rem, after SAFSTOR dormancy periods of 10, 30 and 50 years respectively. This estimate is based on an analysis of area by area decommissioning worker occupancy, current radiation levels and projected radionuclide decay. The estimates for dormancy periods greater than 10 years are within the range of SAFSTOR dose estimates (326-834 person-rem) provided in Table 4-1 of the GEIS. As suggested in footnote (b) of Table 4-1, comparison of occupational radiation exposure to that of the DECON option may be more appropriate for short dormancy periods. As such, the estimated exposure of 1,215 person-rem for the 10 year dormancy period compares favorably with the 1,874 person-rem provided in Table 4-1 for the DECON option.

Public Dose

Section 4.3.8 of the GEIS considered doses from liquid and gaseous effluents when evaluating the potential impacts of decommissioning activities on the public. Table G-15 of the GEIS compared effluent releases between operating facilities and decommissioning facilities and concluded that decommissioning releases are lower. The GEIS also concluded that the collective dose and the dose to the maximally exposed individual from decommissioning activities are expected to be well within the regulatory standards in 10 CFR Part 20 and Part 50.

The expected radiation dose to the public from VYNPS decommissioning activities will be maintained within regulatory limits and below comparable levels when the plant was operating through the continued application of radiation protection and contamination controls combined with the reduced source term available in the facility. Also Section 7.1 of the SEIS (Reference 7) concluded that there were no site-specific radiological dose aspects associated with decommissioning of VYNPS. Therefore, ENVY concludes that the impacts of VYNPS decommissioning on public dose are small and are bounded by the GEIS.

5.1.9 Radiological Accidents

The likelihood of a large offsite radiological release that impacts public health and safety after VYNPS is shut down and defueled is considerably lower than the already very low likelihood of a release from the plant during power operation. This is because the majority of the potential releases associated with power operation are not relevant after the fuel has been removed from the reactor. Furthermore, handling of spent fuel assemblies will continue to be controlled under work procedures designed to minimize the likelihood and consequences of a fuel handling accident. In addition, emergency plans and procedures will remain in place to protect the health and safety of the public while the possibility of significant radiological releases exists.

Section 4.3.9 of the GEIS assessed the range of possible radiological accidents during decommissioning and separated them into two general categories; fuel related accidents and non-fuel related accidents. Fuel related accidents have the potential to be more severe and zirconium fire accidents, in particular, could produce offsite doses that exceed EPA's protective action guides (Reference 14). As part of its effort to develop generic, risk-informed requirements for decommissioning, the NRC staff performed analysis of the offsite radiological consequences of beyond-design-basis spent fuel pool accidents using fission product inventories at 30 and 90 days and 2, 5, and 10 years. The results of the study indicate that the risk at spent fuel pools is low and well within the NRC's Quantitative Health Objectives. The generic risk is low primarily due to the very low likelihood of a zirconium fire. (Reference 3)

The potential for decommissioning activities to result in radiological releases not involving spent fuel (i.e., releases related to decontamination, dismantlement, and waste handling activities) will be minimized by use of procedures designed to minimize the likelihood and consequences of such releases.

Therefore, ENVY concludes that the impacts of VYNPS decommissioning on radiological accidents are small and are bounded by the previously issued GEIS.

5.1.10 Occupational Issues

Occupational issues are related to human health and safety. Section 4.3.10 of the GEIS evaluates physical, chemical, ergonomic, and biological hazards. ENVY has reviewed these occupational hazards in the GEIS and concluded that the decommissioning approach chosen for VYNPS poses no unique hazards from what was evaluated in the GEIS. ENVY will continue to maintain appropriate administrative controls and requirements to ensure occupational hazards are minimized and that applicable federal, state and local occupational safety standards and requirements continue to be met. Therefore, ENVY concludes that the impacts of VYNPS decommissioning on occupational issues are bounded by the GEIS.

5.1.11 Cost

Decommissioning costs for VYNPS are discussed in Section 4.0 and in Attachment 1 to this report. Section 4.3.11 of the GEIS recognizes that an evaluation of decommissioning cost is not a National Environmental Policy Act requirement. Therefore, a bounding analysis is not applicable.

5.1.12 Socioeconomics

Decommissioning of VYNPS is expected to result in negative socioeconomic impacts. As VYNPS transitions from an operating plant to a shutdown plant and into the different phases of decommissioning, an overall decrease in plant staff will occur. The lost wages of these plant staff will result in decreases in revenues available to support the local economy and local tax authorities. Some laid-off workers may relocate, thus potentially impacting the local cost of housing and availability of public services.

Section 4.3.12 of the GEIS evaluated changes in workforce and population, changes in local tax revenues, and changes in public services. The evaluation also examined large plants located in rural areas that permanently shut down early and selected the SAFSTOR option. The GEIS determined that this situation is the likeliest to have negative impacts. The GEIS concluded that socioeconomic impacts are neither detectable nor destabilizing and that mitigation measures are not warranted. Therefore, ENVY concludes that the impacts of VYNPS decommissioning on socioeconomic impacts are bounded by the GEIS.

5.1.13 Environmental Justice

Executive Order 12898 dated February 16, 1994, directs Federal executive agencies to consider environmental justice under the National Environmental Policy Act. It is designed to ensure that low-income and minority populations do not experience disproportionately high and adverse human health or environmental effects because of Federal actions.

Section 4.4.6 of the SEIS (Reference 7) analyzed 2000 census data within 50 miles of VYNPS to identify minority and low income populations. The SEIS analysis concluded that there were no census block groups in Vermont or New Hampshire within the 50-mile region that exceeded the NRC thresholds defining minority populations. The only census block groups that exceeded the NRC minority population thresholds were located south and southeast of VYNPS in Massachusetts. The majority of the census block groups exceeding the thresholds defining a low-income population were also located in the same communities to the south and southeast of the site containing minority populations. Additional low-income census block groups were located in Greenfield, Adams, and Pittsfield, Massachusetts, in Bennington, Vermont, and in Keene, New Hampshire.

Section 4.13.3 of the GEIS reviewed environmental justice decommissioning impacts related to land use, environmental and human health, and socioeconomics. ENVY does not anticipate any

offsite land disturbances during decommissioning, thus the land use impacts are not applicable for VYNPS. In addition as previously discussed in Section 5.1.12, it was determined that socioeconomic impacts from decommissioning are bounded by the GEIS. Potential impacts to minority and low-income populations would mostly consist of radiological effects. Based on the radiological environmental monitoring program data from VYNPS, the SEIS determined that the radiation and radioactivity in the environmental media monitored around the plant have been well within applicable regulatory limits. As a result, the SEIS found that no disproportionately high and adverse human health impacts would be expected in special pathway receptor populations (i.e., minority and/or low income populations) in the region as a result of subsistence consumption of water, local food, fish, and wildlife.

Therefore, ENVY concludes that the impacts of VYNPS decommissioning on environmental justice are small and are bounded by the GEIS.

5.1.14 Cultural, Historic, and Archeological Resources

Based on a review of the Vermont State Historic Preservation Office (SHPO) files and information provided by the applicant, the NRC concluded in Section 4.4.5 of the SEIS (Reference 7) that the potential impacts from license renewal of VYNPS on historic and archaeological resources would be small. The NRC's conclusion was based on: 1) no prehistoric archaeological sites have been identified on the VYNPS property, and 2) environmental review procedures have been put in place at VYNPS regarding undertakings that involve land disturbing activities in undisturbed surface and subsurface areas as well as modifications to historic structures (i.e., Governor Hunt House). These environmental protection procedures include contacting the SHPO to establish the actions necessary to protect known or as of yet undiscovered cultural resources before an action are allowed to occur.

The cultural, historic, and archeological impact evaluation conducted in the GEIS (Reference 6) focused on similar attributes as the SEIS (Reference 7). The GEIS evaluated direct effects such as land clearing and indirect effects such as erosion and siltation. The conclusion for the license renewal evaluation is also applicable to the decommissioning period because: 1) decommissioning activities will be primarily contained to disturbed areas located away from areas of existing or high potential for archaeological sites 2) construction activities that disturb one acre or greater of soil are permitted by VTDEC and BMPs are required to control sediment and the effects of erosion, and 3) environmental protection procedures pertaining to archaeological and cultural resources will remain in effect during decommissioning.

Therefore, ENVY concludes that the impacts of VYNPS decommissioning on cultural, historic, and archeological resources are small and are bounded by the GEIS.

5.1.15 Aesthetic Issues

During decommissioning, the impact of activities on aesthetic resources will be temporary and remain consistent with the aesthetics of an industrial plant. In most cases, Section 4.3.15 of the GEIS concludes that impacts such as dust, construction disarray, and noise would not easily be detectable offsite.

The GEIS concluded that the retention of structures during a SAFSTOR period or the retention of structures onsite at the time the license is terminated is likewise not an increased visual impact, but instead a continuation of the visual impact analyzed in the facility construction or operations final environmental statement.

After the decommissioning process is complete, site restoration activities will result in structures being removed from the site and the site being backfilled, graded and landscaped as needed. The GEIS concludes that the removal of structures is generally considered beneficial to the aesthetic impacts of the site.

Therefore, ENVY concludes that the impacts of VYNPS decommissioning on aesthetic issues are bounded by the GEIS.

5.1.16 Noise

General noise levels during the decommissioning process are not expected to be any more severe than during refueling outages and are not expected to present an audible intrusion on the surrounding community. Some decommissioning activities may result in higher than normal onsite noise levels (i.e., some types of demolition activities). However, these noise levels would be temporary and are not expected to experience an audible intrusion on the surrounding community.

Section 4.3.16 of the GEIS indicates that noise impacts are not detectable or destabilizing and makes a generic conclusion that potential noise impacts are small. Based on the standard decommissioning approach proposed for VYNPS, ENVY concludes that the impacts of VYNPS decommissioning on noise are bounded by the GEIS.

5.1.17 Transportation

The transportation impacts of decommissioning are dependent on the number of shipments to and from the plant, the types of shipments, the distance the material is shipped, and the radiological waste quantities and disposal plans. The shipments to and from the plant would primarily result from construction activities associated with the ISFSI expansion and shipments of radioactive wastes and non-radioactive wastes associated with dismantlement and disposal of structures, systems and components.

The estimated cubic feet of radioactive waste associated with VYNPS decommissioning that will either be destined for land disposal (Class A, B and C) or a geologic repository (Greater than Class C) is summarized as follows:

- Class A: 664,829 cubic feet
- Class B: 1,002 cubic feet
- Class C: 505 cubic feet
- Greater than Class C (GTCC): 357 cubic feet

Table 4-7 of the GEIS estimated that the volume of land needed for LLRW (Class A, B and C) disposal from the referenced BWR was 636,000 cubic feet under the SAFSTOR alternative. ENVY presently estimates the LLRW volume (Class A, B, and C) for VYNPS that is destined for land disposal is approximately 666,336 cubic feet using the SAFSTOR alternative. This volume of LLRW is comparable to the range analyzed in the GEIS.

ENVY must comply with applicable regulations when shipping radioactive waste from decommissioning. The NRC has concluded in Section 4.3.17 of the GEIS that these regulations are adequate to protect the public against unreasonable risk from the transportation of radioactive materials.

The number of GTCC waste shipments during decommissioning is expected to be below the number referenced in Table 4-6 of the GEIS. These shipments will occur over an extended period of time and will not result in significant changes to local traffic density or patterns, the need for construction of new methods of transportation, or significant dose to workers or the public.

In addition, shipments of non-radioactive wastes from the site are not expected to result in measurable deterioration of affected roads or a destabilizing increase in traffic density.

Therefore, ENVY concludes that the impacts of VYNPS decommissioning on transportation are bounded by the GEIS.

5.1.18 Irreversible and Irretrievable Commitment of Resources

Irreversible commitments are commitments of resources that cannot be recovered, and irretrievable commitments of resources are those that are lost for only a period of time.

Uranium is a natural resource that is irretrievably consumed during power operation. After the plant is shutdown, uranium is no longer consumed. The use of the environment (air, water, land) is not considered to represent a significant irreversible or irretrievable resource commitment, but rather a relatively short-term investment. Since the VYNPS site will be decommissioned to meet the unrestricted release criteria found in 10 CFR 20.1402, the land is not considered an

irreversible resource. The only irretrievable resources that would occur during decommissioning would be materials used to decontaminate the facility (e.g., rags, solvents, gases, and tools), and the fuel used for decommissioning activities and transportation of materials to and from the site. However, the use of these resources is minor.

While the GEIS does not specify quantitative bounds for commitment of irreversible and irretrievable resources, ENVY concludes that the impacts of VYNPS decommissioning on these resources are negligible and consistent with the conclusions of the GEIS.

5.2 Environmental Impacts of License Termination - NUREG-1496

According to the schedule provided in Section 3 of this report, a license termination plan for VYNPS will not be developed until approximately two years prior to the final site decontamination (currently assumed to be approximately the year 2072 subject to ENVY's commitment regarding the commencement of radiological decommissioning in the Settlement Agreement (Attachment 2)). At that time, a supplemental environmental report will be submitted as required by 10 CFR 50.82(a)(9). While detailed planning for license termination activities will not be performed until after the SAFSTOR dormancy period, the absence of any unique site-specific factors, significant groundwater contamination, unusual demographics, or impediments to achieving unrestricted release support an expectation that impacts resulting from license termination will be similar to those evaluated in NUREG-1496 (Reference 6).

5.3 Discussion of Decommissioning in the Supplemental Environmental Impact Statement (SEIS)

As part of the VYNPS license renewal process, decommissioning was discussed in Section 7.0 of the SEIS (Reference 7). Identified were six issues related to decommissioning as follows:

- Radiation Doses
- Waste Management
- Air Quality
- Water Quality
- Ecological Resources
- Socioeconomic Impacts

The NRC staff did not identify any new and significant information during their independent review of the VYNPS license renewal environmental report (Reference 15), the site audit, or the scoping process for license renewal. The NRC concluded that there are no impacts related to

these issues beyond those discussed in the GEIS for license renewal (Reference 16) or the GEIS for decommissioning (Reference 3). For the issues identified above, the license renewal and decommissioning GEISs both concluded the impacts are small. The NRC found no site-specific issues related to decommissioning. There are no contemplated decommissioning activities that would alter that conclusion.

5.4 Additional Considerations

The following considerations are relevant to concluding that decommissioning activities will not result in significant environmental impacts not previously reviewed:

- The release of effluents will continue to be controlled by plant license requirements and plant procedures.
- ENVY will continue to comply with the Offsite Dose Calculation Manual, Radiological Environmental Monitoring Program, and the Groundwater Protection Initiative Program during decommissioning.
- Releases of non-radiological effluents will continue to be controlled per the requirements of the NPDES permit and applicable State of Vermont permits.
- Systems used to treat or control effluents during power operation will either be maintained or replaced by temporary or mobile systems for the decommissioning activities.
- Radiation protection principles used during plant operations will remain in effect during decommissioning.
- Sufficient decontamination and source term reduction prior to dismantlement will be performed to ensure that occupational dose and public exposure will be maintained below applicable limits.
- Transport of radioactive waste will be in accordance with plant procedures, applicable Federal regulations, and the requirements of the receiving facility.
- Site access control during decommissioning will minimize or eliminate radiation release pathways to the public.
- The Settlement Agreement (Attachment 2) requires ENVY to conduct all activities in Vermont, including at the VY Station site, in accordance with federal and state laws, including VDH's Radiological Health Rule.

Additionally, NUREG-2157, Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel, found that the generic environmental impacts of ongoing spent fuel storage are small (Reference 17).

5.5 Conclusions

Based on the above discussions, ENVY concludes that the environmental impacts associated with planned VYNPS site-specific decommissioning activities are less than and bounded by the impacts addressed by previously issued environmental impact statements. Specifically, the environmental impacts are bounded by the GEIS (Reference 3) and SEIS (Reference 7).

1. The postulated impacts associated with the decommissioning method chosen, SAFSTOR, have already been considered in the SEIS and GEIS.

2. There are no unique aspects of VYNPS or of the decommissioning techniques to be utilized that would invalidate the conclusions reached in the SEIS and GEIS.

3. The methods assumed to be employed to dismantle and decontaminate VYNPS are standard construction-based techniques fully considered in the SEIS and GEIS.

Therefore, it can be concluded that the environmental impacts associated with the site-specific decommissioning activities for VYNPS will be bounded by appropriate previously issued environmental impact statements.

10 CFR 50.82(a)(6)(ii) states that licensees shall not perform any decommissioning activities, as defined in 10 CFR 50.2 that result in significant environmental impacts not previously reviewed. No such impacts have been currently identified. ENVY will conduct ongoing reviews during the decommissioning process to assure identification of any such impacts.

6.0 REFERENCES

1. Regulatory Guide 1.185, Standard Format and Content for Post-Shutdown Decommissioning Activities Report, Revision 1. June 2013.

2. Letter, Entergy Nuclear Operations, Inc., to USNRC, Notification of Permanent Cessation of Power Operations, BVY 13-079. September 23, 2013. (ADAMS Accession No. ML13273A204)

3. NUREG-0586, Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors, Final Report. November 2002.

4. AIF/NESP-036, A Guideline for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates. May 1986.

5. Regulatory Guide 1.159, Assuring the Availability of Funds for Decommissioning Nuclear Reactors, Revision 2. October 2011.

6. NUREG-1496, Generic Environmental Impact Statement in Support of Rulemaking on Radiological Criteria for License Termination of NRC-Licensed Nuclear Facilities. July 1997.

7. NUREG-1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 30, Regarding Vermont Yankee Nuclear Power Station. August 2007.

8. Entergy Nuclear Vermont Yankee, LLC NPDES Permit No. VT0000264. October 2014.

9. Entergy Nuclear Vermont Yankee, LLC Indirect Discharge Permit ID-9-0036. January 2011.

10. Entergy Nuclear Vermont Yankee, LLC Solid Waste Management Facility Certification F0405.August 2014.

11. Entergy Nuclear Vermont Yankee Public Water System Temporary Permit to Operate No. 8332. July 2008.

12. Entergy Nuclear Vermont Yankee Public Water System Temporary Permit to Operate No. 20738. August 2008.

13. Vermont Yankee Air Contaminant Source Registration Certificate WM2335. 2014.

14. PAG Manual, Protective Action Guides and Planning Guidance for Radiological Incidents, Draft for Interim Use and Public Comment. March 2013.

15. Vermont Yankee Nuclear Power Station, License Renewal Application. Appendix E, Applicant's Environmental Report. January 2006.

16. NUREG-1437, Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants. June 2013.

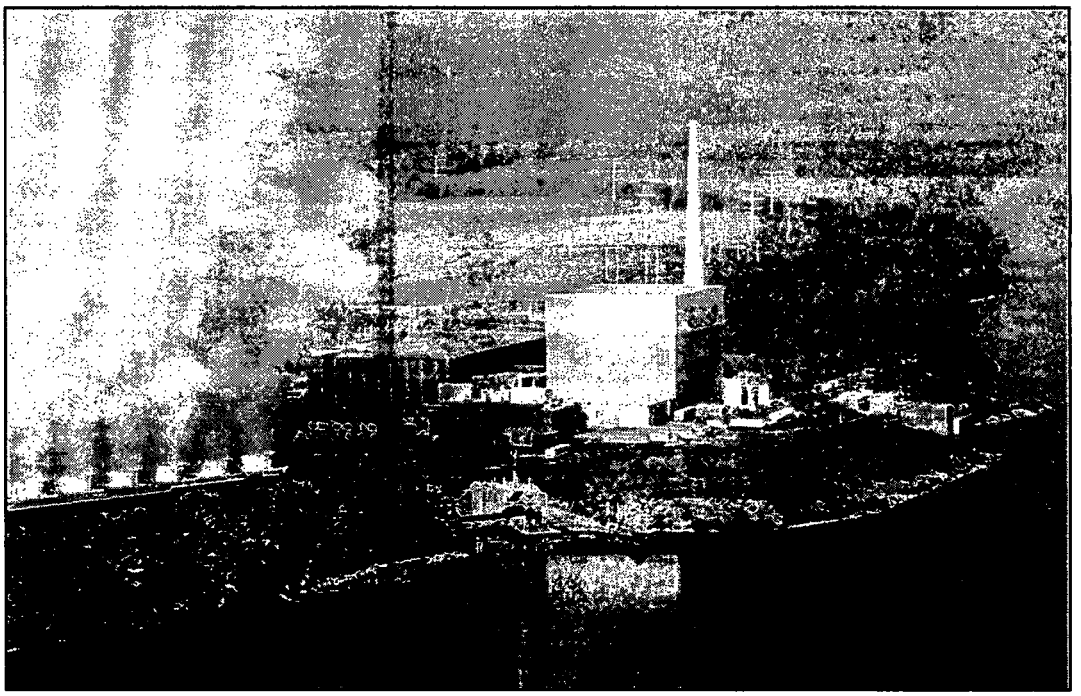
17. NUREG-2157, Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel, Final Report. September 2014.

Attachment 1: VYNPS Site-Specific Decommissioning Cost Estimate

SITE SPECIFIC DECOMMISSIONING COST ESTIMATE

for the

VERMONT YANKEE NUCLEAR POWER STATION



prepared for

ENTERGY NUCLEAR VERMONT YANKEE

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December 2014

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No.	Date	Item Revised	Reason for Revision
0	12-16-2014		Original Issue

EXECUTIVE SUMMARY

This report presents a site-specific estimate of the cost to decommission the Vermont Yankee Nuclear Power Station (Vermont Yankee) following the scheduled cessation of plant operations. By letter dated September 23, 2013,[1] Entergy Nuclear Operations notified the Nuclear Regulatory Commission (NRC) that it intended to permanently cease power operations at Vermont Yankee at the end of the current operating cycle. The target date for the cessation of operations is December 29, 2014. This estimate has been prepared for Entergy Nuclear Vermont Yankee (Entergy VY) to comply with the requirements of 10 CFR 50.82(a)(8)(iii).[2]

The analysis relies upon the detailed planning that has been performed in anticipation of the pending cessation of operations and the site-specific, technical information from an earlier evaluation prepared in 2011,[3] updated to reflect current assumptions pertaining to the disposition of the nuclear unit and relevant industry experience in undertaking such projects.

The current estimate is designed to provide Entergy VY with sufficient information to assess its financial obligations, as they pertain to the decommissioning of the nuclear unit. It is not a detailed budget and engineering document, but a financial analysis prepared in advance of the detailed budgeting and engineering work that will be required to carry out the decommissioning.

The estimate does include the detailed planning (and budgeting) for placing the unit in safe-storage and moving the spent fuel from the pool located within the reactor building to the on-site dry storage facility. It may not reflect the actual plan to decommission Vermont Yankee; the plan may differ from the assumptions made in this analysis based on facts that exist at the time the plant is dismantled.

Entergy VY intends to decommission the plant using the NRC-approved SAFSTOR alternative. The projected total cost to decommission the nuclear unit, after an extended period of safe storage, is estimated at $1.243 billion, as reported in 2014 dollars. The cost includes monies anticipated to be spent for operating license termination (radiological remediation), interim spent fuel storage and site

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1 Letter, Entergy Nuclear Operations, Inc., to USNRC, "Notification of Permanent Cessation of Power Operations," BVY 13-079, dated September 23, 2013. (ADAMS Accession No. ML13273A204)

2 Within 2 years following permanent cessation of operations, if not already submitted, the licensee shall submit a site-specific decommissioning cost estimate.

3 "Decommissioning Cost Analysis for the Vermont Yankee Nuclear Power Station," TLG Document No. E11-1543-001, Rev. 1, February 2012

restoration activities. The cost is 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.

A discussion of the assumptions relied upon in this analysis is provided in Section 3, along with schedules of annual expenditures. A sequence of significant project activities is provided in Section 4 along with a timeline for the scenario. A detailed cost report, used to generate the summary tables presented within this document, is provided in Appendix C.

The estimate includes the continued operation of the reactor building as an interim wet fuel storage facility for approximately five and one-half years after operations cease. During this time period, the spent fuel residing in the storage pool will be transferred to an independent spent fuel storage installation (ISFSI) at the site. The ISFSI will remain operational until the Department of Energy (DOE) is able to complete the transfer of the fuel to a federal facility (e.g., a monitored retrievable storage facility).[4]

DOE has breached its obligations to remove fuel from reactor sites on the contracted schedule, and has also failed to provide plant owners with information about how it will ultimately perform and fulfill its obligation. DOE officials have stated that DOE does not have an obligation to accept already-canistered fuel without an amendment to DOE's contracts with plant licensees to remove the fuel (the "Standard Contract"), but DOE has not explained what costs any such amendment would involve. Consequently, the plant owner has no information or expectations on how DOE will remove fuel from the site in the future. In the absence of information about how DOE will specifically deal with already-canistered fuel, and for purposes of this analysis only, this cost estimate assumes that there will be no additional costs associated with DOE's acceptance of such fuel. If this assumption is incorrect, it is assumed that DOE will have liability for costs incurred to transfer the fuel to DOE-supplied containers, and to dispose of existing containers.

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4 Projected expenditures for spent fuel management identified in the cost analyses do not consider the outcome of the litigation (including compensation for damages) with the DOE with regard to the delays incurred by Entergy VY in the timely removal of spent fuel from the site. As such, this analysis takes no credit for collection of damages, even though utilities are now routinely being awarded such damages in the courts. Collection of spent fuel damages from the DOE is expected to provide the majority of funds needed for spent fuel management following shutdown.

Alternatives and Regulations

The NRC provided general decommissioning guidance in a rule adopted on June 27, 1988.[5] In this rule, the NRC set forth technical and financial criteria for decommissioning licensed nuclear facilities. The regulations addressed planning needs, timing, funding methods, and environmental review requirements for decommissioning. The rule also defined three decommissioning alternatives as being acceptable to the NRC: DECON, SAFSTOR, and ENTOMB.

> DECON is defined as "the alternative in which the equipment, structures, and portions of a facility and site containing radioactive contaminants are removed or decontaminated to a level that permits the property to be released for unrestricted use shortly after cessation of operations."[6]
>
> 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."[7] Decommissioning is required 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."[8] As with the SAFSTOR alternative, decommissioning is currently required to be completed within 60 years, although longer time periods will also be considered when necessary to protect public health and safety.
>
> The 60-year restriction has limited the practicality for the ENTOMB alternative at commercial reactors that generate significant amounts of long-lived radioactive material. In 1997, the Commission directed its staff

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5 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

6 Ibid. Page FR24022, Column 3

7 Ibid.

8 Ibid. Page FR24023, Column 2

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 its 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.[9] 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 that are acceptable to the NRC staff for implementing the requirements of the 1996 revised rule that relate to the initial activities and the major phases of the decommissioning process. The costs and schedules presented in this analysis follow the general guidance and sequence in the amended regulations. The format and content of the estimate is also consistent with the recommendations of Regulatory Guide 1.202, issued February 2005.[10]

In 2011, the NRC published amended regulations to improve decommissioning planning and thereby reduce the likelihood that any current operating facility will become a legacy site.[11] The amended regulations require licensees to report additional details in their decommissioning cost estimate including a decommissioning estimate for the ISFSI. This estimate is provided in Appendix D.

Basis of the Cost Estimate

For planning purposes, the SAFSTOR decommissioning alternative has been selected by Entergy VY for Vermont Yankee. In SAFSTOR, the facility is placed in a safe and stable condition and maintained in that state, allowing levels of radioactivity to decrease through radioactive decay. After the safe storage period, the facility is decontaminated and dismantled, removing residual radioactivity so as to permit termination of the operating license and unrestricted use of the site.

The existing ISFSI will be expanded so that the entire inventory of spent fuel (generated over the reactor's operating life) can be accommodated. The spent fuel will

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9 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

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

11 U.S. Code of Federal Regulations, Title 10, Parts 20, 30, 40, 50, 70, and 72, "Decommissioning Planning," Nuclear Regulatory Commission, Federal Register Volume 76, (p 35512 et seq.), June 17, 2011

remain in storage until it can be transferred to a DOE facility. Based upon the performance assumptions discussed herein, Entergy VY anticipates that the removal of spent fuel from the site could be completed by the end of year 2052.

For purposes of this analysis, the plant is assumed to remain in safe-storage until 2068, at which time decommissioning will commence. The start date allows sufficient time to accomplish the activities described in this document and to terminate the operating license within the required 60-year time period.

Methodology

Entergy VY's Decommissioning Project Organization, the corporate Project Management Organization, plant staff, and numerous other corporate entities and subject matter experts have been engaged in the detailed planning and engineering needed to transition the nuclear unit and its operating organization from power generation to safe-storage. This information was used to create working budgets and the forecast for the first six years following the cessation of operations, or until the spent fuel is relocated to the ISFSI (years 2015 through 2020) and the plant secured for long-term storage.

These same organizations provided substantial input into estimating the annual costs associated with maintaining the station in a dormancy state (years 2021 through 2067).

The methodology used to develop the estimate for the deferred decontamination and dismantling activities described within this document (years 2068 through 2075) follows the basic approach originally presented in the cost estimating guidelines[12] developed by the Atomic Industrial Forum (now Nuclear Energy Institute). This reference describes a unit factor method for determining decommissioning activity costs. The unit factors used in this analysis incorporate site-specific costs and the latest available information on worker productivity in decommissioning.

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

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

Contingency

Consistent with standard cost estimating practices, contingencies are applied to the decontamination and dismantling costs developed as a "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."[13] The cost elements in the estimate 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 period of performance (these factors are typically addressed in a funding analysis).

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 is available to accomplish the intended tasks.

Low-Level Radioactive Waste Management

The contaminated and neutron-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 Amendments of 1985,[14] the states became ultimately responsible for the disposition of low-level radioactive waste generated within their own borders.

Vermont, along with Maine, joined with Texas to form a compact for the disposal of low-level radioactive waste generated by the three states, with Texas as the host state. The Maine Legislature subsequently voted to exit the Texas compact (effective April 5, 2002) following the shutdown and decommissioning of its only commercial nuclear unit (Maine Yankee). Vermont remains a member of the compact.

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

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

The Texas Commission on Environmental Quality (TCEQ), the environmental agency for the state, is responsible for the licensing of any low-level radioactive waste disposal facility in Texas. In 2004, the agency received an application from Waste Control Specialists (WCS) for authorization to construct and operate a low-level radioactive disposal site in Andrews County. The agency granted WCS a disposal license in 2009 and approval to commence construction in early 2011. Construction of the disposal facility is now complete and is now receiving waste from compact members (and limited quantities from non-compact members).

For the purposes of this analysis, low-level radioactive waste generated in the decontamination and dismantling of the plant and remediation of the Vermont Yankee site is assumed to be disposed of at the Texas Compact site. Waste disposal costs are based upon representative rates for the facility consistent with the waste classification.[15]

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

For purposes of this analysis only, the GTCC radioactive waste is assumed to be packaged and disposed of in a similar manner as high-level waste and at a cost equivalent to that envisioned for the spent fuel. The GTCC is shipped directly to a DOE facility as it is generated (assuming that the spent fuel has been removed from the site prior to the start of decommissioning).

High-Level Radioactive Waste Management

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.

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15 Low-level radioactive waste is classified in accordance with U.S. Code of Federal Regulations, Title 10, Part 61.55

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 assumes that spent fuel allocations will 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.[16] Entergy VY's current spent fuel management plan for the Vermont Yankee spent fuel assumed in this estimate is based in general upon: 1) a 2025 start date for DOE initiating transfer of commercial spent fuel to a federal facility (not necessarily a final repository), and 2) expectations for spent fuel receipt by the DOE for the Vermont Yankee fuel. The DOE's generator allocation/receipt schedules are based upon the oldest fuel receiving the highest priority. Assuming a maximum rate of transfer of 3,000 metric tons of uranium (MTU)/year, [17] the removal of spent fuel from the site is assumed to be completed in 2052 for a 2014 shutdown. Different DOE acceptance schedules may result in different completion dates.

Today, the country is at an impasse on high-level waste disposal, despite DOE's submittal of its License Application for a geologic repository to the NRC in 2008. The current administration has eliminated the budget for the repository program while promising to "conduct a comprehensive review of policies for managing the back end of the nuclear fuel cycle ... and make recommendations for a new plan."[18] 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."[19]

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16 In 2008, the DOE issued a report to Congress in which it concluded that it did not have authority, under present law, to accept spent nuclear fuel for interim storage from decommissioned commercial nuclear power reactor sites. However, the Blue Ribbon Commission, in its final report, noted that: "[A]ccepting spent fuel according to the OFF [Oldest Fuel First] priority ranking instead of giving priority to shutdown reactor sites could greatly reduce the cost savings that could be achieved through consolidated storage if priority could be given to accepting spent fuel from shutdown reactor sites before accepting fuel from still-operating plants. .... The magnitude of the cost savings that could be achieved by giving priority to shutdown sites appears to be large enough (i.e., in the billions of dollars) to warrant DOE exercising its right under the Standard Contract to move this fuel first." For planning purposes only, this estimate does not assume that Vermont Yankee, as a permanently shutdown unit, will receive priority; the fuel removal schedule assumed in this estimate is based upon DOE acceptance of fuel according to the "Oldest Fuel First" priority ranking. The plant owner will seek the most expeditious means of removing fuel from the site when DOE commences performance.

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

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

19 Ibid.

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"[20]
- "[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."[21]

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..."[22] This document states:

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

- Sites, designs and licenses, constructs and begins operations of a pilot interim storage facility by 2021 with an initial focus on accepting used nuclear fuel from shut-down reactor sites;
- Advances toward the siting and licensing of a larger interim storage facility to be available by 2025 that will have sufficient capacity to provide flexibility in the waste management system and allows for acceptance of enough used nuclear fuel to reduce expected government liabilities; and
- Makes demonstrable progress on the siting and characterization of repository sites to facilitate the availability of a geologic repository by 2048."[23]

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20 "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

21 Ibid., p.27

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

23 Ibid., p.2

The NRC's review of DOE's license application to construct a geologic repository at Yucca Mountain was suspended in 2011 when the Administration significantly reduced the budget for completing that work. However, the US Court of Appeals for the District of Columbia Circuit issued a writ of mandamus (in August 2013)[24] ordering NRC to comply with federal law and resume its review of DOE's Yucca Mountain repository license application to the extent allowed by previously appropriated funding for the review. That review is now underway, and two volumes of the safety evaluation report have been published. The current schedule calls for completion and publication of the last safety evaluation reports by January 2015. The adjudicatory hearing, which must be completed before a licensing decision can be made, remains suspended.

The NRC requires that licensees establish a program to manage and provide funding for the caretaking of all irradiated fuel at the reactor site until title of the fuel is transferred to the DOE.[25] Interim storage of the fuel, until the DOE has completed the transfer, will be in the reactor building's spent fuel storage pool, as well as at an on-site ISFSI.

An ISFSI, operated under a Part 50 General License (in accordance with 10 CFR 72, Subpart K[26]), was constructed to support continued plant operations. The facility will be expanded following the cessation of plant operations to accommodate all spent fuel generated over the plant life. Once the spent fuel storage pool is emptied the reactor building will be prepared for long term storage.

Entergy VY's position is that the DOE has a contractual obligation to accept the spent fuel earlier than the projections set out in this cost study, consistent with its contract commitments.[27] No assumption made in this study should be interpreted to be

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24 U.S. Court of Appeals for the District Of Columbia Circuit, In Re: Aiken County, et al, Aug. 2013,http://www.cadc.uscourts.gov/internet/opinions.nsf/BAE0CF34F762EBD985257BC6004DEB18/$file/11-1271-1451347.pdf

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

26 U.S. Code of Federal Regulations, Title 10, Part 72, Subpart K, "General License for Storage of Spent Fuel at Power Reactor Sites"

27 In addition to priority for shutdown reactors, the Standard Contract also includes a provision allowing for "exchanges" of spent fuel acceptance allocations. Entergy VY would have used such exchanges if DOE had been performing under its contract because such use would have obviated the need for dry fuel storage facilities at the plant. But because DOE has not performed under its contract and Entergy VY is required to construct and operate dry fuel storage facilities, this estimate does not assume that Entergy VY will exchange its acceptance allocations to accelerate the removal of fuel from the site. As noted earlier, the fuel removal schedule assumed in this estimate is based upon DOE acceptance of fuel according to the "Oldest Fuel First" priority

inconsistent with this position. However, at this time, including the cost of long-term spent fuel storage at Vermont Yankee in this study and assuming DOE acceptance of fuel on an Oldest Fuel First basis is the most reasonable approach because it insures the availability of sufficient decommissioning funds given that, contrary to its contractual obligation, the DOE has not performed to date.

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 can substantially damage power block structures, potentially weakening the footings and structural supports. 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 is deferred.

This study consequently assumes that the site structures addressed by this analysis are removed and further assumes that such removal will be to a nominal depth of three feet below the local grade level wherever possible. The rubble produced in the demolition and dismantling of the structures is processed to remove the steel rebar and then shipped off-site for further processing (e.g., to recover the aggregate) and/or conventional disposal. Clean fill is brought in to backfill the below grade voids (i.e., the demolition debris, including clean concrete, is not used on-site for fill). The site can then be graded and stabilized.

Summary

The estimate to decommission Vermont Yankee assumes the removal of all contaminated and activated plant components and structural materials after a storage period such that Energy VY may then have unrestricted use of the site with no further requirement for an operating license. Low-level radioactive waste, other than GTCC waste, is sent to a controlled disposal facility.

Decommissioning is accomplished within the 60-year period required by current NRC regulations. In the interim, the spent fuel remains in storage at the site until such time that the transfer to a DOE facility is complete.

The SAFSTOR alternative evaluated in this analysis is described in Section 2. The assumptions are presented in Section 3, along with schedules of annual expenditures. The major cost contributors are identified in Section 6, with detailed

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ranking.

activity costs, waste volumes, and associated manpower requirements delineated in Appendix C. The major cost components are also identified in the cost summary provided at the end of this section.

The cost elements are assigned to one of three subcategories: NRC License Termination (radiological remediation), Spent Fuel Management, and Site Restoration. The subcategory "NRC License Termination" is used to accumulate costs that are consistent with "decommissioning" as defined by the NRC in its financial assurance regulations (i.e., 10 CFR §50.75). In situations where the long-term management of spent fuel is not an issue, the cost reported for this subcategory is generally sufficient to terminate a reactor's operating license.

The "Spent Fuel Management" subcategory contains costs associated with the construction of a second ISFSI pad, containerization and transfer of spent fuel to the ISFSI, and the operation of the ISFSI until such time that the transfer of all fuel from this facility to an off-site location is complete. It does not include any costs related to the final disposal of the spent fuel.

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

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

As noted within this document, the estimate was developed and costs are presented in 2014 dollars. The estimate does not reflect the escalation of costs (due to inflationary and market forces) over the safe-storage and decommissioning period.

The decommissioning subperiods and milestone dates for the analyzed SAFSTOR decommissioning alternative are identified in Table 1. The cost projected for license termination (in accordance with 10 CFR 50.75) is shown in Table 2, along with the costs for spent fuel management and site restoration. The schedule of expenditures for license termination activities is provided in Table 3.

TABLE 1
DECOMMISSIONING SCHEDULE AND PLANT STATUS SUMMARY

Decommissioning Activities / Plant Status	Start	End	Approximate Duration (years)
Pre-Shutdown Planning	Aug 2013	Dec 2014	1.3
Transition from Operations			
Plant Shutdown	29 Dec 2014	--------	--------
Preparations for SAFSTOR Dormancy	29 Dec 2014	30 Apr 2016	1.3
SAFSTOR Dormancy			
Dormancy w/Wet Fuel Storage	2016	2020	4.2
Dormancy w/Dry Fuel Storage	2020	2052	32.5
Dormancy w/No Fuel Storage	2053	2067	15.0
Decommissioning Preparations [1]			
Preparations for D&D	2068	2069	1.5
Dismantling & Decontamination			
Large Component Removal	2069	2070	1.3
Plant Systems Removal and Building Decontamination	2070	2073	2.5
License Termination	2073	2073	0.7
Site Restoration			
Site Restoration	2073	2075	1.5
Total from Shutdown to Completion of License Termination [2]	---------	--------	59.0

[1] Subject to the commitments regarding the commencement of radiological decommissioning in the December 23, 2013 Settlement Agreement with the Vermont Public Service Department, Vermont Agency of Natural Resources, and Vermont Department of Health

[2] Excluding Site Restoration

TABLE 2
DECOMMISSIONING COST SUMMARY
(thousands of 2014 dollars)

Decommissioning Periods	License Termination	Spent Fuel Management	Site Restoration
Planning and Preparations	119,981	23,068	-
Dormancy w/Wet Fuel Storage	45,746	217,244	-
Dormancy w/Dry Fuel Storage	137,229	128,035	-
Dormancy w/No Fuel Storage	54,016	-	-
Site Reactivation	43,277	-	578
Decommissioning Preparation	36,283	-	456
Large Component Removal	141,032	-	25
Plant Sys. Removal and Bldg. Remediation	208,167	-	4,118
License Termination	30,668	-	-
Site Restoration	823	-	51,968
Total [1]	817,219	368,347	57,145

[1] Columns may not add due to rounding

TABLE 3
LICENSE TERMINATION EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equip. & Materials	Energy	Waste Disposal	Other	Total
2013-14	0	0	0	0	15,165	15,165
2015	39,626	533	3,912	38	37,089	81,198
2016	15,512	442	1,004	22	19,145	36,126
2017	2,015	395	184	14	8,216	10,823
2018	1,898	395	184	14	7,057	9,548
2019	1,858	395	184	14	5,722	8,173
2020	5,716	1,234	1,288	1,200	8,326	17,763
2021	1,969	284	187	7	2,794	5,241
2022	1,969	284	187	7	2,744	5,191
2023	1,969	284	187	7	2,744	5,191
2024	1,974	285	187	7	1,196	3,650
2025	1,969	284	187	7	1,144	3,591
2026	1,969	284	187	7	1,286	3,733
2027	1,969	284	187	7	1,336	3,783
2028	1,974	285	187	7	1,288	3,742
2029	1,969	284	187	7	1,286	3,733
2030	1,969	284	187	7	1,336	3,783
2031	1,969	284	187	7	1,286	3,733
2032	1,974	285	187	7	1,288	3,742
2033	1,969	284	187	7	1,336	3,783
2034	1,969	284	187	7	1,286	3,733
2035	1,969	284	187	7	1,286	3,733
2036	1,974	285	187	7	1,338	3,792
2037	1,969	284	187	7	1,286	3,733
2038	1,969	284	187	7	1,286	3,733
2039	1,969	284	187	7	1,336	3,783
2040	1,974	285	187	7	1,288	3,742
2041	1,969	284	187	7	1,286	3,733
2042	1,969	284	187	7	1,336	3,783
2043	1,969	284	187	7	1,286	3,733
2044	1,974	285	187	7	1,288	3,742
2045	1,969	284	187	7	1,336	3,783

TABLE 3 (continued)
LICENSE TERMINATION EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equip. & Materials	Energy	Waste Disposal	Other	Total
2046	1,969	284	187	7	1,286	3,733
2047	1,969	284	187	7	1,286	3,733
2048	1,974	285	187	7	1,338	3,792
2049	1,969	284	187	7	1,286	3,733
2050	1,969	284	187	7	1,286	3,733
2051	1,969	284	187	7	1,336	3,783
2052	1,974	285	187	7	1,288	3,742
2053	1,969	278	187	6	1,142	3,583
2054	1,969	278	187	6	1,192	3,633
2055	1,969	278	187	6	1,142	3,583
2056	1,974	279	187	6	1,144	3,591
2057	1,969	278	187	6	1,192	3,633
2058	1,969	278	187	6	1,142	3,583
2059	1,969	278	187	6	1,142	3,583
2060	1,974	279	187	6	1,194	3,641
2061	1,969	278	187	6	1,142	3,583
2062	1,969	278	187	6	1,142	3,583
2063	1,969	278	187	6	1,192	3,633
2064	1,974	279	187	6	1,144	3,591
2065	1,969	278	187	6	1,142	3,583
2066	1,969	278	187	6	1,192	3,633
2067	1,969	278	187	6	1,142	3,583
2068	35,936	1,912	1,873	32	3,524	43,277
2069	53,909	14,320	1,821	12,174	9,806	92,030
2070	53,452	15,787	1,689	18,228	15,362	104,519
2071	46,489	8,170	1,401	10,716	17,749	84,524
2072	46,616	8,192	1,405	10,745	17,995	84,953
2073	38,409	3,090	599	2,488	5,554	50,139
2074	151	0	0	0	360	512
2075	71	0	0	0	224	295
Total	434,259	68,148	24,326	56,003	234,483	817,219

1. INTRODUCTION

This report presents a site-specific estimate of the cost to decommission the Vermont Yankee Nuclear Power Station (Vermont Yankee). The analysis relies upon the detailed planning that has been performed in anticipation of the pending cessation of operations and the site-specific, technical information from an earlier evaluation prepared in 2011,[1] updated to reflect current assumptions pertaining to the disposition of the nuclear unit and relevant industry experience in undertaking such projects. This estimate has been prepared for Entergy Nuclear Vermont Yankee (Entergy VY) to comply with the requirements of 10 CFR 50.82(a)(8)(iii).[2]

The estimate is designed to provide Entergy VY with sufficient information to assess its financial obligations, as they pertain to the decommissioning of the nuclear unit. It is not a detailed budget and engineering plan, but a financial analysis prepared in advance of the detailed budgeting and engineering work that will be required to carry out the decommissioning.

The estimate does include the detailed planning (and budgeting) for placing the unit in safe-storage and moving the spent fuel from the pool located within the reactor building to the on-site dry storage facility. It may not reflect the actual plan to decommission Vermont Yankee; the plan may differ from the assumptions made in this analysis based on facts that exist at the time the plant is dismantled.

1.1 OBJECTIVE

The plant entered commercial operation in 1972 with a license to operate 40 years. In January 2006, Entergy VY and Entergy Nuclear Operations, Inc. (ENO) submitted an application to the NRC for renewal of the facility operating license (DPR-28) for a period of an additional 20 years. In March 2011, the Nuclear Regulatory Commission (NRC) approved the request to extend the facility operating license from midnight March 21, 2012, to midnight March 21, 2032.

By letter dated September 23, 2013,[3] ENO notified the NRC that it intended to permanently cease power operations of Vermont Yankee at the end of the current operating cycle. The target date for the cessation of operations is December 29, 2014.

The objective of this analysis is to prepare a comprehensive estimate of the cost, detailed schedule of the associated activities, and projections of the low-

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1 References for citations in Sections 1-6 are provided in Section 7

level radioactive waste generated in decommissioning Vermont Yankee for the SAFSTOR alternative. The estimate is based upon the assumptions delineated within this document, including the Department of Energy's (DOE) performance as it relates to the removal of spent fuel from the site.

1.2 SITE DESCRIPTION

Vermont Yankee is a single unit facility located near the town of Vernon, Vermont. The site is located in Windham County on the western shore of the Connecticut River, immediately upstream of the Vernon Hydroelectric Station. The boiling water reactor (BWR), and supporting facilities are owned and operated by Entergy VY.

The station comprises a single BWR, designed and fabricated by General Electric Company, producing steam for direct use in the steam turbine. Supporting facilities were engineered and constructed by Ebasco Services, Inc.

The reactor vessel and the recirculation system are contained within the drywell of a pressure suppression system housed within the reactor building. The system consists of a drywell, a pressure suppression chamber that stores a large volume of water, and a connecting submerged vent system between the drywell and water pool, isolation valves, containment cooling systems, and other service equipment. The reactor building encloses the pressure suppression primary containment thereby providing a secondary containment.

In September 2003, Entergy VY requested an amendment to its facility operating license (DPR-28) to increase the maximum authorized power level from 1593 Megawatts-thermal (MWt) to 1912 MWt. The request was subsequently approved and the unit is operating at the higher level.

Heat produced in the reactor is converted to electrical energy by the power conversion system. A turbine-generator system converts the thermal energy of steam produced by the reactor into mechanical shaft power and then into electrical energy. The turbine consists of a high-pressure cylinder and two double-flow low-pressure cylinders all aligned in tandem. The generator is a direct-driven 1800 rpm conductor-cooled, synchronous generator. The turbine is operated in a closed feedwater cycle which condenses the steam; the heated feedwater is returned to the reactor. Heat rejected in the main condensers is removed by the circulating water system.

The circulating water system provides the heat sink required for removal of waste heat in the power plant's thermal cycle. This system has the principal function of removing heat by absorbing this energy in the main condenser.

Circulating water is drawn from the Connecticut River with heated cooling water returned to the river. Alternatively, the circulating water is recirculated through the system exchanging its heat with the atmosphere by means of cooling towers.

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.[4] 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,"[5] which provided additional guidance to the licensees of nuclear facilities on the financial methods acceptable to the NRC staff for complying with the provisions of the rule. The regulatory guide addressed the funding requirements and provided guidance on the content and form of the financial assurance mechanisms identified in the rule.

The rule defined three decommissioning alternatives as being acceptable to the NRC: DECON, SAFSTOR, and ENTOMB. The DECON alternative assumes that any contaminated or neutron-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, while the SAFSTOR and ENTOMB alternatives defer the process.

The rule also placed limits on the time allowed to complete the decommissioning process. For all alternatives, 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. At the conclusion of a dormancy period, the site would still require significant remediation to meet the unrestricted release limits for license termination.

The ENTOMB alternative has not been viewed as a viable option for power reactors due to the significant time required to isolate the long-lived radionuclides for decay to permissible levels. With the rulemaking permitting the controlled release of a site,[6] the NRC did re-evaluate the alternative. The resulting feasibility study, based upon an assessment by Pacific Northwest National Laboratory, concluded that the method did have conditional merit for

some, if not most reactors. The staff also found that additional rulemaking would be needed before this option could be treated as a generic alternative.

The NRC had considered rulemaking to alter the 60-year time for completing decommissioning and to clarify the use of engineered barriers for reactor entombments.[7] However, the NRC's staff has subsequently recommended that rulemaking be deferred, based upon several factors (e.g., no licensee has committed to pursuing the entombment option, the unresolved issues associated with the disposition of greater-than-Class C material (GTCC), and the NRC's current priorities), at least until after the additional research studies are complete. The Commission concurred with the staff's recommendation.

In 1996, the NRC published revisions to the general requirements for decommissioning nuclear power plants.[8] When the decommissioning regulations were adopted in 1988, it was assumed that the majority of licensees would decommission at the end of the facility's operating licensed life. Since that time, several licensees have permanently and prematurely ceased operations. Exemptions from certain operating requirements were required once the reactor was defueled to facilitate the decommissioning. Each case was handled individually, without clearly defined generic requirements. The NRC amended the decommissioning regulations in 1996 to clarify ambiguities and codify procedures and terminology as a means of enhancing efficiency and uniformity in the decommissioning process. The amendments allow for greater public participation and better define the transition process from operations to decommissioning.

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

1.3.1 High-Level Radioactive Waste Management

Congress passed the "Nuclear Waste Policy Act"[9] (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. It 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.

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 assumes that spent fuel allocations will 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. Entergy VY's current spent fuel management plan for the Vermont Yankee spent fuel assumed in this estimate is based in general upon: 1) a 2025 start date for DOE initiating transfer of commercial spent fuel to a federal facility (not necessarily a final repository), and 2) expectations for spent fuel receipt by the DOE for the Vermont Yankee fuel. The DOE's generator allocation/receipt schedules are based upon the oldest fuel receiving the highest priority. Assuming a maximum rate of transfer of 3,000 metric tons of uranium (MTU)/year, as reflected in DOE's latest Acceptance Priority Ranking and Annual Capacity Report dated June 2004 (DOE/RW-0567),[10] the removal of spent fuel from the site is assumed to be completed in 2052 for a 2014 shutdown. Different DOE acceptance schedules may result in different completion dates.

Today, the country is at an impasse on high-level waste disposal, despite DOE's submittal of its License Application for a geologic repository to the NRC in 2008. The current administration has eliminated the budget for the repository program while promising to "conduct a comprehensive review of policies for managing the back end of the nuclear fuel cycle ... and make recommendations for a new plan." Towards this goal, the administration appointed a Blue Ribbon Commission on America's Nuclear Future (Blue Ribbon Commission) to make recommendations for a new plan for nuclear waste disposal. The Blue Ribbon Commission's charter includes a requirement that it consider "[o]ptions for safe storage of used nuclear fuel while final disposition pathways are selected and deployed."[11]

On January 26, 2012, the Blue Ribbon Commission issued its "Report to the Secretary of Energy" containing a number of recommendations on

nuclear waste disposal. Two of the recommendations that may impact decommissioning planning are:

- "[T]he United States [should] establish a program that leads to the timely development of one or more consolidated storage facilities"
- "[T]he United States should undertake an integrated nuclear waste management program that leads to the timely development of one or more permanent deep geological facilities for the safe disposal of spent fuel and high-level nuclear waste."[12]

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..."[13] This document states:

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

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

The NRC's review of DOE's license application to construct a geologic repository at Yucca Mountain was suspended in 2011 when the Administration significantly reduced the budget for completing that work. However, the US Court of Appeals for the District of Columbia Circuit issued a writ of mandamus (in August 2013)[14] ordering NRC to comply with federal law and resume its review of DOE's Yucca Mountain repository license application to the extent allowed by previously appropriated funding for the review. That review is now

underway, and two volumes of the safety evaluation report have been published. The current schedule calls for completion and publication of the last safety evaluation reports by January 2015. The adjudicatory hearing, which must be completed before a licensing decision can be made, remains suspended.

The NRC requires that licensees establish a program to manage and provide funding for the caretaking of all irradiated fuel at the reactor site until title of the fuel is transferred to the DOE.[15] Interim storage of the fuel, until the DOE has completed the transfer, will be in the reactor building's spent fuel storage pool, as well as at an on-site ISFSI. DOE has breached its obligations to remove fuel from reactor sites, and has also failed to provide the plant owner with information about how it will ultimately perform. DOE officials have stated that DOE does not have an obligation to accept already-canistered fuel without an amendment to DOE's contracts with plant licensees to remove the fuel (the "Standard Contract"), but DOE has not explained what costs any such amendment would involve. Consequently, the plant owner has no information or expectations on how DOE will remove fuel from the site in the future. In the absence of information about how DOE will specifically deal with already-canistered fuel, and for purposes of this analysis only, this cost estimate assumes that there will be no additional costs associated with DOE's acceptance of such fuel. If this assumption is incorrect, it is assumed that DOE will have liability for costs incurred to transfer the fuel to DOE-supplied containers, and to dispose of existing containers.

An ISFSI, operated under a Part 50 General License (in accordance with 10 CFR 72, Subpart K), has been constructed to support continued plant operations. The facility will be expanded following the cessation of plant operations to accommodate all spent fuel generated over the plant life. Once the spent fuel storage pool is emptied the reactor building will be prepared for long term storage.

Entergy VY's position is that the DOE has a contractual obligation to accept Vermont Yankee's fuel earlier than the projections set out in this cost study, consistent with its contract commitments. No assumption made in this study should be interpreted to be inconsistent with this position. However, at this time, including the cost of long-term spent fuel storage at Vermont Yankee in this study and assuming DOE acceptance of fuel on an Oldest Fuel First basis is the most reasonable approach because it insures the availability of sufficient decommissioning funds given that, contrary to its contractual obligation, the DOE has not performed to date.

1.3.2 Low-Level Radioactive Waste Management

The contaminated and activated material generated from 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,[16] and its Amendments of 1985,[17] the states became ultimately responsible for the disposition of low-level radioactive waste generated within their own borders.

Vermont, along with Maine, joined with Texas to form a compact for the disposal of low-level radioactive waste generated by the three states, with Texas as the host state. The Maine Legislature subsequently voted to exit the Texas compact (effective April 5, 2002) following the shutdown and decommissioning of its only commercial nuclear unit (Maine Yankee). Vermont remains a member of the compact.

The Texas Commission on Environmental Quality (TCEQ), the environmental agency for the state, is responsible for the licensing of any low-level radioactive waste disposal facility in Texas. In 2004, the agency received an application from Waste Control Specialists (WCS) for authorization to construct and operate a low-level radioactive disposal site in Andrews County. The agency granted WCS a disposal license in 2009 and approval to commence construction in early 2011. Construction of the disposal facility is now complete and is now receiving waste from compact members (and limited quantities from non-compact members).

For the purposes of this analysis, low-level radioactive waste generated in the decontamination and dismantling of the plant and remediation of the Vermont Yankee site is assumed to be disposed of at the Texas Compact site. Waste disposal costs are based upon representative rates for the facility consistent with the waste classification.[18]

The dismantling of the components residing closest to the reactor core generates radioactive waste that may be considered unsuitable for shallow-land disposal (i.e., low-level radioactive waste with concentrations of radionuclides that exceed the limits established by the NRC for Class C radioactive waste (GTCC)). The Low-Level Radioactive Waste Policy Amendments Act of 1985 assigned the federal government the responsibility for the disposal of this material. The Act also stated that the beneficiaries of the activities resulting in the generation of such radioactive waste bear all reasonable costs of disposing of such waste.

However, to date, the federal government has not identified a cost for disposing of GTCC or a schedule for acceptance.

For purposes of this analysis only, the GTCC radioactive waste is assumed to be packaged and disposed of in a similar manner as high-level waste and at a cost equivalent to that envisioned for the spent fuel. The GTCC is shipped directly to a DOE facility as it is generated (assuming that the spent fuel has been removed from the site prior to the start of decommissioning).

1.3.3 Radiological Criteria for License Termination

In 1997, the NRC published Subpart E, "Radiological Criteria for License Termination,"[19] amending 10 CFR Part 20. This subpart provides radiological criteria for releasing a facility for unrestricted use. The regulation states that the site can be released for unrestricted use if radioactivity levels are such that the average member of a critical group would not receive a Total Effective Dose Equivalent (TEDE) in excess of 25 millirem per year, and provided that residual radioactivity has been reduced to levels that are As Low As Reasonably Achievable (ALARA). The decommissioning estimate assumes that the Vermont Yankee 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).[20] An additional and separate limit of 4 millirem per year, as defined in 40 CFR §141.16, is applied to drinking water.[21]

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)[22] 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 possibility.

2. DECOMMISSIONING ALTERNATIVE

Costs were determined for decommissioning Vermont Yankee for the NRC-approved SAFSTOR decommissioning alternative. The following sections describe the basic activities associated with the SAFSTOR alternative. Although detailed procedures for each activity identified are not provided, and the actual sequence of work may vary, the activity descriptions provide a basis not only for estimating but also for the expected scope of work (i.e., engineering and planning at the time of decommissioning).

The conceptual approach that the NRC has described in its regulations divides decommissioning into three phases. The initial phase commences with the effective date of permanent cessation of operations and involves the transition of both plant and licensee from reactor operations (i.e., power production) to facility de-activation and closure. During the first phase, notification is to be provided to the NRC certifying the permanent cessation of operations and the removal of fuel from the reactor vessel. The licensee is then prohibited from reactor operation.

The second phase encompasses activities during the storage period or during major decommissioning activities, or a combination of the two. The third phase pertains to the activities involved in license termination. The decommissioning estimate developed for Vermont Yankee is also divided into phases or periods; however, demarcation of the phases is based upon major milestones within the project or significant changes in the projected expenditures.

2.1 PERIOD 1 - PREPARATIONS

The NRC defines SAFSTOR as, "A method of decommissioning in which a nuclear facility is placed and maintained in a condition that allows the facility to be safely stored and subsequently decontaminated (deferred decontamination) to levels that permit release for unrestricted use." The facility is left intact (during the dormancy period), with structures maintained in a stable condition. Systems that are not required to support the spent fuel, heating ventilation and air conditioning, the site emergency plan or site security are drained, de-energized, and secured. Access to contaminated areas is maintained for inspection and maintenance.

2.1.1 Engineering and Planning

In anticipation of the cessation of plant operations, detailed preparations are undertaken to provide a smooth transition from plant operations to site decommissioning. Through implementation of a

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

2.1.2 Site Preparations

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

- Creation of an organizational structure to support the decommissioning plan and evolving emergency planning and site security requirements.
- Revision of technical specifications, plans and operating procedures appropriate to the operating conditions and requirements.
- Characterization of the facility and major components as may be necessary to plan and prepare for the dormancy phase.
- Isolation of the spent fuel pool and reconfiguring fuel pool support systems so that draining and de-energizing may commence in other areas of the plant.
- Design and construction of an ISFSI pad expansion.
- Deactivation (de-energizing and /or draining) of systems that are no longer required during the dormancy period.
- Processing and disposal of water and water filter and treatment media not required to support dormancy operation.
- Disposition of incidental waste that may be present prior to the start of the dormancy period, such as excess tools and equipment and waste produced while deactivating systems and preparing the facility for dormancy.
- Reconfiguration of power, lighting, heating, ventilation, fire protection, and any other services needed to support long-term storage and periodic plant surveillance and maintenance.
- Stabilization by fixing or removing loose incidental surface contamination to facilitate future building access and plant

maintenance. Decontamination of high-dose areas is not anticipated.

- Performance of interim radiation surveys of the plant, posting caution signs and establishing access requirements, where appropriate.
- Maintenance of appropriate barriers for contaminated and radiation areas.
- Reconfiguration of security boundaries and surveillance systems, as required.

The following is a general discussion of the planned reconfiguration expected after plant shutdown.

Electrical Systems

The electrical system will undergo a series of reconfigurations between shutdown and the time all spent fuel has been transferred to dry storage. The reconfigurations will be performed to reduce operating and maintenance expenses, while maintaining adequate power for station loads, and backup power for spent fuel pool-related systems and critical security equipment. The expansion of the ISFSI pad requires the removal of a diesel generator currently located where the ISFSI expansion will be built which supports security and other plant equipment. In connection with the expansion a new diesel generator unit and a new uninterruptable power supply unit will be installed.

Mechanical Systems

Following shutdown, as applicable, fluid filled systems will be drained and abandoned, and resins removed based on an evaluation of system category, functionality, and plant configuration. System categories include:

1) Balance of Plant;
2) Emergency Core Cooling System;
3) Nuclear Steam Safety System;
4) Spent Fuel Pool Cooling; and
5) Dry Fuel Storage.

Plant configurations include:

1) Post-shutdown (fuel in the reactor);
2) Post-defuel (no fuel in the reactor);
3) Post-gates in (no fuel in reactor, spent fuel pool is physically isolated from the reactor);
4) Reactor vessel drained;
5) Reduced risk of zirconium fire (spent fuel is in the spent fuel pool); and
6) Post-dry fuel storage (all spent fuel in dry fuel storage).

The plant configuration and functionality of each system within the plant configuration as it evolves will determine when a system can be drained and abandoned.

Ventilation and Heating Systems

Ventilation will be reconfigured for the turbine building and reactor building to support remaining systems and habitability. Fluid-filled systems in the turbine building will either be drained, or freeze protection installed, and the heating steam secured. The reactor building ventilation system will be reconfigured to maintain building temperature to support habitability and the functioning of fuel pool cooling systems, fire protection systems, and dry fuel storage systems. Reactor building ventilation to the stack will be maintained.

Fire Protection Systems

Fire protection systems will be reconfigured based on a fire hazards analysis. The fire hazards analysis provides a comprehensive evaluation of the facility's fire hazards, the fire protection capability relative to the identified hazards, and the ability to protect spent fuel and other radioactive materials from potential fire-induced releases. The fire hazards analysis will be reevaluated and revised as necessary to reflect the unique or different fire protection issues and strategies associated with decommissioning. It is expected that as the plant's systems are drained and the combustible loading footprint shrinks, the fire protection requirements will be reduced.

Maintenance of Systems Critical to Decommissioning

It has been determined that there are no mechanical systems that will be critical to the final decommissioning process. As such, mechanical

systems will be abandoned after all spent fuel has been transferred to dry fuel storage, with the exception of systems required to maintain habitability during dormancy. The site power distribution system will be abandoned with the possible exception of motor control centers that are required to support ventilation and lighting. The ISFSI pads and security system will have a stand-alone power system (off-site feed backed up by a diesel generator).

The organization responsible for the final dismantlement will be expected to establish temporary services, including electrical and cranes.

2.2 PERIOD 2 - DORMANCY

The second phase identified by the NRC in its rule addresses licensed activities during a storage period and is applicable to the dormancy phases of a deferred decommissioning alternative. Activities required during the early dormancy period while spent fuel is stored in the fuel pool will be substantially different than those activities required during dry fuel or no fuel storage.

Early activities include operating and maintaining the spent fuel pool and its associated systems, expanding the ISFSI, and transferring spent fuel from the pool to the ISFSI. Assuming the timely receipt of the required state regulatory approvals, the ISFSI expansion is estimated to be completed in 2017. Spent fuel transfer is expected to be complete by mid-2020. After the fuel transfer is completed, the pool and systems will be drained and de-energized for long-term storage.

Dormancy activities will include a 24-hour security force, preventive and corrective maintenance on security systems, area lighting, general building maintenance, freeze protection heating, ventilation of buildings for periodic habitability, routine radiological inspections of contaminated structures, maintenance of structural integrity, and a site environmental and radiation monitoring program. A fire protection program will be maintained.

Security during the dormancy period will be conducted primarily to safeguard the spent fuel on site and prevent unauthorized entry. A security barrier, sensors, alarms, and other surveillance equipment will be maintained as required to provide security.

An environmental surveillance program will be carried out during the dormancy period to monitor for radioactive material in the environment. Appropriate procedures will be established and initiated for potential releases that exceed prescribed limits. The environmental surveillance program will

consist of a version of the program in effect during normal plant operations that will be modified to reflect the plant's conditions and risks at the time.

Late in the dormancy period, additional activities will include transferring the spent fuel from the ISFSI to the DOE. For planning purposes, Entergy VY's current spent fuel management plan for the Vermont Yankee spent fuel is based, in general, upon the following projections: 1) a 2025 start date for the DOE initiating transfer of commercial spent fuel to a federal facility, 2) a corresponding 2026 date for beginning to remove spent fuel from Vermont Yankee, and 3) a 2052 completion date for removal of all Vermont Yankee spent fuel. This assumption is made for purposes of this estimate, although it is acknowledged that the plant owner will seek the most expeditious means of removing fuel from the site when DOE commences performance. Transfer could occur earlier if the DOE is successful in implementing its current strategy for the management and acceptance of spent fuel. The ISFSI pad and facilities will be decommissioned at the time of plant decommissioning or after DOE has removed all spent fuel from the site.

After a period of safe-storage (such that license termination is accomplished within 60 years of final shutdown), it is required that the licensee submit an application to terminate the license, thereby initiating the third phase.

2.3 PERIOD 3 – PREPARATIONS FOR DECOMMISSIONING

Prior to the commencement of decommissioning operations, preparations will be undertaken to reactivate site services and prepare for decommissioning. Preparations include engineering and planning, a site characterization, and the assembly of a decommissioning management organization. This would likely include the development of work plans, specifications and procedures.

2.4 PERIOD 4 – DECOMMISSIONING OPERATIONS (DECONTAMINATION AND DISMANTLING)

Following the preparations for decommissioning, physical decommissioning activities will take place. This includes the removal and disposal of contaminated and activated components and structures, leading to the termination of the 10 CFR 50 operating license. Although much of the radioactivity will decrease during the dormancy period due to decay of ^{60}Co and other short-lived radionuclides, the internal components of the reactor vessel will still exhibit radiation dose rates that will likely require remote sectioning under water due to the presence of long-lived radionuclides such as ^{94}Nb, ^{59}Ni, and ^{63}Ni. Portions of the biological shield wall may also be radioactive due to the presence of activated trace elements with longer half-lives (such as ^{152}Eu

and ^{154}Eu). It is assumed that radioactive contamination on structures, systems, and component surfaces will not have decayed to levels that will permit unrestricted release. These surfaces will be surveyed and items dispositioned in accordance with the existing radioactive release criteria.

Significant decommissioning activities in this phase include:

- Reconfiguration and modification of site structures and facilities, as needed, to support decommissioning operations. Modifications may also be required to the reactor or other buildings to facilitate movement of equipment and materials, support the segmentation of the reactor vessel and reactor vessel internals, and for large component removal.
- Design and fabrication of temporary and longer-term shielding to support removal and transportation activities, construction of contamination control envelopes, and the procurement of specialty tooling.
- Procurement or leasing of shipping cask, cask liners, and industrial packages for the disposition of low-level radioactive waste.
- Decontamination of components and piping systems, as required, to control (minimize) worker exposure.
- Disposition of the turbine, condenser, main steam piping, and associated equipment; with appropriate dispositioning based upon radiological surveys.
- Disposition of systems and components.
- Removal of the recirculation pumps and associated piping for controlled disposal.
- Characterization of contaminated material for controlled disposal at a low-level radioactive waste disposal facility.
- Disposition of control rod blades.
- Disassembly and segmentation of the reactor vessel internals. This will likely involve use of remotely operated equipment. Some of this material may exceed Class C disposal requirements. This will be packaged for transfer to the DOE.
- Segmentation of the reactor vessel. Similar to the internals some of this work may involve the use of remotely operated equipment. The reactor vessel water level will likely need to be maintained just below the cut to maintain the working area dose rates ALARA.

- Treatment and off-site disposal of the water used in the segmentation of the reactor vessel and internal components.
- Removal of the steel liners from the drywell, torus, refueling pool and spent fuel pool, disposing of the activated and/or contaminated sections as radioactive waste.
- Disposition of the activated and contaminated portions of the concrete biological shield and contaminated concrete surfaces that exceed the material release criteria.
- Survey and release of material free of contamination, e.g., as scrap, recycle, or conventional disposal.
- Remediation of contaminated surface soil or sub-surface media will be performed as necessary to meet the unrestricted use criteria in 10 CFR 20.1402.
- Underground piping (or similar items) and associated soil will be removed as necessary to meet license termination criteria.

At least two years prior to the anticipated date of license termination, a License Termination Plan (LTP) will be submitted to the NRC. That plan will include: a site characterization, description of the remaining dismantling / removal activities, plans for remediation of remaining radioactive materials, developed site-specific Derived Concentration Guideline Levels, plans for the final status (radiation) survey, designation of the end use of the site, an updated cost estimate to complete the decommissioning, and associated environmental concerns.

The final status survey plan will identify the radiological surveys to be performed once the decontamination activities are completed and will be developed using the guidance provided in the "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)."[23] This document incorporates statistical approaches to survey design and data evaluation. It also identifies 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 final status survey is complete, the results will be submitted to the NRC, along with a request for termination of the NRC license.

Per the Settlement Agreement with the State of Vermont,[24] Entergy VY may release unaffected portions of the site on a partial site release basis, as they become available, before all site decommissioning work has been completed.

2.5 PERIOD 5 – SITE RESTORATION

After the NRC terminates the license, site restoration activities will be performed. Subject to the development of site restoration standards pursuant to the Settlement Agreement, Entergy VY currently assumes that remaining clean structures will be removed to a nominal depth of three feet below the surrounding grade level. Affected area(s) would then be backfilled with suitable fill materials, graded, and appropriate erosion controls established.

Non-contaminated concrete rubble produced by demolition activities is processed to remove reinforcing steel and miscellaneous embedments. The processed material is then trucked off-site for recycling/recovery and/or disposal as construction debris.

Clean fill is brought in to backfill the below grade voids (i.e., the demolition debris, including clean concrete, is not used on-site for fill). The site can then be graded and stabilized.

3. COST ESTIMATE

The estimate prepared for decommissioning Vermont Yankee considers the unique features of the site, including the nuclear steam system supply, electric power generating systems, structures, and supporting facilities. The basis of the estimate, including the sources of information relied upon, the estimating methodology employed, site-specific considerations, and other pertinent assumptions, is described in this section.

3.1 BASIS OF ESTIMATE

The estimate relies upon the detailed planning and engineering that has been performed in anticipation of the pending cessation of operations and the site-specific, technical information from an earlier evaluation prepared in 2011. The 2011 information was reviewed for the current analysis and updated to reflect any significant changes in the plant configuration over the past three years. The site-specific considerations and assumptions used in the previous evaluation were also revisited. Modifications were incorporated where new information was available or experience from previously completed decommissioning projects provided viable alternatives or improved processes.

3.2 METHODOLOGY

Entergy VY's Decommissioning Project Organization, the corporate Project Management Organization, plant staff, and numerous other corporate entities and subject matter experts have been engaged in the detailed planning and engineering needed to transition the nuclear unit and its operating organization from power generation to safe-storage. This information was used to create working budgets and the forecast for the first six years following the cessation of operations, or until the spent fuel is relocated to the ISFSI (years 2015 through 2020) and the plant secured for long-term storage.

These same organizations provided substantial input into estimating the annual costs associated with maintaining the station in a dormancy state (years 2021 through 2067).

The methodology used to develop the estimate for the deferred decontamination and dismantling activities described within this document (years 2068 through 2075) follows the basic approach originally presented in the AIF/NESP-036 study report, "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates,"[25] and the DOE "Decommissioning Handbook."[26] These documents present a unit cost factor

method for estimating decommissioning activity costs that simplifies the 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 then 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.[27]

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

This analysis reflects lessons learned from TLG's involvement in the Shippingport Station decommissioning, 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 Rancho Seco, Trojan, Yankee Rowe, Big Rock Point, Maine Yankee, Humboldt Bay-3, Connecticut Yankee, San Onofre, and Crystal River nuclear units have provided additional insight into the process, the regulatory aspects, and the technical challenges of decommissioning commercial nuclear units.

Work Difficulty Factors

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

- Access Factor 0% to 30%
- Respiratory Protection Factor 0% to 50%
- Radiation/ALARA Factor 0% to 10%
- Protective Clothing Factor 0% to 50%
- Work Break Factor 8.33%

The factors and their associated range of values were originally developed in conjunction with the AIF/NESP-036 study. The factors (and their application) are discussed in more detail in Appendix E.

Scheduling Program Durations

Area activity durations are used to develop the total decommissioning program schedule. The unit cost factors, adjusted for WDFs as described above, are applied against the inventory of materials to be removed in each defined work area. The work area is then evaluated for the most efficient number of workers/crews for the identified decommissioning activities. The adjusted unit cost factors are then compared against the available manpower so that an overall duration for removal of components and piping from each work area can be calculated.

The schedule is used to assign carrying costs, which include program management, administration, field engineering, equipment rental, and support services such as quality assurance and security.

3.3 FINANCIAL COMPONENTS OF THE COST MODEL

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

3.3.1 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 allowances 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"[28] as "specific provision for unforeseeable elements of cost within the defined project scope; particularly important where previous experience relating estimates and actual costs has shown that unforeseeable events which will increase costs are likely to occur." The cost elements in this analysis are based upon ideal conditions and

maximum efficiency; therefore, consistent with industry practice, contingency is included. In the AIF/NESP-036 study, the types of unforeseeable events that are likely to occur in decommissioning are discussed and guidelines are provided for percentage contingency in each category. It should be noted that contingency, as used in this analysis, does not account for price escalation and inflation over the period of performance (these factors are typically addressed in the funding analysis).

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

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

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

Contingency funds are an integral part of the total cost to complete the decommissioning process. 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 0% to 75%, depending on the degree of difficulty judged to be appropriate from TLG's actual decommissioning experience. Typical contingency values used in this study, particularly for the deferred decontamination and dismantling phases, 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%
• GTCC Disposal	15%
• Non-Radioactive Component Removal	15%
• Heavy Equipment and Tooling	15%
• Supplies	25%
• Engineering	15%
• Energy	15%
• Insurance, Taxes and Fees	10%
• Staffing	15%
• Characterization and Termination Surveys	30%
• 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. A composite value is then reported at the end of the detailed estimate. For example, the composite contingency value reported in Appendix C is approximately 17.3%.

It should be noted that where Entergy VY provided cost information for near-term projects or site activities, the contingency component value(s) may be less, commensurate with the increased cost certainty. In some

instances, Entergy VY did not specify a contingency component for a specific project and/or site activity. This can be seen for many of the line item costs in the first in six years (Periods 1 through 2aa in Appendix C).

3.3.2 Financial Risk

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

- Delays in approval of the decommissioning plan due to intervention, 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, or the start and rate of acceptance of spent fuel by the DOE).
- Pricing changes for basic inputs, such as labor, energy, materials, and waste disposal.

This cost study does not add any additional costs to the estimate for financial risk. Uncertainties as discussed above that would impact the estimate are revisited periodically and addressed through repeated revisions or updates of the base estimate (e.g., in accordance with Regulatory Guide 1.159).

3.4 SITE-SPECIFIC CONSIDERATIONS

There are a number of site-specific considerations that affect the method for dismantling and removal of equipment from the site and the degree of restoration required. The cost impacts of the considerations identified below are included with the estimate.

3.4.1 Spent Fuel Disposition

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

Completion of the decommissioning process is highly dependent upon the DOE's ability to remove spent fuel from the site. DOE's repository program assumes that spent fuel is accepted for disposal from the nation's commercial nuclear plants in the order (the "queue") in which it was removed from service ("oldest fuel first"). The contracts that U.S. generators have with the DOE provide mechanisms for altering the oldest fuel first allocation scheme, including emergency deliveries, exchanges of allocations amongst generators and the option of providing priority acceptance from permanently shutdown nuclear reactors. Given DOE's failure to accept fuel under its contracts, it is unclear how these mechanisms may operate once DOE begins accepting spent fuel from commercial reactors. Accordingly, this study assumes that DOE will accept spent fuel in an oldest fuel first order. The timing for removal of spent fuel from the site is based upon the DOE's most recently published annual acceptance rates of 400 MTU/year for year 1, 3,800 MTU total for years 2 through 4 and 3,000 MTU/year for year 5 and beyond.[29]

ISFSI

An ISFSI was constructed within the protected area to support continued plant operations. The current ISFSI pad has a capacity of 36 dry storage casks. A total of 13 casks have been placed on the pad since 2008 (in three

separate campaigns). As such, under the current assumptions for DOE performance, a second pad will be required to completely off-load the spent fuel pool (requiring 45 casks) at the cessation of plant operations.

Construction costs for the second pad are included within the estimate. Also included are the costs to purchase and load the multi-purpose spent fuel storage canisters (MPCs) and transfer the MPCs from the spent fuel pool to the ISFSI. An allowance is included for the eventual transfer of the MPCs to a DOE-provided transport vehicle for off-site disposal.

Operational costs for the ISFSI are included within the estimate and include the cost for staffing the facility, as well as security, insurance, and licensing fees through 2052.

Storage Canister Design

The design and capacity of the ISFSI is based upon the Holtec HI-STORM 100S dry cask storage system. The system consists of a MPC with a nominal capacity of 68 fuel assemblies and a concrete storage overpack. DOE has not identified any cask systems it may use.

ISFSI Decommissioning

In accordance with 10 CFR §72.30, licensees must have a proposed decommissioning plan for the ISFSI site and facilities that includes a cost estimate for the plan. The plan should contain sufficient information on the proposed practices and procedures for the decontamination of the ISFSI and for the disposal of residual radioactive materials after all spent fuel, high-level radioactive waste, and reactor-related GTCC waste have been removed.

A multi-purpose (storage and transport) dry shielded spent fuel storage canister with a vertical, reinforced concrete storage overpack is used as a basis for the cost analyses. The overpack liners are assumed to have some level of neutron-induced activation, as a result of the long-term storage of the fuel, i.e., to levels exceeding free-release limits. As an allowance, 6 overpacks are assumed to require remediation, equivalent to the number of overpacks required to accommodate the final core off load. The cost of the disposition of this material, as well as the demolition of the ISFSI facility, is included in the estimate.

The 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. The cost summary for decommissioning the ISFSI is presented in Appendix D.

GTCC

The dismantling of the reactor internals generates radioactive waste considered unsuitable for shallow land disposal (i.e., low-level radioactive waste with concentrations of radionuclides that exceed the limits established by the NRC for Class C radioactive waste (GTCC)). The Low-Level Radioactive Waste Policy Amendments Act of 1985 assigned the Federal Government the responsibility for the disposal of this material. The Act also stated that the beneficiaries of the activities resulting in the generation of such radioactive waste bear all reasonable costs of disposing of such waste. Although the DOE is responsible for disposing of GTCC waste, any costs for that service have not been determined. For purposes of this estimate, the GTCC radioactive waste has been assumed to be packaged in the spent fuel MPCs (the DOE has not identified a disposal package), at a cost equivalent to that envisioned for the spent fuel. The number of canisters required and the packaged volume for GTCC was based upon experience at Maine Yankee (e.g., the constraints on loading as identified in the canister's certificate of compliance).

The GTCC material is assumed to be shipped directly to a DOE facility as it is generated (since the fuel has been removed from the site prior to the start of decommissioning and the ISFSI deactivated).

3.4.2 Reactor Vessel and Internal Components

The reactor pressure vessel and reactor internal components are expected to be segmented for disposal and shipped in shielded, reusable transportation casks. Segmentation and packaging of the internals are expected to be performed in the dryer-separator pool, where a turntable and remote cutter are installed. The vessel is segmented in place, using a mast-mounted cutter supported off the lower head and directed from a shielded work platform installed overhead in the reactor well. Transportation cask specifications and Department of Transportation (DOT) transportation regulations will dictate the segmentation and packaging methodology (i.e., packaging will meet the current physical and radiological limitations and regulations). Cask shipments are made in DOT-approved, currently available truck casks.

3.4.3 Primary System Components

The estimate does not include decontamination of the reactor and reactor recirculation system components with chemical agents due to the delay (and subsequent decay of the radionuclides) in the start of cutting operations.

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

3.4.4 Main Turbine and Condenser

The main turbine is dismantled using conventional maintenance procedures. The turbine rotors and shafts are removed to a laydown area. The lower turbine casings are removed from their anchors by controlled demolition. The main condensers are also disassembled and moved to a laydown area. Material is then prepared for transportation to for controlled disposal.

3.4.5 Retired Components from Operational Period

The analysis includes the disposition of retired turbine rotors, inner and upper turbine casings and a recirculation pump motor, and miscellaneous equipment included in 10 Sealand containers.

3.4.6 Transportation Methods

It is expected that most of the contaminated piping, components, and structural material, other than the highly activated reactor vessel and internal components, will qualify as LSA-I, II or III or Surface Contaminated Object, SCO-I or II, as described in Title 49 of the Code of Federal Regulations.[30] The contaminated material is 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. Some of the reactor vessel internal components are expected to be transported in accordance with 10 CFR Part 71, in Type B containers.

Any fuel cladding failure that occurred during the lifetime of the plant is assumed to have released fission products at sufficiently low levels that the buildup of long-lived isotopes (e.g., ^{137}Cs, ^{90}Sr, or transuranics) has not reached levels exceeding those that permit the major reactor components to be shipped under current transportation regulations and disposal requirements.

Transport of the highly activated metal, produced in the segmentation of the reactor vessel and internal components, is by shielded truck cask. Cask shipments may exceed 95,000 pounds, including vessel segment(s), supplementary shielding, cask tie-downs, and tractor-trailer. The maximum level of activity per shipment assumed permissible is 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.

Transportation costs for the low-level radioactive waste generated by the decontamination and dismantling activities are based upon the mileage to the waste disposal facility in Texas. Truck transport costs were developed from published tariffs from Tri-State Motor Transit.[31] Although rail may be an option at the time of decommissioning, the estimate assumes truck transport as a bounding condition.

3.4.7 Low-Level Radioactive Waste Conditioning and Disposal

The mass of radioactive waste generated during the various decommissioning activities is reported by line-item in Appendix C and summarized in Section 5. The Section 5 waste summary is consistent with 10 CFR Part 61 classifications. Commercially-available steel containers are used for the disposal of piping, small components, and concrete. Larger components can serve as their own containers, with proper closure of all openings, access ways, and penetrations. The waste volumes are calculated on the exterior package dimensions for containerized material or a dimensional calculation for components serving as their own waste containers.

The more highly activated reactor components are transported in reusable, shielded truck casks with disposable liners. In calculating disposal costs, the burial fees are applied against the liner volume. Packaging efficiencies are lower for the highly activated materials (greater than Class A waste), where high concentrations of gamma-emitting radionuclides limit the capacity of the transportation casks.

Waste disposal costs are based upon representative rates for the facility consistent with the waste classification.

3.4.8 Site Remediation

The current analysis revisited the requirements for site remediation, based upon the records maintained by the plant (i.e., in accordance with 10 CFR 50.75(g)) for radiological incidents and design information on underground services, e.g., piping, electrical duct banks and cabling.

3.4.9 Contaminated Soil

The volume of soil (and some associated concrete) to be removed for controlled disposal was estimated for specific areas of concern. Approximately 2,005 cubic yards was calculated as required to envelope the specific areas of concern. The volume would be expected to decrease with time and the natural decay of the radionuclides; however, for this analysis, no downward adjustment was made.

The dismantling and removal of site structures and services will likely involve excavation in and around the power block and adjacent areas. As an allowance, 10% of the excavated soil (3,574 cubic yards) is included in the off-site disposal volume, as an allowance.

It should be noted that no additional remediation of the soil in the vicinity of the AOG building was included, based upon the earlier remediation (soil removal) performed by Entergy VY and the findings from the GZA groundwater investigation that only tritium had migrated into the groundwater.[32] Tritium is a low-energy beta emitter with a half-life of approximately 12.3 years, decaying to non-radioactive helium. As such, any residual sub-grade tritium is not expected to require any further remediation at the time of decommissioning in order to meet site release criteria.

3.4.10 Site Conditions Following Decommissioning

The NRC will terminate the site license if it determines that site remediation has been performed in accordance with the license termination plan, and that the terminal radiation survey and associated documentation demonstrate that the facility is suitable for release. The NRC's involvement in the decommissioning process ends at this point. Building codes, state environmental regulations and state commitments

dictate the next step in the decommissioning process, as well as the owner's future plans for the site.

The demolition of the majority of buildings and site structures at the site are included within the estimate. Specifically excluded are the electrical switchyards, Governor Hunt House, Plant Support Building and any offsite facilities (e.g., corporate offices and training center in Brattleboro). Minor structures may be grouped together for purposes of cost reporting (e.g., miscellaneous foundation pads, sheds and other outbuildings). A list of the site buildings / structures considered in the estimate is provided in Table 3.2. While the majority of the structures are designated for removal during decommissioning operations, there are several small structures assumed to be removed during the early preparation for the safe-storage phase. This work is included in the upfront project costs.

Foundations and exterior building 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. A removal depth of three feet is commonly used by the nuclear industry as an estimating basis[33] and has been used since 1989 as a basis for site restoration estimates for Vermont Yankee. It is also consistent with the restoration practices employed at the decommissioned Maine Yankee, Yankee Rowe and Connecticut Yankee sites.

3.4.11 Disposition of Underground Piping and Site Services

The disposition of underground piping and site services is based upon the information presented in the "Buried Piping and Tanks Inspection and Monitoring Program" and associated construction drawings. Easily accessible steel and transite piping is removed and sent off site for disposal. Large concrete piping, located at a depth of less than 20 feet, is excavated, breeched and backfilled. Large concrete piping, located at a depth greater than 20 feet is abandoned in place (with access ways sealed).

A significant amount of the below grade piping is located around the perimeter of the power block. The estimate includes a cost to excavate this area to an average depth of four feet so as to expose the piping, duct bank, conduit, and any near-surface grounding grid. The overburden is surveyed and stockpiled on site for future use in backfilling the below grade voids. In addition to the plant perimeter, the cost model includes

excavation of other targeted areas, including the north and south septic fields.

Approximately 10 percent of the volume (estimating allowance) was assumed to require off-site disposal and included within the Contaminated Soil volume.

Construction debris, excluding concrete and steel from demolition activities, is removed from the site and disposed of as clean waste. Steel is recovered and recycled at no cost or credit to the project. Concrete rubble is processed on-site to remove reinforcing steel and miscellaneous embedments and to reduce the debris size. The processed material is then trucked off-site for aggregate recovery and recycling. Asphalt surfaces in the immediate vicinity of site buildings are broken up. The material is assumed to be trucked off-site for reclamation and reuse. The site access road and rail spur remain in place.

3.5 ASSUMPTIONS

The following assumptions were made in the development of the estimate for decommissioning the Vermont Yankee unit.

3.5.1 Estimating Basis

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

The estimate relies upon the physical plant inventory that was the basis for the 2011 analysis.

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

3.5.2 Labor Costs

For purposes of this estimate, it is assumed that Entergy VY (or a comparable organization) will manage the decontamination and dismantling of the nuclear unit in addition to maintaining site security, radiological health and safety, quality assurance and overall site administration during the decommissioning. A Decommissioning Operations Contractor (DOC) will provide the supervisory staff needed to oversee the labor subcontractors, consultants, and specialty contractors engaged to perform the field work associated with the decontamination and dismantling efforts.

Personnel costs are based upon salary information provided by Entergy VY for the site. Overhead costs are included for site and corporate support; such overhead costs are reduced commensurate with the staffing levels envisioned throughout the project.

Reduction in the operating organization is assumed to be handled through normal staffing processes (e.g., reassignment and outplacement). Severance costs are included for the SAFSTOR organization (that will ready the facility for safe-storage and transfer the spent fuel to the ISFSI) only.

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

Security, while reduced from operating levels, is maintained throughout the decommissioning for access control, material control, and to safeguard the spent fuel (in accordance with the requirements of 10 CFR Part 37, Part 72, and Part 73). Security costs include provisions for institutional overtime and recurring expenses. The estimate is based upon the security force transitioning to a contracted organization once all the fuel has been relocated to the ISFSI in 2020. Once the fuel has been transferred to the DOE in 2052, the security organization will be reduced to Part 37 requirements.

3.5.3 Design Conditions

Activation levels in the vessel and internal components are based upon an activation analysis prepared by WMG, Inc.[34] The activation source terms were adjusted for the SAFSTOR decay period.

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

Activation of the reactor building structures is assumed to be confined to the sacrificial shield and pedestal.

3.5.4 General

Transition Activities

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

- Drain and collect fuel oils, lubricating oils, and transformer oils for recycle and/or sale.
- Drain and collect acids, caustics, and other chemical stores for recycle and/or sale.
- Process operating waste inventories. Disposal of operating wastes (e.g., filtration media, charcoal, resins) during this initial period is not considered a decommissioning expense; however, the estimate does include the disposition of the retired low-pressure turbine rotors currently in storage, and some small volumes of mixed waste solvents, battery acid, and the condensate and reactor water cleanup resins currently in storage.

Scrap and Salvage

The existing plant equipment is assumed to be obsolete and suitable for scrap as deadweight quantities only. Entergy VY will make economically reasonable efforts to salvage equipment following final plant shutdown. However, dismantling techniques assumed by TLG for equipment in this analysis are not consistent with removal techniques required for salvage (resale) of equipment. Experience has indicated that buyers prefer equipment stripped down to very specific requirements before they would consider purchase. This can require expensive rework after the equipment had been removed from its installed location. Since placing salvage value on this machinery and equipment would be speculative,

this analysis does not attempt to quantify the value that an owner may realize based upon those efforts.

It is assumed, for purposes of this analysis, that any value received from the sale of scrap generated in the dismantling process would be more than offset by the on-site processing costs to segment, store, and radioactively survey the scrap material. The dismantling techniques assumed in the decommissioning estimate do not include the additional cost for size reduction and preparation to meet "furnace ready" conditions. With a volatile market, the potential profit margin in scrap recovery is highly speculative, regardless of the ability to free release this material.

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

Energy

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

The plant heating boiler is expected to be operational through the year 2020.

Emergency Planning

FEMA and state (Vermont, Massachusetts and New Hampshire) fees associated with emergency planning are assumed to continue through 2016. At this time, the fees are discontinued. The timing is based upon the anticipated condition of the spent fuel (i.e., the hottest spent fuel assemblies are assumed to be cool enough that no substantial Zircaloy oxidation and off-site event would occur with the loss of spent fuel pool water).

Insurance

Costs for continuing coverage (nuclear liability and property insurance) following cessation of plant operations and during decommissioning are

included and based upon current operating premiums. Reductions in coverages and premiums were based upon an evaluation performed by Entergy's subject matter experts.

Property Tax

Entergy VY currently pays taxes to the state based upon annual megawatts generated (generation tax). Under the current law, payments cease once the plant is permanently shutdown.

Local property taxes are paid in accordance with a Tax Stabilization Agreement with the Town of Vernon. The agreement is only valid during the operating life of the plant. Once shutdown, local property taxes would most likely be assessed at the fair market value of the property under normal property tax rules. However, there are no specific provisions for determining the value of a shutdown unit (and significant remediation project), if any.

Therefore, for purposes of this cost analysis, the decommissioning estimate includes an allowance for post-operation tax payments with the assumption that the property would be assessed as vacant land. These payments occur through the decommissioning project, ending with the completion of site restoration in 2075.

Tax payments are included for off-site facilities in Brattleboro (for year 2015 and the first half of 2016) and in Vernon for 2015.

A negotiated one-time payment of $5 million (to the State of Vermont Department of Taxes) is included in year 2015, as per the Settlement Agreement.

Site Modifications

The perimeter fence and in-plant security barriers are assumed to be moved, as appropriate, to conform to the site security plan in force during the various stages of the project.

3.6 COST ESTIMATE SUMMARY

Summaries of the decommissioning costs and annual expenditures are provided in Tables 3.3 through 3.6. The schedules are based upon the costs reported in Appendix C.

The cost elements in Table C are assigned to one of three subcategories: "License Termination," "Spent Fuel Management," and "Site Restoration." The subcategory "License Termination" is used to accumulate costs that are consistent with "decommissioning" as defined by the NRC in its financial assurance regulations (i.e., 10 CFR §50.75). The cost reported for this subcategory is generally sufficient to terminate the plant's operating license, recognizing that there may be some additional cost impact from spent fuel management. The License Termination cost subcategory also includes costs to decommission the ISFSI (as required by 10 CFR §72.30). The basis for the ISFSI decommissioning cost is provided in Appendix D.

The "Spent Fuel Management" subcategory contains costs associated with the containerization and transfer of spent fuel from the pool to the ISFSI, and the transfer of the multipurpose canisters from the ISFSI to the DOE. Costs are also included for the operations of the pool and management of the ISFSI until such time that the transfer of all fuel from this facility to an off-site location (e.g., interim storage facility) is complete.

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

The disposal of the GTCC is assumed to be concurrent with the disposal of the other reactor internals. While designated for disposal at the geologic repository along with the spent fuel, GTCC waste is still classified as low-level radioactive waste and, as such, included as a "License Termination" expense.

Decommissioning costs are reported in 2014 dollars. Costs are not inflated, escalated, or discounted over the period of expenditure (or projected lifetime of the plant). The schedules are based upon the detailed activity costs reported in Appendix C, along with the timeline presented in Section 4.

TABLE 3.1
SPENT FUEL MANAGEMENT SCHEDULE
(Fuel Assembly Totals by Location)

Year	Pool Inventory	ISFSI Inventory	DOE Acceptance[1]
2014	2,996	884	
2015	2,996	884	
2016	2,996	884	
2017	2,996	884	
2018	2,996	884	
2019	820	3,060	
2020	0	3,880[2]	
2021		3,880	
2022		3,880	
2023		3,880	
2024		3,880	
2025		3,880	
2026		3,502	378
2027		3,502	-
2028		3,284	218
2029		3,010	274
2030		2,784	226
2031		2,558	226
2032		2,422	136
2033		2,286	136
2034		2,157	129
2035		2,029	128
2036		1,901	128
2037		1,781	120
2038		1,661	120
2039		1,549	112
2040		1,549	-
2041		1,464	85
2042		1,405	59
2043		1,209	196
2044		1,073	136
2045		949	124

TABLE 3.1 (continued)
SPENT FUEL MANAGEMENT SCHEDULE
(Fuel Assembly Totals by Location)

Year	Pool Inventory	ISFSI Inventory	DOE Acceptance[1]
2046		821	128
2047		701	120
2048		585	116
2049		469	116
2050		349	120
2051		349	-
2052		-	349[2]
Total			3,880

[1] DOE acceptance schedule provided by Energy Resources International, Inc., assuming industry acceptance begins in year 2025 and Vermont Yankee acceptance begins in year 2026. The schedule is provided for illustrative purposes only. It is expected that Entergy VY will seek to accelerate acceptance based on shutdown reactor priority, exchanges of acceptance allocations and other contractual provisions.

[2] Includes one fuel debris canister which, for purposes of this analysis and for convenience, is assumed to be picked up in the final year (2052)

TABLE 3.2
DISPOSITION OF SITE STRUCTURES

Building / Structure	SAFSTOR Preparations	Decommissioning Operations	Not Included
Reactor Building			
AOG			
Bottle Storage Shed			
Construction Office			
Control			
Control Access			
Cooling Towers			
Discharge & Aerating			
Equipment Lock			
Gatehouse 1			
Gatehouse 2			
Gatehouse 3			
Governor Hunt House			
Haz Mat Storage			
Intake			
LLRW			
Miscellaneous Yard Structures			
Mixed Gases Shed			
New Warehouse			
North Warehouse			
Off-Site Property			
Office Area (Turbine)			
Oxygen Bottle Shed			
Pipe Storage			
Propane Storage			
PSB			
Radwaste			
Radwaste Compactor			
Rotor (Facilities/Chemistry)			
Security Mods			
Service			
Station Blackout Diesel			
Switchyards			
Tan Ugly Building			
Turbine			
Turbine Storage			
Vent Stack			

TABLE 3.3
TOTAL ANNUAL EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equip. & Materials	Energy	Waste Disposal	Other	Total
2014	0	0	0	0	19,918	19,918
2015	39,626	533	3,912	38	51,408	95,516
2016	24,606	442	2,626	22	37,935	65,631
2017	15,562	395	2,379	14	41,523	59,873
2018	15,445	395	2,379	14	53,644	71,878
2019	15,405	395	2,379	14	49,664	67,858
2020	12,471	1,234	2,379	1,200	21,225	38,508
2021	5,207	622	266	7	3,135	9,237
2022	5,207	622	266	7	3,085	9,187
2023	5,207	622	266	7	3,085	9,187
2024	5,221	624	267	7	1,538	7,657
2025	5,207	622	266	7	1,485	7,587
2026	5,207	622	266	7	1,627	7,729
2027	5,207	622	266	7	1,677	7,779
2028	5,221	624	267	7	1,630	7,749
2029	5,207	622	266	7	1,627	7,729
2030	5,207	622	266	7	1,677	7,779
2031	5,207	622	266	7	1,627	7,729
2032	5,221	624	267	7	1,630	7,749
2033	5,207	622	266	7	1,677	7,779
2034	5,207	622	266	7	1,627	7,729
2035	5,207	622	266	7	1,627	7,729
2036	5,221	624	267	7	1,680	7,799
2037	5,207	622	266	7	1,627	7,729
2038	5,207	622	266	7	1,627	7,729
2039	5,207	622	266	7	1,677	7,779
2040	5,221	624	267	7	1,630	7,749
2041	5,207	622	266	7	1,627	7,729
2042	5,207	622	266	7	1,677	7,779
2043	5,207	622	266	7	1,627	7,729
2044	5,221	624	267	7	1,630	7,749
2045	5,207	622	266	7	1,677	7,779

TABLE 3.3 (continued)
TOTAL ANNUAL EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equip. & Materials	Energy	Waste Disposal	Other	Total
2046	5,207	622	266	7	1,627	7,729
2047	5,207	622	266	7	1,627	7,729
2048	5,221	624	267	7	1,680	7,799
2049	5,207	622	266	7	1,627	7,729
2050	5,207	622	266	7	1,627	7,729
2051	5,207	622	266	7	1,677	7,779
2052	5,221	624	267	7	1,630	7,749
2053	1,969	278	187	6	1,142	3,583
2054	1,969	278	187	6	1,192	3,633
2055	1,969	278	187	6	1,142	3,583
2056	1,974	279	187	6	1,144	3,591
2057	1,969	278	187	6	1,192	3,633
2058	1,969	278	187	6	1,142	3,583
2059	1,969	278	187	6	1,142	3,583
2060	1,974	279	187	6	1,194	3,641
2061	1,969	278	187	6	1,142	3,583
2062	1,969	278	187	6	1,142	3,583
2063	1,969	278	187	6	1,192	3,633
2064	1,974	279	187	6	1,144	3,591
2065	1,969	278	187	6	1,142	3,583
2066	1,969	278	187	6	1,192	3,633
2067	1,969	278	187	6	1,142	3,583
2068	36,514	1,912	1,873	32	3,524	43,854
2069	54,366	14,329	1,821	12,174	9,807	92,496
2070	53,633	15,839	1,689	18,228	15,525	104,915
2071	47,287	8,332	1,401	10,716	18,462	86,198
2072	47,416	8,355	1,405	10,745	18,711	86,631
2073	39,260	3,408	604	2,488	5,782	51,542
2074	22,293	9,325	187	0	3,014	34,819
2075	10,505	4,394	88	0	1,950	16,937
Total	630,663	93,389	36,450	56,003	426,207	1,242,712

TABLE 3.4
LICENSE TERMINATION EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equip. & Materials	Energy	Waste Disposal	Other	Total
2014	0	0	0	0	15,165	15,165
2015	39,626	533	3,912	38	37,089	81,198
2016	15,512	442	1,004	22	19,145	36,126
2017	2,015	395	184	14	8,216	10,823
2018	1,898	395	184	14	7,057	9,548
2019	1,858	395	184	14	5,722	8,173
2020	5,716	1,234	1,288	1,200	8,326	17,763
2021	1,969	284	187	7	2,794	5,241
2022	1,969	284	187	7	2,744	5,191
2023	1,969	284	187	7	2,744	5,191
2024	1,974	285	187	7	1,196	3,650
2025	1,969	284	187	7	1,144	3,591
2026	1,969	284	187	7	1,286	3,733
2027	1,969	284	187	7	1,336	3,783
2028	1,974	285	187	7	1,288	3,742
2029	1,969	284	187	7	1,286	3,733
2030	1,969	284	187	7	1,336	3,783
2031	1,969	284	187	7	1,286	3,733
2032	1,974	285	187	7	1,288	3,742
2033	1,969	284	187	7	1,336	3,783
2034	1,969	284	187	7	1,286	3,733
2035	1,969	284	187	7	1,286	3,733
2036	1,974	285	187	7	1,338	3,792
2037	1,969	284	187	7	1,286	3,733
2038	1,969	284	187	7	1,286	3,733
2039	1,969	284	187	7	1,336	3,783
2040	1,974	285	187	7	1,288	3,742
2041	1,969	284	187	7	1,286	3,733
2042	1,969	284	187	7	1,336	3,783
2043	1,969	284	187	7	1,286	3,733
2044	1,974	285	187	7	1,288	3,742
2045	1,969	284	187	7	1,336	3,783

TABLE 3.4 (continued)
LICENSE TERMINATION EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equip. & Materials	Energy	Waste Disposal	Other	Total
2046	1,969	284	187	7	1,286	3,733
2047	1,969	284	187	7	1,286	3,733
2048	1,974	285	187	7	1,338	3,792
2049	1,969	284	187	7	1,286	3,733
2050	1,969	284	187	7	1,286	3,733
2051	1,969	284	187	7	1,336	3,783
2052	1,974	285	187	7	1,288	3,742
2053	1,969	278	187	6	1,142	3,583
2054	1,969	278	187	6	1,192	3,633
2055	1,969	278	187	6	1,142	3,583
2056	1,974	279	187	6	1,144	3,591
2057	1,969	278	187	6	1,192	3,633
2058	1,969	278	187	6	1,142	3,583
2059	1,969	278	187	6	1,142	3,583
2060	1,974	279	187	6	1,194	3,641
2061	1,969	278	187	6	1,142	3,583
2062	1,969	278	187	6	1,142	3,583
2063	1,969	278	187	6	1,192	3,633
2064	1,974	279	187	6	1,144	3,591
2065	1,969	278	187	6	1,142	3,583
2066	1,969	278	187	6	1,192	3,633
2067	1,969	278	187	6	1,142	3,583
2068	35,936	1,912	1,873	32	3,524	43,277
2069	53,909	14,320	1,821	12,174	9,806	92,030
2070	53,452	15,787	1,689	18,228	15,362	104,519
2071	46,489	8,170	1,401	10,716	17,749	84,524
2072	46,616	8,192	1,405	10,745	17,995	84,953
2073	38,409	3,090	599	2,488	5,554	50,139
2074	151	0	0	0	360	512
2075	71.35	0	0	0	224	295
Total	434,259	68,148	24,326	56,003	234,483	817,219

TABLE 3.5
SPENT FUEL MANAGEMENT EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equip. & Materials	Energy	Waste Disposal	Other	Total
2014	0	0	0	0	4,753	4,753
2015	0	0	0	0	14,319	14,319
2016	9,093	0	1,622	0	18,790	29,506
2017	13,547	0	2,195	0	33,307	49,049
2018	13,547	0	2,195	0	46,588	62,330
2019	13,547	0	2,195	0	43,942	59,684
2020	6,755	0	1,092	0	12,898	20,745
2021	3,238	338	79	0	341	3,996
2022	3,238	338	79	0	341	3,996
2023	3,238	338	79	0	341	3,996
2024	3,246	339	80	0	342	4,007
2025	3,238	338	79	0	341	3,996
2026	3,238	338	79	0	341	3,996
2027	3,238	338	79	0	341	3,996
2028	3,246	339	80	0	342	4,007
2029	3,238	338	79	0	341	3,996
2030	3,238	338	79	0	341	3,996
2031	3,238	338	79	0	341	3,996
2032	3,246	339	80	0	342	4,007
2033	3,238	338	79	0	341	3,996
2034	3,238	338	79	0	341	3,996
2035	3,238	338	79	0	341	3,996
2036	3,246	339	80	0	342	4,007
2037	3,238	338	79	0	341	3,996
2038	3,238	338	79	0	341	3,996
2039	3,238	338	79	0	341	3,996
2040	3,246	339	80	0	342	4,007
2041	3,238	338	79	0	341	3,996
2042	3,238	338	79	0	341	3,996
2043	3,238	338	79	0	341	3,996
2044	3,246	339	80	0	342	4,007
2045	3,238	338	79	0	341	3,996

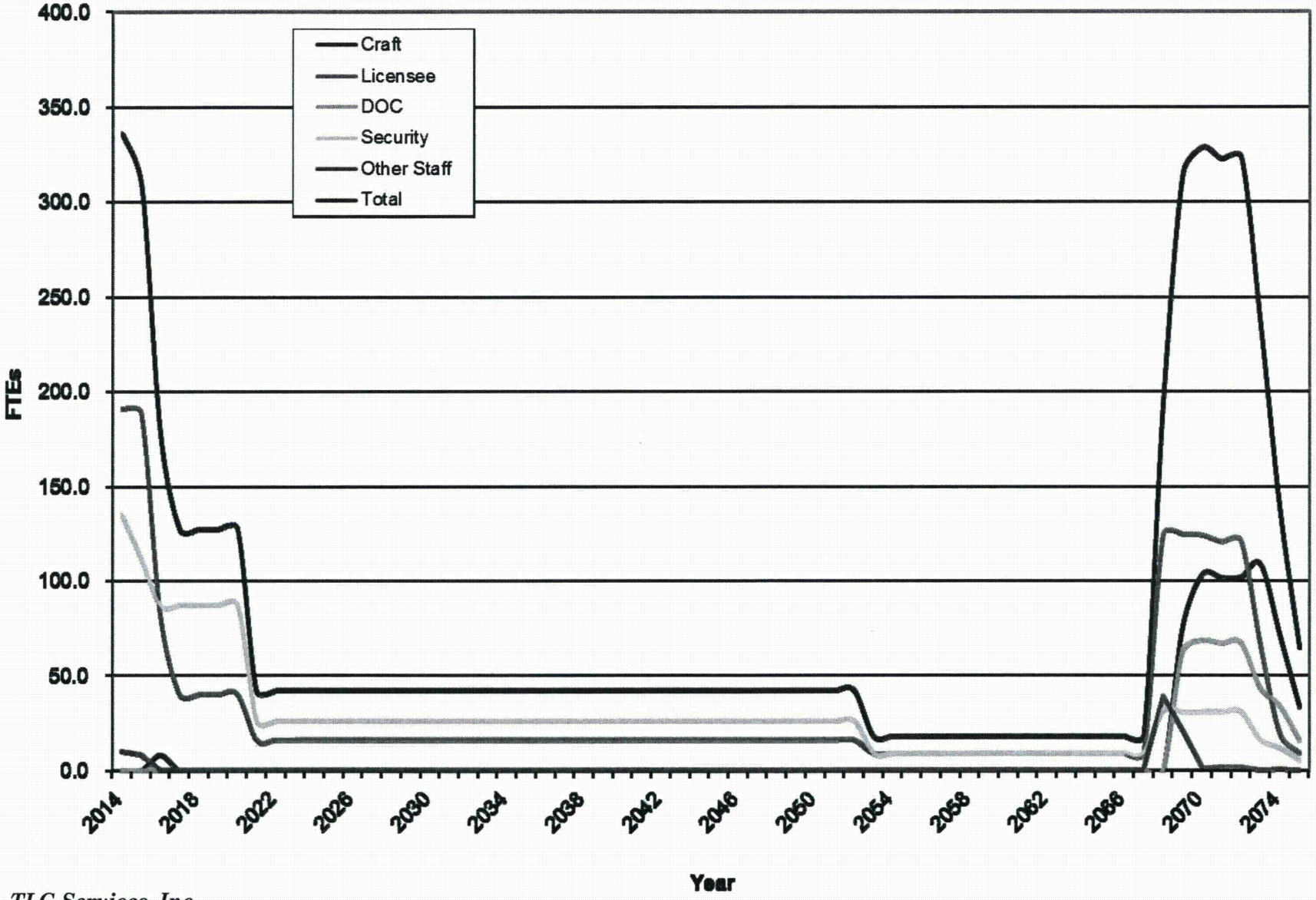
TABLE 3.5 (continued)
SPENT FUEL MANAGEMENT EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equip. & Materials	Energy	Waste Disposal	Other	Total
2046	3,238	338	79	0	341	3,996
2047	3,238	338	79	0	341	3,996
2048	3,246	339	80	0	342	4,007
2049	3,238	338	79	0	341	3,996
2050	3,238	338	79	0	341	3,996
2051	3,238	338	79	0	341	3,996
2052	3,246	339	80	0	342	4,007
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
Total	160,164	10,816	11,843	0	185,524	368,347

TABLE 3.6
SITE RESTORATION EXPENDITURES
(thousands, 2014 dollars)

Year	Labor	Equip. & Materials	Energy	Waste Disposal	Other	Total
2014-2067	0	0	0	0	0	0
2068	578	0	0	0	0	578
2069	456	10	0	0	0	466
2070	181	52	0	0	163	396
2071	798	163	0	0	714	1,674
2072	800	163	0	0	715	1,678
2073	851	318	6	0	229	1,403
2074	22,142	9,325	187	0	2,654	34,308
2075	10,434	4,394	88	0	1,726	16,642
Total	36,240	14,425	280	0	6,200	57,145

FIGURE 3.1
SITE STAFFING LEVELS
(Full Time Equivalent Positions)



4. SCHEDULE

The schedule for the decommissioning scenario considered in this analysis follows the general sequence presented in the AIF/NESP-036 study, with minor changes to reflect recent experience and site-specific constraints. In addition, the scheduling has been revised to reflect the spent fuel management assumptions described in Section 3.4.1.

A schedule or sequence of activities is presented in Figure 4.1. The schedule reflects decommissioning operations following a prolonged period of dormancy. The key activities listed in the schedule do not reflect a one-to-one correspondence with those activities in the Appendix C cost table, but divide some activities for clarity and combine others for convenience. The schedule was prepared using "Microsoft Project Professional 2013" computer software.[35]

4.1 SCHEDULE ESTIMATE ASSUMPTIONS

The schedule was generated using a precedence network and associated software. Activity durations are based upon the actual man-hour estimates calculated for each area (Appendix G). The schedule was assembled by sequencing the work areas, considering work crew availability and material access/egress. The following assumptions were made in the development of the decommissioning schedule(s) as shown in Table 4.1.

- The schedule for the first six years, which includes both Transition from Operations and Dormancy with Wet Fuel Storage, is based upon detailed evaluations by the Vermont Yankee staff. Key milestones in this six year schedule include the availability of the second ISFSI pad by 2017, and the off-loading of the spent fuel pool by mid-2020.
- The 32 year ISFSI operations period (Dormancy with Dry Fuel Storage) is based upon DOE performance and acceptance rates. Key milestones in this interval include DOE first pickup of spent fuel in 2026, and completion of spent fuel pickup by the end of 2052.
- The remaining 15 years of dormancy (Dormancy with No Fuel Storage) is based upon completion of the delayed decommissioning and license termination activities within the NRC-required 60 year timeframe.
- Following the dormancy period, it is estimated that six years will be required to perform the Decommissioning Preparations and Dismantling & Decontamination activities, based in part upon the following considerations:

- All work (except vessel and internals removal) is performed during an 8-hour workday, 5 days per week, with no overtime.
- 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 consistent with efficiency, adequate access, sufficient laydown space, and consideration of worker safety necessary during demolition of heavy components and structures.

- Following license termination, the estimate accounts for 18 months of Site Restoration activities. This includes building demolition, excavation of below grade services, and limited restoration of the site.

4.2 PROJECT SCHEDULE

The period-dependent costs presented in Appendix C are based upon the durations developed in the schedule for decommissioning Vermont Yankee. Durations are established between several milestones in each project period; these durations are used to establish a critical path for the entire project. In turn, the critical path duration for each period is used as the basis for determining the period-dependent costs.

A timeline is provided as Figure 4.2. Milestone dates are based on a December 2014 shutdown and a maximum safe-storage period. The fuel pool is emptied approximately five and one-half years after shutdown, with ISFSI operations continuing at the site until the DOE can complete the transfer of assemblies to a federal facility.

FIGURE 4.1a
SAFSTOR ACTIVITY SCHEDULE
(Years 2014 through 2020)

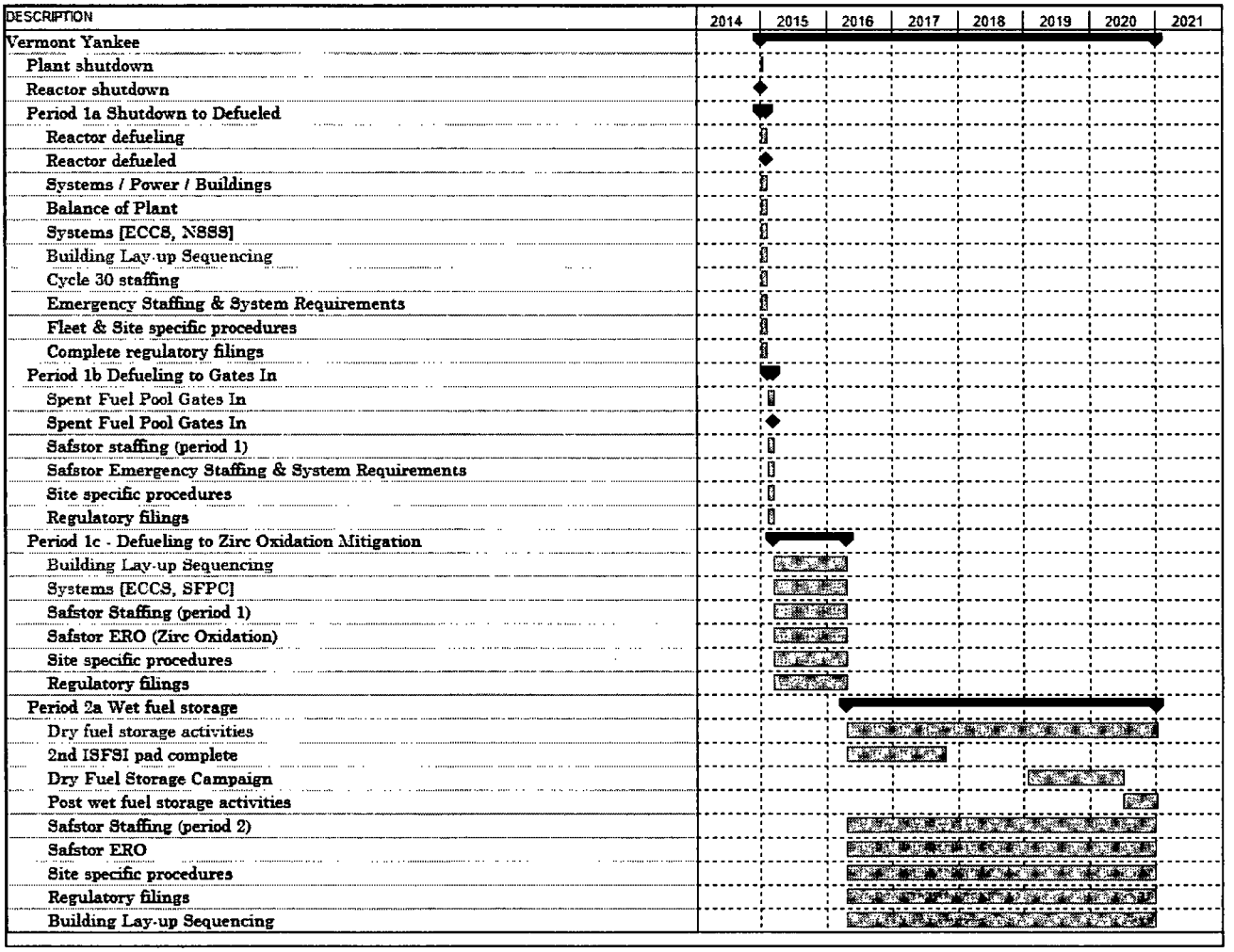


FIGURE 4.1b
SAFSTOR ACTIVITY SCHEDULE
(Years 2068 through 2075)

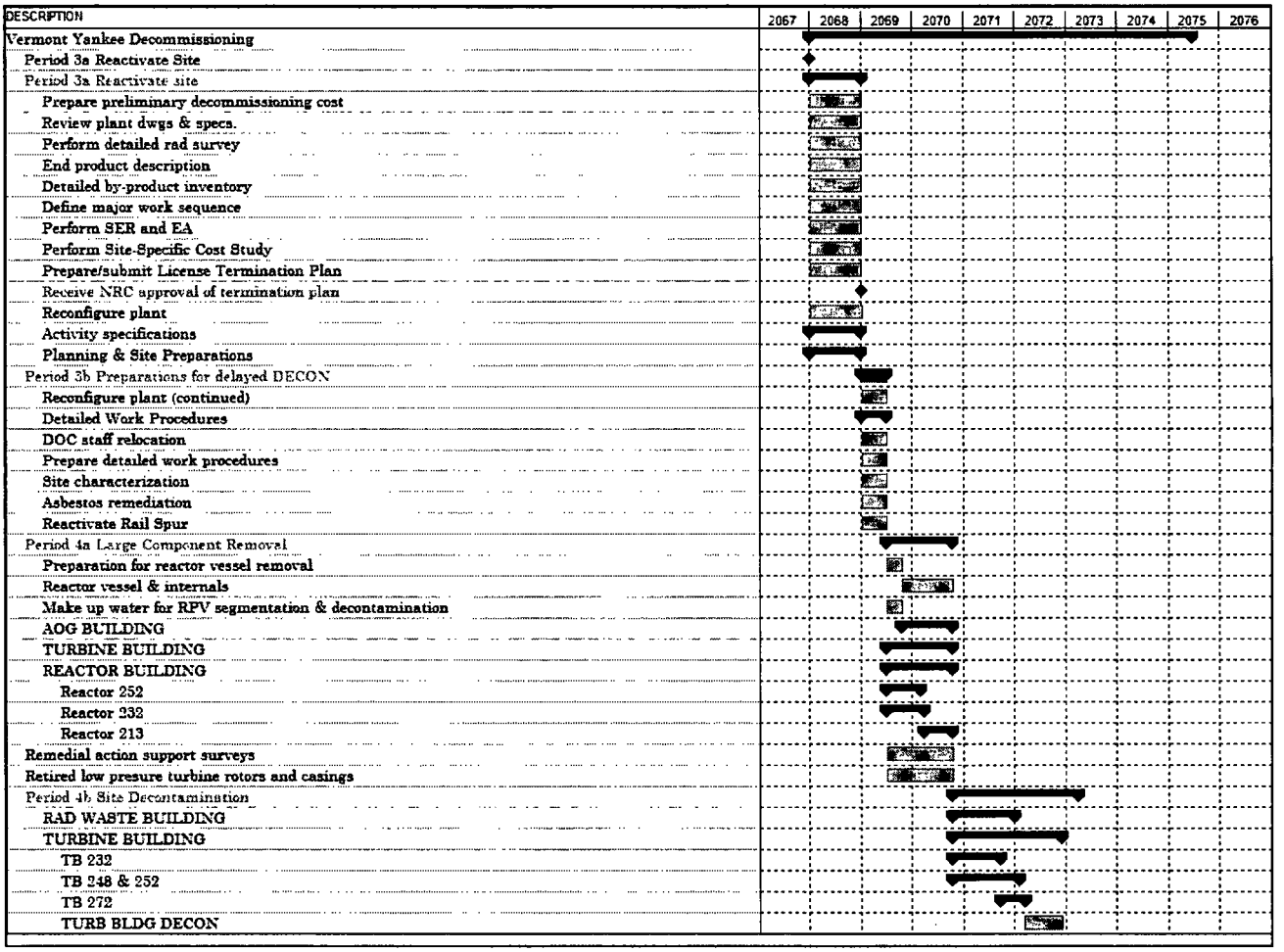


FIGURE 4.1b (continued)
SAFSTOR ACTIVITY SCHEDULE
(Years 2068 through 2075)

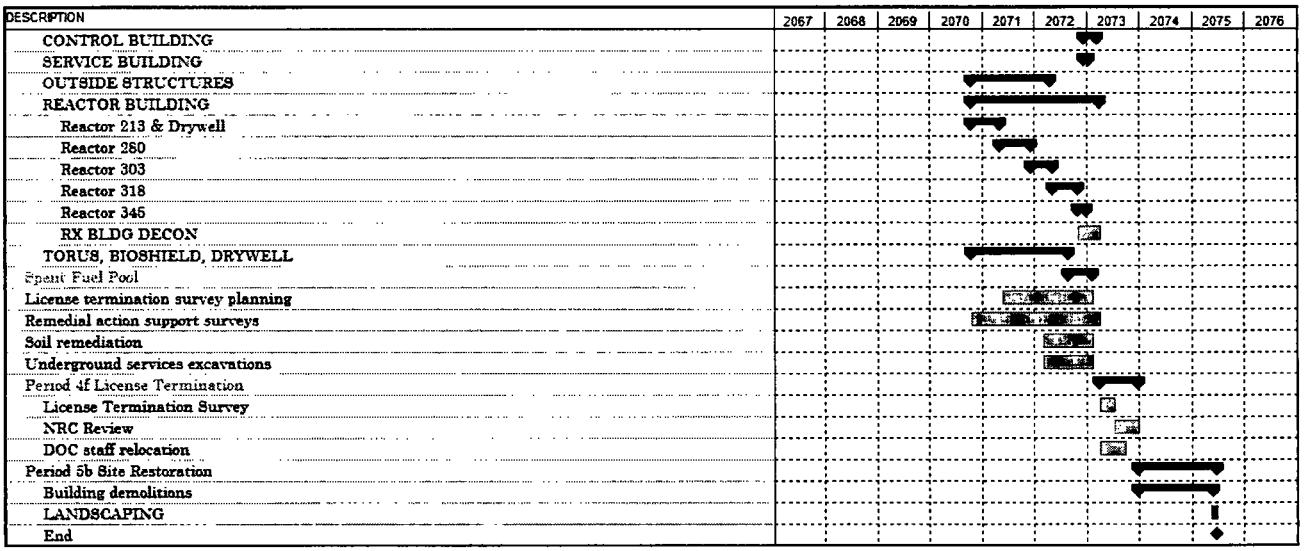


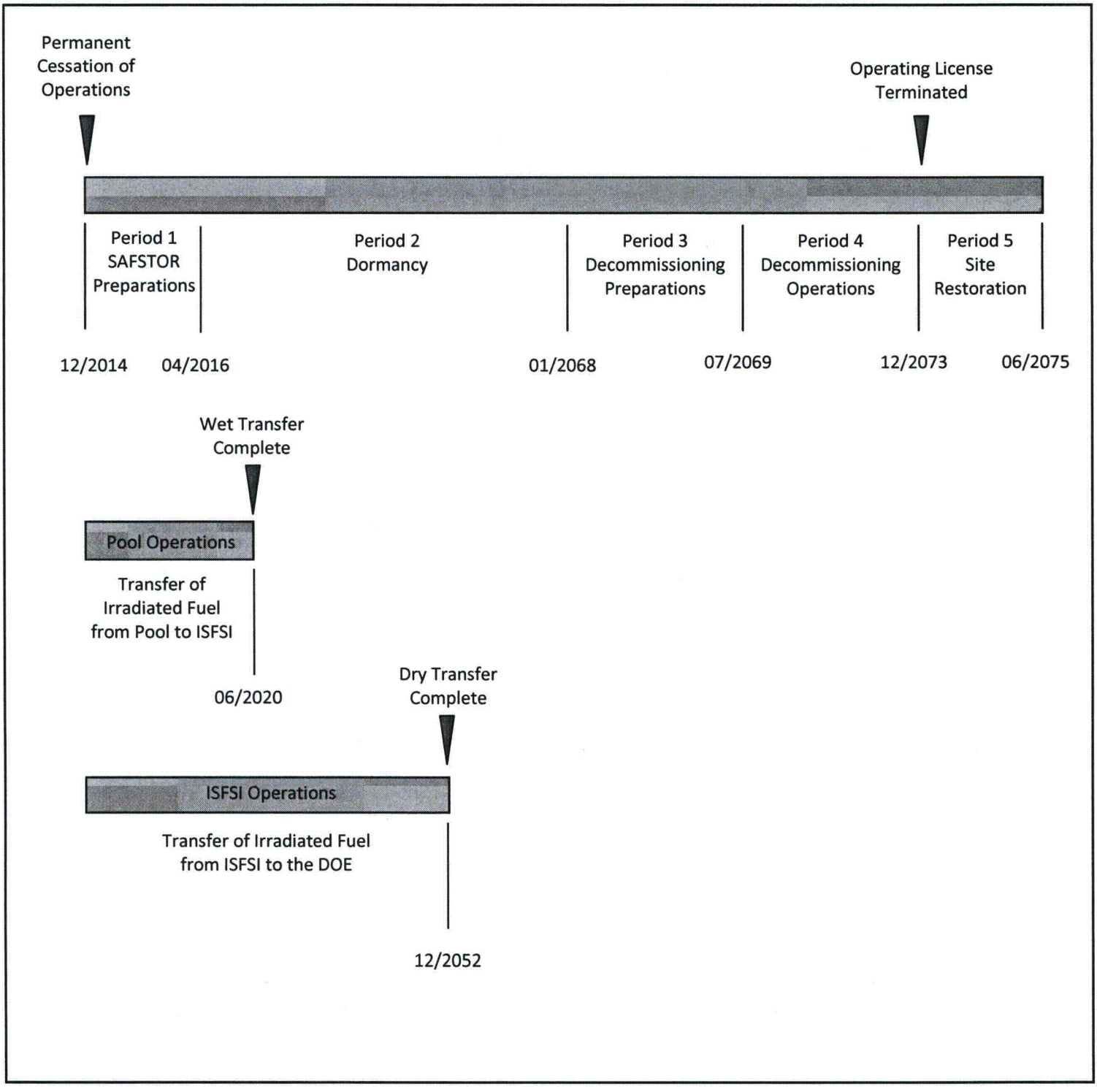
TABLE 4.1
DECOMMISSIONING SCHEDULE AND PLANT STATUS SUMMARY

Decommissioning Activities / Plant Status	Start	End	Approximate Duration (years)
Pre-Shutdown Planning	Aug 2013	Dec 2014	1.3
Transition from Operations			
Plant Shutdown	29 Dec 2014	--------	--------
Preparations for SAFSTOR Dormancy	29 Dec 2014	30 Apr 2016	1.3
SAFSTOR Dormancy			
Dormancy w/Wet Fuel Storage	2016	2020	4.2
Dormancy w/Dry Fuel Storage	2020	2052	32.5
Dormancy w/No Fuel Storage	2053	2067	15.0
Decommissioning Preparations [1]			
Preparations for D&D	2068	2069	1.5
Dismantling & Decontamination			
Large Component Removal	2069	2070	1.3
Plant Systems Removal and Building Decontamination	2070	2073	2.5
License Termination	2073	2073	0.7
Site Restoration			
Site Restoration	2073	2075	1.5
Total from Shutdown to Completion of License Termination [2]	---------	--------	59.0

[1] Subject to the commitments regarding the commencement of radiological decommissioning in the December 23, 2013 Settlement Agreement with the Vermont Public Service Department, Vermont Agency of Natural Resources, and Vermont Department of Health

[2] Excluding Site Restoration

FIGURE 4.2
DECOMMISSIONING TIMELINE
(not to scale)



5. DECOMMISSIONING WASTE STREAMS

Decontamination and dismantling activities will generate waste products that will need to be treated and/or disposed of in the process of amending or terminating the NRC license(s), remediating the property and releasing the site for alternative and unrestricted use. The waste products generated in decommissioning a nuclear power plant include radioactive and well as non-radioactive materials.

Radioactive Wastes

The objectives of the decommissioning process are the removal of all radioactive material from the site that would restrict its future use and the termination of the NRC license(s). This currently requires the remediation of all radioactive material at the site in excess of applicable legal limits. Under the Atomic Energy Act,[36] the NRC is responsible for protecting the public from sources of ionizing radiation. Title 10 of the Code of Federal Regulations delineates the production, utilization, and disposal of radioactive materials and processes. In particular, Part 71 defines radioactive material as it pertains to transportation and Part 61 specifies its disposition.

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

The volumes of radioactive waste generated during the various decommissioning activities at the site are shown by line-item in Appendix C and summarized in Table 5.1. The waste summaries are consistent with Part 61 classifications. Volumes are calculated based on the exterior dimensions for containerized material.

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

No process system containing/handling radioactive substances at shutdown is presumed to meet material release criteria by decay alone (i.e., systems radioactive at shutdown are 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 control the disposition requirements.

Waste disposal costs are based upon representative rates for the facility consistent with the waste classification, with higher charges for Class B and C wastes.

Non-Radioactive Wastes

The non-radioactive waste stream includes concrete debris from building demolition, sanitary waste from the excavation of the septic fields, and hazardous and industrial waste. The waste streams addressed in the decommissioning cost model include the following.

- Concrete Debris (non-contaminated): generated in the dismantling of site structures, rubble will be removed from the site for conventional disposal at an industrial landfill or recycled to recover steel and aggregate.
- Asbestos Containing Materials, Insulation, Transite Piping and Panels: the material is removed from the site and disposed of at an approved facility for asbestos containing materials.
- Excavated Soil: soil removed in the process of excavating subsurface systems and/or structures will be surveyed and characterized. Soil suitable for fill will be stockpiled on site until needed. Soil that does not meet the acceptance criteria will be disposed of off-site at an appropriate facility.

FIGURE 5.1
RADIOACTIVE WASTE DISPOSITION

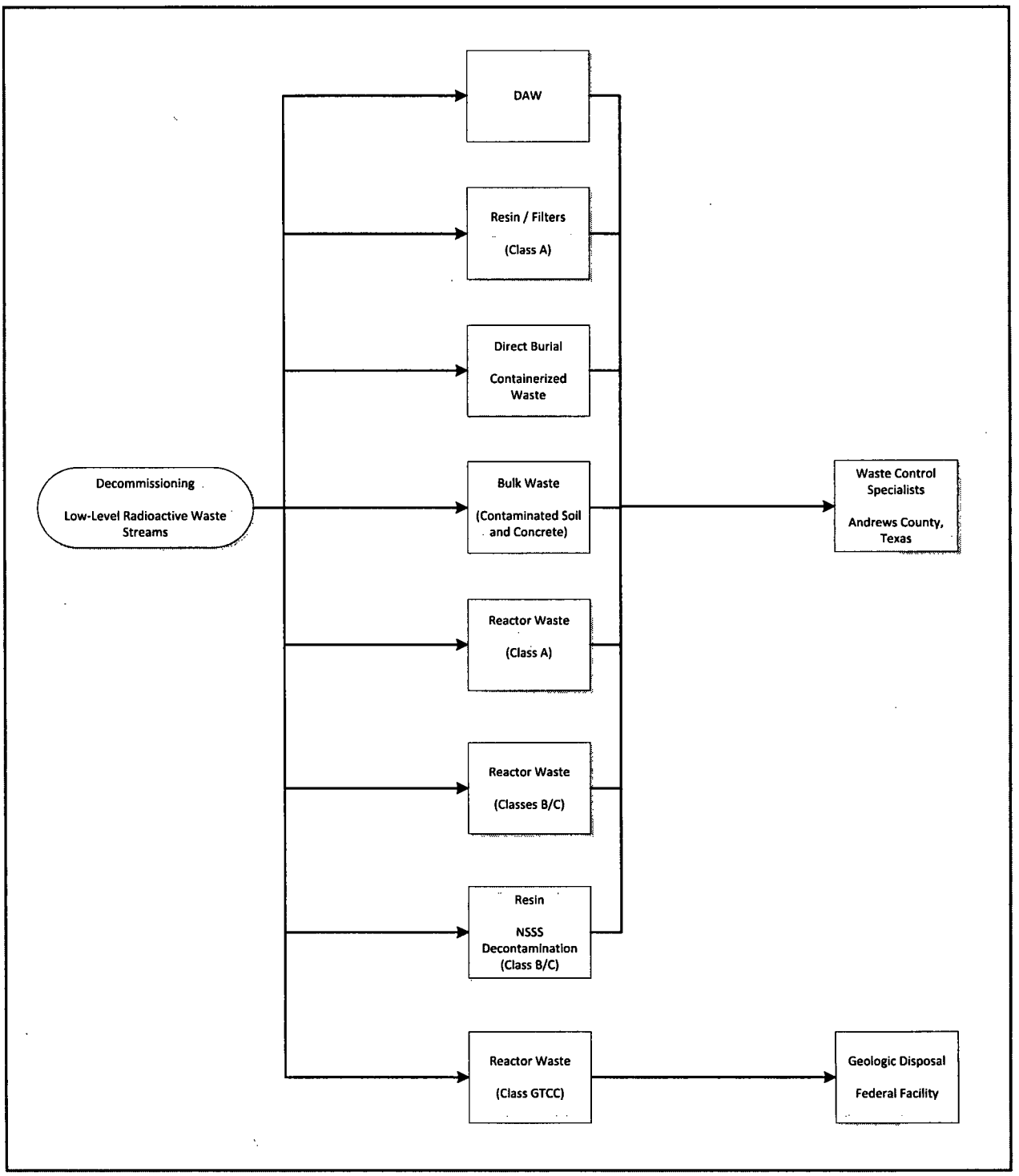


FIGURE 5.2
DECOMMISSIONING WASTE DESTINATIONS
RADIOLOGICAL

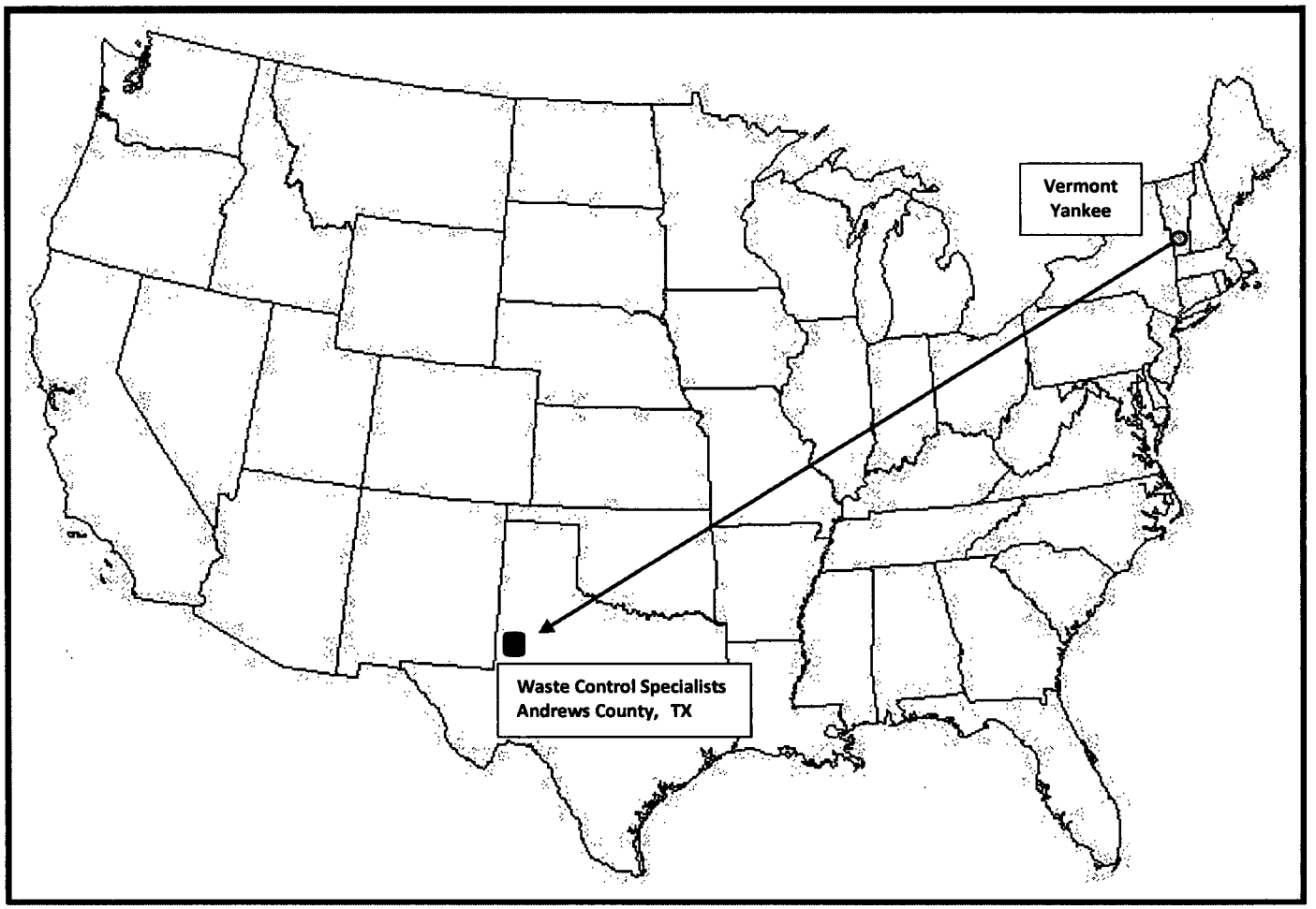


FIGURE 5.3
NON-RADIOACTIVE WASTE DISPOSITION

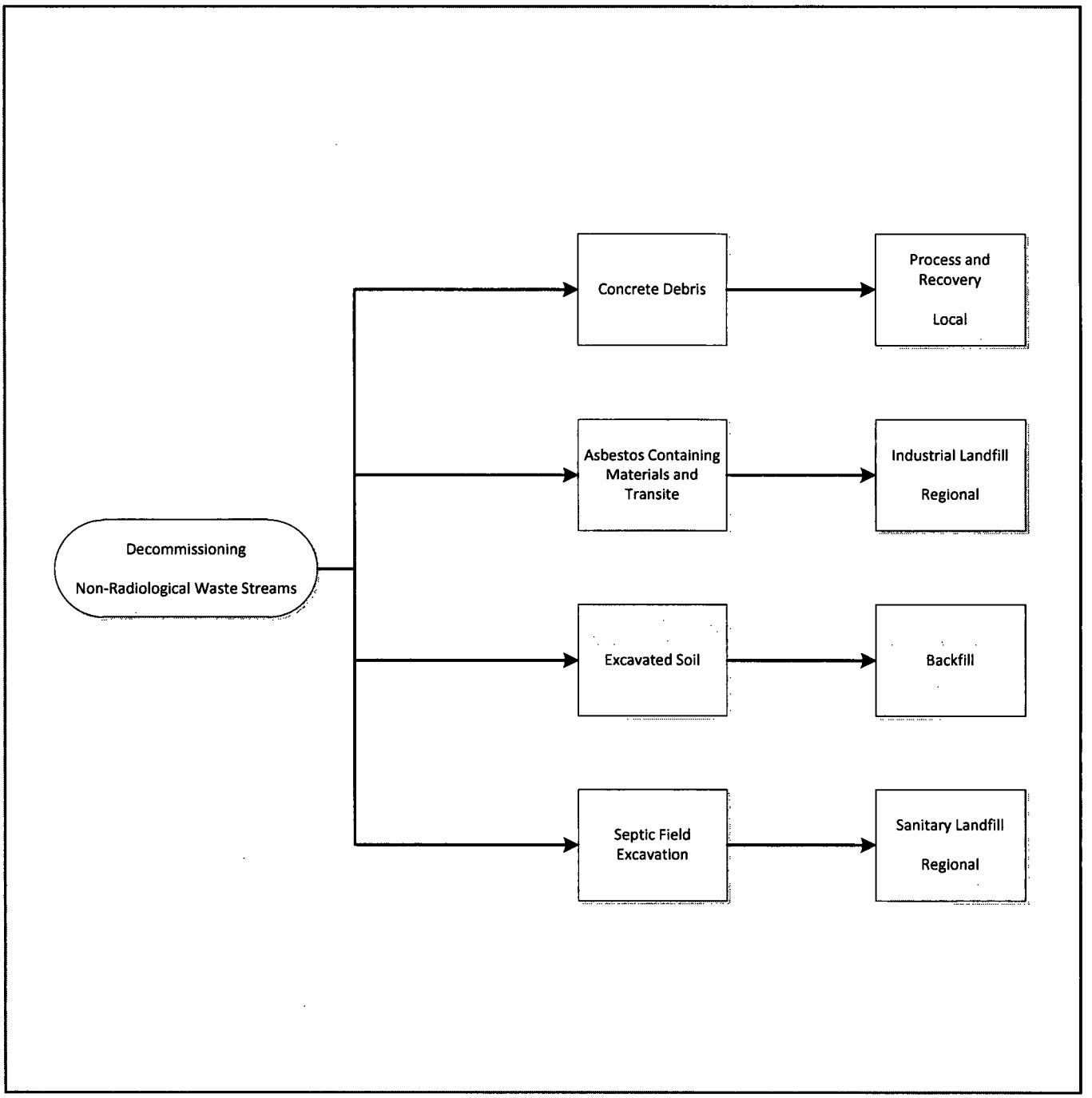


TABLE 5.1
RADIOACTIVE WASTE SUMMARY

Waste	Cost Basis	Class [1]	Waste Volume (cubic feet)	Mass (pounds)
Low-Level Radioactive Waste (near-surface disposal)	WCS Representative Rates	A	664,829	43,733,487
		B	1,002	88,330
		C	505	71,287
Greater than Class C (geologic repository)	Spent Fuel Equivalent	GTCC	357	65,690
Total [2]			666,693	43,958,794

[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 cost to decommission Vermont Yankee relied upon the detailed planning and engineering by the Decommissioning Project Organization, Project Management Organization, plant staff, and numerous corporate entities and subject matter experts for the safe transition from plant operations to safe-storage, as well as the detailed, site-specific estimate prepared in 2011 for the deferred plant decommissioning. While not an engineering study, the estimate provides the owner with sufficient information to assess its financial obligations, as they pertain to the decommissioning of the nuclear station.

The estimate described in this report is based on numerous fundamental assumptions, including regulatory requirements, project contingencies, low-level radioactive waste disposal practices, high-level radioactive waste management options, and site restoration requirements. The cost projected to place the nuclear unit in safe-storage, safeguard the spent fuel until it can be transferred to the DOE, decommissioning the facility and restore the affected area of the site is estimated to be $1.242.7 billion. The majority of this cost (approximately 65.8%) is associated with the termination of the operating license. Another 29.6% is associated with the interim storage and eventual transfer of the spent fuel. The remaining 4.6% is for the demolition of the designated structures and limited restoration of the site. The summary of the costs by these three categories is presented in Table 6.1.

The cost for planning and preparations include site budgets and near-term projections for readying the plant for long-term storage. The initial ("Wet") dormancy period includes the cost for off-loading the spent fuel from the pool to the ISFSI, which is scheduled to be completed by 2020. The "Dry" dormancy period includes the cost to operate the ISFSI until such time that the DOE can complete the transfer (assumed for purposes of this analysis in 2052). The plant will remain in storage ("No Fuel Storage") until decommissioning commences in 2068.

The major contributors to the cost of decommissioning and demolition are presented in Table 6.2. Staffing represents the largest single contributor to the overall decommissioning cost. The magnitude of the expense is a function of both the size of the organization needed to manage the decommissioning, as well as the program duration.

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 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 adjunct of the work being performed in the process of terminating the operating license.

The disposal of low-level radioactive waste includes those costs associated with the controlled disposal of contaminated and activated material generated from decontamination and dismantling activities, including plant equipment and components, structural material, filters, resins and dry-active waste. As described in Section 5, the majority of the waste is assumed to be sent to Waste Control Specialists' facility in Texas. Components requiring additional isolation from the environment (i.e., GTCC), are packaged for geologic disposal.

Characterization and 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 authorities. This process involves a systematic survey of all remaining plant surface areas and surrounding environs, sampling, isotopic analysis and documentation of the findings.

The remaining costs include allocations for waste packaging, transportation, energy consumption, mandated fees, contingencies, and other required expenses related to maintaining a NRC-licensed facility.

The estimate includes the cost for soil remediation and is predicated on a preliminary assessment of the potential for contamination in the soil around the plant (based upon historical evidence). A detailed site characterization was not performed. This allowance will be confirmed and/or modified based upon more detailed analyses to be performed in conjunction with the formulation of a license termination plan.

The decommissioning estimate is based upon current requirements and reflects present-day costs and available technology. It is therefore appropriate that this cost analysis be reviewed periodically and revised as needed (e.g., in accordance with Regulatory Guide 1.159).

TABLE 6.1
DECOMMISSIONING COST SUMMARY
(thousands of 2014 dollars)

Decommissioning Periods	License Termination	Spent Fuel Management	Site Restoration
Planning and Preparations	119,981	23,068	-
Dormancy w/Wet Fuel Storage	45,746	217,244	-
Dormancy w/Dry Fuel Storage	137,229	128,035	-
Dormancy w/No Fuel Storage	54,016	-	-
Site Reactivation	43,277	-	578
Decommissioning Preparation	36,283	-	456
Large Component Removal	141,032	-	25
Plant Sys. Removal and Bldg. Remediation	208,167	-	4,118
License Termination	30,668	-	-
Site Restoration	823	-	51,968
Total [1]	817,219	368,347	57,145

[1] Columns may not add due to rounding

TABLE 6.2
DECOMMISSIONING COST ELEMENTS
(thousands of $2014)

Cost Elements	$000
Safe-Storage	
Planning and Preparations	143,049
Dormancy w/Wet Fuel Storage	262,990
Dormancy w/Dry Fuel Storage	265,263
Dormancy w/No Fuel Storage	54,016
Safe-Storage Subtotal	725,318
Decommissioning and Demolition	
Decontamination	8,163
Removal	112,732
Waste Packaging	17,721
Transportation	24,866
Low-Level Radioactive Waste Disposal	56,026
Project Management	202,104
Site Non-Labor Overhead	1,465
Corporate A&G	12,442
Security	12,444
Property Taxes	56
Insurance	3,173
NRC Fees	2,746
Energy	9,067
Financial and Interest	4,760
Characterization and Surveys	26,655
Misc. Waste and Construction Debris Disposal	4,048
Misc. Support Equipment and Services	6,095
Water Processing	9,860
Other	2,971
Decommissioning and Demolition Subtotal	517,394
TOTAL [1]	1,242,712

TABLE 6.2 (continued)
DECOMMISSIONING COST ELEMENTS
(thousands of $2014)

Cost Categories	$000
License Termination	817,219
Spent Fuel Management [2]	368,347
Site Restoration	57,145
TOTAL [1]	1,242,712

[1] Columns may not add due to rounding

[2] Includes period dependent costs, as appropriate, during fuel storage periods

7. REFERENCES

1. "Decommissioning Cost Analysis for the Vermont Yankee Nuclear Power Station," TLG Document No. E11-1543-001, Rev. 1, February 2012

2. Within 2 years following permanent cessation of operations, if not already submitted, the licensee shall submit a site-specific decommissioning cost estimate.

3. Letter, Entergy Nuclear Operations, Inc., to USNRC, "Notification of Permanent Cessation of Power Operations," BVY 13-079, dated September 23, 2013. (ADAMS Accession No. ML13273A204)

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

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

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

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

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

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

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

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

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

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

14. U.S. Court of Appeals for the District Of Columbia Circuit, In Re: Aiken County, et al, Aug. 2013, http://www.cadc.uscourts.gov/internet/opinions.nsf/BAE0CF34F762EBD985257BC6004DEB18/$file/11-1271-1451347.pdf

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

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

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

18. U.S. Code of Federal Regulations, Title 10, Part 61.55 "Waste Classification"

19. U.S. Code of Federal Regulations, Title 10, Part 20, Subpart E, "Final Rule, Radiological Criteria for License Termination," 62 Fed. Reg. 39058, July 21, 1997

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

21. U.S. Code of Federal Regulations, Title 40, Part 141.16, "Maximum contaminant levels for beta particle and photon radioactivity from man-made radionuclides in community water systems"

22. "Memorandum of Understanding Between the Environmental Protection Agency and the Nuclear Regulatory Commission: Consultation and Finality on Decommissioning and Decontamination of Contaminated Sites," OSWER 9295.8-06a, October 9, 2002

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

7. REFERENCES
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24. Settlement Agreement between Entergy Nuclear Vermont Yankee, LLC, Entergy Nuclear Operations, Inc., the Vermont Public Service Department, the Vermont Agency of Natural Resources, and the Vermont Department of Health, dated December 23, 2013

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

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

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

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34. "Vermont Yankee Reactor Vessel and Internals Activation Evaluation," Report 13-150-RE-169, Revision 0, WMG Inc., May 2014

7. REFERENCES
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35. "Microsoft Project Professional 2013," Microsoft Corporation, Redmond, Washington

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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 packing area.

2. CALCULATIONS

Activity Description	Critical Duration (minutes)
Install contamination controls, remove insulation, and mount pipe cutters	60
Disconnect inlet and outlet lines, cap openings	60
Rig for removal	30
Unbolt from mounts	30
Remove contamination controls	15
Remove heat exchanger, wrap in plastic, and send to packing area	60
Critical Duration	255
Work Adjustments (Work Difficulty Factors)	
+ Respiratory Protection (25% of Critical Duration)	64
+ Radiation/ALARA (10% of Critical Duration)	26
Adjusted Work Duration	345
+ Protective Clothing (30% of Adjusted Work Duration)	104
Productive Work Duration	449
+ Work break adjustment (8.33 % of Productive Work Duration)	37
Total Work Duration	486

*** Total Work Duration = 486 minutes or 8.100 hours ***

APPENDIX A (continued)

3. LABOR REQUIRED

Crew	Number	Duration (hours)	Rate ($/hr)	Cost
Laborers	3.00	8.100	$50.70	$1,232.01
Craftsmen	2.00	8.100	$68.44	$1,108.73
Foreman	1.00	8.100	$72.57	$587.82
General Foreman	0.25	8.100	$76.88	$155.68
Fire Watch	0.05	8.100	$50.70	$20.53
Health Physics Technician	1.00	8.100	$62.00	$502.20
Total labor cost				$3,306.97

4. EQUIPMENT & CONSUMABLES COSTS

Equipment Costs	none
Consumables/Materials Costs	
Universal Sorbent 50 @ $0.50 sq ft {1}	$25.00
Tarpaulins (oil resistant/fire retardant) 50 @ $0.23/sq ft {2}	$11.50
Gas torch consumables 1 @ $15.85/hr x 1 hr {3}	$15.85
Subtotal cost of equipment and materials	$52.35
Overhead & sales tax on equipment and materials @ 16.00%	$8.38
Total costs, equipment & material	$60.73

TOTAL COST: Removal of contaminated heat exchanger <3000 pounds: **$3,667.70**

Total labor cost:	$3,606.97
Total equipment/material costs:	$60.73
Total craft labor man-hours required per unit:	59.13

APPENDIX A (continued)

5. NOTES AND REFERENCES

- Work difficulty factors were developed in conjunction with the AIF (now NEI) program to standardize nuclear decommissioning cost estimates and are delineated in Volume 1, Chapter 5 of the "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates," AIF/NESP-036, May 1986.
- References for equipment & consumables costs:
  1. www.mcmaster.com online catalog, McMaster Carr Spill Control (7193T88)
  2. R.S. Means (2014) Division 01 56, Section 13.60-0600, page 23
  3. R.S. Means (2014) Division 01 54 33, Section 40-6360, page 698
- Material and consumable costs were adjusted using the regional indices for Brattleboro, Vermont.

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	0.56
Removal of clean pipe 0.25 to 2 inches diameter, $/linear foot	5.98
Removal of clean pipe >2 to 4 inches diameter, $/linear foot	8.59
Removal of clean pipe >4 to 8 inches diameter, $/linear foot	16.86
Removal of clean pipe >8 to 14 inches diameter, $/linear foot	32.43
Removal of clean pipe >14 to 20 inches diameter, $/linear foot	42.15
Removal of clean pipe >20 to 36 inches diameter, $/linear foot	62.02
Removal of clean pipe >36 inches diameter, $/linear foot	73.69
Removal of clean valve >2 to 4 inches	111.90
Removal of clean valve >4 to 8 inches	168.63
Removal of clean valve >8 to 14 inches	324.29
Removal of clean valve >14 to 20 inches	421.49
Removal of clean valve >20 to 36 inches	620.18
Removal of clean valve >36 inches	736.92
Removal of clean pipe hanger for small bore piping	37.58
Removal of clean pipe hanger for large bore piping	133.92
Removal of clean pump, <300 pound	284.21
Removal of clean pump, 300-1000 pound	791.25
Removal of clean pump, 1000-10,000 pound	3,125.00
Removal of clean pump, >10,000 pound	6,042.80
Removal of clean pump motor, 300-1000 pound	331.62
Removal of clean pump motor, 1000-10,000 pound	1,299.76
Removal of clean pump motor, >10,000 pound	2,924.47
Removal of clean heat exchanger <3000 pound	1,679.25
Removal of clean heat exchanger >3000 pound	4,225.88
Removal of clean feedwater heater/deaerator	11,904.31
Removal of clean moisture separator/reheater	24,462.45
Removal of clean tank, <300 gallons	365.63
Removal of clean tank, 300-3000 gallon	1,153.39
Removal of clean tank, >3000 gallons, $/square foot surface area	9.70

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of clean electrical equipment, <300 pound	154.68
Removal of clean electrical equipment, 300-1000 pound	539.93
Removal of clean electrical equipment, 1000-10,000 pound	1,079.86
Removal of clean electrical equipment, >10,000 pound	2,574.55
Removal of clean electrical transformer < 30 tons	1,787.98
Removal of clean electrical transformer > 30 tons	5,149.09
Removal of clean standby diesel generator, <100 kW	1,826.28
Removal of clean standby diesel generator, 100 kW to 1 MW	4,076.37
Removal of clean standby diesel generator, >1 MW	8,438.90
Removal of clean electrical cable tray, $/linear foot	14.49
Removal of clean electrical conduit, $/linear foot	6.33
Removal of clean mechanical equipment, <300 pound	154.68
Removal of clean mechanical equipment, 300-1000 pound	539.93
Removal of clean mechanical equipment, 1000-10,000 pound	1,079.86
Removal of clean mechanical equipment, >10,000 pound	2,574.55
Removal of clean HVAC equipment, <300 pound	187.04
Removal of clean HVAC equipment, 300-1000 pound	648.78
Removal of clean HVAC equipment, 1000-10,000 pound	1,293.00
Removal of clean HVAC equipment, >10,000 pound	2,574.55
Removal of clean HVAC ductwork, $/pound	0.60
Removal of contaminated instrument and sampling tubing, $/linear foot	1.36
Removal of contaminated pipe 0.25 to 2 inches diameter, $/linear foot	18.77
Removal of contaminated pipe >2 to 4 inches diameter, $/linear foot	31.45
Removal of contaminated pipe >4 to 8 inches diameter, $/linear foot	51.27
Removal of contaminated pipe >8 to 14 inches diameter, $/linear foot	99.64
Removal of contaminated pipe >14 to 20 inches diameter, $/linear foot	119.24
Removal of contaminated pipe >20 to 36 inches diameter, $/linear foot	165.20
Removal of contaminated pipe >36 inches diameter, $/linear foot	196.08
Removal of contaminated valve >2 to 4 inches	391.41
Removal of contaminated valve >4 to 8 inches	461.58

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of contaminated valve >8 to 14 inches	954.04
Removal of contaminated valve >14 to 20 inches	1,210.95
Removal of contaminated valve >20 to 36 inches	1,609.65
Removal of contaminated valve >36 inches	1,918.45
Removal of contaminated pipe hanger for small bore piping	126.77
Removal of contaminated pipe hanger for large bore piping	409.58
Removal of contaminated pump, <300 pound	811.50
Removal of contaminated pump, 300-1000 pound	1,863.84
Removal of contaminated pump, 1000-10,000 pound	6,265.11
Removal of contaminated pump, >10,000 pound	15,231.70
Removal of contaminated pump motor, 300-1000 pound	800.21
Removal of contaminated pump motor, 1000-10,000 pound	2,538.53
Removal of contaminated pump motor, >10,000 pound	5,715.79
Removal of contaminated heat exchanger <3000 pound	3,667.70
Removal of contaminated heat exchanger >3000 pound	10,628.83
Removal of contaminated feedwater heater/deaerator	26,911.48
Removal of contaminated moisture separator/reheater	58,692.12
Removal of contaminated tank, <300 gallons	1,341.08
Removal of contaminated tank, >300 gallons, $/square foot	27.35
Removal of contaminated electrical equipment, <300 pound	626.86
Removal of contaminated electrical equipment, 300-1000 pound	1,515.23
Removal of contaminated electrical equipment, 1000-10,000 pound	2,903.42
Removal of contaminated electrical equipment, >10,000 pound	5,909.77
Removal of contaminated electrical cable tray, $/linear foot	31.22
Removal of contaminated electrical conduit, $/linear foot	14.58
Removal of contaminated mechanical equipment, <300 pound	719.61
Removal of contaminated mechanical equipment, 300-1000 pound	1,734.37
Removal of contaminated mechanical equipment, 1000-10,000 pound	3,330.59
Removal of contaminated mechanical equipment, >10,000 pound	5,909.77
Removal of contaminated HVAC equipment, <300 pound	719.61

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of contaminated HVAC equipment, 300-1000 pound	1,734.37
Removal of contaminated HVAC equipment, 1000-10,000 pound	3,330.59
Removal of contaminated HVAC equipment, >10,000 pound	5,909.77
Removal of contaminated HVAC ductwork, $/pound	1.84
Removal/plasma arc cut of contaminated thin metal components, $/linear in.	3.43
Additional decontamination of surface by washing, $/square foot	7.15
Additional decontamination of surfaces by hydrolasing, $/square foot	31.36
Decontamination rig hook up and flush, $/ 250 foot length	6,063.80
Chemical flush of components/systems, $/gallon	16.04
Removal of clean standard reinforced concrete, $/cubic yard	153.29
Removal of grade slab concrete, $/cubic yard	206.25
Removal of clean concrete floors, $/cubic yard	394.87
Removal of sections of clean concrete floors, $/cubic yard	1,193.13
Removal of clean heavily rein concrete w/#9 rebar, $/cubic yard	252.00
Removal of contaminated heavily rein concrete w/#9 rebar, $/cubic yard	1,801.95
Removal of clean heavily rein concrete w/#18 rebar, $/cubic yard	318.66
Removal of contaminated heavily rein concrete w/#18 rebar, $/cubic yard	2,381.39
Removal heavily rein concrete w/#18 rebar & steel embedments, $/cubic yard	492.34
Removal of below-grade suspended floors, $/cubic yard	394.87
Removal of clean monolithic concrete structures, $/cubic yard	1,007.73
Removal of contaminated monolithic concrete structures, $/cubic yard	1,796.44
Removal of clean foundation concrete, $/cubic yard	790.86
Removal of contaminated foundation concrete, $/cubic yard	1,672.62
Explosive demolition of bulk concrete, $/cubic yard	34.27
Removal of clean hollow masonry block wall, $/cubic yard	106.75
Removal of contaminated hollow masonry block wall, $/cubic yard	265.49
Removal of clean solid masonry block wall, $/cubic yard	106.75
Removal of contaminated solid masonry block wall, $/cubic yard	265.49
Backfill of below-grade voids, $/cubic yard	29.15
Removal of subterranean tunnels/voids, $/linear foot	125.70

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Placement of concrete for below-grade voids, $/cubic yard	111.65
Excavation of clean material, $/cubic yard	3.19
Excavation of contaminated material, $/cubic yard	32.62
Removal of clean concrete rubble (tipping fee included), $/cubic yard	23.87
Removal of contaminated concrete rubble, $/cubic yard	22.97
Removal of building by volume, $/cubic foot	0.33
Removal of clean building metal siding, $/square foot	1.43
Removal of contaminated building metal siding, $/square foot	3.60
Removal of standard asphalt roofing, $/square foot	2.65
Removal of transite panels, $/square foot	2.36
Scarifying contaminated concrete surfaces (drill & spall), $/square foot	10.27
Scabbling contaminated concrete floors, $/square foot	6.32
Scabbling contaminated concrete walls, $/square foot	17.48
Scabbling contaminated ceilings, $/square foot	60.05
Scabbling structural steel, $/square foot	5.32
Removal of clean overhead crane/monorail < 10 ton capacity	758.80
Removal of contaminated overhead crane/monorail < 10 ton capacity	1,615.36
Removal of clean overhead crane/monorail >10-50 ton capacity	1,821.10
Removal of contaminated overhead crane/monorail >10-50 ton capacity	3,865.71
Removal of polar crane > 50 ton capacity	7,626.80
Removal of gantry crane > 50 ton capacity	32,181.82
Removal of structural steel, $/pound	0.23
Removal of clean steel floor grating, $/square foot	5.49
Removal of contaminated steel floor grating, $/square foot	11.52
Removal of clean free standing steel liner, $/square foot	14.55
Removal of contaminated free standing steel liner, $/square foot	31.78
Removal of clean concrete-anchored steel liner, $/square foot	7.27
Removal of contaminated concrete-anchored steel liner, $/square foot	36.98
Placement of scaffolding in clean areas, $/square foot	14.45
Placement of scaffolding in contaminated areas, $/square foot	21.65

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Landscaping with topsoil, $/acre	21,560.98
Cost of CPC B-88 LSA box & preparation for use	1,762.58
Cost of CPC B-25 LSA box & preparation for use	1,615.53
Cost of CPC B-12V 12 gauge LSA box & preparation for use	1,323.57
Cost of CPC B-144 LSA box & preparation for use	8,834.72
Cost of LSA drum & preparation for use	190.14
Cost of cask liner for CNSI 8 120A cask (resins)	10,609.24
Cost of cask liner for CNSI 8 120A cask (filters)	7,719.50
Decontamination of surfaces with vacuuming, $/square foot	0.87

APPENDIX C

DETAILED COST ANALYSES

Table C
Vermont Yankee Nuclear Power Station
SAFSTOR Alternative Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Burial Volumes: Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
PERIOD 0 - Pre-Shutdown Early Planning																			
Period start date: Wednesday, January 1, 2014																			
Period end date: Thursday, January 1, 2015																			
Period duration: 11.99 months																			
Period 0 Additional Costs																			
0.2.1	Financing Cost and Interest	-	-	-	-	-	520	-	520	520	-	-	-	-	-	-	-	-	-
0.2.2	ARO - Outside Contractor Support Studies / Submittals (LT-CTC)	-	-	-	-	-	2,063	-	2,063	2,063	-	-	-	-	-	-	-	-	-
0.2.3	ARO - Outside Contractor Support Decommissioning Cost Estimates (LT-DCE)	-	-	-	-	-	1,500	-	1,500	1,500	-	-	-	-	-	-	-	-	-
0.2.4	ARO - Miscellaneous Expenses (LT-Misc)	-	-	-	-	-	1,011	-	1,011	1,011	-	-	-	-	-	-	-	-	-
0.2.5	ARO - Outside Contractor Support Plant Modifications (LT-Mod's)	-	-	-	-	-	1,567	-	1,567	1,567	-	-	-	-	-	-	-	-	-
0.2.6	ARO - ISFSI Pad (SF-ISFSI)	-	-	-	-	-	3,927	723	4,650	-	4,650	-	-	-	-	-	-	-	-
0.2.7	ARO - Miscellaneous Expenses (SF-MISC)	-	-	-	-	-	95	-	95	-	95	-	-	-	-	-	-	-	-
0.2.8	ARO - DPO and PMO Payroll (LT-PAYROLL)	-	-	-	-	-	3,976	-	3,976	3,976	-	-	-	-	-	-	-	-	-
0.2.9	ARO - Outside Consultants (LT-Consult)	-	-	-	-	-	1,000	-	1,000	1,000	-	-	-	-	-	-	-	-	-
0.2.10	ARO - (Other)	-	-	-	-	-	598	-	598	598	-	-	-	-	-	-	-	-	-
0.2.11	ARO - Spent Fuel Cask (SF-CASK)	-	-	-	-	-	8	-	8	-	8	-	-	-	-	-	-	-	-
0.2.29	Third Party Advisor	-	-	-	-	-	630	-	630	630	-	-	-	-	-	-	-	-	-
0.2.35	Non-Incremental Labor / Site Staff Support (Non-DPO) Planning and Preparation	-	-	-	-	-	1,786	14	1,800	1,800	-	-	-	-	-	-	-	-	-
0.2	Subtotal Period 0 Additional Costs	-	-	-	-	-	18,681	737	19,418	14,665	4,753	-	-	-	-	-	-	-	-
Period 0 Period-Dependent Costs																			
0.4.4	NRC Fees	-	-	-	-	-	455	45	500	500	-	-	-	-	-	-	-	-	-
0.4	Subtotal Period 0 Period-Dependent Costs	-	-	-	-	-	455	45	500	500	-	-	-	-	-	-	-	-	-
PERIOD 0 TOTALS		-	-	-	-	-	19,135	782	19,918	15,165	4,753	-	-	-	-	-	-	-	-
Period start date: Thursday, January 1, 2015																			
Period end date: Sunday, March 1, 2015																			
Period duration: 1.94 months																			
Period 1a Direct Decommissioning Activities																			
Period 1a Additional Costs																			
1a.2.1	Financing Cost and Interest	-	-	-	-	-	116	-	116	116	-	-	-	-	-	-	-	-	-
1a.2.2	ISFSI Pad	-	-	-	-	-	809	408	1,217	-	1,217	-	-	-	-	-	-	-	-
1a.2.3	ISFSI Pad (SAFSTOR Organization Contribution)	-	-	-	-	-	(201)	-	(201)	-	(201)	-	-	-	-	-	-	-	-
1a.2.8	Security Phase 1 & II (Lic Term)	-	-	-	-	-	180	11	191	191	-	-	-	-	-	-	-	-	-
1a.2.9	Security Phase 1 & II (Lic Term) (SAFSTOR Organization Contribution)	-	-	-	-	-	(15)	-	(15)	(15)	-	-	-	-	-	-	-	-	-
1a.2.10	Security Phase 1 & II (Spent Fuel)	-	-	-	-	-	358	-	358	-	358	-	-	-	-	-	-	-	-
1a.2.11	Security Phase 1 & II (Spent Fuel) (SAFSTOR Organization Contribution)	-	-	-	-	-	(14)	-	(14)	(14)	-	-	-	-	-	-	-	-	-
1a.2.12	Rad Waste / Water Mgt.	-	-	-	-	-	143	54	198	198	-	-	-	-	-	-	-	-	-
1a.2.13	Rad Waste / Water Mgt. (SAFSTOR Organization Contribution)	-	-	-	-	-	(6)	-	(6)	(6)	-	-	-	-	-	-	-	-	-
1a.2.14	B.5.B	-	-	-	-	-	40	-	40	40	-	-	-	-	-	-	-	-	-
1a.2.16	System Abandonment	-	-	-	-	-	50	-	50	50	-	-	-	-	-	-	-	-	-
1a.2.17	System Abandonment (SAFSTOR Organization Contribution)	-	-	-	-	-	(22)	-	(22)	(22)	-	-	-	-	-	-	-	-	-
1a.2.18	Building Layups	-	-	-	-	-	249	58	307	307	-	-	-	-	-	-	-	-	-
1a.2.19	Building Layups (SAFSTOR Organization Contribution)	-	-	-	-	-	(20)	-	(20)	(20)	-	-	-	-	-	-	-	-	-
1a.2.20	Credit (Site Non-Labor Overhead, Insurance, NRC Fees, Property Taxes, EP Fees, Energy, Corporate A&G while defueling)	-	-	-	-	-	(2,401)	-	(2,401)	(2,401)	-	-	-	-	-	-	-	-	-
1a.2.21	Credit (Utility and Security Staff Labor - O&M Expenditures while defueling)	-	-	-	-	-	(3,294)	-	(3,294)	(3,294)	-	-	-	-	-	-	-	-	(49,727)
1a.2.22	State of Vermont Payment in Lieu of Taxes	-	-	-	-	-	808	-	808	808	-	-	-	-	-	-	-	-	-
1a.2.23	E Plan and Licensing Contractors	-	-	-	-	-	36	-	36	36	-	-	-	-	-	-	-	-	-
1a.2.27	Asbestos Shipments	-	-	-	-	-	7	-	7	7	-	-	-	-	-	-	-	-	-
1a.2.28	ARO - (Other)	-	-	-	-	-	48	-	48	48	-	-	-	-	-	-	-	-	-
1a.2.29	Third Party Advisor	-	-	-	-	-	99	-	99	99	-	-	-	-	-	-	-	-	-
1a.2.30	IT Support and IT Projects	-	-	-	-	-	78	-	78	78	-	-	-	-	-	-	-	-	-
1a.2.33	Fees Paid by Headquarters (excl NEI annual)	-	-	-	-	-	14	-	14	-	14	-	-	-	-	-	-	-	-
1a.2.36	Communication Plan	-	-	-	-	-	48	-	48	48	-	-	-	-	-	-	-	-	-
1a.2.37	Transcanada - Min River Flow Contract	-	-	-	-	-	4	-	4	4	-	-	-	-	-	-	-	-	-
1a.2.38	NEI Annual Fee	-	-	-	-	-	10	-	10	-	10	-	-	-	-	-	-	-	-
1a.2.39	PMO Discretionary Contingency	-	-	-	-	-	-	404	404	404	-	-	-	-	-	-	-	-	-
1a.2	Subtotal Period 1a Additional Costs	-	-	-	-	-	(2,875)	935	(1,940)	(3,337)	1,398	-	-	-	-	-	-	-	(49,727)
Period 1a Collateral Costs																			
1a.3.1	Legal (License Termination)	-	-	-	-	-	326	-	326	326	-	-	-	-	-	-	-	-	-
1a.3.2	PMO Labor Support (excluding Legal)	-	-	-	-	-	389	58	448	448	-	-	-	-	-	-	-	-	-
1a.3	Subtotal Period 1a Collateral Costs	-	-	-	-	-	715	58	774	774	-	-	-	-	-	-	-	-	-
Period 1a Period-Dependent Costs																			
1a.4.1	Insurance	-	-	-	-	-	313	31	345	345	-	-	-	-	-	-	-	-	-
1a.4.2	Property taxes	-	-	-	-	-	118	12	129	129	-	-	-	-	-	-	-	-	-
1a.4.3	Health physics supplies	-	67	-	-	-	-	17	84	84	-	-	-	-	-	-	-	-	-
1a.4.4	Disposal of DAW generated	-	-	2	2	5	-	2	10	10	-	-	99	-	-	-	1,970	3	-
1a.4.5	Plant energy budget	-	-	-	-	-	598	90	688	688	-	-	-	-	-	-	-	-	-
1a.4.6	NRC Fees	-	-	-	-	-	299	30	329	329	-	-	-	-	-	-	-	-	-
1a.4.7	Emergency Planning Fees	-	-	-	-	-	837	84	920	-	920	-	-	-	-	-	-	-	-
1a.4.8	Site Non-Labor Overhead	-	-	-	-	-	681	102	783	783	-	-	-	-	-	-	-	-	-
1a.4.9	Corporate A&G Cost	-	-	-	-	-	1,398	210	1,608	1,608	-	-	-	-	-	-	-	-	-
1a.4.10	Security Staff Cost	-	-	-	-	-	1,838	276	2,114	2,114	-	-	-	-	-	-	-	-	45,514

Table C
Vermont Yankee Nuclear Power Station
SAFSTOR Alternative Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Burial Volumes: Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Period 1a Period-Dependent Costs (continued)																			
1a.4.11	SAFSTOR Organization Cost	-	-	-	-	-	4,547	682	5,230	5,230	-	-	-	-	-	-	-	-	68,440
1a.4	Subtotal Period 1a Period-Dependent Costs	-	67	2	2	5	10,630	1,535	12,241	11,320	920	-	99	-	-	-	1,970	3	113,954
1a.0	**TOTAL PERIOD 1a COST**	-	67	2	2	5	8,471	2,528	11,075	8,757	2,318	-	99	-	-	-	1,970	3	64,227
PERIOD 1b - SAFSTOR Limited DECON Activities																			
Period start date: Sunday, March 1, 2015																			
Period end date: Sunday, May 1, 2016																			
Period duration: 14.03 months																			
Period 1b Additional Costs																			
1b.2.1	Financing Cost and Interest	-	-	-	-	-	776	-	776	776	-	-	-	-	-	-	-	-	-
1b.2.2	ISFSI Pad	-	-	-	-	-	5,870	2,959	8,829	-	8,829	-	-	-	-	-	-	-	-
1b.2.3	ISFSI Pad (SAFSTOR Organization Contribution)	-	-	-	-	-	(1,549)	-	(1,549)	-	(1,549)	-	-	-	-	-	-	-	-
1b.2.8	Security Phase 1 & II (Lic Term)	-	-	-	-	-	933	57	990	990	-	-	-	-	-	-	-	-	-
1b.2.9	Security Phase 1 & II (Lic Term) (SAFSTOR Organization Contribution)	-	-	-	-	-	(80)	-	(80)	(80)	-	-	-	-	-	-	-	-	-
1b.2.10	Security Phase 1 & II (Spent Fuel)	-	-	-	-	-	1,150	707	1,857	-	1,857	-	-	-	-	-	-	-	-
1b.2.11	Security Phase 1 & II (Spent Fuel) (SAFSTOR Organization Contribution)	-	-	-	-	-	(71)	-	(71)	(71)	-	-	-	-	-	-	-	-	-
1b.2.12	Rad Waste / Water Mgt.	-	-	-	-	-	743	283	1,025	1,025	-	-	-	-	-	-	-	-	-
1b.2.13	Rad Waste / Water Mgt. (SAFSTOR Organization Contribution)	-	-	-	-	-	(30)	-	(30)	(30)	-	-	-	-	-	-	-	-	-
1b.2.14	B.5.B	-	-	-	-	-	210	-	210	210	-	-	-	-	-	-	-	-	-
1b.2.16	System Abandonment	-	-	-	-	-	259	-	259	259	-	-	-	-	-	-	-	-	-
1b.2.17	System Abandonment (SAFSTOR Organization Contribution)	-	-	-	-	-	(112)	-	(112)	(112)	-	-	-	-	-	-	-	-	-
1b.2.18	Building Layups	-	-	-	-	-	1,263	370	1,632	1,632	-	-	-	-	-	-	-	-	-
1b.2.19	Building Layups (SAFSTOR Organization Contribution)	-	-	-	-	-	(105)	-	(105)	(105)	-	-	-	-	-	-	-	-	-
1b.2.22	State of Vermont Payment in Lieu of Taxes	-	-	-	-	-	4,192	-	4,192	4,192	-	-	-	-	-	-	-	-	-
1b.2.23	E Plan and Licensing Contractors	-	-	-	-	-	217	-	217	217	-	-	-	-	-	-	-	-	-
1b.2.27	Asbestos Shipments	-	-	-	-	-	51	-	51	51	-	-	-	-	-	-	-	-	-
1b.2.28	ARO - (Other)	-	-	-	-	-	331	-	331	331	-	-	-	-	-	-	-	-	-
1b.2.29	Third Party Advisor	-	-	-	-	-	600	-	600	600	-	-	-	-	-	-	-	-	-
1b.2.30	IT Support and IT Projects	-	-	-	-	-	542	-	542	542	-	-	-	-	-	-	-	-	-
1b.2.31	SAFSTOR Organization Severance	-	-	-	-	-	1,389	-	1,389	1,389	-	-	-	-	-	-	-	-	-
1b.2.33	Fees Paid by Headquarters (excl NEI annual)	-	-	-	-	-	100	-	100	-	100	-	-	-	-	-	-	-	-
1b.2.36	Communication Plan	-	-	-	-	-	261	-	261	261	-	-	-	-	-	-	-	-	-
1b.2.37	Transcanada - Min River Flow Contract	-	-	-	-	-	29	-	29	29	-	-	-	-	-	-	-	-	-
1b.2.38	NEI Annual Fee	-	-	-	-	-	70	-	70	-	70	-	-	-	-	-	-	-	-
1b.2.39	PMO Discretionary Contingency	-	-	-	-	-	-	3,088	3,088	3,088	-	-	-	-	-	-	-	-	-
1b.2	Subtotal Period 1b Additional Costs	-	-	-	-	-	17,038	7,463	24,501	15,194	9,307	-	-	-	-	-	-	-	-
Period 1b Collateral Costs																			
1b.3.2	Legal (License Termination)	-	-	-	-	-	2,230	-	2,230	2,230	-	-	-	-	-	-	-	-	-
1b.3.3	PMO Labor Support (excluding Legal)	-	-	-	-	-	2,566	385	2,951	2,951	-	-	-	-	-	-	-	-	-
1b.3	Subtotal Period 1b Collateral Costs	-	-	-	-	-	4,797	385	5,182	5,182	-	-	-	-	-	-	-	-	-
Period 1b Period-Dependent Costs																			
1b.4.2	Insurance	-	-	-	-	-	2,223	222	2,445	2,445	-	-	-	-	-	-	-	-	-
1b.4.3	Property taxes	-	-	-	-	-	663	66	729	729	-	-	-	-	-	-	-	-	-
1b.4.4	Health physics supplies	-	488	-	-	-	-	122	610	610	-	-	-	-	-	-	-	-	-
1b.4.5	Disposal of DAW generated	-	-	13	13	36	-	12	73	73	-	-	713	-	-	-	14,261	23	-
1b.4.6	Plant energy budget	-	-	-	-	-	3,858	579	4,436	4,436	-	-	-	-	-	-	-	-	-
1b.4.7	NRC Fees	-	-	-	-	-	1,973	197	2,171	2,171	-	-	-	-	-	-	-	-	-
1b.4.8	Emergency Planning Fees	-	-	-	-	-	6,083	608	6,691	-	6,691	-	-	-	-	-	-	-	-
1b.4.9	Site Non-Labor Overhead	-	-	-	-	-	4,569	685	5,254	5,254	-	-	-	-	-	-	-	-	-
1b.4.10	Corporate A&G Cost	-	-	-	-	-	9,046	1,357	10,403	10,403	-	-	-	-	-	-	-	-	-
1b.4.11	Security Staff Cost	-	-	-	-	-	10,267	1,540	11,807	11,807	-	-	-	-	-	-	-	-	248,685
1b.4.12	SAFSTOR Organization Cost	-	-	-	-	-	32,829	4,924	37,754	37,754	-	-	-	-	-	-	-	-	495,320
1b.4	Subtotal Period 1b Period-Dependent Costs	-	488	13	13	36	71,510	10,314	82,373	75,683	6,691	-	713	-	-	-	14,261	23	744,005
1b.0	**TOTAL PERIOD 1b COST**	-	488	13	13	36	93,345	18,162	112,057	96,059	15,998	-	713	-	-	-	14,261	23	744,005
PERIOD 1 TOTALS		-	556	15	14	41	101,816	20,690	123,132	104,816	18,316	-	812	-	-	-	16,231	26	808,232
PERIOD 2a - SAFSTOR Dormancy with Wet Spent Fuel Storage																			
Period start date: Sunday, May 1, 2016																			
Period end date: July 1, 2020																			
Period duration: 50 months																			
Period 2a Direct Decommissioning Activities																			
2a.1.1	Quarterly Inspection	-	-	-	-	-	-	-	a	-	-	-	-	-	-	-	-	-	-
2a.1.2	Semi-annual environmental survey	-	-	-	-	-	-	-	a	-	-	-	-	-	-	-	-	-	-
2a.1.3	Prepare reports	-	-	-	-	-	-	-	a	-	-	-	-	-	-	-	-	-	-
2a.1.4	Bituminous roof replacement	-	-	-	-	-	121	18	139	139	-	-	-	-	-	-	-	-	-
2a.1.5	Maintenance supplies	-	-	-	-	-	579	145	724	724	-	-	-	-	-	-	-	-	-
2a.1	Subtotal Period 2a Activity Costs	-	-	-	-	-	700	163	863	863	-	-	-	-	-	-	-	-	-

Table C
Vermont Yankee Nuclear Power Station
SAFSTOR Alternative Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Burial Volumes: Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Period 2a Additional Costs																			
2a.2.1	Financing Cost and Interest	-	-	-	-	-	2,367	-	2,367	2,367	-	-	-	-	-	-	-	-	-
2a.2.2	ISFSI Pad	-	-	-	-	-	5,745	2,896	8,641	-	8,641	-	-	-	-	-	-	-	-
2a.2.3	ISFSI Pad (SAFSTOR Organization Contribution)	-	-	-	-	-	(2,556)	-	(2,556)	-	(2,556)	-	-	-	-	-	-	-	-
2a.2.4	2019 DFS Campaign	-	-	-	-	-	73,670	7,367	81,037	-	81,037	-	-	-	-	-	-	-	-
2a.2.6	2020 DFS Campaign	-	-	-	-	-	26,200	2,620	28,820	-	28,820	-	-	-	-	-	-	-	-
2a.2.10	Security Phase 1 & II (Spent Fuel)	-	-	-	-	-	5,423	1,627	7,050	-	7,050	-	-	-	-	-	-	-	-
2a.2.18	Building Layups	-	-	-	-	-	51	63	114	114	-	-	-	-	-	-	-	-	-
2a.2.23	E Plan and Licensing Contractors	-	-	-	-	-	467	-	467	467	-	-	-	-	-	-	-	-	-
2a.2.24	2018 Spent Fuel Pool Clean Up (New Components to SFP Post Shutdown)	-	-	-	-	-	410	-	410	410	-	-	-	-	-	-	-	-	-
2a.2.27	Asbestos Shipments	-	-	-	-	-	205	-	205	205	-	-	-	-	-	-	-	-	-
2a.2.28	ARO - (Other)	-	-	-	-	-	521	-	521	521	-	-	-	-	-	-	-	-	-
2a.2.29	Third Party Advisor	-	-	-	-	-	171	-	171	171	-	-	-	-	-	-	-	-	-
2a.2.30	IT Support and IT Projects	-	-	-	-	-	301	-	301	301	-	-	-	-	-	-	-	-	-
2a.2.31	SAFSTOR Organization Severance	-	-	-	-	-	3,707	-	3,707	3,707	-	-	-	-	-	-	-	-	-
2a.2.33	Fees Paid by Headquarters (excl NEI annual)	-	-	-	-	-	359	-	359	-	359	-	-	-	-	-	-	-	-
2a.2.36	Communication Plan	-	-	-	-	-	170	-	170	170	-	-	-	-	-	-	-	-	-
2a.2.37	Transcanada - Min River Flow Contract	-	-	-	-	-	104	-	104	104	-	-	-	-	-	-	-	-	-
2a.2.38	NEI Annual Fee	-	-	-	-	-	250	-	250	-	250	-	-	-	-	-	-	-	-
2a.2.39	PMO Discretionary Contingency	-	-	-	-	-	-	6,383	6,383	6,383	-	-	-	-	-	-	-	-	-
2a.2	Subtotal Period 2a Additional Costs	-	-	-	-	-	117,564	20,955	138,519	14,918	123,601	-	-	-	-	-	-	-	-
Period 2a Collateral Costs																			
2a.3.1	Legal (License Termination)	-	-	-	-	-	6,752	-	6,752	6,752	-	-	-	-	-	-	-	-	-
2a.3.2	PMO Labor Support (excluding Legal)	-	-	-	-	-	5,262	789	6,052	6,052	-	-	-	-	-	-	-	-	-
2a.3	Subtotal Period 2a Collateral Costs	-	-	-	-	-	12,014	789	12,804	12,804	-	-	-	-	-	-	-	-	-
Period 2a Period-Dependent Costs																			
2a.4.1	Insurance	-	-	-	-	-	3,072	307	3,379	2,239	1,140	-	-	-	-	-	-	-	-
2a.4.2	Property taxes	-	-	-	-	-	216	22	238	238	-	-	-	-	-	-	-	-	-
2a.4.3	Health physics supplies	-	700	-	-	-	-	175	875	875	-	-	-	-	-	-	-	-	-
2a.4.4	Disposal of DAW generated	-	-	17	17	48	-	16	99	99	-	-	962	-	-	-	19,238	31	-
2a.4.5	Plant energy budget	-	-	-	-	-	8,764	1,315	10,079	779	9,300	-	-	-	-	-	-	-	-
2a.4.6	NRC Fees	-	-	-	-	-	3,523	352	3,875	3,875	-	-	-	-	-	-	-	-	-
2a.4.7	Emergency Planning Fees	-	-	-	-	-	5,930	593	6,523	-	6,523	-	-	-	-	-	-	-	-
2a.4.8	Site Non-Labor Overhead	-	-	-	-	-	8,520	1,278	9,798	374	9,424	-	-	-	-	-	-	-	-
2a.4.9	Corporate A&G Cost	-	-	-	-	-	9,851	1,478	11,329	563	10,766	-	-	-	-	-	-	-	-
2a.4.10	Security Staff Cost	-	-	-	-	-	32,747	4,912	37,659	3,092	34,568	-	-	-	-	-	-	-	756,651
2a.4.11	SAFSTOR Organization Cost	-	-	-	-	-	23,434	3,515	26,949	5,027	21,923	-	-	-	-	-	-	-	347,886
2a.4	Subtotal Period 2a Period-Dependent Costs	-	700	17	17	48	96,059	13,963	110,804	17,161	93,643	-	962	-	-	-	19,238	31	1,104,537
2a.0	**TOTAL PERIOD 2a COST**	-	700	17	17	48	226,338	35,870	262,990	45,746	217,244	-	962	-	-	-	19,238	31	1,104,537
PERIOD 2aa - Post Spent Fuel Pool Layup Activities																			
Period start date: July 1, 2020 **Period end date: Friday, January 1, 2021** **Period duration: 6.05 months**																			
Period 2aa Direct Decommissioning Activities																			
2aa.1.1	Prepare support equipment for storage	-	485	-	-	-	-	73	558	558	-	-	-	-	-	-	-	3,000	-
2aa.1.2	Install containment pressure equal. lines	-	48	-	-	-	-	7	55	55	-	-	-	-	-	-	-	700	-
2aa.1.3	Interim survey prior to dormancy	-	-	-	-	-	733	220	953	953	-	-	-	-	-	-	-	11,126	-
2aa.1.4	Secure building accesses	-	-	-	-	-	-	-	a	-	-	-	-	-	-	-	-	-	-
2aa.1.5	Prepare & submit interim report	-	-	-	-	-	74	11	85	85	-	-	-	-	-	-	-	-	583
2aa.1	Subtotal Period 2aa Activity Costs	-	533	-	-	-	807	311	1,651	1,651	-	-	-	-	-	-	-	14,826	583
Period 2aa Additional Costs																			
2aa.2.1	Financing Cost and Interest	-	-	-	-	-	261	-	261	261	-	-	-	-	-	-	-	-	-
2aa.2.25	Reactivate Rail Spur ($125 K)	-	-	-	-	-	125	-	125	125	-	-	-	-	-	-	-	-	-
2aa.2.26	Spent Fuel Racks	658	77	130	256	798	-	599	2,517	2,517	-	-	10,634	-	-	-	638,066	1,332	-
2aa.2.31	SAFSTOR Organization Severance	-	-	-	-	-	905	-	905	905	-	-	-	-	-	-	-	-	-
2aa.2.33	Fees Paid by Headquarters (excl NEI annual)	-	-	-	-	-	43	-	43	-	43	-	-	-	-	-	-	-	-
2aa.2.37	Transcanada - Min River Flow Contract	-	-	-	-	-	13	-	13	13	-	-	-	-	-	-	-	-	-
2aa.2.38	NEI Annual Fee	-	-	-	-	-	30	-	30	-	30	-	-	-	-	-	-	-	-
2aa.2.39	PMO Discretionary Contingency	-	-	-	-	-	-	126	126	126	-	-	-	-	-	-	-	-	-
2aa.2	Subtotal Period 2aa Additional Costs	658	77	130	256	798	1,377	725	4,020	3,947	73	-	10,634	-	-	-	638,066	1,332	-
Period 2aa Collateral Costs																			
2aa.3.1	Process decommissioning water waste	58	-	32	138	147	-	89	464	464	-	-	367	-	-	-	22,008	72	-
2aa.3.3	Small tool allowance	-	13	-	-	-	-	2	15	15	-	-	-	-	-	-	-	-	-
2aa.3.4	Legal (License Termination)	-	-	-	-	-	804	-	804	804	-	-	-	-	-	-	-	-	-
2aa.3.5	PMO Labor Support (excluding Legal)	-	-	-	-	-	578	87	665	665	-	-	-	-	-	-	-	-	-
2aa.3	Subtotal Period 2aa Collateral Costs	58	13	32	138	147	1,382	178	1,949	1,949	-	-	367	-	-	-	22,008	72	-
Period 2aa Period-Dependent Costs																			
2aa.4.1	Insurance	-	-	-	-	-	266	27	292	292	-	-	-	-	-	-	-	-	-
2aa.4.2	Property taxes	-	-	-	-	-	3	0	4	4	-	-	-	-	-	-	-	-	-
2aa.4.3	Health physics supplies	-	210	-	-	-	-	53	263	263	-	-	-	-	-	-	-	-	-

Table C
Vermont Yankee Nuclear Power Station
SAFSTOR Alternative Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Burial Volumes: Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Period 2aa Period-Dependent Costs (continued)																			
2aa.4.4	Disposal of DAW generated	-	-	3	3	10	-	3	20	20	-	-	194	-	-	-	3,874	6	-
2aa.4.5	Plant energy budget	-	-	-	-	-	1,040	156	1,196	1,196	-	-	-	-	-	-	-	-	-
2aa.4.6	NRC Fees	-	-	-	-	-	287	29	316	316	-	-	-	-	-	-	-	-	-
2aa.4.7	Site Non-Labor Overhead	-	-	-	-	-	163	24	188	188	-	-	-	-	-	-	-	-	-
2aa.4.8	Corporate A&G Cost	-	-	-	-	-	598	90	687	687	-	-	-	-	-	-	-	-	-
2aa.4.9	Security Staff Cost	-	-	-	-	-	1,268	190	1,458	1,458	-	-	-	-	-	-	-	-	27,337
2aa.4.10	SAFSTOR Organization Cost	-	-	-	-	-	955	143	1,098	1,098	-	-	-	-	-	-	-	-	16,823
2aa.4	Subtotal Period 2aa Period-Dependent Costs	-	210	3	3	10	4,581	715	5,523	5,523	-	-	194	-	-	-	3,874	6	44,160
2aa.0	**TOTAL PERIOD 2aa COST**	716	834	165	397	954	8,147	1,929	13,143	13,070	73	-	11,195	-	-	-	663,948	16,236	44,743
PERIOD 2b - SAFSTOR Dormancy with Dry Spent Fuel Storage																			
	Period start date: Friday, January 1, 2021																		
	Period end date: Wednesday, January 1, 2053																		
	Period duration: 384 months																		
Period 2b Direct Decommissioning Activities																			
2b.1.1	Quarterly Inspection	-	-	-	-	-	-	-	a	-	-	-	-	-	-	-	-	-	-
2b.1.2	Semi-annual environmental survey	-	-	-	-	-	-	-	a	-	-	-	-	-	-	-	-	-	-
2b.1.3	Prepare reports	-	-	-	-	-	-	-	a	-	-	-	-	-	-	-	-	-	-
2b.1.4	Bituminous roof replacement	-	-	-	-	-	931	140	1,071	1,071	-	-	-	-	-	-	-	-	-
2b.1.5	Maintenance supplies	-	-	-	-	-	4,448	1,112	5,560	5,560	-	-	-	-	-	-	-	-	-
2b.1	Subtotal Period 2b Activity Costs	-	-	-	-	-	5,379	1,252	6,631	6,631	-	-	-	-	-	-	-	-	-
Period 2b Additional Costs																			
2b.2.1	Financing Cost and Interest	-	-	-	-	-	4,710	-	4,710	4,710	-	-	-	-	-	-	-	-	-
2b.2.2	NEI Annual Fee	-	-	-	-	-	1,920	-	1,920	-	1,920	-	-	-	-	-	-	-	-
2b.2	Subtotal Period 2b Additional Costs	-	-	-	-	-	6,630	-	6,630	4,710	1,920	-	-	-	-	-	-	-	-
Period 2b Collateral Costs																			
2b.3.1	Spent Fuel Capital and Transfer	-	-	-	-	-	12,540	1,881	14,421	-	14,421	-	-	-	-	-	-	-	-
2b.3.2	Legal (License Termination)	-	-	-	-	-	4,800	-	4,800	4,800	-	-	-	-	-	-	-	-	-
2b.3	Subtotal Period 2b Collateral Costs	-	-	-	-	-	17,340	1,881	19,221	4,800	14,421	-	-	-	-	-	-	-	-
Period 2b Period-Dependent Costs																			
2b.4.1	Insurance	-	-	-	-	-	15,633	1,563	17,196	17,196	-	-	-	-	-	-	-	-	-
2b.4.2	Property taxes	-	-	-	-	-	218	22	239	239	-	-	-	-	-	-	-	-	-
2b.4.3	Health physics supplies	-	2,601	-	-	-	-	650	3,252	3,252	-	-	-	-	-	-	-	-	-
2b.4.4	Disposal of DAW generated	-	-	63	63	177	-	60	363	363	-	-	3,539	-	-	-	70,783	115	-
2b.4.5	Plant energy budget	-	-	-	-	-	7,412	1,112	8,524	5,981	2,543	-	-	-	-	-	-	-	-
2b.4.6	NRC Fees	-	-	-	-	-	10,403	1,040	11,443	11,443	-	-	-	-	-	-	-	-	-
2b.4.7	Site Non-Labor Overhead	-	-	-	-	-	9,278	1,392	10,669	2,876	7,794	-	-	-	-	-	-	-	-
2b.4.8	Corporate A&G Cost	-	-	-	-	-	4,817	722	5,539	4,324	1,215	-	-	-	-	-	-	-	-
2b.4.9	Security Staff Cost	-	-	-	-	-	80,556	12,083	92,640	23,742	68,898	-	-	-	-	-	-	-	1,736,503
2b.4.10	Entergy VY Staff Cost	-	-	-	-	-	60,672	9,101	69,773	38,603	31,170	-	-	-	-	-	-	-	1,068,617
2b.4	Subtotal Period 2b Period-Dependent Costs	-	2,601	63	63	177	188,988	27,746	219,638	108,018	111,620	-	3,539	-	-	-	70,783	115	2,805,120
2b.0	**TOTAL PERIOD 2b COST**	-	2,601	63	63	177	218,337	30,879	252,120	124,159	127,961	-	3,539	-	-	-	70,783	115	2,805,120
PERIOD 2c - SAFSTOR Dormancy without Spent Fuel Storage																			
	Period start date: Wednesday, January 1, 2053																		
	Period end date: Sunday, January 1, 2068																		
	Period duration: 179.98 months																		
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	-	-	-	-	-	436	65	502	502	-	-	-	-	-	-	-	-	-
2c.1.5	Maintenance supplies	-	-	-	-	-	2,085	521	2,606	2,606	-	-	-	-	-	-	-	-	-
2c.1	Subtotal Period 2c Activity Costs	-	-	-	-	-	2,521	587	3,108	3,108	-	-	-	-	-	-	-	-	-
Period 2c Additional Costs																			
2c.2.1	Financing Cost and Interest	-	-	-	-	-	2,200	-	2,200	2,200	-	-	-	-	-	-	-	-	-
2c.2	Subtotal Period 2c Additional Costs	-	-	-	-	-	2,200	-	2,200	2,200	-	-	-	-	-	-	-	-	-
Period 2c Period-Dependent Costs																			
2c.4.1	Insurance	-	-	-	-	-	7,327	733	8,060	8,060	-	-	-	-	-	-	-	-	-
2c.4.2	Property taxes	-	-	-	-	-	102	10	112	112	-	-	-	-	-	-	-	-	-
2c.4.3	Health physics supplies	-	1,149	-	-	-	-	287	1,437	1,437	-	-	-	-	-	-	-	-	-
2c.4.4	Disposal of DAW generated	-	-	27	27	77	-	26	157	157	-	-	1,532	-	-	-	30,644	50	-
2c.4.5	Plant energy budget	-	-	-	-	-	2,437	366	2,803	2,803	-	-	-	-	-	-	-	-	-
2c.4.6	NRC Fees	-	-	-	-	-	3,223	322	3,545	3,545	-	-	-	-	-	-	-	-	-
2c.4.7	Site Non-Labor Overhead	-	-	-	-	-	1,172	176	1,348	1,348	-	-	-	-	-	-	-	-	-
2c.4.8	Corporate A&G Cost	-	-	-	-	-	1,762	264	2,026	2,026	-	-	-	-	-	-	-	-	-
2c.4.9	Security Staff Cost	-	-	-	-	-	9,676	1,451	11,127	11,127	-	-	-	-	-	-	-	-	281,726
2c.4.10	Entergy VY Staff Cost	-	-	-	-	-	15,733	2,360	18,093	18,093	-	-	-	-	-	-	-	-	281,726

Table C
Vermont Yankee Nuclear Power Station
SAFSTOR Alternative Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Burial Volumes Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
2c.4	Subtotal Period 2c Period-Dependent Costs	-	1,149	27	27	77	41,432	5,996	48,708	48,708	-	-	1,532	-	-	-	30,644	50	563,451
2c.0	**TOTAL PERIOD 2c COST**	-	1,149	27	27	77	46,153	6,582	54,016	54,016	-	-	1,532	-	-	-	30,644	50	563,451
PERIOD 2 TOTALS		716	5,284	274	504	1,256	498,975	75,260	582,269	236,990	345,279	-	17,228	-	-	-	784,613	16,433	4,517,852
PERIOD 3a - Reactivate Site Following SAFSTOR Dormancy																			
Period start date: Sunday, January 1, 2068																			
Period end date: Tuesday, January 1, 2069																			
Period duration: 12.02 months																			
Period 3a Direct Decommissioning Activities																			
3a.1.1	Prepare preliminary decommissioning cost	-	-	-	-	-	165	25	189	189	-	-	-	-	-	-	-	-	1,300
3a.1.2	Review plant dwgs & specs.	-	-	-	-	-	583	87	670	670	-	-	-	-	-	-	-	-	4,600
3a.1.3	Perform detailed rad survey	-	-	-	-	-	-	-	a	-	-	-	-	-	-	-	-	-	-
3a.1.4	End product description	-	-	-	-	-	127	19	146	146	-	-	-	-	-	-	-	-	1,000
3a.1.5	Detailed by-product inventory	-	-	-	-	-	165	25	189	189	-	-	-	-	-	-	-	-	1,300
3a.1.6	Define major work sequence	-	-	-	-	-	950	143	1,093	1,093	-	-	-	-	-	-	-	-	7,500
3a.1.7	Perform SER and EA	-	-	-	-	-	393	59	452	452	-	-	-	-	-	-	-	-	3,100
3a.1.8	Perform Site-Specific Cost Study	-	-	-	-	-	634	95	729	729	-	-	-	-	-	-	-	-	5,000
3a.1.9	Prepare/submit License Termination Plan	-	-	-	-	-	519	78	597	597	-	-	-	-	-	-	-	-	4,096
3a.1.10	Receive NRC approval of termination plan	-	-	-	-	-	-	-	a	-	-	-	-	-	-	-	-	-	-
Activity Specifications																			
3a.1.11.1	Re-activate plant & temporary facilities	-	-	-	-	-	934	140	1,074	967	-	107	-	-	-	-	-	-	7,370
3a.1.11.2	Plant systems	-	-	-	-	-	528	79	607	546	-	61	-	-	-	-	-	-	4,167
3a.1.11.3	Reactor internals	-	-	-	-	-	900	135	1,035	1,035	-	-	-	-	-	-	-	-	7,100
3a.1.11.4	Reactor vessel	-	-	-	-	-	824	124	947	947	-	-	-	-	-	-	-	-	6,500
3a.1.11.5	Sacrificial shield	-	-	-	-	-	63	10	73	73	-	-	-	-	-	-	-	-	500
3a.1.11.6	Moisture separators/reheaters	-	-	-	-	-	127	19	146	146	-	-	-	-	-	-	-	-	1,000
3a.1.11.7	Reinforced concrete	-	-	-	-	-	203	30	233	117	-	117	-	-	-	-	-	-	1,600
3a.1.11.8	Main Turbine	-	-	-	-	-	265	40	304	304	-	-	-	-	-	-	-	-	2,088
3a.1.11.9	Main Condensers	-	-	-	-	-	265	40	304	304	-	-	-	-	-	-	-	-	2,088
3a.1.11.10	Pressure suppression structure	-	-	-	-	-	253	38	291	291	-	-	-	-	-	-	-	-	2,000
3a.1.11.11	Drywell	-	-	-	-	-	203	30	233	233	-	-	-	-	-	-	-	-	1,600
3a.1.11.12	Plant structures & buildings	-	-	-	-	-	395	59	455	227	-	227	-	-	-	-	-	-	3,120
3a.1.11.13	Waste management	-	-	-	-	-	583	87	670	670	-	-	-	-	-	-	-	-	4,600
3a.1.11.14	Facility & site closeout	-	-	-	-	-	114	17	131	66	-	66	-	-	-	-	-	-	900
3a.1.11	Total	-	-	-	-	-	5,656	848	6,504	5,927	-	578	-	-	-	-	-	-	44,633
Planning & Site Preparations																			
3a.1.12	Prepare dismantling sequence	-	-	-	-	-	304	46	350	350	-	-	-	-	-	-	-	-	2,400
3a.1.13	Plant prep. & temp. svces	-	-	-	-	-	3,000	450	3,450	3,450	-	-	-	-	-	-	-	-	-
3a.1.14	Design water clean-up system	-	-	-	-	-	177	27	204	204	-	-	-	-	-	-	-	-	1,400
3a.1.15	Rigging/Cont. Cntrl Envlps/tooling/etc.	-	-	-	-	-	2,300	345	2,645	2,645	-	-	-	-	-	-	-	-	-
3a.1.16	Procure casks/liners & containers	-	-	-	-	-	156	23	179	179	-	-	-	-	-	-	-	-	1,230
3a.1	Subtotal Period 3a Activity Costs	-	-	-	-	-	15,128	2,269	17,397	16,820	-	578	-	-	-	-	-	-	77,559
Period 3a Additional Costs																			
3a.2.1	Financing Cost and Interest	-	-	-	-	-	520	-	520	520	-	-	-	-	-	-	-	-	-
3a.2	Subtotal Period 3a Additional Costs	-	-	-	-	-	520	-	520	520	-	-	-	-	-	-	-	-	-
Period 3a Period-Dependent Costs																			
3a.4.1	Insurance	-	-	-	-	-	534	53	588	588	-	-	-	-	-	-	-	-	-
3a.4.2	Property taxes	-	-	-	-	-	7	1	7	7	-	-	-	-	-	-	-	-	-
3a.4.3	Health physics supplies	-	366	-	-	-	-	91	457	457	-	-	-	-	-	-	-	-	-
3a.4.4	Heavy equipment rental	-	727	-	-	-	-	109	836	836	-	-	-	-	-	-	-	-	-
3a.4.5	Disposal of DAW generated	-	-	9	9	26	-	9	53	53	-	-	516	-	-	-	10,315	17	-
3a.4.6	Plant energy budget	-	-	-	-	-	1,629	244	1,873	1,873	-	-	-	-	-	-	-	-	-
3a.4.7	NRC Fees	-	-	-	-	-	215	21	236	236	-	-	-	-	-	-	-	-	-
3a.4.8	Site Non-Labor Overhead	-	-	-	-	-	119	18	137	137	-	-	-	-	-	-	-	-	-
3a.4.9	Corporate A&G Cost	-	-	-	-	-	1,760	264	2,024	2,024	-	-	-	-	-	-	-	-	-
3a.4.10	Security Staff Cost	-	-	-	-	-	1,732	260	1,992	1,992	-	-	-	-	-	-	-	-	64,834
3a.4.11	Entergy VY Staff Cost	-	-	-	-	-	15,420	2,313	17,733	17,733	-	-	-	-	-	-	-	-	259,337
3a.4	Subtotal Period 3a Period-Dependent Costs	-	1,093	9	9	26	21,416	3,384	25,937	25,937	-	-	516	-	-	-	10,315	17	324,171
3a.0	**TOTAL PERIOD 3a COST**	-	1,093	9	9	26	37,064	5,653	43,854	43,277	-	578	516	-	-	-	10,315	17	401,730
PERIOD 3b - Decommissioning Preparations																			
Period start date: Tuesday, January 1, 2069																			
Period end date: Monday, July 1, 2069																			
Period duration: 5.95 months																			
Period 3b Direct Decommissioning Activities																			
Detailed Work Procedures																			
3b.1.1.1	Plant systems	-	-	-	-	-	600	90	690	621	-	69	-	-	-	-	-	-	4,733
3b.1.1.2	Reactor internals	-	-	-	-	-	507	76	583	583	-	-	-	-	-	-	-	-	4,000
3b.1.1.3	Remaining buildings	-	-	-	-	-	171	26	197	49	-	148	-	-	-	-	-	-	1,350

Table C
Vermont Yankee Nuclear Power Station
SAFSTOR Alternative Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Burial Volumes Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Detailed Work Procedures (continued)																			
3b.1.1.4	CRD housings & NIs	-	-	-	-	-	127	19	146	146	-	-	-	-	-	-	-	-	1,000
3b.1.1.5	Incore instrumentation	-	-	-	-	-	127	19	146	146	-	-	-	-	-	-	-	-	1,000
3b.1.1.6	Removal primary containment	-	-	-	-	-	253	38	291	291	-	-	-	-	-	-	-	-	2,000
3b.1.1.7	Reactor vessel	-	-	-	-	-	460	69	529	529	-	-	-	-	-	-	-	-	3,630
3b.1.1.8	Facility closeout	-	-	-	-	-	152	23	175	87	-	87	-	-	-	-	-	-	1,200
3b.1.1.9	Sacrificial shield	-	-	-	-	-	152	23	175	175	-	-	-	-	-	-	-	-	1,200
3b.1.1.10	Reinforced concrete	-	-	-	-	-	127	19	146	73	-	73	-	-	-	-	-	-	1,000
3b.1.1.11	Main Turbine	-	-	-	-	-	264	40	303	303	-	-	-	-	-	-	-	-	2,080
3b.1.1.12	Main Condensers	-	-	-	-	-	265	40	304	304	-	-	-	-	-	-	-	-	2,088
3b.1.1.13	Moisture separators & reheaters	-	-	-	-	-	253	38	291	291	-	-	-	-	-	-	-	-	2,000
3b.1.1.14	Radwaste building	-	-	-	-	-	346	52	398	358	-	40	-	-	-	-	-	-	2,730
3b.1.1.15	Reactor building	-	-	-	-	-	346	52	398	358	-	40	-	-	-	-	-	-	2,730
3b.1.1	Total	-	-	-	-	-	4,149	622	4,771	4,315	-	456	-	-	-	-	-	-	32,741
3b.1	Subtotal Period 3b Activity Costs	-	-	-	-	-	4,149	622	4,771	4,315	-	456	-	-	-	-	-	-	32,741
Period 3b Additional Costs																			
3b.2.1	Financing Cost and Interest	-	-	-	-	-	357	-	357	357	-	-	-	-	-	-	-	-	-
3b.2.2	Site characterization	-	-	-	-	-	3,013	904	3,917	3,917	-	-	-	-	-	-	-	19,100	7,852
3b.2.3	Asbestos remediation	-	2,227	63	84	1,482	-	946	4,801	4,801	-	-	35,826	-	-	-	734,506	27,290	-
3b.2.4	Reactivate Rail Spur	-	-	-	-	-	125	-	125	125	-	-	-	-	-	-	-	-	-
3b.2	Subtotal Period 3b Additional Costs	-	2,227	63	84	1,482	3,495	1,850	9,200	9,200	-	-	35,826	-	-	-	734,506	46,390	7,852
Period 3b Collateral Costs																			
3b.3.1	Decon equipment	750	-	-	-	-	-	113	863	863	-	-	-	-	-	-	-	-	-
3b.3.2	DOC staff relocation expenses	-	-	-	-	-	1,080	162	1,242	1,242	-	-	-	-	-	-	-	-	-
3b.3.3	Small tool allowance	-	28	-	-	-	-	4	33	33	-	-	-	-	-	-	-	-	-
3b.3.4	Pipe cutting equipment	-	1,100	-	-	-	-	165	1,265	1,265	-	-	-	-	-	-	-	-	-
3b.3	Subtotal Period 3b Collateral Costs	750	1,128	-	-	-	1,080	444	3,402	3,402	-	-	-	-	-	-	-	-	-
Period 3b Period-Dependent Costs																			
3b.4.1	Decon supplies	23	-	-	-	-	-	6	28	28	-	-	-	-	-	-	-	-	-
3b.4.2	Insurance	-	-	-	-	-	264	26	291	291	-	-	-	-	-	-	-	-	-
3b.4.3	Property taxes	-	-	-	-	-	3	0	4	4	-	-	-	-	-	-	-	-	-
3b.4.4	Health physics supplies	-	305	-	-	-	-	76	381	381	-	-	-	-	-	-	-	-	-
3b.4.5	Heavy equipment rental	-	359	-	-	-	-	54	413	413	-	-	-	-	-	-	-	-	-
3b.4.6	Disposal of DAW generated	-	-	5	5	14	-	5	30	30	-	-	289	-	-	-	5,770	9	-
3b.4.7	Plant energy budget	-	-	-	-	-	805	121	926	926	-	-	-	-	-	-	-	-	-
3b.4.8	NRC Fees	-	-	-	-	-	190	19	209	209	-	-	-	-	-	-	-	-	-
3b.4.9	Site Non-Labor Overhead	-	-	-	-	-	89	13	102	102	-	-	-	-	-	-	-	-	-
3b.4.10	Corporate A&G Cost	-	-	-	-	-	987	148	1,135	1,135	-	-	-	-	-	-	-	-	-
3b.4.11	Security Staff Cost	-	-	-	-	-	857	129	985	985	-	-	-	-	-	-	-	-	32,063
3b.4.12	DOC Staff Cost	-	-	-	-	-	5,297	795	6,092	6,092	-	-	-	-	-	-	-	-	57,920
3b.4.13	Entergy VY Staff Cost	-	-	-	-	-	7,626	1,144	8,769	8,769	-	-	-	-	-	-	-	-	128,251
3b.4	Subtotal Period 3b Period-Dependent Costs	23	664	5	5	14	16,118	2,536	19,365	19,365	-	-	289	-	-	-	5,770	9	218,234
3b.0	TOTAL PERIOD 3b COST	773	4,020	68	89	1,496	24,842	5,452	36,739	36,283	-	456	36,115	-	-	-	740,276	46,399	258,827
PERIOD 3 TOTALS		773	5,113	77	98	1,522	61,906	11,105	80,593	79,559	-	1,034	36,630	-	-	-	750,592	46,416	660,557
PERIOD 4a - Large Component Removal																			
Period start date: Monday, July 1, 2069																			
Period end date: Friday, October 10, 2070																			
Period duration: 15.31 months																			
Period 4a Direct Decommissioning Activities																			
Nuclear Steam Supply System Removal																			
4a.1.1.1	Recirculation System Piping & Valves	25	82	21	42	164	-	82	416	416	-	-	1,181	-	-	-	131,132	1,762	-
4a.1.1.2	Recirculation Pumps & Motors	9	42	14	64	139	-	61	329	329	-	-	1,969	-	-	-	111,100	946	-
4a.1.1.3	CRDMs & NIs Removal	22	534	198	75	195	-	224	1,248	1,248	-	-	2,065	-	-	-	155,900	8,874	-
4a.1.1.4	Reactor Vessel Internals	31	3,330	3,864	1,981	6,877	304	7,458	23,846	23,846	-	-	2,128	1,002	505	-	349,132	28,867	1,287
4a.1.1.5	Vessel & Internals GTCC Disposal	-	-	-	-	1,428	-	214	1,642	1,642	-	-	-	-	-	357	65,690	-	-
4a.1.1.6	Reactor Vessel	13	7,143	2,149	1,151	1,337	304	6,903	19,001	19,001	-	-	10,777	-	-	-	1,090,230	28,867	1,287
4a.1.1	Totals	100	11,130	6,247	3,313	10,141	609	14,943	46,482	46,482	-	-	18,121	1,002	505	357	1,903,184	69,315	2,573
Removal of Major Equipment																			
4a.1.2	Main Turbine/Generator	-	248	897	1,202	3,751	-	1,270	7,367	7,367	-	-	50,008	-	-	-	3,000,454	3,897	-
4a.1.3	Main Condensers	-	530	503	675	2,105	-	810	4,623	4,623	-	-	28,067	-	-	-	1,684,000	8,400	-
Cascading Costs from Clean Building Demolition																			
4a.1.4.1	Reactor	-	760	-	-	-	-	114	874	874	-	-	-	-	-	-	-	7,765	-
4a.1.4.2	AOG	-	97	-	-	-	-	15	111	111	-	-	-	-	-	-	-	1,032	-
4a.1.4.3	Radwaste	-	31	-	-	-	-	5	36	36	-	-	-	-	-	-	-	339	-
4a.1.4.4	Turbine	-	268	-	-	-	-	40	309	309	-	-	-	-	-	-	-	2,999	-
4a.1.4	Totals	-	1,156	-	-	-	-	173	1,330	1,330	-	-	-	-	-	-	-	12,134	-

Table C
Vermont Yankee Nuclear Power Station
SAFSTOR Alternative Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
													Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Disposal of Plant Systems																			
Reactor Building System Components																			
4a.1.5.1	RX-BLD-213-2_2	-	154	36	43	95	-	72	400	400	-	-	1,901	-	-	-	107,770	2,569	-
4a.1.5.2	RX-BLD-213-3_2	-	135	27	30	65	-	57	315	315	-	-	1,310	-	-	-	74,368	2,268	-
4a.1.5.3	RX-BLD-213-4_2	-	142	14	17	37	-	49	258	258	-	-	732	-	-	-	41,539	2,334	-
4a.1.5.4	RX-BLD-213-5_2	-	252	70	84	185	-	129	722	722	-	-	3,717	-	-	-	210,751	4,219	-
4a.1.5.5	RX-BLD-232-2_2	-	128	40	45	99	-	68	380	380	-	-	1,983	-	-	-	112,573	2,154	-
4a.1.5.6	RX-BLD-232-3_2	-	115	39	46	100	-	65	365	365	-	-	2,003	-	-	-	113,661	1,956	-
4a.1.5.7	RX-BLD-232-4_2	-	56	7	7	15	-	20	105	105	-	-	303	-	-	-	17,240	904	-
4a.1.5.8	RX-BLD-232-5_2	-	62	11	12	27	-	25	138	138	-	-	541	-	-	-	30,688	1,013	-
4a.1.5.9	RX-BLD-252-10_2	-	11	1	1	2	-	3	17	17	-	-	32	-	-	-	1,818	171	-
4a.1.5.10	RX-BLD-252-1_2	-	8	0	1	1	-	2	12	12	-	-	23	-	-	-	1,303	120	-
4a.1.5.11	RX-BLD-252-1_3	-	3	0	0	0	-	1	5	5	-	-	10	-	-	-	565	53	-
4a.1.5.12	RX-BLD-252-2_2	-	41	12	14	32	-	21	120	120	-	-	632	-	-	-	35,818	673	-
4a.1.5.13	RX-BLD-252-3_2	-	51	5	6	14	-	18	95	95	-	-	277	-	-	-	15,708	834	-
4a.1.5.14	RX-BLD-252-3_3	-	2	0	0	1	-	1	5	5	-	-	19	-	-	-	1,080	40	-
4a.1.5.15	RX-BLD-252-4_2	-	107	34	41	89	-	59	329	329	-	-	1,788	-	-	-	101,361	1,810	-
4a.1.5.16	RX-BLD-252-4_3	-	1	0	0	0	-	0	2	2	-	-	5	-	-	-	270	14	-
4a.1.5.17	RX-BLD-252-5_2	-	264	47	57	126	-	111	606	606	-	-	2,522	-	-	-	142,959	4,315	-
4a.1.5.18	RX-BLD-252-5_3	-	115	19	16	34	-	42	226	226	-	-	684	-	-	-	39,041	1,668	-
4a.1.5.19	RX-BLD-252-6_2	-	220	35	43	95	-	89	483	483	-	-	1,915	-	-	-	108,509	3,576	-
4a.1.5.20	RX-BLD-252-6_3	-	119	20	17	37	-	43	236	236	-	-	735	-	-	-	41,939	1,733	-
4a.1.5.21	RX-BLD-252-7_2	-	198	19	22	49	-	67	355	355	-	-	977	-	-	-	55,423	3,209	-
4a.1.5.22	RX-BLD-252-8_2	-	60	9	10	23	-	23	126	126	-	-	458	-	-	-	25,996	976	-
4a.1.5.23	RX-BLD-252-9_2	-	99	11	12	27	-	34	184	184	-	-	539	-	-	-	30,580	1,603	-
4a.1.5.24	RX-BLD-252-9_3	-	22	4	5	10	-	9	50	50	-	-	201	-	-	-	11,423	344	-
4a.1.5	Totals	-	2,366	462	530	1,164	-	1,008	5,530	5,530	-	-	23,305	-	-	-	1,322,380	38,556	-
Turbine Building System Components																			
4a.1.6.1	TURB-BLD-222-10_2	-	112	12	14	32	-	39	209	209	-	-	646	-	-	-	36,021	1,862	-
4a.1.6.2	TURB-BLD-222-11_2	-	69	8	9	20	-	24	130	130	-	-	401	-	-	-	22,764	1,133	-
4a.1.6.3	TURB-BLD-222-1_2	-	446	130	146	320	-	226	1,268	1,268	-	-	6,414	-	-	-	364,074	7,518	-
4a.1.6.4	TURB-BLD-222-2_2	-	346	147	170	372	-	220	1,255	1,255	-	-	7,459	-	-	-	423,204	5,922	-
4a.1.6.5	TURB-BLD-222-3_2	-	99	35	42	93	-	58	327	327	-	-	1,867	-	-	-	105,854	1,657	-
4a.1.6.6	TURB-BLD-222-8_2	-	287	31	35	77	-	100	530	530	-	-	1,547	-	-	-	87,777	4,753	-
4a.1.6.7	TURB-BLD-222-9_2	-	162	118	122	267	-	137	806	806	-	-	5,340	-	-	-	303,519	2,912	-
4a.1.6.8	TURB-BLD-228-12_2	-	230	24	28	62	-	79	423	423	-	-	1,237	-	-	-	70,144	3,757	-
4a.1.6.9	TURB-BLD-228-13_2	-	150	11	14	30	-	48	252	252	-	-	601	-	-	-	34,088	2,457	-
4a.1.6.10	TURB-BLD-228-1_2	-	143	27	30	66	-	59	325	325	-	-	1,332	-	-	-	74,682	2,341	-
4a.1.6.11	TURB-BLD-228-2_2	-	420	162	175	384	-	244	1,385	1,385	-	-	7,692	-	-	-	436,884	7,211	-
4a.1.6.12	TURB-BLD-228-3_2	-	356	88	110	242	-	175	970	970	-	-	4,844	-	-	-	274,516	5,982	-
4a.1.6.13	TURB-BLD-228-4_2	-	396	102	127	278	-	198	1,101	1,101	-	-	5,583	-	-	-	316,403	6,640	-
4a.1.6.14	TURB-BLD-228-5_2	-	186	56	71	157	-	102	572	572	-	-	3,147	-	-	-	178,117	3,124	-
4a.1.6.15	TURB-BLD-228-6_2	-	153	47	60	132	-	85	478	478	-	-	2,654	-	-	-	150,217	2,594	-
4a.1.6	Totals	-	3,553	999	1,153	2,533	-	1,794	10,032	10,032	-	-	50,764	-	-	-	2,878,265	59,863	-
Augmented Offgas Building System Components																			
4a.1.7.1	AOG-BLD-FL1-1_2	-	36	6	6	14	-	14	76	76	-	-	274	-	-	-	15,388	585	-
4a.1.7.2	AOG-BLD-FL1-2_2	-	110	27	33	71	-	53	294	294	-	-	1,494	-	-	-	81,203	1,796	-
4a.1.7.3	AOG-BLD-FL1-3_2	-	108	27	29	64	-	50	278	278	-	-	1,288	-	-	-	73,150	1,754	-
4a.1.7.4	AOG-BLD-FL1-4_2	-	113	23	25	54	-	48	263	263	-	-	1,077	-	-	-	61,191	1,829	-
4a.1.7.5	AOG-BLD-FL1-5_2	-	113	13	16	36	-	41	220	220	-	-	732	-	-	-	41,112	1,825	-
4a.1.7.6	AOG-BLD-FL2-1_2	-	70	16	18	39	-	31	174	174	-	-	780	-	-	-	44,286	1,145	-
4a.1.7.7	AOG-BLD-FL2-2_2	-	8	1	1	2	-	3	16	16	-	-	50	-	-	-	2,815	135	-
4a.1.7.8	AOG-BLD-FL2-3_2	-	8	1	1	2	-	3	15	15	-	-	44	-	-	-	2,532	125	-
4a.1.7.9	AOG-BLD-FL2-4_2	-	60	15	17	38	-	29	159	159	-	-	760	-	-	-	43,099	982	-
4a.1.7.10	AOG-BLD-FL2-5_2	-	8	1	1	1	-	2	13	13	-	-	28	-	-	-	1,593	126	-
4a.1.7.11	AOG-BLD-FL2-6_2	-	7	1	1	2	-	3	14	14	-	-	44	-	-	-	2,532	117	-
4a.1.7.12	AOG-BLD-FL2-7_2	-	34	4	4	8	-	12	62	62	-	-	167	-	-	-	9,513	548	-
4a.1.7.13	AOG-BLD-FL2-8_2	-	17	2	2	5	-	6	32	32	-	-	93	-	-	-	5,274	268	-
4a.1.7.14	AOG-BLD-FL2-9_2	-	110	28	33	72	-	53	295	295	-	-	1,477	-	-	-	82,001	1,777	-
4a.1.7.15	AOG-BLDG-1_2	-	55	9	9	20	-	21	114	114	-	-	401	-	-	-	22,818	880	-
4a.1.7.16	AOG-BLDG-2_2	-	184	4	5	10	-	50	253	253	-	-	209	-	-	-	11,635	2,489	-
4a.1.7.17	AOG-BLDG-PENT_2	-	39	6	7	16	-	16	85	85	-	-	330	-	-	-	18,674	620	-
4a.1.7.18	AOG-BLDG-RF_2	-	85	21	27	59	-	42	233	233	-	-	1,182	-	-	-	66,958	1,338	-
4a.1.7	Totals	-	1,165	205	235	515	-	476	2,596	2,596	-	-	10,431	-	-	-	585,776	18,338	-
4a.1.8	Scaffolding in support of decommissioning	-	1,300	28	32	69	-	350	1,779	1,779	-	-	1,388	-	-	-	78,630	23,202	-
4a.1	Subtotal Period 4a Activity Costs	100	21,448	9,341	7,140	20,277	609	20,824	79,739	79,739	-	-	182,083	1,002	505	357	11,452,689	233,705	2,573
Period 4a Additional Costs																			
4a.2.1	Financing Cost and Interest	-	-	-	-	-	765	-	765	765	-	-	-	-	-	-	-	-	-
4a.2.2	Remedial action support surveys	-	-	-	-	-	1,645	494	2,139	2,139	-	-	-	-	-	-	-	26,538	-
4a.2.3	Retired low presure turbine rotors and casings	-	-	276	353	150	-	118	896	896	-	-	2,000	-	-	-	750,842	3,840	-
4a.2.4	Make up water for RPV segmentation & decontamination	-	-	-	-	-	100	15	115	115	-	-	-	-	-	-	-	-	-
4a.2	Subtotal Period 4a Additional Costs	-	-	276	353	150	2,510	627	3,915	3,915	-	-	2,000	-	-	-	750,842	30,378	-

Table C
Vermont Yankee Nuclear Power Station
SAFSTOR Alternative Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	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 Collateral Costs																			
4a.3.1	Process decommissioning water waste	1	-	1	5	5	-	3	15	15	-	-	13	-	-	-	802	3	-
4a.3.3	Small tool allowance	-	213	-	-	-	-	32	245	220	-	24	-	-	-	-	-	-	-
4a.3	Subtotal Period 4a Collateral Costs	1	213	1	5	5	-	35	260	235	-	24	13	-	-	-	802	3	-
Period 4a Period-Dependent Costs																			
4a.4.1	Decon supplies	58	-	-	-	-	-	15	73	73	-	-	-	-	-	-	-	-	-
4a.4.2	Insurance	-	-	-	-	-	680	68	748	748	-	-	-	-	-	-	-	-	-
4a.4.3	Property taxes	-	-	-	-	-	9	1	10	9	-	1	-	-	-	-	-	-	-
4a.4.4	Health physics supplies	-	1,444	-	-	-	-	361	1,805	1,805	-	-	-	-	-	-	-	-	-
4a.4.5	Heavy equipment rental	-	2,736	-	-	-	-	410	3,147	3,147	-	-	-	-	-	-	-	-	-
4a.4.6	Disposal of DAW generated	-	-	82	82	229	-	78	470	470	-	-	4,581	-	-	-	91,619	149	-
4a.4.7	Plant energy budget	-	-	-	-	-	1,970	295	2,265	2,265	-	-	-	-	-	-	-	-	-
4a.4.8	NRC Fees	-	-	-	-	-	490	49	539	539	-	-	-	-	-	-	-	-	-
4a.4.9	Site Non-Labor Overhead	-	-	-	-	-	259	39	298	298	-	-	-	-	-	-	-	-	-
4a.4.10	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	512	77	589	589	-	-	-	-	-	-	-	-	-
4a.4.11	Corporate A&G Cost	-	-	-	-	-	2,541	381	2,922	2,922	-	-	-	-	-	-	-	-	-
4a.4.12	Security Staff Cost	-	-	-	-	-	2,206	331	2,536	2,536	-	-	-	-	-	-	-	-	82,549
4a.4.13	DOC Staff Cost	-	-	-	-	-	16,503	2,476	18,979	18,979	-	-	-	-	-	-	-	-	183,737
4a.4.14	Entergy VY Staff Cost	-	-	-	-	-	19,793	2,969	22,762	22,762	-	-	-	-	-	-	-	-	332,857
4a.4	Subtotal Period 4a Period-Dependent Costs	58	4,180	82	82	229	44,962	7,549	57,143	57,142	-	1	4,581	-	-	-	91,619	149	599,143
4a.0	TOTAL PERIOD 4a COST	159	25,841	9,700	7,579	20,662	48,081	29,035	141,057	141,032	-	25	188,678	1,002	505	357	12,295,951	264,235	601,716
PERIOD 4b - Site Decontamination																			
	Period start date: Friday, October 10, 2070																		
	Period end date: Sunday, March 26, 2073																		
	Period duration: 29.5 months																		
Disposal of Plant Systems																			
Reactor Building System Components																			
4b.1.2.1	RX-BLD-213-1_2	-	1,224	330	413	906	-	627	3,501	3,501	-	-	18,173	-	-	-	1,029,806	21,766	-
4b.1.2.2	RX-BLD-213-1_3	-	57	8	10	22	-	22	121	121	-	-	451	-	-	-	25,534	935	-
4b.1.2.3	RX-BLD-232-1_2	-	532	172	210	462	-	297	1,674	1,674	-	-	9,262	-	-	-	525,020	8,796	-
4b.1.2.4	RX-BLD-232-1_3	-	25	3	4	8	-	9	49	49	-	-	164	-	-	-	9,323	377	-
4b.1.2.5	RX-BLD-280-1_2	-	26	3	3	7	-	9	49	49	-	-	148	-	-	-	8,440	423	-
4b.1.2.6	RX-BLD-280-1_3	-	55	7	9	19	-	21	111	111	-	-	385	-	-	-	21,809	910	-
4b.1.2.7	RX-BLD-280-2_2	-	31	4	4	9	-	11	59	59	-	-	185	-	-	-	10,509	498	-
4b.1.2.8	RX-BLD-280-2_3	-	83	19	23	51	-	39	215	215	-	-	1,031	-	-	-	58,399	1,370	-
4b.1.2.9	RX-BLD-280-3_2	-	219	66	79	174	-	117	656	656	-	-	3,497	-	-	-	198,263	3,618	-
4b.1.2.10	RX-BLD-280-4_2	-	91	15	14	31	-	34	186	186	-	-	628	-	-	-	35,742	1,469	-
4b.1.2.11	RX-BLD-280-5_2	-	186	25	28	60	-	68	367	367	-	-	1,209	-	-	-	68,643	3,003	-
4b.1.2.12	RX-BLD-280-6_2	-	202	22	27	60	-	72	383	383	-	-	1,194	-	-	-	67,700	3,269	-
4b.1.2.13	RX-BLD-280-7_2	-	164	47	53	117	-	83	464	464	-	-	2,340	-	-	-	132,776	2,697	-
4b.1.2.14	RX-BLD-280-ROOF_2	-	31	35	30	67	-	32	195	195	-	-	1,327	-	-	-	75,665	571	-
4b.1.2.15	RX-BLD-303-1_2	-	46	6	7	15	-	17	91	91	-	-	302	-	-	-	17,154	762	-
4b.1.2.16	RX-BLD-303-1_3	-	154	37	41	90	-	71	393	393	-	-	1,795	-	-	-	101,906	2,541	-
4b.1.2.17	RX-BLD-303-2_3	-	66	9	11	25	-	25	137	137	-	-	509	-	-	-	27,957	1,069	-
4b.1.2.18	RX-BLD-303-3_3	-	24	2	2	4	-	7	39	39	-	-	82	-	-	-	4,658	384	-
4b.1.2.19	RX-BLD-303-4_2	-	218	59	66	144	-	106	593	593	-	-	2,880	-	-	-	163,484	3,580	-
4b.1.2.20	RX-BLD-303-5_2	-	23	2	3	6	-	8	42	42	-	-	118	-	-	-	6,707	381	-
4b.1.2.21	RX-BLD-303-6_2	-	13	1	1	3	-	4	22	22	-	-	50	-	-	-	2,857	212	-
4b.1.2.22	RX-BLD-303-7_2	-	95	19	24	52	-	42	233	233	-	-	1,051	-	-	-	59,595	1,554	-
4b.1.2.23	RX-BLD-303-7_3	-	24	4	6	13	-	10	57	57	-	-	251	-	-	-	14,218	368	-
4b.1.2.24	RX-BLD-303-8_2	-	84	14	15	34	-	33	180	180	-	-	680	-	-	-	38,605	1,332	-
4b.1.2.25	RX-BLD-318-1_3	-	20	2	2	4	-	6	34	34	-	-	83	-	-	-	4,563	328	-
4b.1.2.26	RX-BLD-318-2_3	-	38	5	4	9	-	13	69	69	-	-	182	-	-	-	10,393	590	-
4b.1.2.27	RX-BLD-318-3_3	-	28	3	3	8	-	10	52	52	-	-	150	-	-	-	8,524	447	-
4b.1.2.28	RX-BLD-318-4_2	-	591	93	118	260	-	240	1,302	1,302	-	-	5,207	-	-	-	294,977	9,640	-
4b.1.2.29	RX-BLD-318-4_3	-	15	3	3	6	-	6	31	31	-	-	114	-	-	-	6,458	224	-
4b.1.2.30	RX-BLD-318-5_2	-	104	21	25	54	-	45	250	250	-	-	1,098	-	-	-	61,777	1,673	-
4b.1.2.31	RX-BLD-318-6_2	-	56	7	8	18	-	20	108	108	-	-	353	-	-	-	19,905	848	-
4b.1.2.32	RX-BLD-318-7_2	-	46	10	11	24	-	20	111	111	-	-	482	-	-	-	27,356	745	-
4b.1.2.33	RX-BLD-345-1_3	-	309	1	1	2	-	78	391	391	-	-	48	-	-	-	2,722	5,187	-
4b.1.2.34	RX-BLD-345-2_3	-	217	0	0	1	-	54	272	272	-	-	12	-	-	-	672	3,647	-
4b.1.2.35	RX-BLD-345-3_2	-	474	2	3	7	-	121	607	607	-	-	138	-	-	-	7,809	7,973	-
4b.1.2.36	RX-BLD-345-3_3	-	6	1	1	3	-	2	13	13	-	-	51	-	-	-	2,905	92	-
4b.1.2.37	RX-BLD-345-4_2	-	6	0	0	0	-	2	8	8	-	-	8	-	-	-	456	91	-
4b.1.2.38	RX-BLD-345-5_2	-	54	8	11	23	-	22	118	118	-	-	466	-	-	-	26,434	862	-
4b.1.2.39	RX-BLD-345-6_2	-	69	8	10	21	-	25	133	133	-	-	419	-	-	-	23,790	1,126	-
4b.1.2.40	RX-BLD-345-7_2	-	41	7	9	19	-	17	92	92	-	-	376	-	-	-	21,318	653	-
4b.1.2.41	RX-BLD-345-8_2	-	42	5	6	14	-	16	84	84	-	-	282	-	-	-	15,995	665	-
4b.1.2.42	RX-BLD-DW_2	-	319	43	51	112	-	120	645	645	-	-	2,248	-	-	-	127,507	5,276	-
4b.1.2.43	RX-BLD-DW_3	-	560	187	199	438	-	298	1,681	1,681	-	-	8,752	-	-	-	497,188	9,191	-
4b.1.2	Totals	-	6,666	1,318	1,549	3,402	-	2,881	15,816	15,816	-	-	68,180	-	-	-	3,865,518	111,146	-

Table C
Vermont Yankee Nuclear Power Station
SAFSTOR Alternative Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Burial Volumes Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Turbine Building System Components																			
4b.1.3.1	TURB-BLD-232-1_2	-	147	21	26	57	-	57	309	309	-	-	1,171	-	-	-	64,658	2,435	-
4b.1.3.2	TURB-BLD-232-2_2	-	259	47	46	101	-	102	555	555	-	-	2,019	-	-	-	114,863	4,242	-
4b.1.3.3	TURB-BLD-232-3_2	-	165	19	20	44	-	57	304	304	-	-	885	-	-	-	49,962	2,669	-
4b.1.3.4	TURB-BLD-232-4_2	-	129	15	15	33	-	44	236	236	-	-	656	-	-	-	37,297	2,077	-
4b.1.3.5	TURB-BLD-232-5_2	-	174	24	24	53	-	63	338	338	-	-	1,065	-	-	-	60,559	2,835	-
4b.1.3.6	TURB-BLD-232-6_2	-	200	21	24	52	-	69	366	366	-	-	1,045	-	-	-	59,284	3,252	-
4b.1.3.7	TURB-BLD-232-7_2	-	135	14	15	33	-	46	243	243	-	-	665	-	-	-	37,680	2,189	-
4b.1.3.8	TURB-BLD-246-1_2	-	126	38	45	100	-	67	377	377	-	-	2,002	-	-	-	113,533	2,112	-
4b.1.3.9	TURB-BLD-248-1_2	-	127	24	28	61	-	53	292	292	-	-	1,224	-	-	-	68,773	2,102	-
4b.1.3.10	TURB-BLD-248-2_2	-	180	12	15	34	-	57	298	298	-	-	679	-	-	-	38,457	2,962	-
4b.1.3.11	TURB-BLD-248-3_2	-	329	104	132	289	-	185	1,039	1,039	-	-	5,796	-	-	-	328,421	5,549	-
4b.1.3.12	TURB-BLD-248-4_2	-	228	83	103	227	-	138	779	779	-	-	4,554	-	-	-	258,072	3,863	-
4b.1.3.13	TURB-BLD-248-5_2	-	59	14	16	35	-	27	150	150	-	-	691	-	-	-	39,213	970	-
4b.1.3.14	TURB-BLD-248-6_2	-	132	22	27	58	-	54	292	292	-	-	1,168	-	-	-	66,208	2,163	-
4b.1.3.15	TURB-BLD-248-7_2	-	81	28	36	78	-	48	271	271	-	-	1,569	-	-	-	88,893	1,368	-
4b.1.3.16	TURB-BLD-252-10_2	-	163	15	19	41	-	56	295	295	-	-	832	-	-	-	47,144	2,693	-
4b.1.3.17	TURB-BLD-252-13_2	-	142	10	12	27	-	45	237	237	-	-	547	-	-	-	30,986	2,276	-
4b.1.3.18	TURB-BLD-252-14_2	-	105	12	14	32	-	38	201	201	-	-	634	-	-	-	35,940	1,704	-
4b.1.3.19	TURB-BLD-252-1_2	-	102	39	48	106	-	63	359	359	-	-	2,115	-	-	-	119,925	1,694	-
4b.1.3.20	TURB-BLD-252-2_2	-	100	39	47	104	-	62	352	352	-	-	2,083	-	-	-	118,092	1,669	-
4b.1.3.21	TURB-BLD-252-3_2	-	24	3	4	8	-	9	48	48	-	-	169	-	-	-	9,227	387	-
4b.1.3.22	TURB-BLD-252-4_2	-	31	1	2	4	-	9	46	46	-	-	72	-	-	-	4,089	507	-
4b.1.3.23	TURB-BLD-252-5_2	-	206	18	21	46	-	68	359	359	-	-	926	-	-	-	52,525	3,413	-
4b.1.3.24	TURB-BLD-252-6_2	-	73	2	2	5	-	20	101	101	-	-	92	-	-	-	5,200	1,206	-
4b.1.3.25	TURB-BLD-252-7_2	-	154	30	36	80	-	67	367	367	-	-	1,608	-	-	-	90,912	2,513	-
4b.1.3.26	TURB-BLD-252-8_2	-	54	4	5	12	-	18	93	93	-	-	232	-	-	-	13,148	876	-
4b.1.3.27	TURB-BLD-252-9_2	-	223	36	42	92	-	89	481	481	-	-	1,902	-	-	-	104,780	3,632	-
4b.1.3.28	TURB-BLD-272-1_2	-	31	13	17	36	-	21	118	118	-	-	728	-	-	-	41,225	533	-
4b.1.3.29	TURB-BLD-272-3_2	-	370	41	48	105	-	130	694	694	-	-	2,105	-	-	-	119,414	5,911	-
4b.1.3.30	TURB-BLD-272-4_2	-	147	28	36	78	-	64	353	353	-	-	1,590	-	-	-	88,841	2,374	-
4b.1.3.31	TURB-BLD-272-5_2	-	108	18	23	52	-	45	247	247	-	-	1,034	-	-	-	58,615	1,699	-
4b.1.3.32	TURB-BLD-272-6_2	-	149	28	36	79	-	65	358	358	-	-	1,581	-	-	-	89,636	2,352	-
4b.1.3.33	TURB-BLD-272-9_0	-	13	-	-	-	-	2	15	-	-	15	-	-	-	-	-	212	-
4b.1.3	Totals	-	4,666	825	984	2,161	-	1,936	10,571	10,556	-	15	43,439	-	-	-	2,455,571	76,434	-
Control/Radwaste/Other Building System Components																			
4b.1.4.1	CONT-BLD-248-1_0	-	157	-	-	-	-	24	181	-	-	181	-	-	-	-	-	2,578	-
4b.1.4.2	CONT-BLD-248-1_2	-	1	0	0	0	-	1	3	3	-	-	8	-	-	-	459	20	-
4b.1.4.3	CONT-BLD-248-2_0	-	2	-	-	-	-	0	2	-	-	2	-	-	-	-	-	36	-
4b.1.4.4	CONT-BLD-262-1_0	-	120	-	-	-	-	18	138	-	-	138	-	-	-	-	-	1,974	-
4b.1.4.5	CONT-BLD-272-1_0	-	52	-	-	-	-	8	60	-	-	60	-	-	-	-	-	874	-
4b.1.4.6	CST-BASE-TRENCH_2	-	405	101	120	263	-	195	1,085	1,085	-	-	5,467	-	-	-	299,176	6,602	-
4b.1.4.7	CT_0	-	225	-	-	-	-	34	259	-	-	259	-	-	-	-	-	3,726	-
4b.1.4.8	DISCHARGE-STR_0	-	67	-	-	-	-	10	77	-	-	77	-	-	-	-	-	1,111	-
4b.1.4.9	DST-BASE_0	-	23	-	-	-	-	3	26	-	-	26	-	-	-	-	-	367	-
4b.1.4.10	INTAKE-STR_0	-	162	-	-	-	-	24	187	-	-	187	-	-	-	-	-	2,675	-
4b.1.4.11	RW-BLD-230-1_3	-	108	17	21	46	-	43	235	235	-	-	947	-	-	-	51,774	1,754	-
4b.1.4.12	RW-BLD-230-2_3	-	141	25	30	65	-	59	320	320	-	-	1,362	-	-	-	74,325	2,295	-
4b.1.4.13	RW-BLD-230-3_3	-	61	8	8	18	-	22	118	118	-	-	367	-	-	-	20,683	982	-
4b.1.4.14	RW-BLD-230-4_3	-	43	6	7	16	-	16	88	88	-	-	326	-	-	-	17,849	700	-
4b.1.4.15	RW-BLD-230-5_3	-	34	4	5	11	-	12	66	66	-	-	227	-	-	-	12,445	547	-
4b.1.4.16	RW-BLD-230-7_3	-	161	21	22	49	-	58	312	312	-	-	987	-	-	-	56,089	2,532	-
4b.1.4.17	RW-BLD-246-8_2	-	45	5	5	12	-	16	83	83	-	-	235	-	-	-	13,363	720	-
4b.1.4.18	RW-BLD-252-10_2	-	16	1	1	2	-	5	25	25	-	-	50	-	-	-	2,834	259	-
4b.1.4.19	RW-BLD-252-11_2	-	14	2	2	5	-	5	28	28	-	-	103	-	-	-	5,837	226	-
4b.1.4.20	RW-BLD-252-12_2	-	104	19	22	48	-	43	236	236	-	-	1,015	-	-	-	55,091	1,652	-
4b.1.4.21	RW-BLD-252-13_2	-	85	14	17	36	-	34	186	186	-	-	764	-	-	-	41,439	1,347	-
4b.1.4.22	RW-BLD-252-1_2	-	74	4	6	12	-	23	119	119	-	-	246	-	-	-	13,918	1,212	-
4b.1.4.23	RW-BLD-252-2_2	-	41	7	9	20	-	17	94	94	-	-	393	-	-	-	22,278	678	-
4b.1.4.24	RW-BLD-252-3_2	-	17	1	2	4	-	6	31	31	-	-	83	-	-	-	4,683	286	-
4b.1.4.25	RW-BLD-252-4_2	-	29	3	3	8	-	10	53	53	-	-	152	-	-	-	8,597	487	-
4b.1.4.26	RW-BLD-252-5_2	-	43	7	7	16	-	16	89	89	-	-	318	-	-	-	17,993	683	-
4b.1.4.27	RW-BLD-252-6_3	-	80	14	13	28	-	30	164	164	-	-	550	-	-	-	31,337	1,282	-
4b.1.4.28	RW-BLD-252-7_3	-	27	3	4	8	-	10	52	52	-	-	173	-	-	-	9,544	437	-
4b.1.4.29	RW-BLD-252-8_2	-	47	8	7	16	-	18	95	95	-	-	319	-	-	-	18,153	755	-
4b.1.4.30	RW-BLD-252-9_3	-	50	5	6	13	-	17	92	92	-	-	274	-	-	-	15,278	807	-
4b.1.4.31	RW-BLD-264-1_2	-	5	0	0	0	-	1	6	6	-	-	2	-	-	-	103	78	-
4b.1.4.32	RW-BLD-264-2_2	-	6	0	0	0	-	2	9	9	-	-	10	-	-	-	544	100	-
4b.1.4.33	RW-BLD-264-RF_2	-	19	2	3	6	-	7	38	38	-	-	125	-	-	-	7,067	310	-
4b.1.4.34	RW-BLD-280-1_2	-	13	2	3	6	-	6	30	30	-	-	127	-	-	-	7,184	224	-
4b.1.4.35	RW-BLD-280-2_2	-	10	0	1	1	-	3	16	16	-	-	28	-	-	-	1,588	167	-
4b.1.4.36	SERV-BLD-248-1_2	-	79	8	10	21	-	27	144	144	-	-	419	-	-	-	23,780	1,281	-
4b.1.4.37	STACK_2	-	73	9	10	23	-	26	141	141	-	-	455	-	-	-	25,806	1,166	-
4b.1.4.38	YARD-252-CONT_2	-	640	331	424	930	-	489	2,814	2,814	-	-	18,663	-	-	-	1,057,171	10,842	-
4b.1.4.39	YARD-252-CONT_3	-	50	7	7	16	-	18	97	97	-	-	312	-	-	-	17,757	718	-
4b.1.4.40	YARD-252-SBO_0	-	60	-	-	-	-	9	69	-	-	69	-	-	-	-	-	983	-
4b.1.4.41	YARD-252_0	-	330	-	-	-	-	49	379	-	-	379	-	-	-	-	-	5,599	-
4b.1.4	Totals	-	3,721	634	775	1,702	-	1,416	8,248	6,869	-	1,379	34,506	-	-	-	1,934,146	61,072	-

Table C
Vermont Yankee Nuclear Power Station
SAFSTOR Alternative Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Burial Volumes Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
4b.1.5	Scaffolding in support of decommissioning	-	1,950	42	47	104	-	525	2,669	2,669	-	-	2,082	-	-	-	117,945	34,804	-
Decontamination of Site Buildings																			
4b.1.6.1	Reactor	1,682	2,972	1,342	1,219	2,543	-	2,537	12,294	12,294	-	-	50,644	-	-	-	3,000,101	76,812	-
4b.1.6.2	AOG	197	108	5	23	30	-	137	499	499	-	-	604	-	-	-	51,817	4,700	-
4b.1.6.3	Control	1	2	0	0	0	-	1	5	5	-	-	9	-	-	-	786	46	-
4b.1.6.4	Equipment Lock	14	2	0	2	2	-	8	29	29	-	-	43	-	-	-	3,708	255	-
4b.1.6.5	LLRW	2	-	-	-	-	-	1	3	3	-	-	-	-	-	-	-	27	-
4b.1.6.6	Radwaste	145	156	3	30	40	-	126	500	500	-	-	796	-	-	-	66,517	4,572	-
4b.1.6.7	Radwaste Compactor	6	11	0	2	3	-	7	28	28	-	-	52	-	-	-	4,494	249	-
4b.1.6.8	Service	1	19	0	3	4	-	7	36	36	-	-	88	-	-	-	7,662	298	-
4b.1.6.9	Turbine	1,145	697	206	375	510	-	951	3,884	3,884	-	-	10,137	-	-	-	836,948	28,582	-
4b.1.6.10	Vent Stack	29	150	2	44	57	-	73	356	356	-	-	1,130	-	-	-	97,890	2,590	-
4b.1.6.11	Reactor (SFP & Sacrifical Shield)	186	1,476	89	1,265	1,645	-	1,072	5,734	5,734	-	-	32,758	-	-	-	2,814,668	22,718	-
4b.1.6	Totals	3,407	5,593	1,648	2,964	4,835	-	4,920	23,367	23,367	-	-	96,260	-	-	-	6,884,591	140,850	-
4b.1	Subtotal Period 4b Activity Costs	3,407	22,597	4,467	6,319	12,204	-	11,677	60,671	59,277	-	1,393	244,467	-	-	-	15,257,772	424,306	-
Period 4b Additional Costs																			
4b.2.1	Financing Cost and Interest	-	-	-	-	-	1,482	-	1,482	1,482	-	-	-	-	-	-	-	-	-
4b.2.2	License termination survey planning	-	-	-	-	-	1,536	461	1,997	1,997	-	-	-	-	-	-	-	-	12,480
4b.2.3	Remedial action support surveys	-	-	-	-	-	3,171	951	4,122	4,122	-	-	-	-	-	-	-	51,140	-
4b.2.4	Soil remediation	-	106	607	6,523	7,532	-	2,949	17,716	17,716	-	-	150,643	-	-	-	13,256,570	2,669	-
4b.2.5	Underground services excavations	-	431	-	-	-	66	75	572	-	-	572	-	-	-	-	-	4,421	-
4b.2.6	Septic field removal	-	412	-	-	-	1,460	281	2,153	-	-	2,153	-	-	-	-	-	3,359	-
4b.2.7	License termination - ISFSI	-	149	139	369	638	2,754	1,012	5,062	5,062	-	-	12,370	-	-	-	1,080,379	12,333	8,911
4b.2.8	Operational tools & equipment	-	-	7	115	-	87	31	240	240	-	-	-	-	-	-	-	41	-
4b.2.9	Water Processing	-	-	-	-	-	7,487	2,246	9,733	9,733	-	-	-	-	-	-	-	-	-
4b.2	Subtotal Period 4b Additional Costs	-	1,098	753	7,007	8,170	18,043	8,005	43,076	40,352	-	2,725	163,013	-	-	-	14,336,949	73,963	21,391
Period 4b Collateral Costs																			
4b.3.1	Process decommissioning water waste	6	-	9	38	40	-	20	112	112	-	-	100	-	-	-	6,016	20	-
4b.3.3	Small tool allowance	-	361	-	-	-	-	54	415	415	-	-	-	-	-	-	-	-	-
4b.3.4	Decommissioning Equipment Disposition	-	-	129	144	316	-	114	703	703	-	-	6,348	-	-	-	359,614	88	-
4b.3	Subtotal Period 4b Collateral Costs	6	361	138	182	357	-	187	1,230	1,230	-	-	6,449	-	-	-	365,630	108	-
Period 4b Period-Dependent Costs																			
4b.4.1	Decon supplies	1,542	-	-	-	-	-	386	1,928	1,928	-	-	-	-	-	-	-	-	-
4b.4.2	Insurance	-	-	-	-	-	1,311	131	1,442	1,442	-	-	-	-	-	-	-	-	-
4b.4.3	Property taxes	-	-	-	-	-	17	2	18	18	-	-	-	-	-	-	-	-	-
4b.4.4	Health physics supplies	-	2,727	-	-	-	-	682	3,409	3,409	-	-	-	-	-	-	-	-	-
4b.4.5	Heavy equipment rental	-	5,466	-	-	-	-	820	6,286	6,286	-	-	-	-	-	-	-	-	-
4b.4.6	Disposal of DAW generated	-	-	129	128	360	-	122	740	740	-	-	7,208	-	-	-	144,159	235	-
4b.4.7	Plant energy budget	-	-	-	-	-	2,997	450	3,446	3,446	-	-	-	-	-	-	-	-	-
4b.4.8	NRC Fees	-	-	-	-	-	818	82	900	900	-	-	-	-	-	-	-	-	-
4b.4.9	Site Non-Labor Overhead	-	-	-	-	-	479	72	551	551	-	-	-	-	-	-	-	-	-
4b.4.10	Liquid Radwaste Processing Equipment/Services	-	-	-	-	-	986	148	1,134	1,134	-	-	-	-	-	-	-	-	-
4b.4.11	Corporate A&G Cost	-	-	-	-	-	4,557	683	5,240	5,240	-	-	-	-	-	-	-	-	-
4b.4.12	Security Staff Cost	-	-	-	-	-	4,250	638	4,888	4,888	-	-	-	-	-	-	-	-	159,074
4b.4.13	DOC Staff Cost	-	-	-	-	-	31,067	4,660	35,727	35,727	-	-	-	-	-	-	-	-	343,806
4b.4.14	Entergy VY Staff Cost	-	-	-	-	-	36,172	5,426	41,598	41,598	-	-	-	-	-	-	-	-	605,509
4b.4	Subtotal Period 4b Period-Dependent Costs	1,542	8,194	129	128	360	82,654	14,300	107,308	107,308	-	-	7,208	-	-	-	144,159	235	1,108,389
4b.0	**TOTAL PERIOD 4b COST**	4,955	32,249	5,487	13,635	21,091	100,697	34,170	212,285	208,167	-	4,118	421,137	-	-	-	30,104,510	498,612	1,129,780
PERIOD 4f - License Termination																			
Period start date: Sunday, March 26, 2073																			
Period end date: Thursday, December 21, 2073																			
Period duration: 8.87 months																			
Period 4f Direct Decommissioning Activities																			
4f.1.1	ORISE confirmatory survey	-	-	-	-	-	171	51	223	223	-	-	-	-	-	-	-	-	-
4f.1.2	Terminate license	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4f.1	Subtotal Period 4f Activity Costs	-	-	-	-	-	171	51	223	223	-	-	-	-	-	-	-	-	-
Period 4f Additional Costs																			
4f.2.1	Financing Cost and Interest	-	-	-	-	-	397	-	397	397	-	-	-	-	-	-	-	-	-
4f.2.2	License termination survey	-	-	-	-	-	10,968	3,290	14,258	14,258	-	-	-	-	-	-	-	165,937	6,240
4f.2	Subtotal Period 4f Additional Costs	-	-	-	-	-	11,364	3,290	14,655	14,655	-	-	-	-	-	-	-	165,937	6,240
Period 4f Collateral Costs																			
4f.3.1	DOC staff relocation expenses	-	-	-	-	-	1,080	162	1,242	1,242	-	-	-	-	-	-	-	-	-
4f.3	Subtotal Period 4f Collateral Costs	-	-	-	-	-	1,080	162	1,242	1,242	-	-	-	-	-	-	-	-	-
Period 4f Period-Dependent Costs																			
4f.4.1	Insurance	-	-	-	-	-	31	3	34	34	-	-	-	-	-	-	-	-	-
4f.4.2	Property taxes	-	-	-	-	-	5	1	6	6	-	-	-	-	-	-	-	-	-
4f.4.3	Health physics supplies	-	642	-	-	-	-	160	802	802	-	-	-	-	-	-	-	-	-
4f.4.4	Disposal of DAW generated	-	-	6	6	17	-	6	35	35	-	-	345	-	-	-	6,897	11	-

Table C
Vermont Yankee Nuclear Power Station
SAFSTOR Alternative Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Burial Volumes: Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
Period 4f Period-Dependent Costs (continued)																			
4f.4.5	Plant energy budget	-	-	-	-	-	240	36	276	276	-	-	-	-	-	-	-	-	-
4f.4.6	NRC Fees	-	-	-	-	-	242	24	267	267	-	-	-	-	-	-	-	-	-
4f.4.7	Site Non-Labor Overhead	-	-	-	-	-	36	5	41	41	-	-	-	-	-	-	-	-	-
4f.4.8	Corporate A&G Cost	-	-	-	-	-	611	92	703	703	-	-	-	-	-	-	-	-	-
4f.4.9	Security Staff Cost	-	-	-	-	-	586	88	674	674	-	-	-	-	-	-	-	-	18,514
4f.4.10	DOC Staff Cost	-	-	-	-	-	5,184	778	5,962	5,962	-	-	-	-	-	-	-	-	56,314
4f.4.11	Entergy VY Staff Cost	-	-	-	-	-	4,998	750	5,748	5,748	-	-	-	-	-	-	-	-	73,286
4f.4	Subtotal Period 4f Period-Dependent Costs	-	642	6	6	17	11,935	1,943	14,549	14,549	-	-	345	-	-	-	6,897	11	148,114
4f.0	**TOTAL PERIOD 4f COST**	-	642	6	6	17	24,550	5,446	30,668	30,668	-	-	345	-	-	-	6,897	165,948	154,354
PERIOD 4 TOTALS		5,114	58,732	15,194	21,220	41,770	173,329	68,651	384,010	379,866	-	4,144	610,160	1,002	505	357	42,407,358	928,795	1,885,850
PERIOD 5b - Site Restoration																			
	Period start date: Thursday, December 21, 2073																		
	Period end date: Saturday, June 22, 2075																		
	Period duration: 18 months																		
Period 5b Direct Decommissioning Activities																			
Demolition of Remaining Site Buildings																			
5b.1.1.1	Reactor	-	4,326	-	-	-	-	649	4,974	-	-	4,974	-	-	-	-	-	44,306	-
5b.1.1.2	AOG	-	1,846	-	-	-	-	277	2,123	-	-	2,123	-	-	-	-	-	19,658	-
5b.1.1.3	Bottle Storage Shed	-	7	-	-	-	-	1	8	-	-	8	-	-	-	-	-	81	-
5b.1.1.4	Construction Office	-	66	-	-	-	-	10	76	-	-	76	-	-	-	-	-	961	-
5b.1.1.5	Control	-	197	-	-	-	-	30	227	-	-	227	-	-	-	-	-	2,292	-
5b.1.1.6	Control Access	-	90	-	-	-	-	14	104	-	-	104	-	-	-	-	-	1,197	-
5b.1.1.7	Cooling Towers	-	2,053	-	-	-	-	308	2,361	-	-	2,361	-	-	-	-	-	30,940	-
5b.1.1.8	Discharge & Aerating Structures	-	237	-	-	-	-	35	272	-	-	272	-	-	-	-	-	1,688	-
5b.1.1.9	Equipment Lock	-	90	-	-	-	-	14	104	-	-	104	-	-	-	-	-	1,094	-
5b.1.1.10	Gatehouse 1	-	12	-	-	-	-	2	13	-	-	13	-	-	-	-	-	148	-
5b.1.1.11	Gatehouse 2	-	24	-	-	-	-	4	27	-	-	27	-	-	-	-	-	287	-
5b.1.1.12	Intake Structure	-	497	-	-	-	-	75	572	-	-	572	-	-	-	-	-	4,732	-
5b.1.1.13	LLRW	-	87	-	-	-	-	13	100	-	-	100	-	-	-	-	-	1,126	-
5b.1.1.14	Misc Yard Structures	-	1,185	-	-	-	-	178	1,363	-	-	1,363	-	-	-	-	-	13,551	-
5b.1.1.15	New Warehouse	-	290	-	-	-	-	43	333	-	-	333	-	-	-	-	-	4,054	-
5b.1.1.16	Office Area (Turbine Bldg)	-	116	-	-	-	-	17	133	-	-	133	-	-	-	-	-	1,530	-
5b.1.1.17	Radwaste	-	284	-	-	-	-	43	327	-	-	327	-	-	-	-	-	3,147	-
5b.1.1.18	Radwaste Compactor	-	6	-	-	-	-	1	7	-	-	7	-	-	-	-	-	74	-
5b.1.1.19	Security Modifications	-	581	-	-	-	-	87	668	-	-	668	-	-	-	-	-	5,069	-
5b.1.1.20	Service	-	70	-	-	-	-	10	80	-	-	80	-	-	-	-	-	949	-
5b.1.1.21	Station Blackout Diesel	-	55	-	-	-	-	8	63	-	-	63	-	-	-	-	-	681	-
5b.1.1.22	Turbine	-	2,497	-	-	-	-	375	2,872	-	-	2,872	-	-	-	-	-	28,234	-
5b.1.1.23	Turbine Pedestal	-	656	-	-	-	-	98	754	-	-	754	-	-	-	-	-	6,331	-
5b.1.1.24	Turbine Storage Facility	-	127	-	-	-	-	19	147	-	-	147	-	-	-	-	-	1,986	-
5b.1.1.25	Vent Stack	-	760	-	-	-	-	114	874	-	-	874	-	-	-	-	-	9,329	-
5b.1.1.26	Vent Stack (Concrete Duct)	-	159	-	-	-	-	24	182	-	-	182	-	-	-	-	-	2,023	-
5b.1.1.27	Reactor (SFP & Sacrifical Shield)	-	32	-	-	-	-	5	37	-	-	37	-	-	-	-	-	512	-
5b.1.1	Totals	-	16,348	-	-	-	-	2,452	18,800	-	-	18,800	-	-	-	-	-	185,978	-
Site Closeout Activities																			
5b.1.2	Grade & landscape site	-	92	-	-	-	-	14	106	-	-	106	-	-	-	-	-	286	-
5b.1.3	Final report to NRC	-	-	-	-	-	198	30	227	227	-	-	-	-	-	-	-	-	1,560
5b.1	Subtotal Period 5b Activity Costs	-	92	-	-	-	198	43	333	227	-	106	-	-	-	-	-	286	1,560
Period 5b Additional Costs																			
5b.2.1	Financing Cost and Interest	-	-	-	-	-	1,240	-	1,240	-	-	1,240	-	-	-	-	-	-	-
5b.2.2	Intake & discharge structure cofferdams	-	665	-	-	-	-	100	764	-	-	764	-	-	-	-	-	6,383	-
5b.2.3	Concrete processing for concrete recycling	-	550	-	-	-	1,079	244	1,874	-	-	1,874	-	-	-	-	-	2,875	-
5b.2.4	Backfill underground services excavation	-	768	-	-	-	-	115	884	-	-	884	-	-	-	-	-	4,967	-
5b.2.5	Backfill structures	-	663	-	-	-	-	99	762	-	-	762	-	-	-	-	-	1,364	-
5b.2.6	Demolition and site restoration - ISFSI	-	1,066	-	-	-	120	178	1,364	-	-	1,364	-	-	-	-	-	11,667	160
5b.2.7	Disposal of contruction debris from demolition	-	-	-	-	-	860	129	989	-	-	989	-	-	-	-	-	-	-
5b.2	Subtotal Period 5b Additional Costs	-	3,712	-	-	-	3,300	866	7,877	-	-	7,877	-	-	-	-	-	27,255	160
Period 5b Collateral Costs																			
5b.3.1	Small tool allowance	-	191	-	-	-	-	29	219	-	-	219	-	-	-	-	-	-	-
5b.3.2	Corporate A&G Cost	-	-	-	-	-	364	55	418	-	-	418	-	-	-	-	-	-	-
5b.3	Subtotal Period 5b Collateral Costs	-	191	-	-	-	364	83	637	-	-	637	-	-	-	-	-	-	-
Period 5b Period-Dependent Costs																			
5b.4.1	Insurance	-	-	-	-	-	64	6	70	-	-	70	-	-	-	-	-	-	-
5b.4.2	Property taxes	-	-	-	-	-	10	1	11	-	-	11	-	-	-	-	-	-	-
5b.4.3	Heavy equipment rental	-	4,970	-	-	-	-	746	5,716	-	-	5,716	-	-	-	-	-	-	-
5b.4.4	Plant energy budget	-	-	-	-	-	244	37	280	-	-	280	-	-	-	-	-	-	-
5b.4.5	NRC Fees	-	-	-	-	-	541	54	595	595	-	-	-	-	-	-	-	-	-
5b.4.6	Site Non-Labor Overhead	-	-	-	-	-	292	44	336	-	-	336	-	-	-	-	-	-	-
5b.4.7	Security Staff Cost	-	-	-	-	-	1,190	178	1,368	-	-	1,368	-	-	-	-	-	-	37,577

Table C
Vermont Yankee Nuclear Power Station
SAFSTOR Alternative Decommissioning Cost Estimate
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Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Burial Volumes				Burial / Processed Wt., Lbs.	Craft Manhours	Utility and Contractor Manhours
													Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Period 5b Period-Dependent Costs (continued)																			
5b.4.8	DOC Staff Cost	-	-	-	-	-	10,289	1,543	11,833	-	-	11,833	-	-	-	-	-	-	106,469
5b.4.9	Entergy VY Staff Cost	-	-	-	-	-	4,290	644	4,934	-	-	4,934	-	-	-	-	-	-	61,063
5b.4	Subtotal Period 5b Period-Dependent Costs	-	4,970	-	-	-	16,920	3,253	25,143	595	-	24,548	-	-	-	-	-	-	205,109
5b.0	**TOTAL PERIOD 5b COST**	-	25,312	-	-	-	20,781	6,697	52,790	823	-	51,968	-	-	-	-	-	213,520	206,829
PERIOD 5 TOTALS		-	25,312	-	-	-	20,781	6,697	52,790	823	-	51,968	-	-	-	-	-	213,520	206,829
TOTAL COST TO DECOMMISSION		6,604	94,997	15,559	21,837	44,588	875,941	183,186	1,242,712	817,219	368,347	57,145	664,829	1,002	505	357	43,958,794	1,205,190	8,079,320

TOTAL COST TO DECOMMISSION WITH 17.3% CONTINGENCY:	**1,242,712**	**thousands of 2014 dollars**
TOTAL NRC LICENSE TERMINATION COST IS 65.8% OR:	**817,219**	**thousands of 2014 dollars**
SPENT FUEL MANAGEMENT COST IS 29.6% OR:	**368,347**	**thousands of 2014 dollars**
NON-NUCLEAR DEMOLITION COST IS 4.6% OR:	**57,145**	**thousands of 2014 dollars**
TOTAL LOW-LEVEL RADIOACTIVE WASTE VOLUME BURIED (EXCLUDING GTCC):	**666,336**	**cubic feet**
TOTAL GREATER THAN CLASS C RADWASTE VOLUME GENERATED:	**357**	**cubic feet**
TOTAL CRAFT LABOR REQUIREMENTS:	**1,205,190**	**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

ISFSI DECOMMISSIONING

Table D
Vermont Yankee Nuclear Power Station
ISFSI Decommissioning Cost Estimate
(thousands of 2014 dollars)

Activity Description	Removal Costs	Packaging Costs	Transport Costs	LLRW Disposal Costs	Other Costs	Total Costs	Burial Volume Class A (cubic feet)	Craft Manhours	Oversight and Contractor Manhours
Decommissioning Contractor									
Planning (characterization, specs and procedures)	-	-	-	-	264.9	264.9	-	-	1,072.0
Decontamination (activated MPC disposition)	149.2	139.1	369.3	638.0	-	1,295.6	12,370.0	1,563.8	
License Termination (radiological surveys)	-	-	-	-	1,257.3	1,257.3	-	10,769.6	-
Subtotal	**149.2**	**139.1**	**369.3**	**638.0**	**1,522.2**	**2,817.8**	**12,370.0**	**12,333.4**	**1,072.0**
Supporting Costs									
NRC and NRC Contractor Fees and Costs	-	-	-	-	397.6	397.6	-	-	776.0
Insurance					49.0	49.0			
Property Taxes					2.3	2.3			
Plant Energy Budget					53.8	53.8			
Non-Labor Overhead					276.1	276.1			
Corporate A&G					50.0	50.0			
Security Staff Cost					220.7	220.7			4,995.8
Oversight Staff Cost					182.4	182.4			2,067.2
Subtotal	-	-	-	-	**1,231.8**	**1,231.8**	-	-	**7,839.1**
Total (w/o contingency)	**149.2**	**139.1**	**369.3**	**638.0**	**2,754.1**	**4,049.7**	**12,370.0**	**12,333.4**	**8,911.1**
Total (w/25% contingency)	**186.5**	**173.9**	**461.6**	**797.5**	**3,442.6**	**5,062.1**			

The application of contingency (25%) is consistent with the evaluation criteria referenced by the NRC in NUREG-1757 ("Consolidated Decommissioning Guidance, Financial Assurance, Recordkeeping, and Timeliness," U.S. NRC's Office of Nuclear Material Safety and Safeguards, NUREG-1757, Vol. 3, Rev. 1, February 2012)

APPENDIX E

WORK DIFFICULTY ADJUSTMENT FACTORS

APPENDIX E

WORK DIFFICULTY ADJUSTMENT FACTORS

TLG has historically applied work difficulty adjustment factors in determining Unit Cost Factors to account for working in a radiological controlled environment. In performing an area-by-area decommissioning cost/schedule estimate the work difficulty factors are to be applied on an "area" basis, based on the nominal area conditions. Where practical, areas are established based on similar working conditions. The intent of the use of these factors is to provide the estimator an appropriate means to achieve an additional element of consistency within the estimate.

Access Factor:

Controlling Variables:

- Height of the component above the working floor
- Difficulty in working around the component (restricted access)

Source of Variable Information:

- Estimator's observation or judgment
- Plant drawings

Range of Access Factor Adjustments:

0% Components are accessible and located near a working level floor or platform.

10% Scaffolding (component less than <12 feet above floor) is required to access the majority of the components *or* the area around the components is congested.

20% Scaffolding (component less than <12 feet above floor) is required to access the majority of the components *and* the area around the components is congested.

30% Scaffolding (component between 12 - 20 feet above floor) is required to access the majority of the components *or* the areas around the components are extremely congested.

40% Scaffolding (component between 20 - 45 feet above floor) is required to access the majority of the components).

50% Scaffolding (component greater than 45 feet above floor) is required to access the majority of the components).

Respiratory Protection Factor:

Controlling Variables:

- Component surface contamination levels (internal or external)
- Type of work (potential to create an airborne problem)
- General area surface contamination levels
- Site-specific requirements for maintaining respirator qualifications (initial qualification, requalification, etc.)
- Personal air sampler requirements

Sources of Variable Information:

- Radiation Work Permit Requirements
- Area Survey Maps
- Site Radiation Protection Program Manual

Range of Respiratory Protection Factor Adjustments:

0% Respiratory protection is not required (clean system or loose surface contamination has been removed).

25% Respiratory protection is only required during limited segments of the work (i.e. physical cutting).

50% Respiratory protection is continuously required while working on the component.

Radiation/ALARA Factor:

Controlling Variables:

- Component contact dose rate
- General area dose rate

- Site-specific requirements for maintaining radiation worker qualification (initial qualification, requalification, etc.)
- Dosimetry requirements

Sources of Variable Information:

- Area Survey Maps
- Site Radiation Protection Program Manual
- Radiation Work Permit Requirements

Range of Radiation/ALARA Factor Adjustments:
(Note surface contamination levels are principally accounted for in protective clothing requirements and respiratory protection requirements)

0% Component is clean and is not located in a radiological controlled area.

10% Component is located in a radiological controlled area (General Area Radiation field < 2 .5 mrem/hr).

20% Component is located in a radiological controlled area (General Area Radiation field between 2. 5 to 15 mrem/hr).

40% Component is located in a radiological controlled area (General Area Radiation field between 16 and 99 mrem/hr).

100% Component is located in a radiological controlled area (General Area Radiation field > 100 mrem/hr).

Protective Clothing Factor:

Controlling Variables:

- Component surface contamination levels (internal or external)
- General area surface contamination levels
- Type of activity (wet/dry work, potential to create a surface contamination problem)
- Site specific work schedule arrangements

Sources of Variable Information:

- Radiation Work Permit Requirements
- Area Survey Maps
- Site Radiation Protection Program Manual

Range of Protective Clothing Factor Adjustments (alternate site-specific schedules may dictate alternate adjustments):

0% Component is clean and is not located in a radiological controlled area.

30% Component is clean or contaminated and is located in a surface contamination controlled area. Work is to be completed in accordance with the requirements of an RWP, which specifies a single or double set of "PC's", or "PC's" with plastics.

50% Component is located in a surface contamination controlled area. Work is to be completed in accordance with the requirements of an RWP, which specifies "plastics" in addition to double PC's for protective clothing.

100% Component is located in a surface contamination controlled area. Work is to be completed in accordance with the requirements of an RWP, which specifies double "PC's" and double "plastics" (extremely wet or humid working environment).

Work Break Factor:

Controlling Variables:

- Site specific work schedule arrangements

Sources of Variable Information:

- Typical site work schedule

Range of Work Break Factor Adjustments:

8.33% Workday schedule outlined in AIF/NESP-036 (alternate site-specific schedules may dictate alternate adjustments).

TABLE E-1
WORK DIFFICULTY ADJUSTMENT FACTORS

Area Identification	Area Description	Area Designation	Work Difficulty Factors			
			Access	Respirator	ALARA	Clothing
AOG-BLD-FL1	Guard Beds A/B and Pipe Access	AOG-BLD-FL1-1	20%	25%	10%	30%
	Charcoal Beds	AOG-BLD-FL1-2	20%	25%	10%	30%
	A Recombiner	AOG-BLD-FL1-3	20%	25%	10%	30%
	B Recombiner	AOG-BLD-FL1-4	20%	25%	10%	30%
	Central Corridor	AOG-BLD-FL1-5	10%	25%	10%	30%
AOG-BLD-FL2	A Dryer Skid	AOG-BLD-FL2-1	20%	25%	10%	30%
	A Dryer Skid/Prefilter	AOG-BLD-FL2-2	10%	25%	10%	30%
	Entry-A train	AOG-BLD-FL2-3	10%	25%	10%	30%
	B Dryer Skid	AOG-BLD-FL2-4	20%	25%	10%	30%
	B Dryer Skid/Prefilter	AOG-BLD-FL2-5	20%	25%	10%	30%
	Entry-B train	AOG-BLD-FL2-6	10%	25%	10%	30%
	After Filters/Vacuum Pumps	AOG-BLD-FL2-7	10%	25%	10%	30%
	Valve Alley	AOG-BLD-FL2-8	10%	25%	10%	30%
	Central Corridor 2nd Floor	AOG-BLD-FL2-9	10%	25%	10%	30%
AOG-BLD-PENT		AOG-BLD-PENT	0%	25%	10%	30%
AOG-BLDG	Pipe Tunnel Area	AOG-BLDG-1	30%	25%	10%	30%
	Underground Utilities-(Piping)	AOG-BLDG-2	10%	25%	10%	30%
	AOG Bldg-Roof Area	AOG-BLDG-RF	0%	25%	10%	30%
CONT-BLD-248	4 KV Switchgear Room	CONT-BLD-248-1	20%	0%	0%	0%
	RW & RX Corridor	CONT-BLD-248-2	10%	25%	10%	30%
CONT-BLD-262	Cable Vault	CONT-BLD-262-1	20%	0%	0%	0%
CONT-RM-272	Control Room	CONT-RM-272-1	20%	0%	0%	0%
CST-BASE-TRENCH	Condensate Storage Tank & Moat	CST-BASE-TRENCH	10%	25%	10%	30%

Area Identification	Area Description	Area Designation	Work Difficulty Factors			
			Access	Respirator	ALARA	Clothing
CT	Cooling Towers/Yard South	CT	0%	0%	0%	0%
INTAKE-STR		INTAKE-STR	20%	0%	0%	0%
DISCHARGE-STR		DISCHARGE-STR	20%	0%	0%	0%
DST-BASE	Demineralized Water Storage Tank	DST-BASE	20%	0%	0%	0%
LL-RW-SITE		LL-RW-SITE	0%	0%	10%	0%
NORTH-WAREHOUSE	North Warehouse-RCA	NORTH-WAREHOUSE	0%	25%	10%	30%
RW-BLD-230	Condensate separators A/B	RW-BLD-230-1	30%	50%	10%	50%
	Waste/Floor Drain Coll Tnks	RW-BLD-230-2	30%	50%	10%	50%
	Spent Resin Tnk/Pumps	RW-BLD-230-3	30%	50%	10%	50%
	Waste Sludge Tank	RW-BLD-230-4	30%	50%	10%	50%
	Chem Waste Tank	RW-BLD-230-5	30%	50%	10%	50%
	Sump/Central Area	RW-BLD-230-7	20%	25%	10%	30%
RW-BLD-246-8	Pipe Tunnel Area	RW-BLD-246-8	30%	50%	10%	30%
RW-BLD-252	Control Room-RWB	RW-BLD-252-1	10%	25%	10%	30%
	Cask Room--Loading Bay	RW-BLD-252-2	10%	25%	10%	30%
	Respirator Wash/Filters	RW-BLD-252-3	10%	25%	10%	30%
	Dress-Out Area	RW-BLD-252-4	10%	25%	10%	30%
	Waste Filter Air Tnk/Pumps	RW-BLD-252-5	20%	25%	10%	30%
	Holding Pump Alley	RW-BLD-252-6	20%	25%	10%	30%
	SFP Filter/Demin	RW-BLD-252-7	30%	50%	10%	50%
	Waste Sample Pump Room	RW-BLD-252-8	20%	25%	10%	30%
	Waste Demin/Coll Filter/Flr Drn Filter	RW-BLD-252-9	30%	50%	10%	50%
	Center Corrridor/Area	RW-BLD-252-10	10%	25%	10%	30%
	Compactor Area-Bldg	RW-BLD-252-11	10%	25%	10%	30%
	Floor Drain/Waste Sample Tanks	RW-BLD-252-12	20%	25%	10%	30%
	Surge Tank	RW-BLD-252-13	20%	25%	10%	30%
RW-BLD-264	East Room	RW-BLD-264-1	10%	25%	10%	30%
	West Rooms	RW-BLD-264-2	10%	25%	10%	30%
	Radwaste Roof	RW-BLD-264-RF	10%	25%	10%	30%

Area Identification	Area Description	Area Designation	Work Difficulty Factors			
			Access	Respirator	ALARA	Clothing
RW-BLD-280	Penthouse East/West Rooms	RW-BLD-280-1	10%	25%	10%	30%
	Penthouse East/West Rooms	RW-BLD-280-2	10%	25%	10%	30%
RX-BLD-213	Torus elev 213	RX-BLD-213-1	30%	25%	10%	30%
	RHR A northeast corner	RX-BLD-213-2	20%	25%	10%	30%
	RHR B southeast corner	RX-BLD-213-3	20%	25%	10%	30%
	RCIC@213'	RX-BLD-213-4	20%	25%	10%	30%
	HPCI - SW Corner	RX-BLD-213-5	20%	25%	10%	30%
RX-BLD-232	TORUS elev 232	RX-BLD-232-1	30%	25%	10%	30%
	RHR A-northeast corner	RX-BLD-232-2	20%	25%	10%	30%
	RHR B southeast corner	RX-BLD-232-3	20%	25%	10%	30%
	RCIC@232'	RX-BLD-232-4	20%	25%	10%	30%
	CRD Pump room	RX-BLD-232-5	20%	25%	10%	30%
RX-BLD-252	Tip Room	RX-BLD-252-1	10%	25%	10%	30%
	Drywell Ante Room	RX-BLD-252-2	10%	25%	10%	30%
	CRD Rebuild Room	RX-BLD-252-3	20%	25%	10%	30%
	Steam Tunnel--250/261	RX-BLD-252-4	30%	25%	10%	30%
	North HCU's	RX-BLD-252-5	20%	25%	10%	30%
	South HCU's	RX-BLD-252-6	20%	25%	10%	30%
	East Corridor	RX-BLD-252-7	20%	25%	10%	30%
	Equipment Lock Area	RX-BLD-252-8	20%	25%	10%	30%
	CRD Control Station	RX-BLD-252-9	20%	25%	10%	30%
	Reactor Building Airlock	RX-BLD-252-10	20%	25%	10%	30%
RX-BLD-280	RWCU Pump Rooms A/B	RX-BLD-280-1	20%	25%	10%	30%
	RWCU Regen & Non-regen Hx Room	RX-BLD-280-2	20%	25%	10%	50%
	Motor Gen Sets A/B	RX-BLD-280-3	20%	25%	10%	30%
	Standby Gas Treatment A/B	RX-BLD-280-4	20%	25%	10%	30%
	Vital AC MG Set/Ex Gas Monitor	RX-BLD-280-5	20%	25%	10%	30%
	North Corridor	RX-BLD-280-6	20%	25%	10%	30%
	East Corridor	RX-BLD-280-7	20%	25%	10%	30%
	RX BLDG 280' Roof Area	RX-BLD-280-ROOF	0%	25%	10%	30%

Area Identification	Area Description	Area Designation	Work Difficulty Factors			
			Access	Respirator	ALARA	Clothing
RX-BLD-303	SFP Hx Room	RX-BLD-303-1	30%	50%	10%	50%
	CleanUp Phase Separator A/B	RX-BLD-303-2	30%	50%	10%	50%
	CU Sludge Mixing/Decant Pumps	RX-BLD-303-3	30%	50%	10%	50%
	RBCCW Hx Area	RX-BLD-303-4	10%	25%	10%	30%
	Hot Maintenance Shop (old CESA)	RX-BLD-303-5	10%	25%	10%	30%
	Calibration Lab	RX-BLD-303-6	10%	25%	10%	30%
	East Corridor/Equip Hatch	RX-BLD-303-7	10%	25%	10%	30%
	Primary Containment Air Comp	RX-BLD-303-8	10%	25%	10%	30%
RX-BLD-318	CleanUp Filter/Demin	RX-BLD-318-1	30%	50%	10%	50%
	CleanUp Demin Pumps	RX-BLD-318-2	20%	25%	10%	30%
	Skimmer Pump Room	RX-BLD-318-3	20%	25%	10%	30%
	Battery Racks/MG Sets	RX-BLD-318-4	10%	25%	10%	30%
	SLC Pumps/Demin	RX-BLD-318-5	10%	25%	10%	30%
	RBCCW Surge Tank	RX-BLD-318-6	10%	25%	10%	30%
	East Corridor/Equip Hatch	RX-BLD-318-7	10%	25%	10%	30%
RX-BLD-345	Reactor Cavity	RX-BLD-345-1	20%	50%	10%	50%
	Dryer Separator Storage	RX-BLD-345-2	20%	50%	10%	50%
	Spent Fuel Storage Pool	RX-BLD-345-3	20%	50%	10%	50%
	New Fuel Storage Vault	RX-BLD-345-4	10%	25%	10%	30%
	SW Laydown area	RX-BLD-345-5	10%	25%	10%	30%
	NE(Decon Area)	RX-BLD-345-6	10%	25%	10%	30%
	SE Corner-(Equipment Hatch area)	RX-BLD-345-7	10%	25%	10%	30%
	NW Laydown Area	RX-BLD-345-8	10%	25%	10%	30%
DRYWELL	Drywell	RX-BLD-DW	30%	50%	10%	30%
SERV-BLD-248	HP Check Point & Chem Labs	SERV-BLD-248-1	10%	25%	10%	30%
STACK	Stack all elevations	STACK	20%	25%	10%	30%
TURB-BLD-222	A Condenser	TURB-BLD-222-1	20%	25%	10%	30%
	B Condenser	TURB-BLD-222-2	20%	25%	10%	30%

Area Identification	Area Description	Area Designation	Work Difficulty Factors			
			Access	Respirator	ALARA	Clothing
	Heater Drain Pumps	TURB-BLD-222-3	20%	25%	10%	30%
	TBCCW Hx/Pumps	TURB-BLD-222-8	20%	25%	10%	30%
	Condensate Pumps A/B/C	TURB-BLD-222-9	20%	25%	10%	30%
	Condensate Backwash Rec.Tank Room	TURB-BLD-222-10	30%	25%	10%	30%
	Condensate Backwash Pump Room	TURB-BLD-222-11	20%	25%	10%	30%
TURB-BLD-228	Turb Lube Oil Storage/Pumps	TURB-BLD-228-1	20%	25%	10%	30%
	Reactor Feedwater Pumps A/B/C	TURB-BLD-228-2	20%	25%	10%	30%
	E3-LP Heaters A/B	TURB-BLD-228-3	20%	25%	10%	30%
	E4-LP Heaters A/B	TURB-BLD-228-4	20%	25%	10%	30%
	Moisture Sep A/B	TURB-BLD-228-5	20%	25%	10%	30%
	Moisture Sep C/D	TURB-BLD-228-6	20%	25%	10%	30%
	TB 228 @ under Stop/Bypass Valves	TURB-BLD-228-12	10%	25%	10%	30%
	Condensor Heater Bay West	TURB-BLD-228-13	10%	25%	10%	30%
TURB-BLD-232	Condensate Demins A-E	TURB-BLD-232-1	30%	25%	10%	30%
	Condensate Demin/Transfer Pumps	TURB-BLD-232-2	30%	25%	10%	30%
	Condensate Precoat Area	TURB-BLD-232-3	20%	25%	10%	30%
	Condensate/Demin Transfer Pumps	TURB-BLD-232-4	20%	25%	10%	30%
	Stator Liquid Cooling /H2 Seal oil	TURB-BLD-232-5	20%	25%	10%	30%
	Instrument Air Dryers	TURB-BLD-232-6	20%	25%	10%	30%
	Main Condenser Vacuum Pump	TURB-BLD-232-7	20%	25%	10%	30%
TURB-BLD-246	Steam Jet Air Ejectors	TURB-BLD-246-1	20%	25%	10%	30%
TURB-BLD-248	Turbine Oil Tk/Pumps/Hx	TURB-BLD-248-1	20%	25%	10%	30%
	North Corridor	TURB-BLD-248-2	10%	25%	10%	30%
	E1-HP Heaters A/B	TURB-BLD-248-3	20%	25%	10%	30%
	E2-HP Heaters C/D	TURB-BLD-248-4	20%	25%	10%	30%
	Turb Stop Valves	TURB-BLD-248-5	20%	25%	10%	30%
	Main Gen Bus/Coolers	TURB-BLD-248-6	20%	25%	10%	30%
	Turbine Bypass Valves	TURB-BLD-248-7	20%	25%	10%	30%

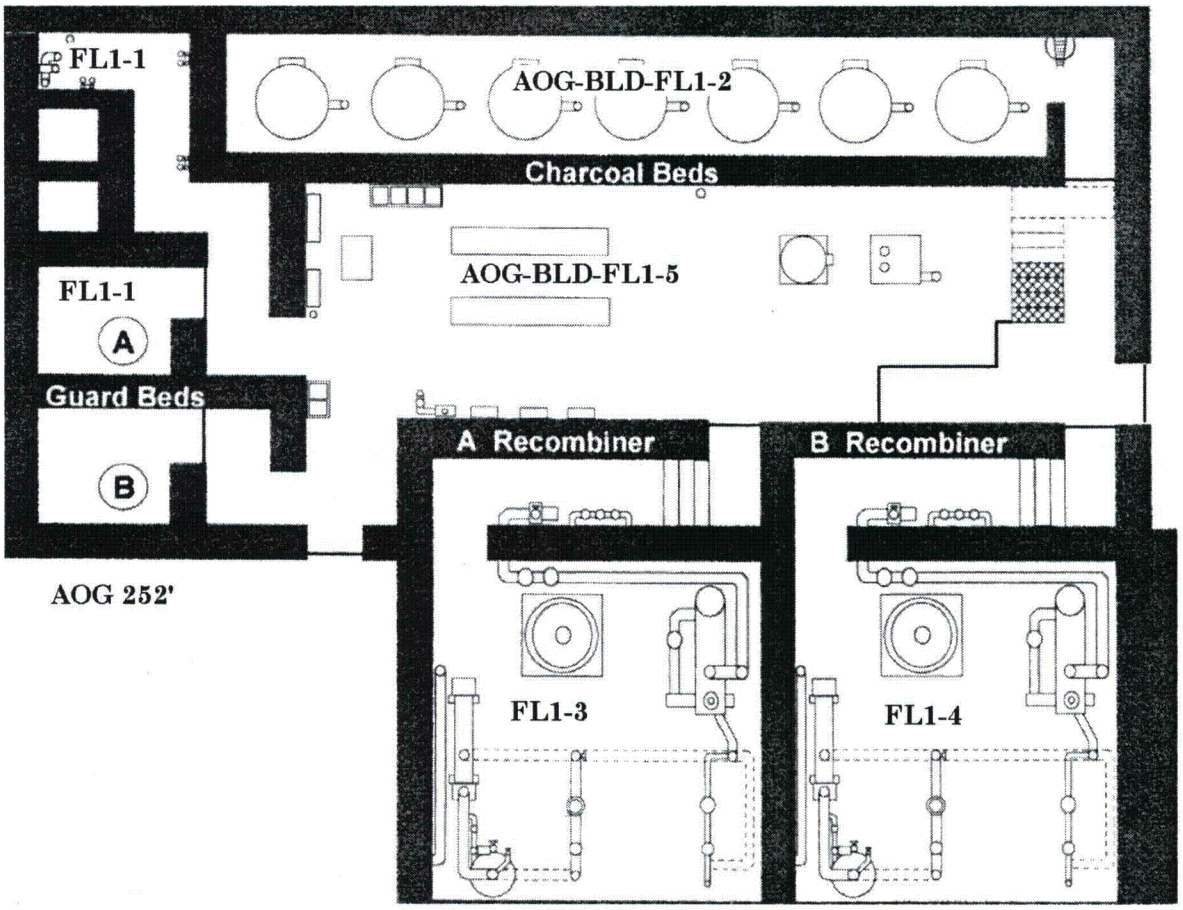
Area Identification	Area Description	Area Designation	Work Difficulty Factors			
			Access	Respirator	ALARA	Clothing
TURB-BLD-252	Diesel Generator A	TURB-BLD-252-1	20%	0%	10%	0%
	Diesel Generator B	TURB-BLD-252-2	20%	0%	10%	0%
	Diesel Oil Day Tanks	TURB-BLD-252-3	20%	25%	10%	30%
	TBCCW Surge Tank Area	TURB-BLD-252-4	10%	25%	10%	30%
	Decon Area	TURB-BLD-252-5	10%	25%	10%	30%
	Turb Loading Bay	TURB-BLD-252-6	10%	25%	10%	30%
	Heating Boiler/Blowdown Tank	TURB-BLD-252-7	20%	0%	0%	0%
	Boiler Oil Pumps	TURB-BLD-252-8	20%	0%	0%	0%
	Clearwell Tank/Chem Trtmt Skid	TURB-BLD-252-9	20%	0%	0%	0%
	Maintenance Shop	TURB-BLD-252-10	10%	25%	10%	30%
	Warehouse/Office	TURB-BLD-252-13	20%	0%	0%	0%
	Cond/Demin Corridor	TURB-BLD-252-14	10%	25%	10%	30%
TURB-BLD-272	Main Turbine	TURB-BLD-272-1	10%	25%	10%	30%
	Operating Deck	TURB-BLD-272-3	10%	25%	10%	30%
	Heating Vent.Supply Fan Room	TURB-BLD-272-4	20%	0%	0%	0%
	Heating Vent. Exhaust Fan Room	TURB-BLD-272-5	20%	0%	0%	0%
	AC Equipment (CR and Serv. Bldg)	TURB-BLD-272-6	20%	0%	0%	0%
	Maintenance Roof/DG Snubbers	TURB-BLD-272-9	0%	0%	0%	0%
YARD AREA	Yard Area	YARD-252	0%	0%	0%	0%
	Yard Area - North40	YARD-252-NORTH40	0%	0%	0%	0%
	Yard Cont. Piping-OG & RW	YARD-252-CONT	10%	25%	10%	30%

APPENDIX F

AREA MAPS

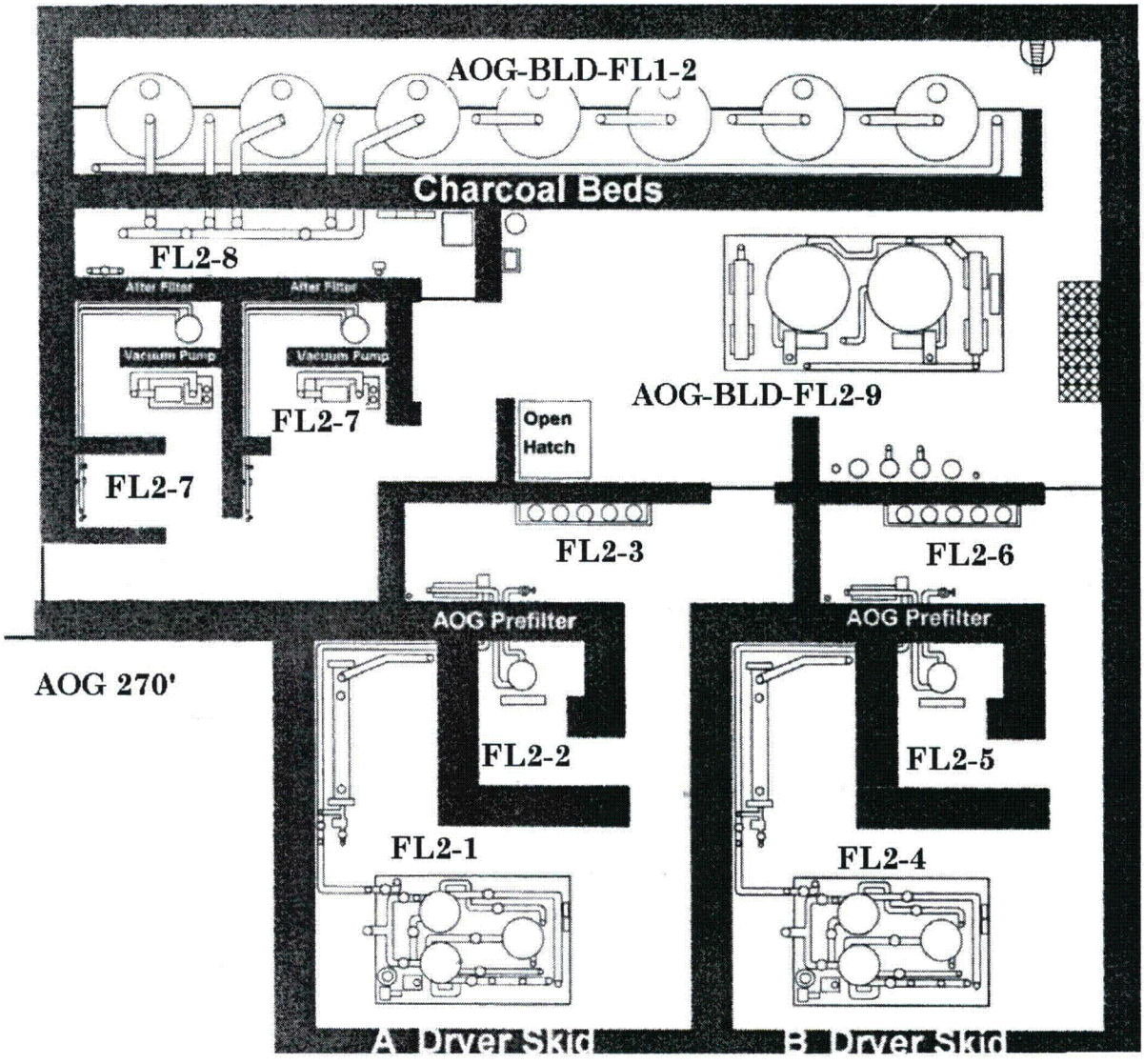
APPENDIX F

AOG BUILDING
(Elevation 252)



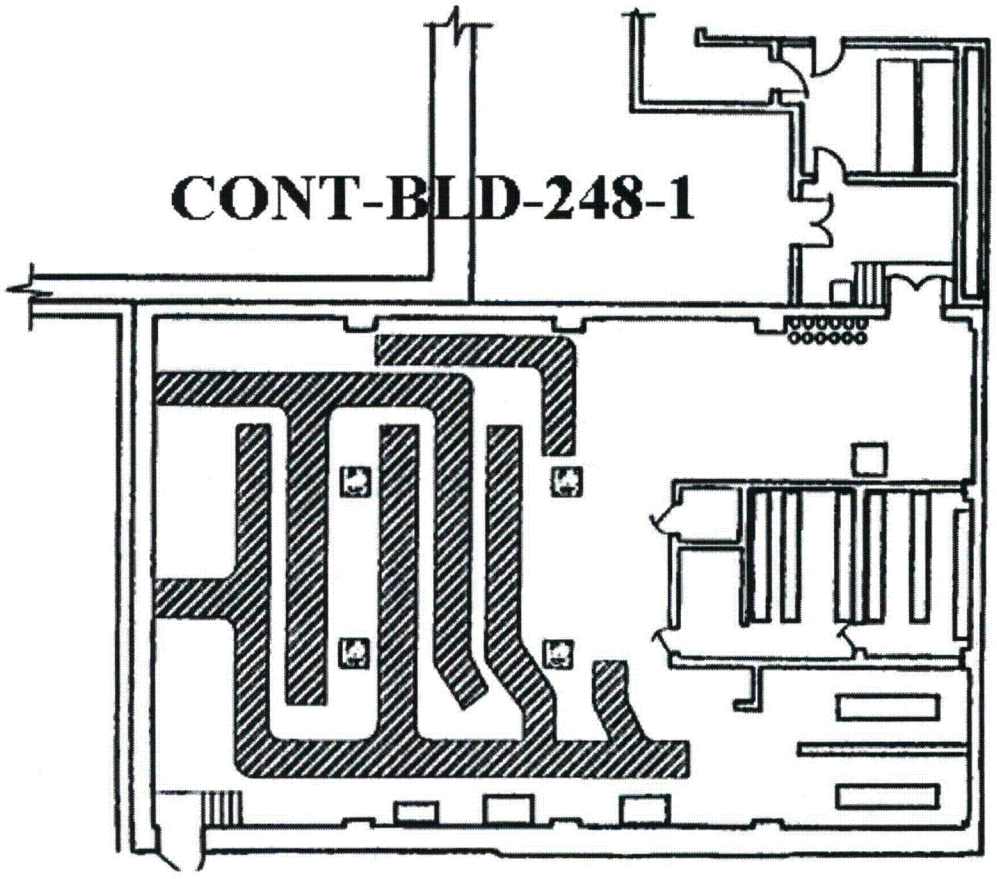
APPENDIX F

AOG BUILDING
(Elevation 270)



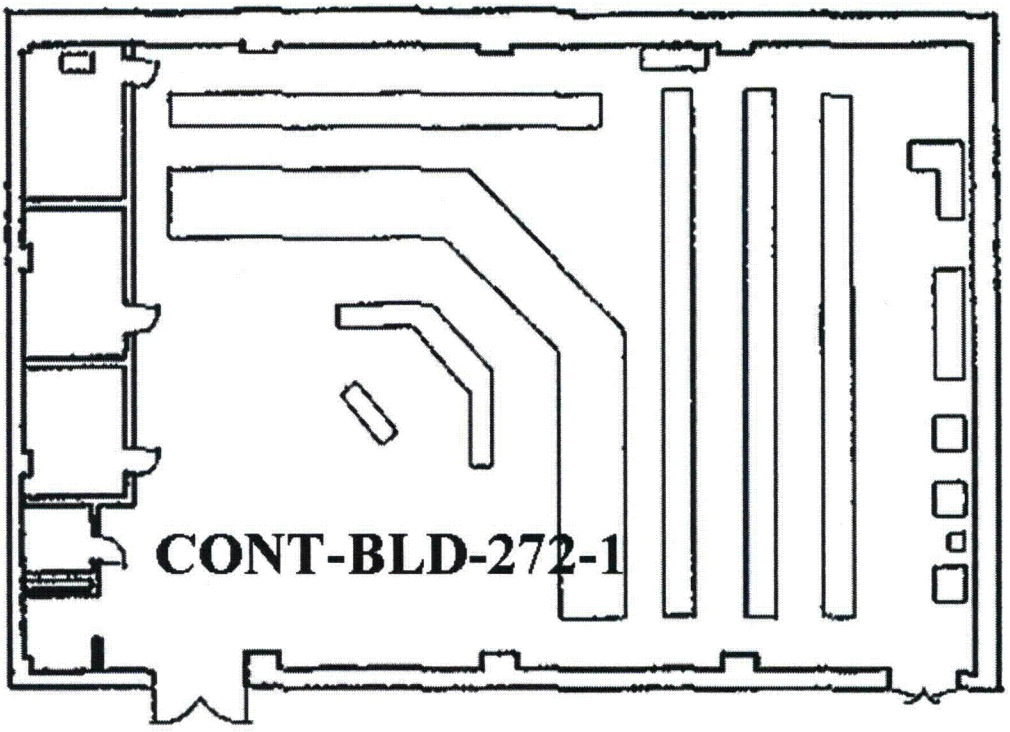
APPENDIX F

CONTROL BUILDING
(Elevation 248)



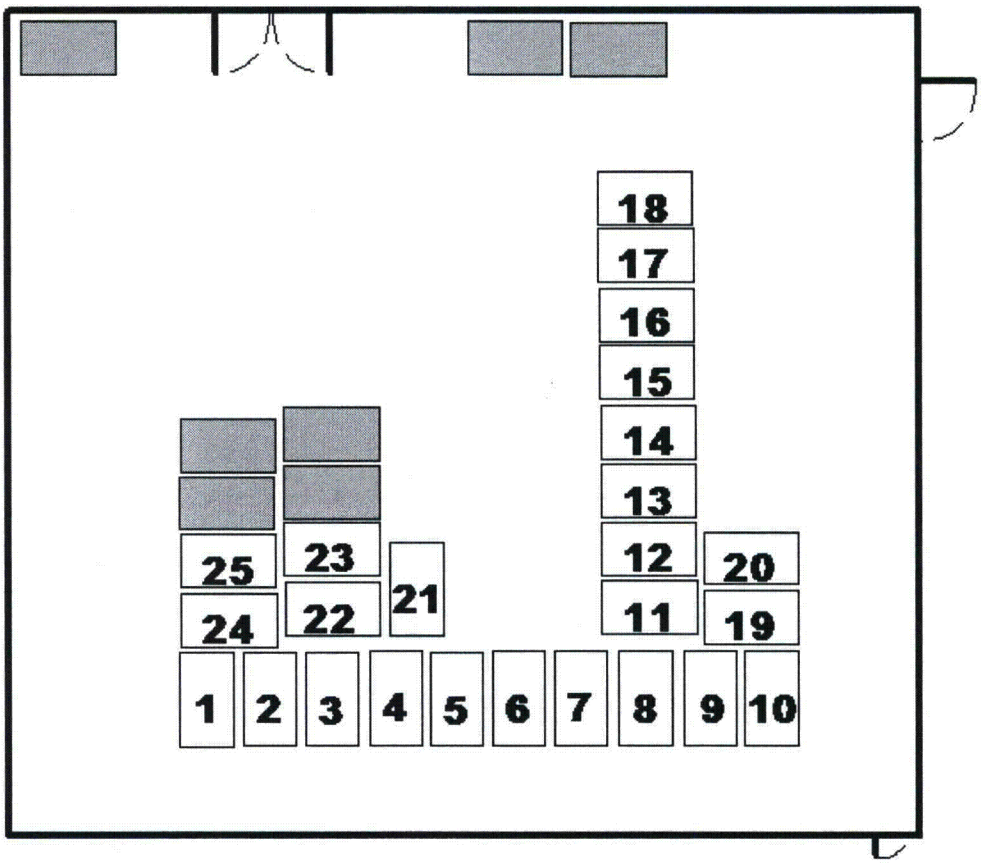
APPENDIX F

CONTROL BUILDING
(Elevation 272)



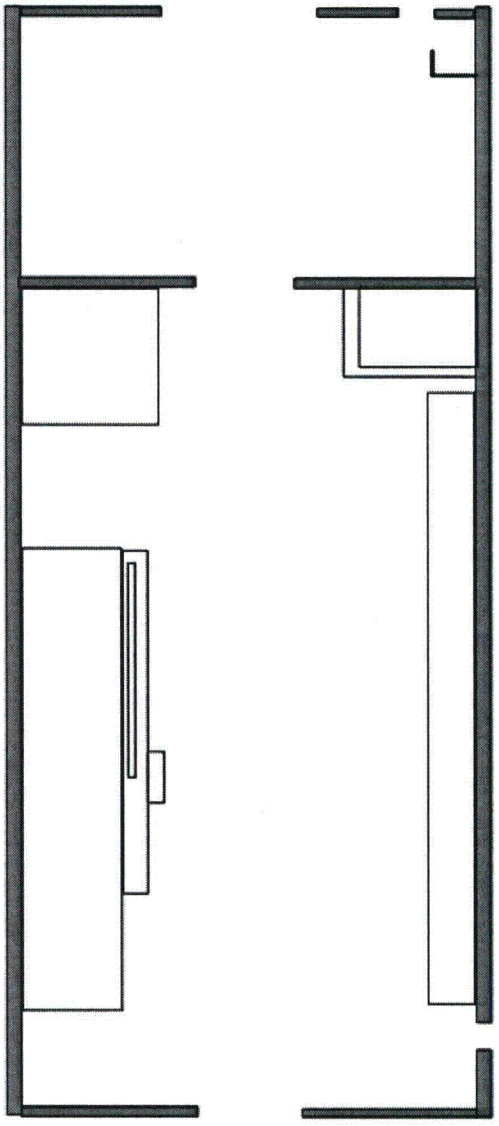
APPENDIX F

LOW-LEVEL RADIOACTIVE WASTE AREA



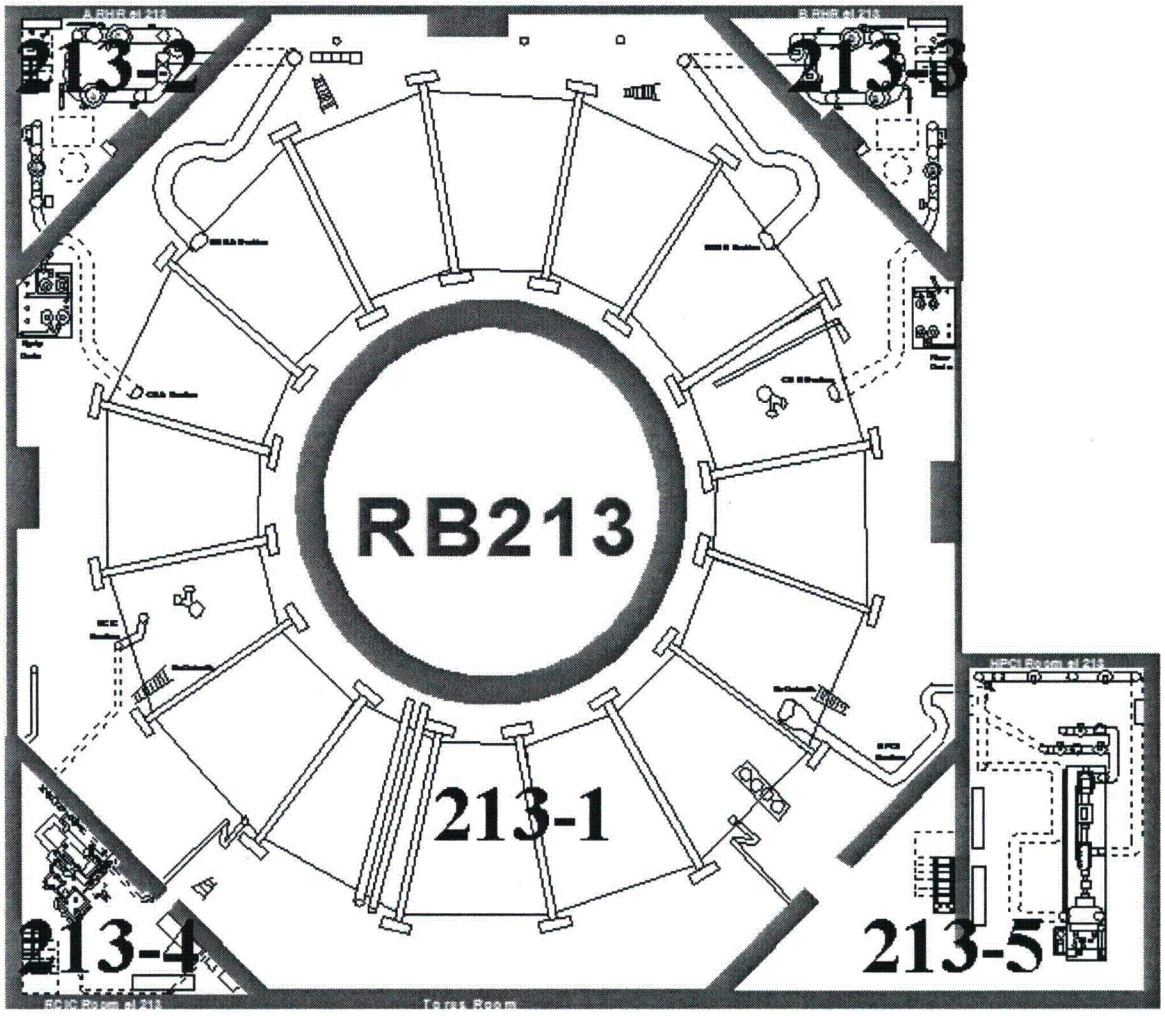
APPENDIX F

NORTH WAREHOUSE



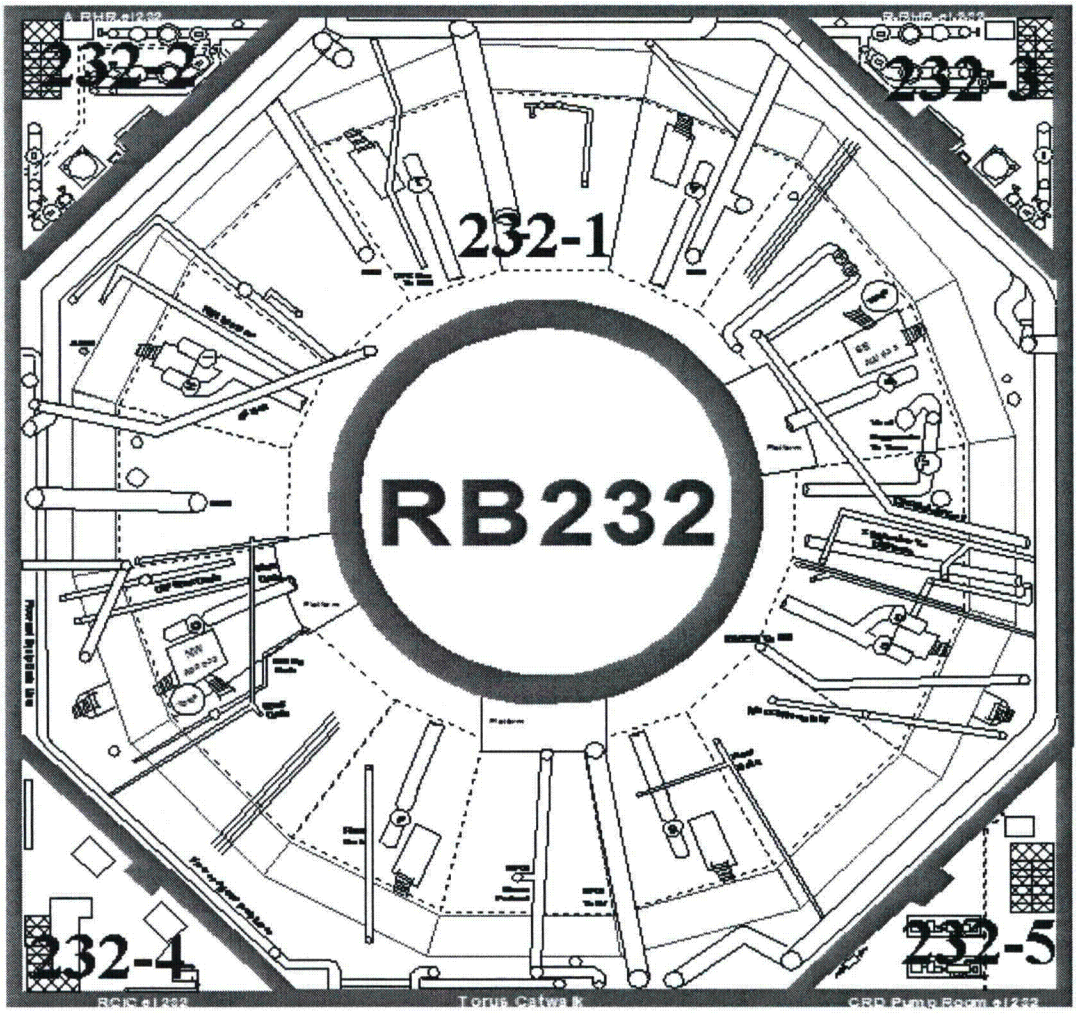
APPENDIX F

REACTOR BUILDING
(Elevation 213)



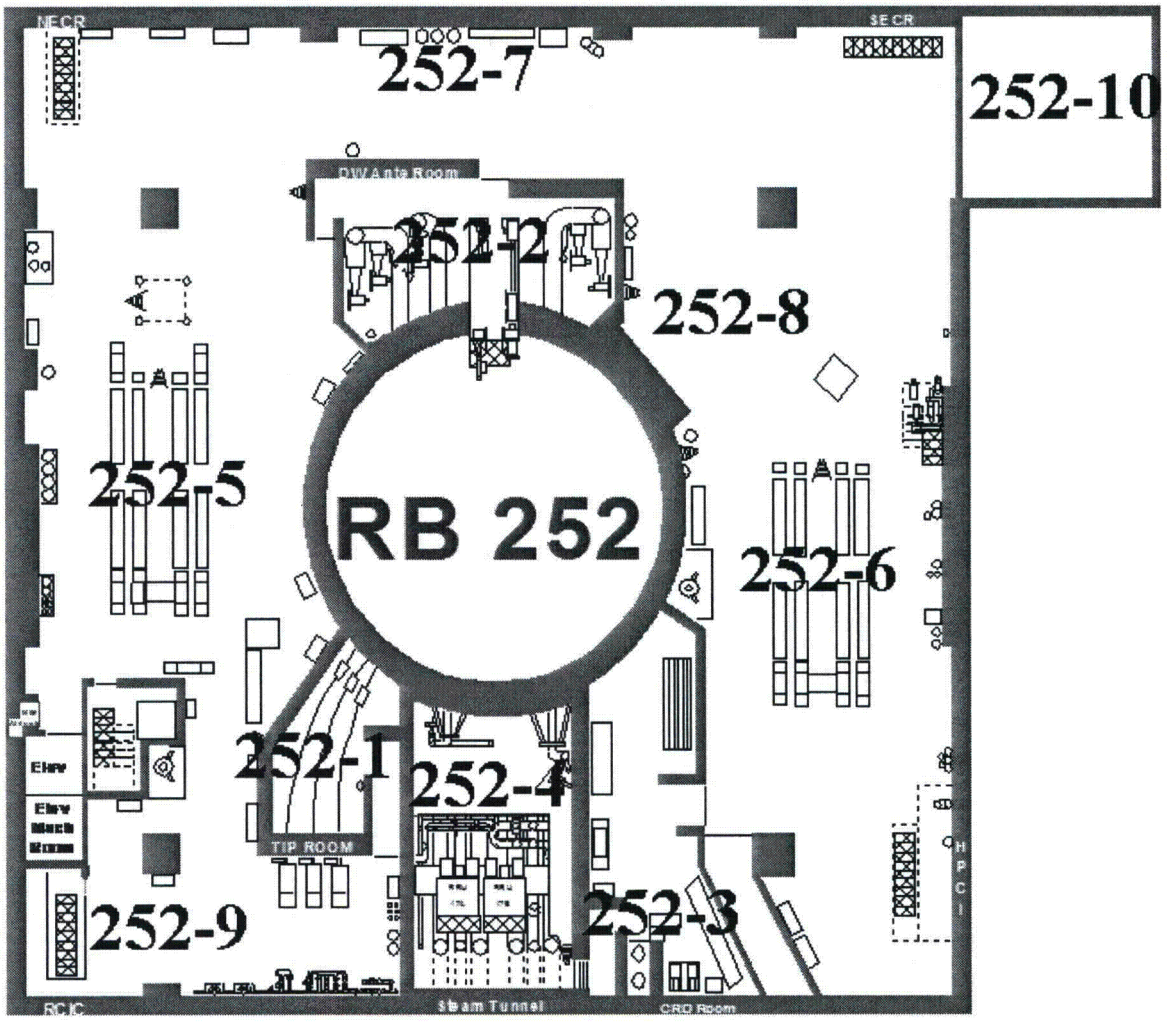
APPENDIX F

REACTOR BUILDING
(Elevation 232)



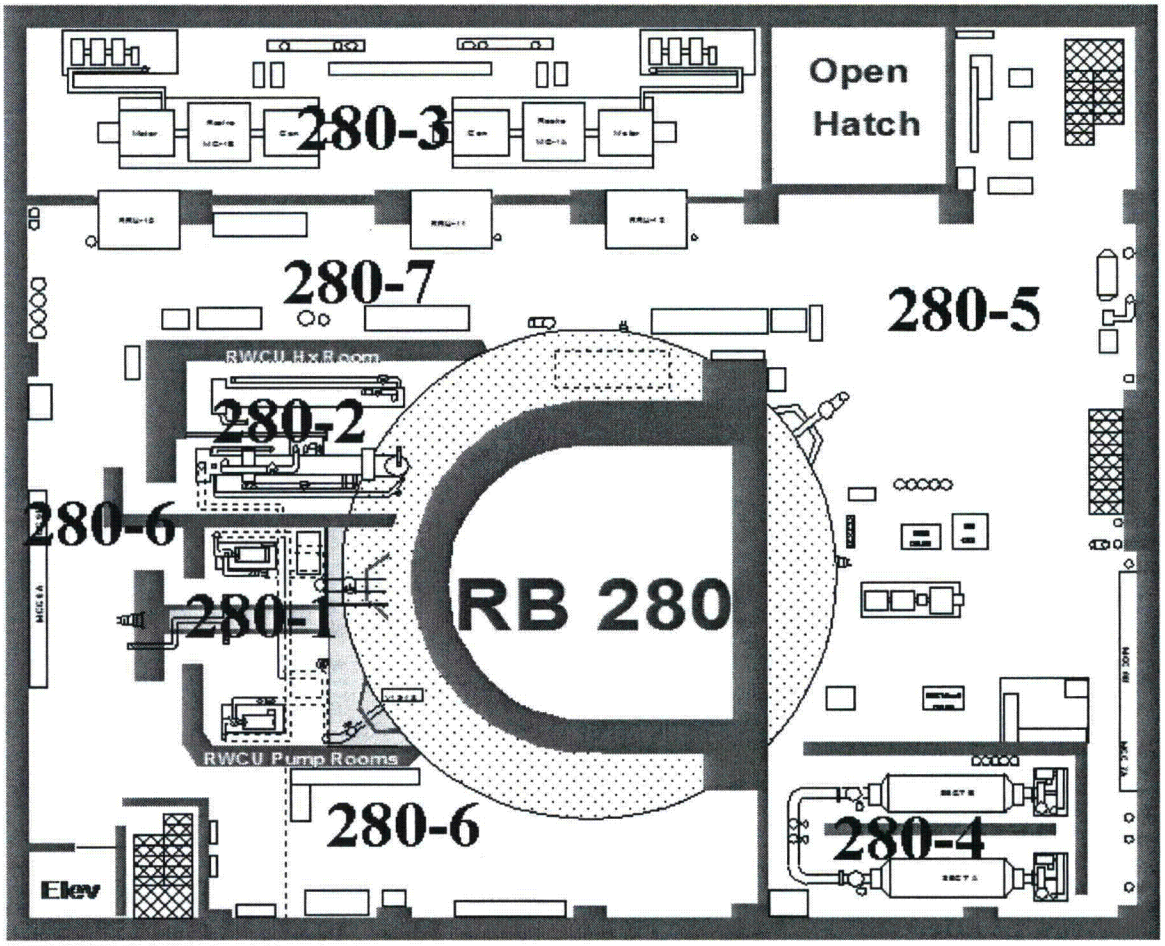
APPENDIX F

REACTOR BUILDING
(Elevation 252)



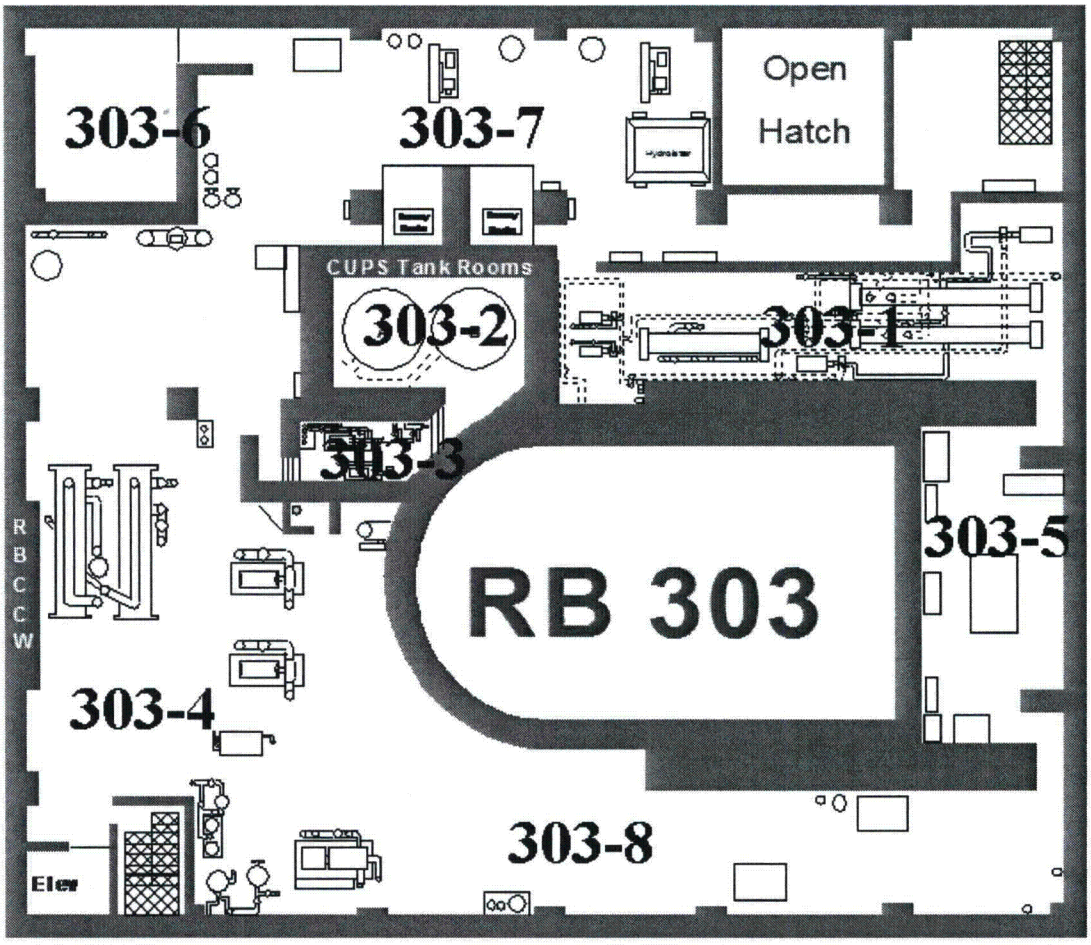
APPENDIX F

REACTOR BUILDING
(Elevation 280)



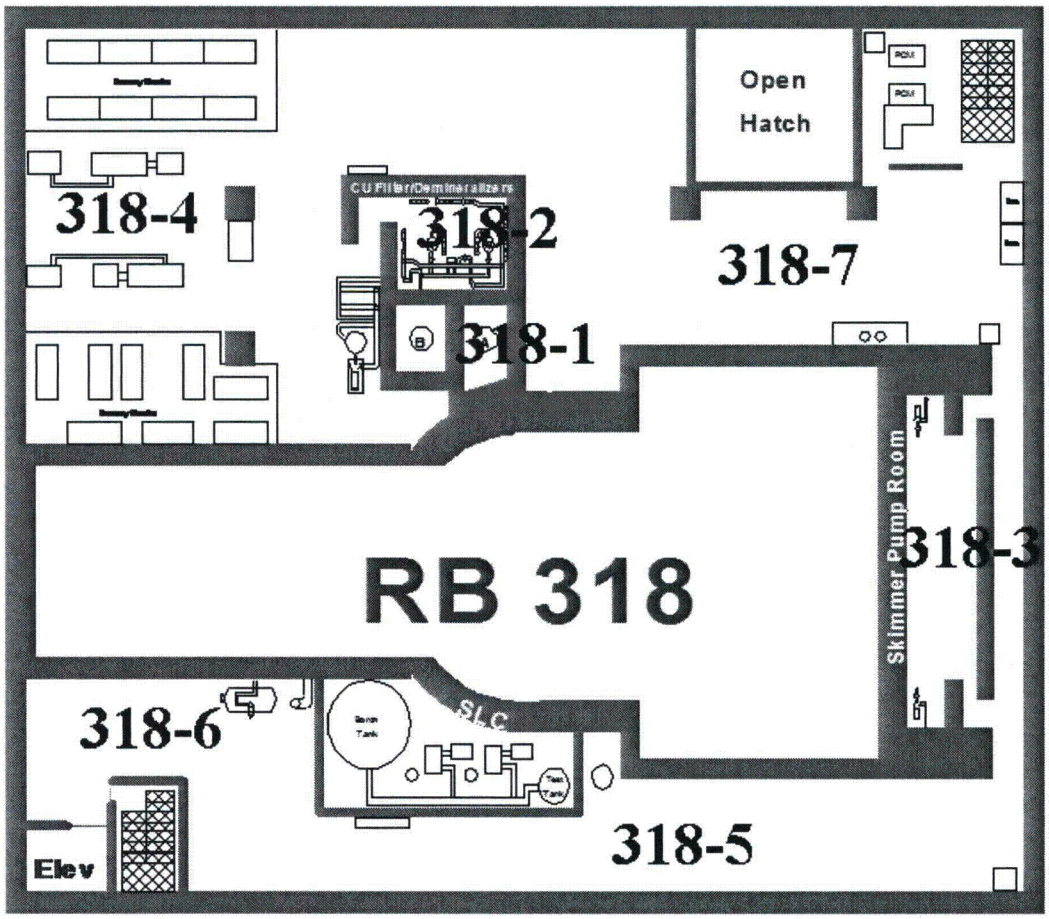
APPENDIX F

REACTOR BUILDING
(Elevation 303)



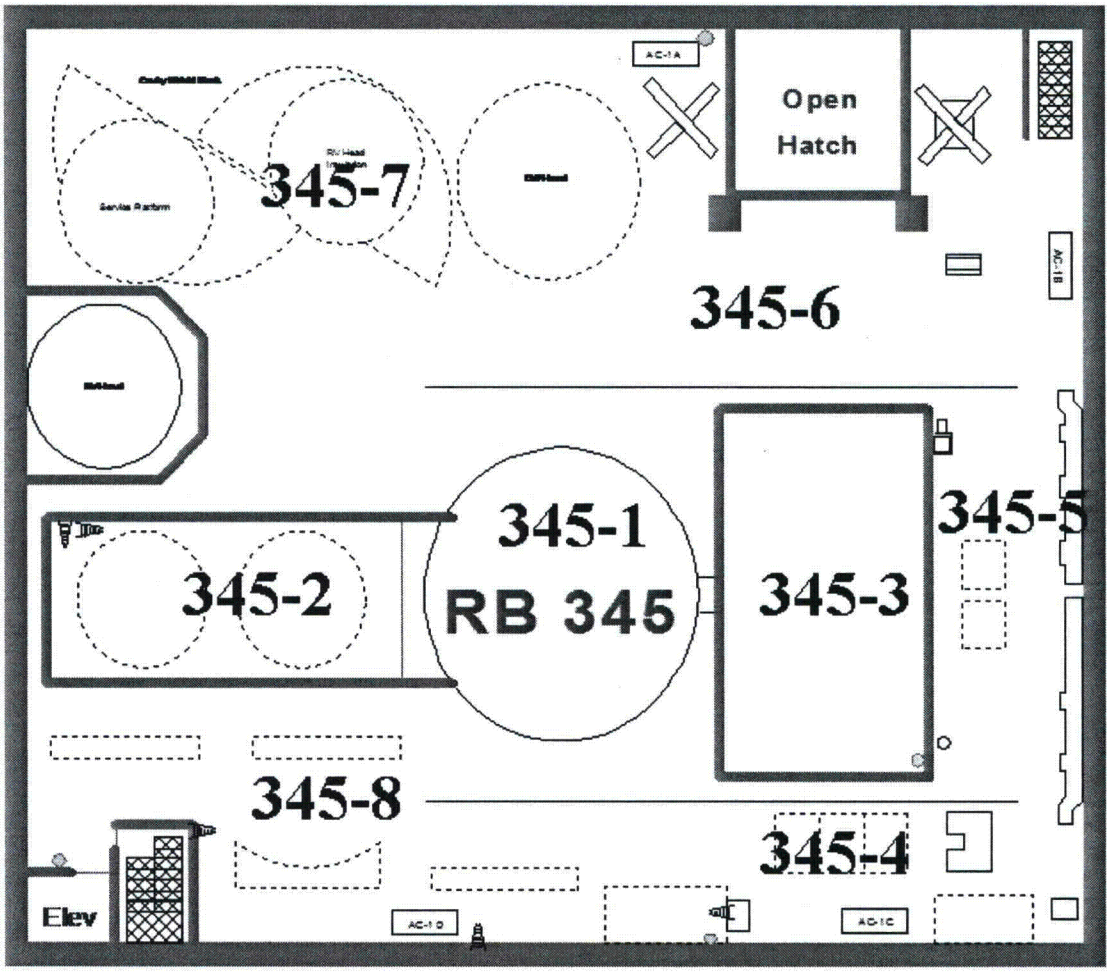
APPENDIX F

REACTOR BUILDING
(Elevation 318)



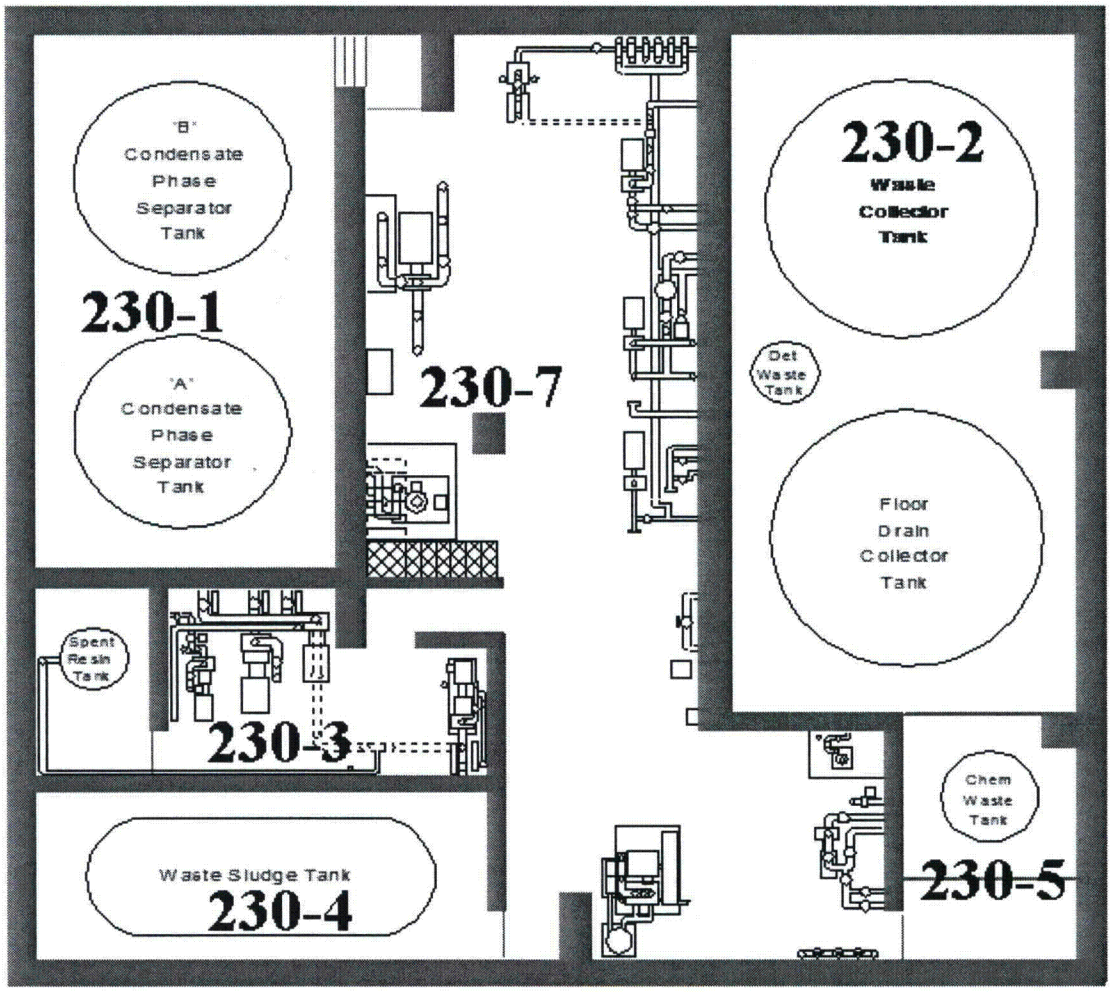
APPENDIX F

REACTOR BUILDING
(Elevation 345)



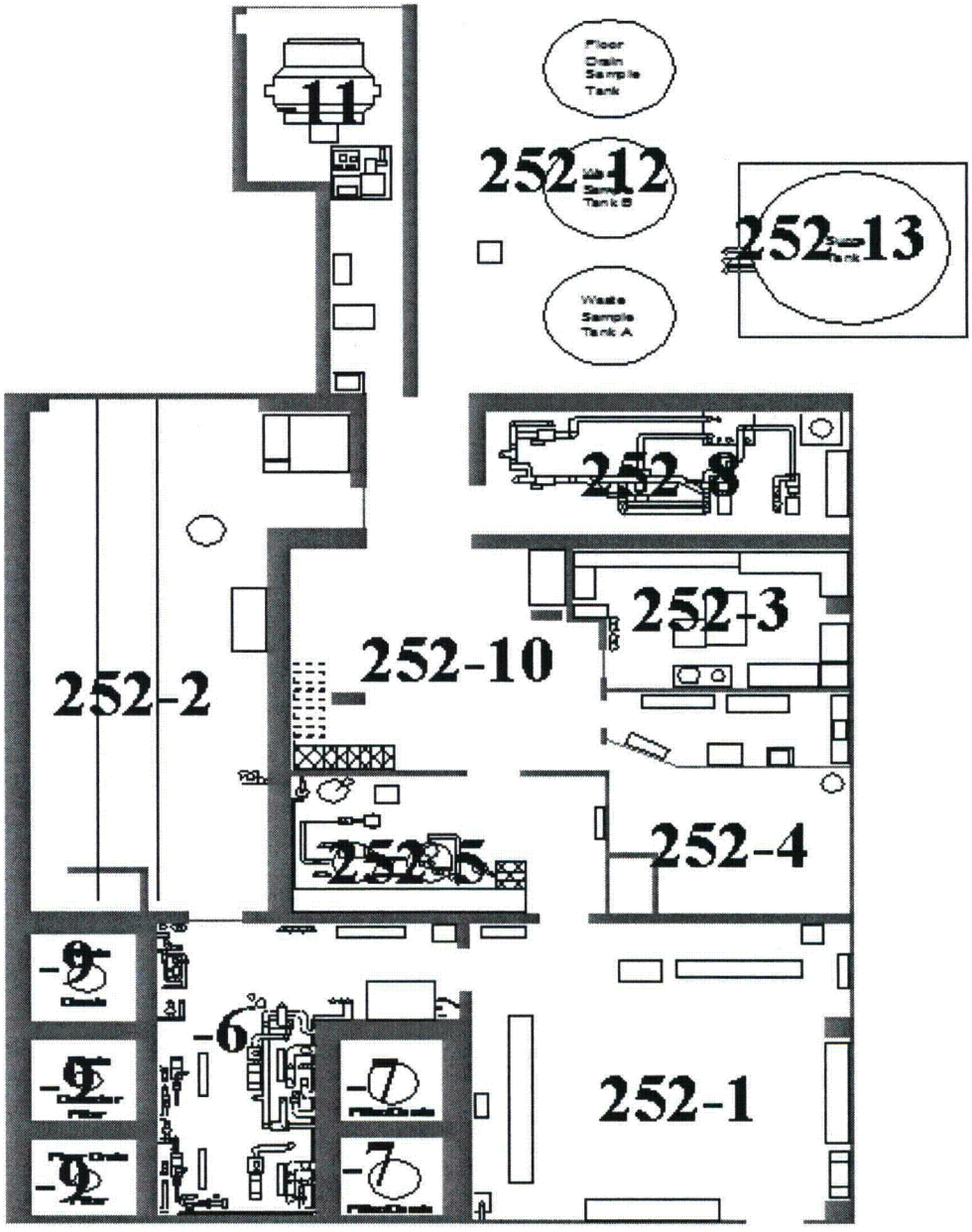
APPENDIX F

RADIOLOGICAL WASTE BUILDING
(Elevation 230)



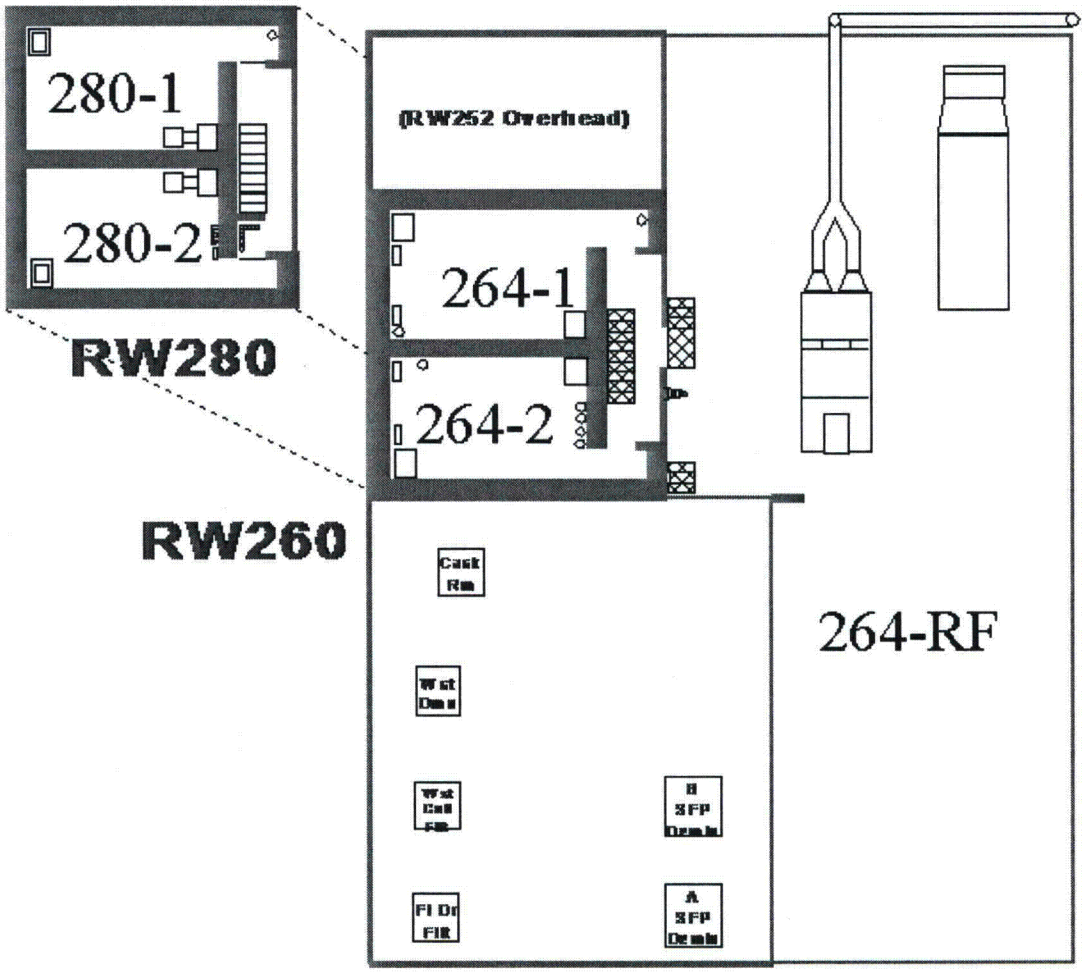
APPENDIX F

RADIOLOGICAL WASTE BUILDING
(Elevation 252)



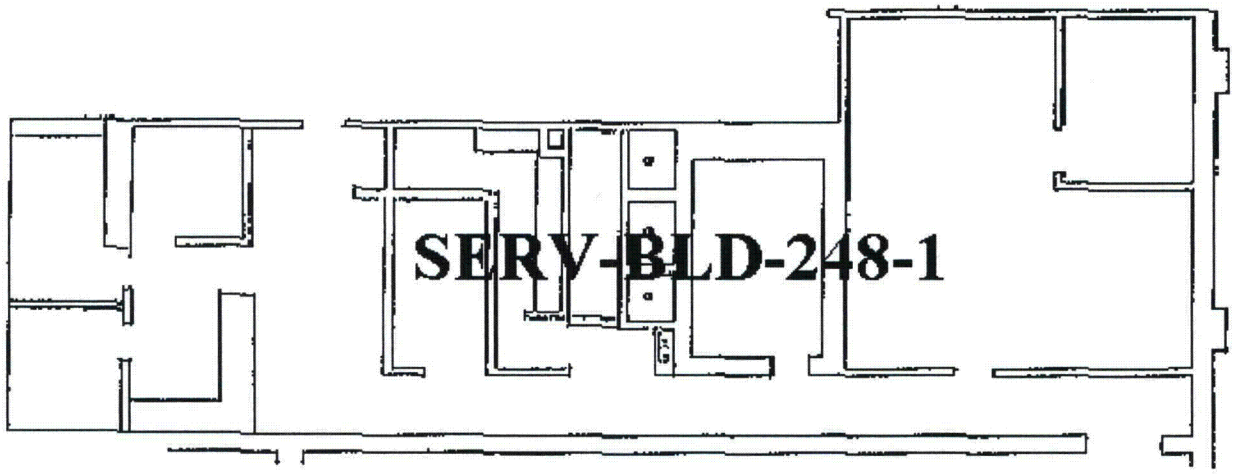
APPENDIX F

RADIOLOGICAL WASTE BUILDING
(Elevation 264)



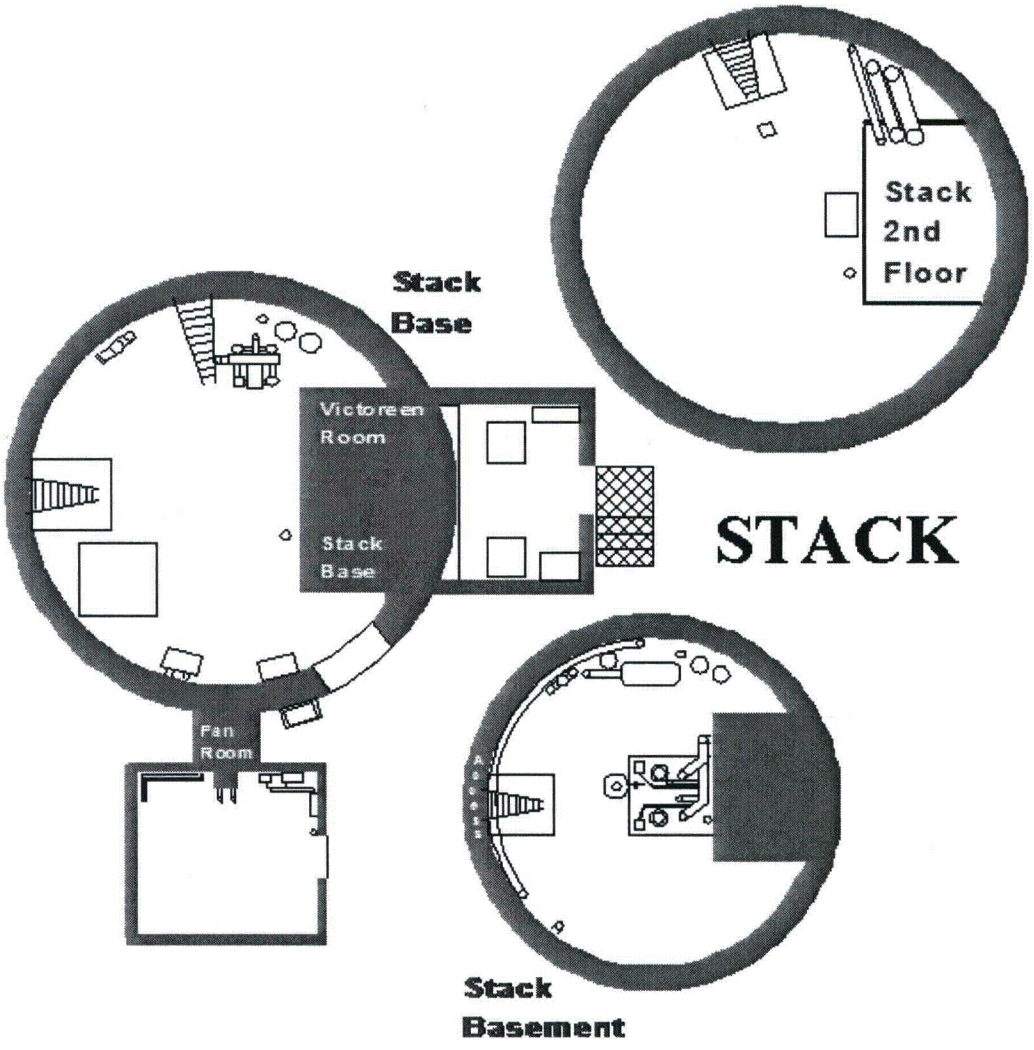
APPENDIX F

SERVICE BUILDING
(Elevation 248)



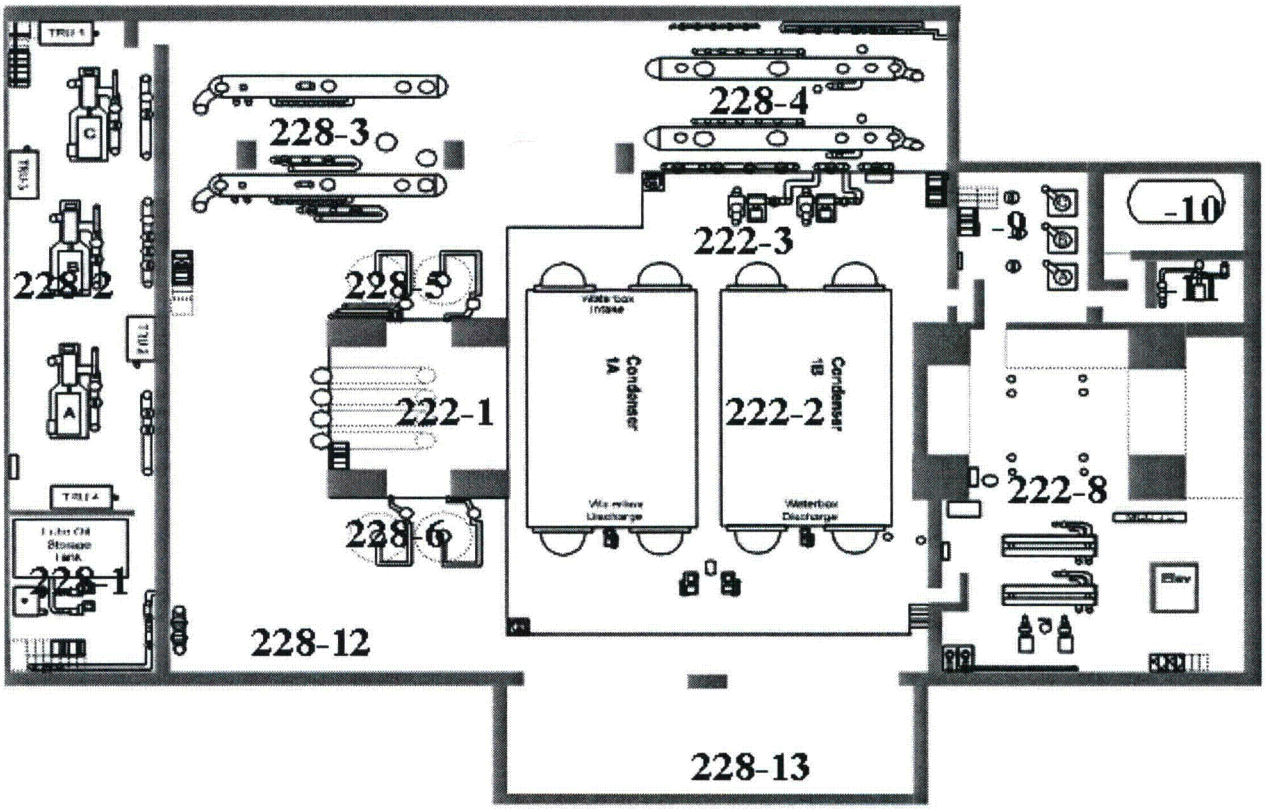
APPENDIX F

STACK



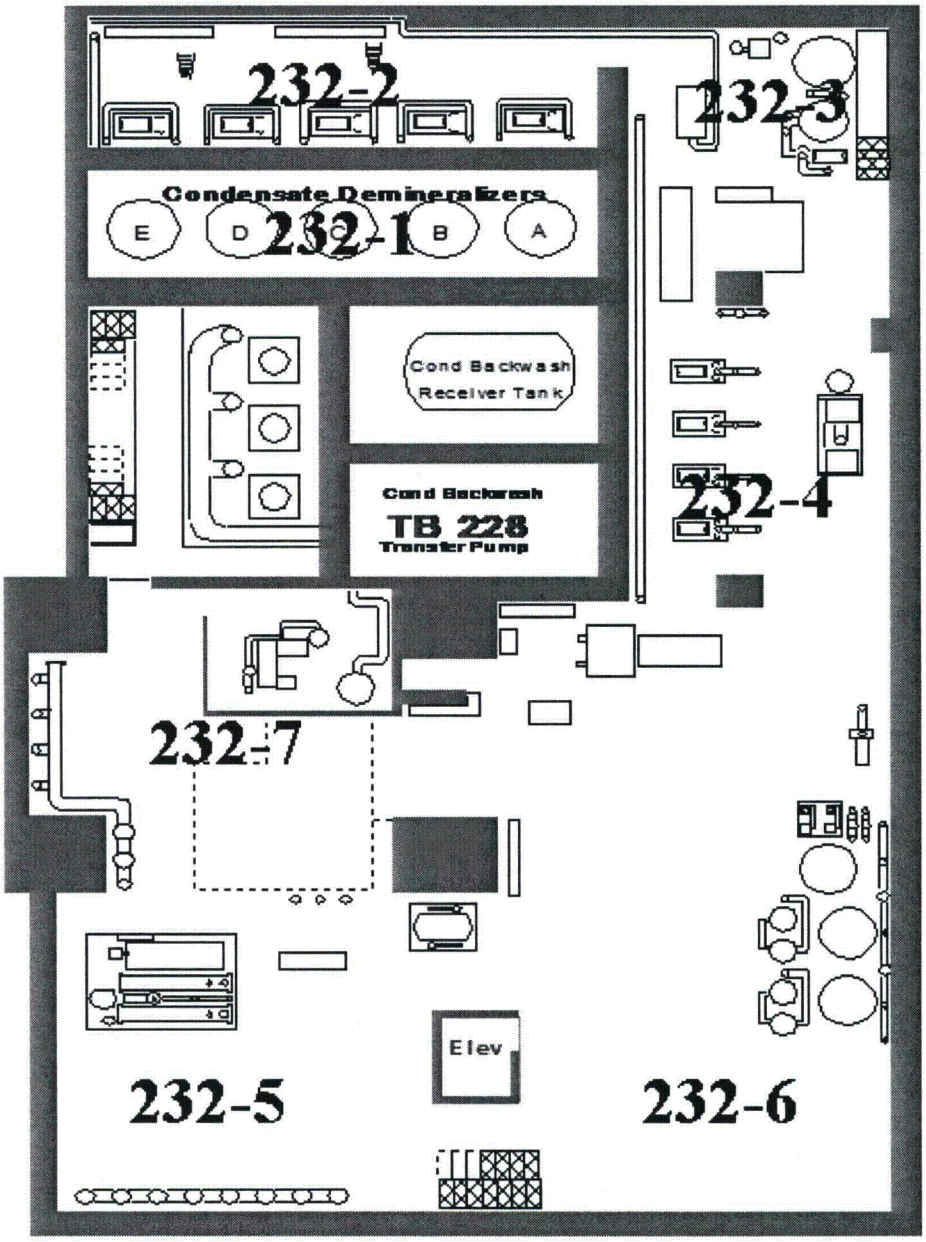
APPENDIX F

TURBINE BUILDING
(Elevations 228 and 222)



APPENDIX F

TURBINE BUILDING
(Elevation 232)



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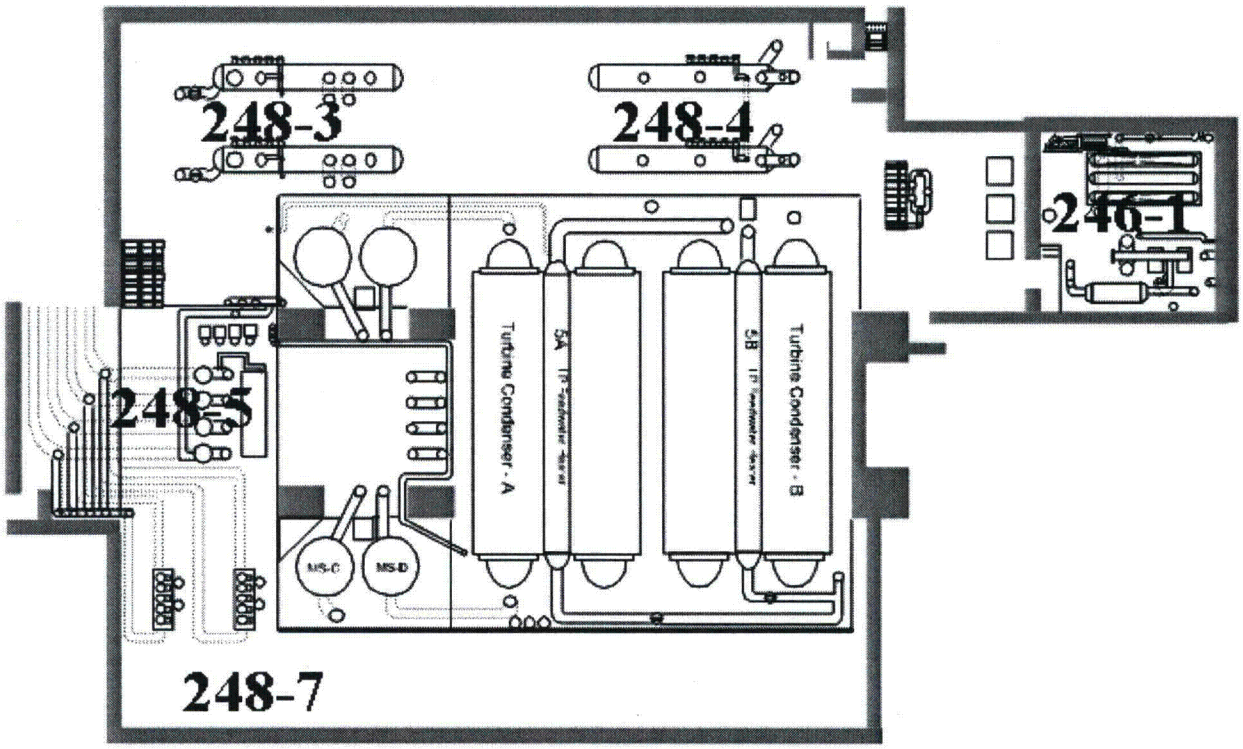
TURBINE BUILDING
(Elevation 248)



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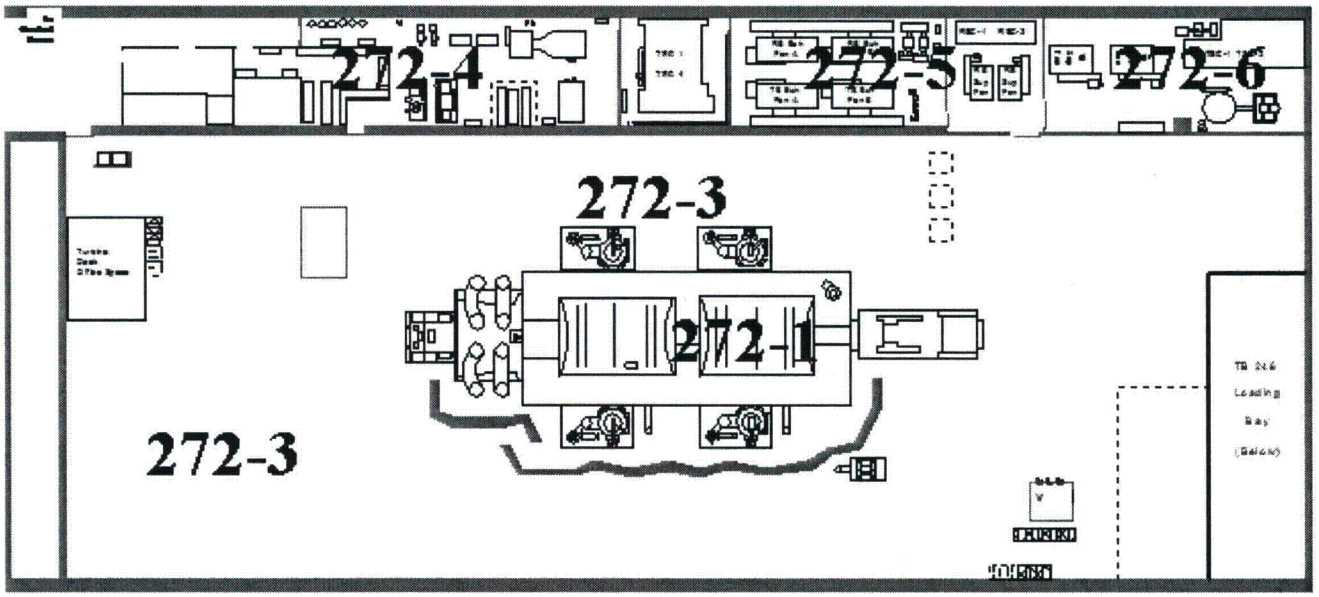
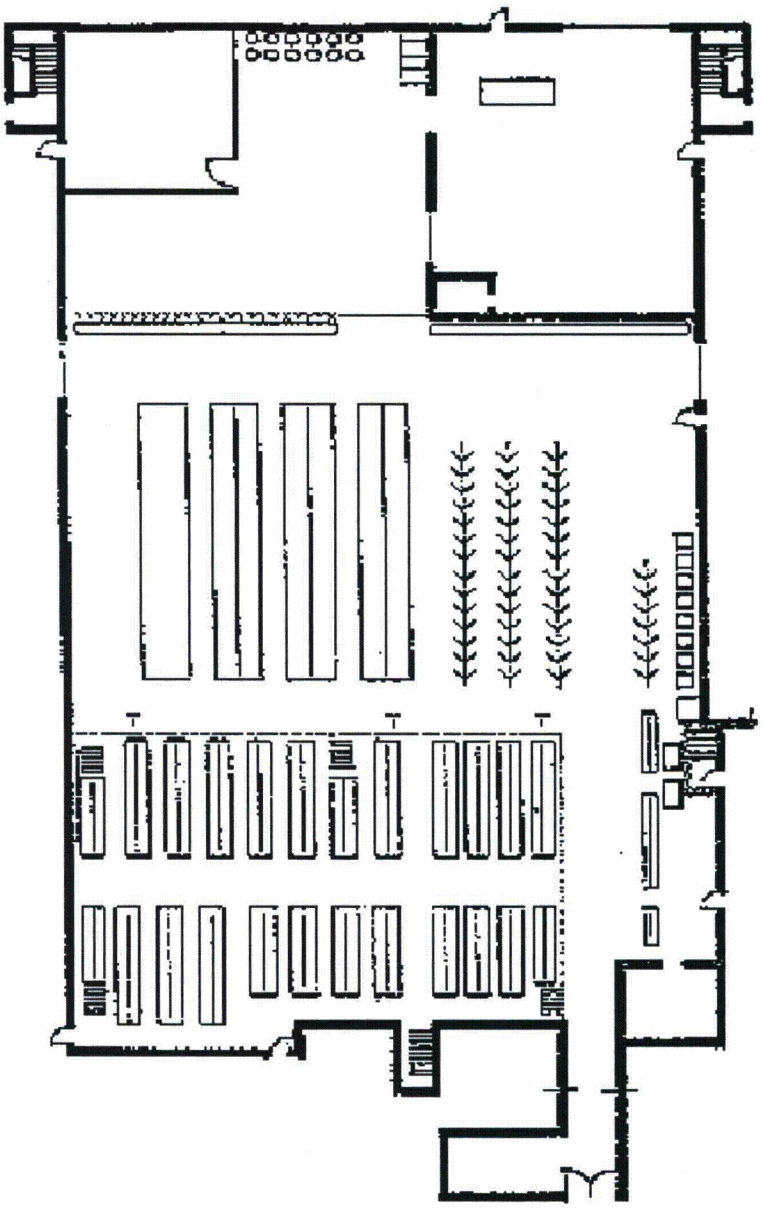
TURBINE BUILDING
(Elevation 272)



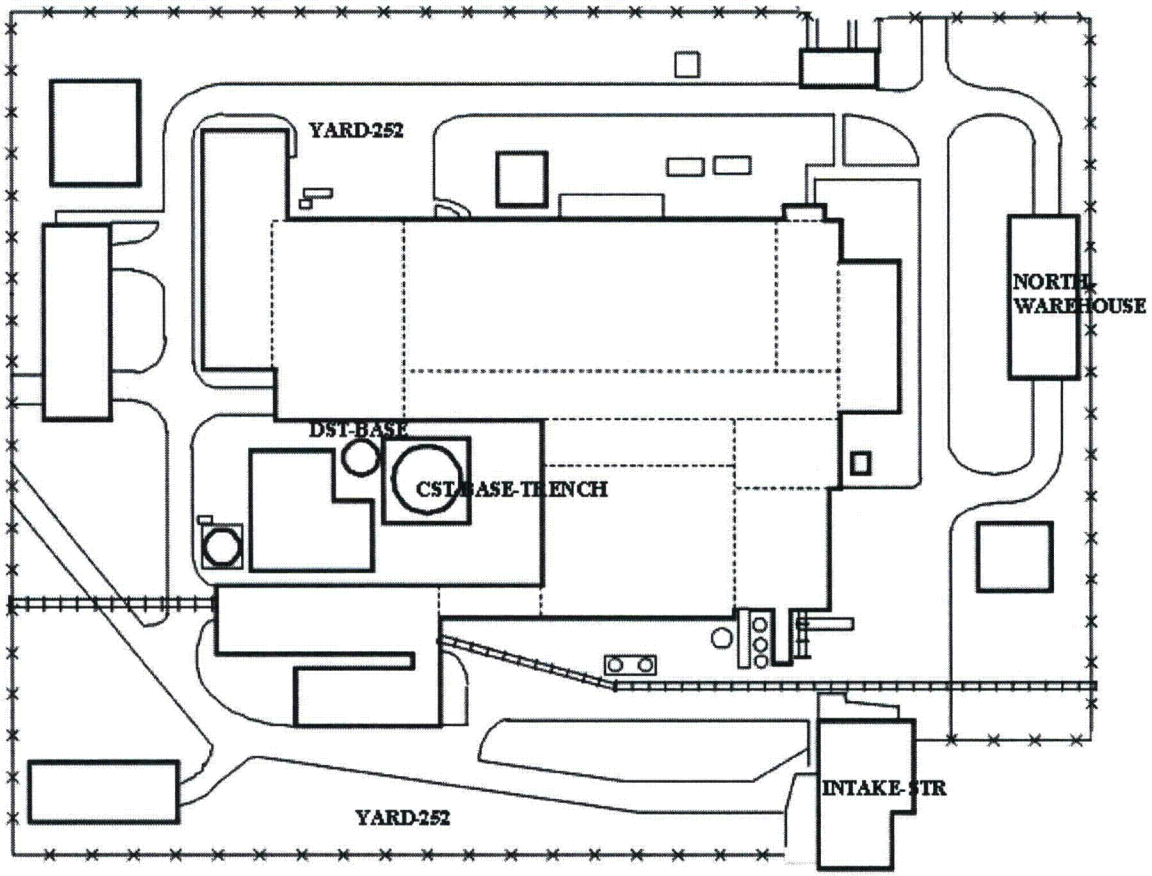
APPENDIX F

NEW WAREHOUSE



APPENDIX F

YARD AREA



Attachment 2: Settlement Agreement between ENO, ENVY and State of Vermont

SETTLEMENT AGREEMENT

This Settlement Agreement ("Agreement") is entered into by and between Entergy Nuclear Vermont Yankee, LLC ("EVY"), Entergy Nuclear Operations, Inc. ("ENO," and together with EVY, "Entergy VY"), the Vermont Public Service Department ("PSD"), the Vermont Agency of Natural Resources ("ANR"), and the Vermont Department of Health ("VDH") (collectively, "the Parties").

A. The Vermont Yankee Nuclear Power Station ("VY Station") is a nuclear power plant located in Vernon, Vermont, that is owned by EVY and operated by ENO.

B. Entergy VY operated the VY Station until March 21, 2012, pursuant to a license from the Nuclear Regulatory Commission ("NRC") and a Certificate of Public Good ("CPG") from the Vermont Public Service Board ("Board"). Before the expiration of those approvals, the NRC renewed the license of Entergy VY for a further 20-year term, and EVY and ENO petitioned the Board for a new CPG for a further 20-year term. The Parties disagree whether EVY had authority from the State of Vermont to operate the VY Station after March 21, 2012. The Parties also disagree about much of the evidence presented to the Board in connection with Entergy VY's petition for a further 20-year term, including, among other things, the degree, extent, and duration of economic dislocation that residents of Vermont would experience as a result of the shutdown of the VY Station.

C. Until August 27, 2013, Entergy VY was seeking from the Board a CPG that would permit Entergy VY to operate the VY Station through 2032. On August 27, 2013, Entergy VY announced that it will cease operating the VY Station at the end of the current operating cycle. On August 27, 2013, Entergy VY filed a Second Amended Petition with the Board, seeking a CPG from the Board to continue operations to generate electricity only through December 31, 2014. On September 23, 2013, ENO formally notified the NRC that the VY Station would permanently cease power operations effective at the end of the current operating cycle, which is expected to be no later than December 31, 2014.

D. Entergy VY and the State of Vermont ("State") are engaged in and/or contemplating other actual and potential litigation relating to the VY Station, including: (1) potential petitions for review by the United States Supreme Court of the August 14, 2013, decision of the United States Court of Appeals for the Second Circuit in *Entergy v. Shumlin* (2d Cir. Docket Nos. 12-707 and 12-791); (2) Entergy VY's motion for attorneys' fees in *Entergy v. Shumlin* (D. Vt. Docket No. 1:11-cv-99); (3) Public Service Board Docket No. 7600; (4) potential petitions for review of the December 10, 2013, decision of the United States Court of Appeals for the Second Circuit in Entergy VY's challenge to Vermont's generation tax enacted in 2012 (2d Cir. Docket No. 12-4659); and (5) Entergy VY's appeal to the Supreme Court of Vermont from the Board's decisions in Public Service Board Docket No. 7440 (Sup. Ct. Vt. Docket No. 2013-043). In accordance with this Agreement, Entergy VY and the State of Vermont (through its appropriate agencies and departments) are entering into other agreements and/or filing pleadings that will resolve the claims between the Parties in items (1) - (5) above, with each Party to bear its own costs, including attorneys' fees, with the exception of any fees or costs that are covered by statutory bill-back or other state billing authority.

E. It is in the best interests of Entergy VY and the State that post-operation matters concerning the VY Station be addressed as constructively and transparently as possible, and be guided by the following principles: (1) the VY Station should be permitted to operate through the end of the current operating cycle to allow a reasonable transition and adjustment period for plant employees and other affected stakeholders; (2) to facilitate the decommissioning and overall closure of the VY Station, spent nuclear fuel ("SNF") should be moved from the spent fuel pool to dry cask storage in a timely manner; (3) to facilitate the prompt economic redevelopment of the VY Station site, the decommissioning process should occur without unreasonable delay, as soon as there are sufficient funds in the Nuclear Decommissioning Trust ("NDT") for the VY Station; (4) it is in the best interests of the State for the VY Station site to be available for prompt economic redevelopment through the expeditious progress and completion of decommissioning and, as provided for in prior agreements, site restoration; and (5) a specific fund should be established related to Entergy VY's site restoration obligations in connection with the VY Station as agreed to herein.

In consideration of all of the foregoing, the obligations hereafter set forth and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Parties agree as follows.

1. On or before December 31, 2014, Entergy VY shall cease all nuclear power generating operations at the VY Station, except for the operation of emergency back-up generators as needed, including periodic testing of same. Notwithstanding the foregoing, in the event the current operating cycle is affected by unexpected operational events that are beyond Entergy VY's reasonable control (whether external to the plant or otherwise), Entergy VY may seek permission to operate the VY Station for a limited period of time after December 31, 2014. Entergy VY will not operate the VY Station beyond December 31, 2014, unless: (1) PSD supports Entergy VY's request to extend operation, and (2) Entergy VY seeks and obtains approval from both the NRC and the Board by December 31, 2014, for such limited continued operation. It shall not be sufficient that Entergy VY commenced the steps needed to obtain NRC and Board approval before December 31, 2014; Entergy shall not operate in 2015 unless, during 2014, it receives every approval necessary for those limited operations. Entergy VY assumes the risk that either the NRC or the Board or both may not approve Entergy VY's request in 2014. In the event that Entergy VY obtains the Board and NRC approvals to operate beyond December 31, 2014, under no circumstance, including pursuant to 3 V.S.A. § 814(b), shall Entergy VY refuel or in any way supplement or extend the normal life of the fuel at the VY Station for the current operating cycle, or conduct nuclear power generating operations at the VY Station after February 28, 2015.

2. Entergy VY and PSD shall jointly recommend to and shall support before the Board the issuance of CPG(s) effective as of March 21, 2012, for: (1) operation of the VY Station through December 31, 2014, and (2) storage of SNF derived from such operation, as requested by the second amended petition filed by Entergy VY in Board Docket No. 7862 on August 27, 2013. Entergy VY and PSD will submit a Memorandum of Understanding ("MOU") to the Board, in the form attached as Exhibit A, in connection with those filings.

   In the event that by March 31, 2014, the Board has not granted Entergy VY a CPG that: (i) approves operation of the VY Station until December 31, 2014, and the storage of SNF derived from such operation; and (ii) approves the Parties' jointly filed MOU substantially in its entirety and contains conditions that do not materially alter, add to, or reject what is

provided for by the MOU, each Party agrees that this Agreement may terminate, if such Party so determines in its sole discretion and provides written notice within ten (10) days of Board issuance of its order, whereupon each Party shall be placed in the position that it occupied before entering into this Agreement, except that the obligations of paragraph 3(a) through (c) and the actions taken thereunder are final and shall not be affected by any termination.

3. Contemporaneous with this Agreement and subject to the provision for costs and fees in paragraph 24 of this Agreement, Entergy VY and the State or the PSD shall take the following steps or refrain from taking the steps noted (as appropriate) with respect to the litigation described below, which they are engaged in and/or contemplating:

   a. Entergy VY and the State shall not file petitions for writs of *certiorari* for review by the United States Supreme Court of the August 14, 2013, decision of the United States Court of Appeals for the Second Circuit in *Entergy v. Shumlin* (2d Cir. Docket Nos. 12-707 and 12-791);

   b. Entergy VY shall move to dismiss, with prejudice, its claim for attorneys' fees in *Entergy v. Shumlin* (D. Vt. Docket No. 1:11-cv-99);

   c. Entergy VY shall not file petitions for rehearing or writ of *certiorari* for review by the United States Supreme Court of the December 10, 2013, decision of the United States Court of Appeals for the Second Circuit (2d Cir. Docket No. 12-4659) in connection with the generation tax, and shall not challenge the generating tax at issue in that case in any other proceeding or tribunal; and

   d. Within thirty (30) days of this Agreement or receipt, as appropriate, Entergy VY shall pay all outstanding and all properly submitted future bill-back invoices issued by the State.

   Upon the Board's issuance of a CPG as described in paragraph 2:

   e. Entergy VY shall withdraw its appeal to the Supreme Court of Vermont from the Board's decisions in Public Service Board Docket No. 7440 (Sup. Ct. Vt. Docket No. 2013-043); and

   f. Entergy VY and PSD shall jointly recommend that the Board close Docket 7600.

4. Entergy VY shall conduct all activities in Vermont, including at the VY Station site, in accordance with federal and state laws, including VDH's Radiological Health Rule.

5. Entergy VY shall operate the VY Station in accordance with its existing National Pollutant Discharge Elimination System ("NPDES") permit. Entergy VY and ANR agree to continue to pursue issues related to Entergy VY's thermal discharge through ANR's NPDES permitting process, in accordance with state and federal law.

6. By December 31, 2014, Entergy VY shall complete and shall provide to PSD, ANR, and VDH a site assessment study of the costs and tasks of radiological decommissioning, SNF management, and site restoration of the VY Station. One scenario evaluated in that site assessment study shall be proceeding to prompt decontamination and dismantling (DECON),

rather than putting the VY Station into a storage and monitoring phase prior to decontamination and dismantling (SAFSTOR), as those terms are defined by the NRC. The site assessment study shall include, without limitation, an analysis of steps required to move all SNF to dry fuel storage and to close the spent fuel pool. The site assessment study also shall include, without limitation, a full assessment of non-radiological conditions at the VY Station site. In connection with the site assessment study, Entergy VY shall conduct a good faith search for, and provide to, ANR and VDH copies of all commercial general liability insurance policies in its possession, along with all pollution legal liability policies and all other insurance policies in its possession that may provide coverage for investigation and cleanup of releases of pollutants at or from the VY Station site from the date construction of the VY Station began, to the present. Once the site assessment study is completed, and before any submission to the NRC of the site assessment study, any site-specific estimate, or any Post-Shutdown Decommissioning Activities Report ("PSDAR"), Entergy VY shall review the results of the study with PSD, ANR, and VDH, and shall consider any comments provided by those parties for inclusion in the PSDAR that Entergy VY, as the NRC licensee, is responsible for submitting to the NRC, without limitation of the State's rights to otherwise comment or participate in the NRC process. Entergy VY shall file its PSDAR for the VY Station with the NRC no sooner than sixty (60) days after completing the site assessment study described in this paragraph. Any PSDAR Entergy VY submits for the VY Station will include this Agreement and reflect Entergy VY's commitments to the State in that report.

7. Entergy VY shall make appropriate filings with the NRC to obtain authority to begin radiological decommissioning within one hundred twenty (120) days after it has made a reasonable determination that the funds in the NDT are adequate to complete decommissioning and remaining SNF management activities that the federal government has not yet agreed (or been ordered) to reimburse. Once Entergy VY receives either NRC approval of, or non-opposition to, its filings, Entergy VY shall promptly commence, pursue, and complete as soon as reasonably possible radiological decontamination and dismantling activities. Entergy VY shall provide to the PSD such additional explanatory or supporting information as the PSD reasonably may request relating to its evaluation of the adequacy of the NDT.

8. As used in this Agreement, the period of "site restoration" applies only to the period of time after radiological decommissioning has been completed to the satisfaction of the NRC. EVY expressly acknowledges the State's jurisdiction over site restoration. Following completion of the site assessment study specified in paragraph 6, EVY, PSD, ANR, and VDH shall work in good faith to determine in a timely and cost-effective manner overall site restoration standards necessary to support use of the property without limitation (excepting any independent spent fuel storage installation ("ISFSI") and any perimeter related to it), including that EVY shall not employ rubblization at the VY Station site (*i.e.*, demolition of an above-grade decontaminated concrete structure into rubble that is buried on site) and addressing removal of structures and radiological exposure levels. Nothing in this Agreement is intended to limit the authority of state agencies to require standards for site restoration commensurate with the standards most protective to the environment as employed at similar sites nationwide or required by law.

9. EVY shall commence site restoration in accordance with the overall site restoration standards established pursuant to paragraph 8 promptly after completing radiological decommissioning. The standards and timing for site restoration may be adjusted by agreement of EVY, PSD, ANR, and/or VDH if the property or any sub-unit of the property is to be used solely for

industrial, commercial, or other similar uses that do not require immediate or full completion of "site restoration" to accommodate such use of the property.

10. Upon the Board's issuance of a CPG as described in paragraph 2, EVY shall establish a separate trust fund specifically and solely dedicated to funding site restoration at the VY Station ("Site Restoration Fund"), as described in paragraphs 8 and 9. EVY shall designate the State of Vermont as a material beneficiary to the Site Restoration Fund until site restoration is completed in accordance with the overall site restoration standards established pursuant to paragraph 8, and shall provide to the State within sixty (60) days of the Board's issuance of a CPG draft trust terms and provisions. Within thirty (30) days of receipt of the draft trust terms and provisions, the State shall provide comments to EVY regarding the same, which EVY shall accept and incorporate so long as commercially reasonable. Provided that the Board issues the CPG as described in paragraph 2, EVY will make initial deposits, in the form of cash or other equivalent financial instrument (including a secured note) in a form acceptable to the PSD (which approval shall not be unreasonably withheld) and the Board, into the Site Restoration Fund as follows:

    a) $10 million within thirty (30) days of the Board's issuance of a CPG as described in paragraph 2;

    b) $5 million by December 31, 2015;

    c) $5 million by December 31, 2016;

    d) $5 million by December 31, 2017.

    Those initial deposits into the Site Restoration Fund shall not be drawn from the NDT or affect any financial assurance or guarantee in existence with respect to the VY Station as of the date of this Agreement. EVY shall also provide financial assurance, in the form of a parent guarantee from Entergy Corporation in the amount of $20 million for the Site Restoration Fund, provided, however, that such $20 million guarantee shall be established only after the existing parent guarantee from Entergy Corporation, dated January 26, 2010, and related to paragraph 13 of the Memorandum of Understanding in Docket No. 6545 is terminated. The $20 million parent guarantee can be eliminated if the balance in the Site Restoration Fund exceeds $60 million (either as a result of additional deposits or fund performance).

11. Except as otherwise provided in this Agreement, the Parties reserve all rights regarding further proceedings related to the VY Station, including without limitation its decommissioning and the proper use of the NDT and to seek or contest expenditures from that fund with the NRC and in any other appropriate forum. No Party's exercise of such rights shall affect the terms of this Agreement or release or reduce the obligations of the Parties hereunder. Notwithstanding the foregoing:

    (a) In the event that funds from the NDT are expended for SNF management activities, Entergy VY shall diligently pursue all available reimbursement of such expenses, including from the federal government, and Entergy VY shall deposit all such proceeds into either: (i) the NDT, or (ii) a separate trust (if allowed under existing federal and state law, and other agreements), provided that the funds in any such trust are: (1) dedicated to meeting the liabilities of EVY, including

decommissioning, SNF management, and site restoration activities at the VY Station; (2) considered original transferred trust funds (not as new contributions from Entergy VY) subject to calculation and distribution of any Excess Funds under paragraph 3 of the Memorandum of Understanding in Docket No. 6545, as amended by the Board's Orders in that docket; and (3) considered part of the NDT for purposes of determining whether "the funds in the NDT are adequate" as required by paragraph 7 of this Agreement, and included in EVY's submission to the NRC and considered part of sufficient funds under 10 C.F.R. Part 50 for purposes of commencing decommissioning. Any such separate trust shall be in a form that is commercially consistent with trusts of that type, provided that Entergy VY shall provide the trust document(s) to the PSD at least sixty (60) days before the trust is formed and shall provide notice to the PSD at least sixty (60) days before any material change is made to the trust document(s) so that the State will have the opportunity to pursue any legal remedies available to it to redress any concerns it may have with the trust formation or amendment document(s) if such concerns cannot be resolved through mutual agreement of the parties.

(b) Entergy VY shall not seek reimbursement from the NDT or Department of Energy ("DOE") of any amount relating to: (i) the five (5) annual economic development payments of $2 million each (for a total of $10 million) identified in paragraph 17 below; or (ii) the released escrow funds (approximately $5.2 million) identified in paragraph 14 below.

(c) Entergy VY shall not seek reimbursement from the NDT or DOE for deposits to the Site Restoration Fund. Consistent with prior agreements and orders regarding proper use of the NDT and distributions of any excess funds in the NDT, including paragraph 3 of the Memorandum of Understanding in Docket No. 6545 as amended by the Board's orders in that docket, after site restoration activities have been completed in accordance with the overall site restoration standards established pursuant to paragraph 8, any remaining funds in the Site Restoration Fund shall be released to EVY or its designee.

12. Entergy VY shall apply to the NRC for every approval needed to release portions of the VY Station site for other use after Entergy VY determines in good faith that such portions reasonably could be made available for such use, and shall diligently pursue such applications to completion, provided, however, that Entergy VY shall not be required to submit such applications for parcels smaller than ten acres nor more frequently than once every five years. Entergy VY shall not wait until completion of radiological decommissioning to apply to the NRC to make appropriate portions of the site available for reuse.

13. EVY or its affiliate owns the property on which the VY Station is located ("VY Property"). EVY for itself or on behalf of its affiliate shall grant the State (through its designated agency or department) a right of first refusal to purchase the VY Property, and if the owner of the VY Property offers less than all of the VY Property for sale at any one time, the right of first refusal shall apply to each portion from time to time, as they are so offered. The price payable by the State shall be fair market value as determined by an independent appraisal performed by a mutually agreed upon MAI appraiser at the time the right of first refusal is exercised. If the parties are unable to agree on an appraiser within 60 days, each party shall select an

independent appraiser, who in turn will select a third independent appraiser to conduct the valuation. The State's right of first refusal as to each offered portion of the VY Property must be exercised by July 1 of the year following EVY's notice to the State that the VY Property or a portion thereof is available for sale. The State and the owner of the VY Property shall enter into any separate documents or instruments necessary to effectuate this right of first refusal and the intent of this provision.

14. EVY has made quarterly payments related to the Clean Energy Development Fund ("CEDF") into an escrow account since March 21, 2012. In consideration of all provisions of this Agreement, EVY shall make no future payments into that escrow account and make no further payments into the CEDF, with the exception that all amounts held in the escrow account (approximately $5.2 million at the time of execution of this Agreement) shall be paid to the CEDF within thirty (30) days of the Board's issuance of a CPG as described in paragraph 2, with at least fifty percent (50%) of those amounts to be used in accordance with CEDF criteria for clean energy development activities in or for the benefit of Windham County, Vermont. EVY shall not seek or accept funds from the NDT relating to those escrowed funds.

15. During the period of continued operation of the VY Station for nuclear power generating activities pursuant to paragraph 1 above, EVY shall timely pay all taxes and other monies owed to the State, the Town of Vernon, and any other political subdivision of the State, including the generation tax. Entergy VY specifically reserves its rights to challenge the imposition of, or the amount of, any tax, fee, or other payment not already in effect as of the date of this Agreement which is sought to be imposed on it by the State or any political subdivision thereof, including the right to seek an injunction or other relief in connection with such challenge.

16. In consideration of all provisions of this Agreement, including dismissal of litigation described above, for calendar year 2015 EVY shall make a one-time payment of $5 million on or before April 25, 2015, to the State of Vermont Department of Taxes. Such payment shall not satisfy any obligation(s) EVY may have now or in the future for: amounts owed to any city or town, including, without limitation, the Town of Vernon or the Town of Brattleboro; EVY's obligation to make in January 2015 the fourth quarterly payment of the generation tax owed for calendar year 2014 operations and, in the event that it generates electricity subsequent to 2014, EVY's obligation to pay the generation tax with respect to such subsequent quarters; or EVY's obligations to pay state income, withholding, and sales and use taxes. If a Vermont law is enacted subsequent to execution of this Agreement that imposes on EVY a state property tax or obligation to make payments in lieu of state property tax related to the VY Station effective in calendar year 2015, the $5 million payment required under this paragraph for calendar year 2015 shall be an offset against any such amount owed in calendar year 2015.

17. For each of the next five years -- 2014, 2015, 2016, 2017, and 2018 -- EVY shall make a payment to the State of Vermont on or before April 1 of each year in the amount of $2 million to promote economic development in Windham County, Vermont. EVY shall not seek or accept reimbursement from the NDT for any of these payments. Payments pursuant to this paragraph shall be sent to the attention of the Secretary of Commerce and Community Development, Agency of Commerce and Community Development Central Office, 1 National Life Drive #6, Montpelier, Vermont 05620.

18. The introductory paragraphs contained in this Agreement express the intentions of the Parties

with respect to the VY Station. The binding obligations of the Parties pursuant to this Agreement are set forth in paragraphs 1 through 33. Except as expressly stated in this Agreement, the Parties retain all authority and reserve all rights to take any actions authorized by law. Other than the obligations specifically and expressly undertaken in this Agreement, the Parties reserve and retain all rights, including without limitation Entergy VY's reservation of the right to challenge any requirement or obligation imposed by state law on the ground that such law is preempted by applicable federal law or is otherwise invalid, and the State's reservation of its rights to participate in NRC proceedings and to dispute Entergy VY's use(s) of the NDT.

19. Nothing in this Agreement shall be interpreted as prohibiting or restricting Entergy VY from complying with any requirements or orders of the NRC, or any obligation under its NRC license. To the extent that Entergy VY would be required to obtain approval from the NRC in order to fulfill any obligation under this Agreement, Entergy VY shall pursue such NRC approvals diligently and in good faith, and shall advance each related request by a date reasonably expected to be necessary to meet its obligations under this Agreement.

20. Nothing in this Agreement shall affect, restrict, or limit the jurisdiction or regulatory authority of any state or federal agencies over Entergy VY or the VY Station site.

21. The Parties have made compromises on specific issues to reach this Agreement. This Agreement, and all orders approving and implementing provisions of this Agreement shall not be construed by any Party or tribunal as having precedential impact on any future proceedings involving the Parties, except in a proceeding to enforce the terms of this Agreement.

22. Except as expressly stated in this Agreement, all other agreements, Board orders and MOUs (collectively "Requirements") remain in full force and effect. Entergy VY shall operate and conduct all other activities at the VY Station, including the operation of emergency generators, in full compliance with all such Requirements, as required by state and federal law.

23. The Parties shall negotiate in good faith the terms of necessary instruments to be filed with the appropriate tribunals to embody the terms necessary to accomplish the goals of this Agreement.

24. Each Party bears its own costs and fees in connection with the litigation and other proceedings resolved by this Agreement, including any future litigation related to this Agreement or to the continued operation, shutdown, decommissioning, or site restoration of the VY Station, with the exception of any fees or costs covered by statutory bill-back authority incurred by any state agency.

25. Any notice given pursuant to this Agreement shall be in writing and delivered by: hand (with mailed confirmation copy); receipted overnight delivery service; email (if acknowledged by a reply email from the recipient identified in this Agreement); or mail, first class postage prepaid, with receipted delivery, to the other Party at the address set forth below:

If to PSD:

Commissioner
Vermont Public Service Department
112 State Street – Drawer 20
Montpelier, VT 05620

With a copy to:

Director for Public Advocacy
Vermont Public Service Department
112 State St.
Montpelier, VT 05620-2601

and a copy to:

Vermont Office of the Attorney General
109 State Street
Montpelier, VT 05609-1001

If to ANR:

Secretary
Vermont Agency of Natural Resources
1 National Life Drive, Davis 2
Montpelier, Vermont 05620-3901

With a copy to:

General Counsel
Vermont Agency of Natural Resources
1 National Life Drive, Davis 2
Montpelier, Vermont 05620-3901

and a copy to:

Vermont Office of the Attorney General
109 State Street
Montpelier, VT 05609-1001

If to VDH:

Commissioner
Vermont Department of Health
108 Cherry Street
Burlington, VT 05402

With a copy to:

Senior Policy and Legal Advisor
Vermont Department of Health
108 Cherry Street
Burlington, VT 05402

and a copy to:

Vermont Office of the Attorney General
109 State Street
Montpelier, VT 05609-1001

If to Office of the Attorney General:

Vermont Office of the Attorney General
109 State Street
Montpelier, VT 05609-1001

If to Entergy VY:

Entergy Nuclear Vermont Yankee, LLC
Site Vice President
P.O. Box 250
320 Governor Hunt Rd
Vernon, VT 05354

With a copy to:

Entergy Nuclear Vermont Yankee, LLC
General Counsel
639 Loyola Avenue
New Orleans, LA 70113

26. This Agreement shall be governed by and construed in accordance with the laws of the State of Vermont and the courts of the State of Vermont shall be an available venue for enforcement of any disputes arising under this Agreement. The Parties reserve all rights regarding other possible venues. The Parties' obligations under this Agreement are to be applied and enforced consistent with the plain meaning of the language used herein.

27. Entergy VY, PSD, ANR, and VDH each enter into this Agreement freely and after opportunity for and actual consultation with all desired counsel, legal and otherwise, of its choice.

28. Entergy VY, PSD, ANR, and VDH shall reasonably and in good faith cooperate in connection with this Agreement, including by providing executed versions of documents reasonably requested in connection with carrying out the objectives of this Agreement.

29. Entergy VY, PSD, ANR, and VDH each represent that it possesses the power and authority to execute, deliver and perform its obligations under this Agreement, which obligations are valid, binding, and enforceable under this Agreement.

30. This Agreement shall be binding on, and inure to the benefit of, the respective successors and assigns of Entergy VY, PSD, ANR, and VDH and, in any event, shall continue to be binding upon the Parties. Any Party may name a successor or assign its rights under this Agreement by providing notice to and receiving consent from the other parties pursuant to paragraph 25 of this Agreement, such consent not to be unreasonably withheld.

31. This Agreement and any referenced Exhibits hereto constitute the entire agreement between the Parties. This Agreement shall not be changed, modified or altered in any manner except by an instrument in writing executed by the Parties.

32. If any part of this Agreement is determined not to be valid, such provision shall be null and void and the remainder of the Agreement shall continue in full force and effect.

33. This Agreement is effective as of December 23, 2013.

IN WITNESS WHEREOF, the parties below enter into this Agreement as a sealed instrument. Each person signing this Agreement represents and warrants that he or she has been duly authorized to enter into this Agreement by the party on whose behalf it is indicated that the person is signing.

VERMONT PUBLIC SERVICE DEPARTMENT

By: _____

Name: Christopher Recchia

Title: Commissioner, PSD

Date: December 23, 2013

VERMONT AGENCY OF NATURAL RESOURCES

By: _____

Name: Sec. Deb Markowitz

Title: Sec. ANR

Date: Dec 23, 2013

VERMONT DEPARTMENT OF HEALTH

By: _____

Name: Harry Chen

Title: Commissioner of Health

Date: 12/23/13

As to the terms of ¶¶ 3(a)-(c) and 16 only and otherwise as to form:

VERMONT OFFICE OF THE ATTORNEY GENERAL

By: _____

Name: William H. Sorrell

Title: Attorney General

Date: 12/23/13

ENTERGY NUCLEAR VERMONT YANKEE, LLC

By: _____

Name: T. Michael Twomey

Title: VP- External Affairs

Date: December 23, 2013

ENTERGY NUCLEAR OPERATIONS, INC.

By: _____

Name: T. Michael Twomey

Title: VP- External Affairs

Date: December 23, 2013

As to the terms of ¶ 10 only:
ENTERGY CORPORATION

By: _____

Name: Bill Mohl

Title: President ENC

Date: 12/20/13

As to the terms of ¶ 13 only:

By: _____

Name: T. Michael Twomey

Title: VP- External Affairs ENVY

Date: December 23, 2013